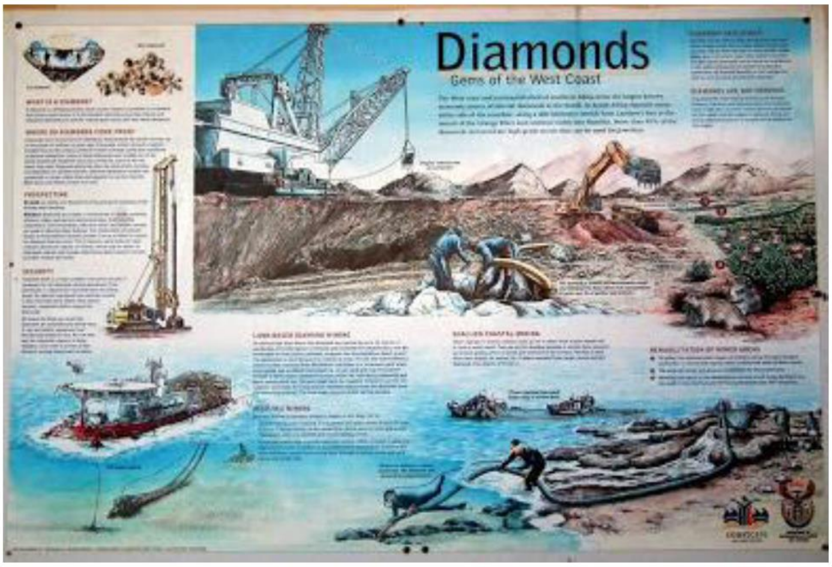

Draft Environmental Impact Assessment Report

Proposed Prospecting Right with Bulk Sampling over Sea Concession 12B, Western Cape

DMR REF. NO.: WC 30/5/1/1/2/10424 PR

February 2023

DOCUMENT NAME:

Proposed Prospecting Right with Bulk Sampling over Sea Concession 12B, Western Cape

PROJECT NUMBER:

WC 30/5/1/1/2/10424 PR

DATE:

February 2023

REPORT STATUS:

Draft Report

CARRIED OUT BY:

GroenbergEnviro (Pty) Ltd

COMMISSIONED BY:

Nisarox (Pty) Ltd

CLIENT CONTACT DETAILS:

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Revision Status

Rev No.	Issue Date	Author	Technical Review	Report Review
0	February 2023	H. Botha		H. Badenhorst

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mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME

FOR LISTED ACTIVITIES ASSOCIATED WITH PROSPECTING RIGHT ACTIVITIES INCLUDING TRENCHING IN CASES OF ALLUVIAL DIAMOND MINING.

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: **Nisarox (Pty) Ltd**

TEL NO: **0794994743**

FAX NO: **086 666 5915**

POSTAL ADDRESS: **P.O. Box 127, Port Nolloth, 8280**

PHYSICAL ADDRESS: **P.O. Box 127, Port Nolloth, 8280**

DMR REFERENCE NUMBER: **WC 30/5/1/1/2/10424 PR**

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3) (b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process—

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the—-
    (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    (ii) degree to which these impacts—
        (aa) can be reversed;
        (bb) may cause irreplaceable loss of resources, and
        (cc) can be avoided, managed or mitigated;
(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
(g) identify suitable measures to manage, avoid or mitigate identified impacts; and
(h) identify residual risks that need to be managed and monitored.

Disclaimer

The opinions expressed in this report have been based on the information supplied to GBE by the Applicant. GBE has exercised all due care in reviewing the supplied information, with conclusions from the review being reliant on the accuracy and completeness of the supplied data.

GBE does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Professional environmental opinions presented in this report apply to the site conditions and features as they existed at the time of GBE's investigations, and those foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GBE had no prior knowledge nor had the opportunity to evaluate.

POPIA

Regulation 42 of the Environmental Impact Assessment Regulations, 2014, as amended (EIA Regulations) provides for the opening and maintenance of a register of interested and affected parties (I&APs), by the proponent or applicant, which must contain personal information (names, contact details and addresses). It is therefore the duty of the proponent or applicant to collect the information that must be contained in the register.

Regulation 42 further requires that these registers must be submitted to the Competent Authority (CA). There is no legal requirement in the EIA Regulations that such registers must be included in the reports that are published for public consultation purposes or be made publicly available as part of the EIA process. Since the information in the registers is personal/private information, it should not be included in or attached to reports and be made available in the public domain. CAs, applicants and environmental assessment practitioners (EAPs) should take note that, if this information was previously included in reports and shared in the public domain, this now requires reconsideration in accordance with the POPIA. The Department realises that EAPs may have included some personal information in these reports when they receive and compile them. Likewise, this information may reach CAs who also now need to be sensitive about the management of this information.

Section 11(1)(a) of POPIA provides further that personal information may only be processed if the data subject consents to the processing.

The requirements of section 18.1 of POPIA requires that if personal information is collected, the responsible party must take reasonably practicable steps to ensure that the data subject is aware of, amongst other things, the information being collected, the name and address of the responsible party (in this case the EAP and applicant), the purpose for which the information is collected, whether or not the supply of the information by the data subject is voluntary or mandatory, the consequence of the failure to provide the required information, further information such as the recipient of the information, as well as the existence of the right to object to the processing of the personal information.

EAPs should obtain express consent from commenting parties to include their names with their comments in the reports. It is therefore recommended that the EAP, when requesting comment, should also request the persons who may comment to provide consent that their names may be included with their comments in the reports. Commenting parties should also be informed that they may opt to not have their names shared, as well as an indication of the consequences of such an option being exercised, in which case only the comments will be included. This will ensure that the requirements of section 11(1)(a) of POPIA, which provides that personal information may only be processed if the data subject consents to the processing, is given effect to. Even when consent is obtained it is recommended that only the minimum details (the names) should be included in reports and the inclusion of unnecessary and excessive information should be avoided.

EXPERTISE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

NAME	Helene Botha	Pieter Badenhorst
RESPONSIBILITY ON PROJECT	Preparation of Environmental Impact Assessment Report, Public Participation Documentation, Final Closure, Decommissioning and Rehabilitation Plan	
QUALIFICATIONS	B. Sc. (Zoology & Genetics) B. SC. Hons. (Animal Behaviour) M. Env. Man (Masters' Degree in Environmental Management)	B. SC. B. Eng. (Civil) M. Eng. (Irrigation) B. Hons. (B&A) MBA
PROFESSIONAL REGISTRATION	Registration with Environmental Assessment Practitioners Association of South Africa (EAPASA): Reg. No.: 2019/558.- in progress	Professional Engineer, member of the Engineering Council of South Africa Member of the South African Institute of Civil Engineers Member of the International Association of Impact Assessment (South Africa) Registration with Environmental Assessment Practitioners Association of South Africa (EAPASA): Reg. No.: 2019/1108– in progress
EXPERIENCE (YEARS)	7 years	47 years
EXPERIENCE & EXPERTISE	The consultant has more than 7 years of experience in project management and reports writing. Miss Botha has worked on numerous Environmental Impact Assessments, Basic Assessments, S24G Rectifications, and Water Use Licenses and has considerable experience in the preparation and compilation of Environmental Impact Reports, Environmental Management Programmes, and project management. Refer to CV Summary attached at **Appendix A, page 267**.	The consultant has more than 47 years of experience in project management and reports writing. He worked at the CSIR in environmental and estuarine management for 16 years. During that time, he was part of the team that developed coastal management guidelines; the first process for EIA's and undertook numerous environmental studies for DEAT in collaboration with a team of ecologists. The past couple of years he has worked mainly in environmental control and environmental impact assessments and has completed EIAs for many projects. He has also attended an EIA peer review on a major development for DEAT and is a member of IAIAsa. The practitioner has attended or organised many meetings/workshops/open days to identify issues for similar projects at the CSIR; Blue Flag for DEAT as well as other DEAT projects. The Blue Flag and other projects required interaction with large groups of stakeholders. Refer to CV Summary attached at **Appendix A, page 267**

DECLARATION OF INDEPENDENCE

I, Helene Botha, declare that –

- I act as the independent environmental assessment practitioner in this role as EAP;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will perform the work relating to the role of EAP in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I will take into account, to the extent possible, the matters listed in Regulation 13 of the Regulations when preparing the reports comprising the Environmental Impact Assessment;
- 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, unless access to that information is protected by law, in which case it will be indicated that such information exists and will be provided to the Competent Authority;
- I will perform all obligations as expected from an environmental assessment practitioner in terms of the Regulations; and,
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;
- ~~I have a vested interest in the proposed activity proceeding, such vested interest being:~~

HBotha

Signature of the Environmental Assessment Practitioner
Name of Company: GroenbergEnviro (Pty) Ltd
Date: 23 February 2022

DEFINITIONS

Alternatives - In relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to –
i. The property on which or location where it is proposed to undertake the activity;
ii. The type of activity to be undertaken;
iii. The design or layout of the activity;
iv. The technology to be used in the activity, and;
v. The operational aspects of the activity.

Aquifer - A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to store and transmit water; and to yield economical quantities of water to boreholes or springs. An aquifer is the storage medium from which groundwater is abstracted.

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.

Biodiversity - The diversity, or variety, of plants, animals and other living things in a particular area or region. It encompasses habitat diversity, species diversity and genetic diversity.

Borehole - Includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer.

Community - Those people who may be impacted upon by the construction and operation of the project. This includes neighbouring landowners, local communities and other occasional users of the area.

Construction Phase - The stage of project development comprising site preparation as well as all construction activities associated with the development.

Consultation - A process for the exchange of views, concerns and proposals about a project through meaningful discussions and the open sharing of information.

Critical Biodiversity Area - Areas of the landscape that must be conserved in a natural or near-natural state in order for the continued existence and functioning of species and ecosystems and the delivery of ecosystem services.

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 surroundings within which humans exist and that are made up of
i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any Part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Environmental Authorisation (EA) – The authorisation by a competent authority of a listed activity.

Environmental Assessment Practitioner (EAP) – The person responsible for planning, management and co-ordination of environmental impact assessment, strategic environmental assessments, environmental management plans or any other appropriate environmental instrument introduced through regulations.

Environmental Impact Assessment (EIA) – In relation to an application to which scoping must be applied, means the process of collecting, organizing, analysing, interpreting and communicating information that is relevant to the consideration of that application. This process necessitates the compilation of an Environmental Impact Report, which describes the process of examining the environmental effects of a proposed development, the anticipated impacts and proposed mitigatory measures.

Environmental Impact Report (EIR) - A report assessing the potential significant impacts as identified during the Scoping phase.

Environmental Management Programme (EMPr) - A management programme designed specifically to introduce the mitigation measures proposed in the Reports and contained in the Conditions of Approval in the Environmental Authorisation.

Gross Domestic Product (GDP) by region - represents the value of all goods and services produced within a region, over a period of one year, plus taxes minus subsidies.

Groundwater - Water found in the subsurface in the saturated zone below the water table. Groundwater is a source of water and is an integral part of the hydrological system.

Hydrocarbons – Oils used in machinery as lubricants, including diesel and petrol used as fuel.

Hydrogeology - In South Africa, the term geohydrology and hydrogeology are used interchangeably. In theory hydrogeology is the study of geology from the perspective of its role and influence in hydrology, while geohydrology is the study of hydrology from the perspective of the influence on geology.

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.

Interested and Affected Party (I&AP) – Any individual, group, organization or associations which are interested in or affected by an activity as well as any organ of state that may have jurisdiction over any aspect of the activity.

Municipality –

(a) Means a metropolitan, district or local municipality established in terms of the Local Government: Municipal Structures Act, 1998 (Act No. 117 of 1998); or

(b) In relation to the implementation of a provision of this Act in an area which falls within both a local municipality and a district municipality, means

  (i) The district municipality, or

  (ii) The local municipality, if the district municipality, by agreement with the local municipality, has assigned the implementation of that provision in that area to the local municipality.

NEMA EIA Regulations - The EIA Regulations means the regulations made under section 24(5) of the National Environmental Management Act (Act 107 of 1998) (Government Notice No. R 982, R 983, R984 and R 985 in the Government Gazette of 4 December 2014 refer as amended by GNR 324, 325, 326 and 327 of 7 April 2017.

No-Go Alternative – The option of not proceeding with the activity, implying a continuation of the current situation / status quo

Public Participation Process (PPP) - A process in which potential Interested and Affected Parties are given an opportunity to comment on, or raise issues relevant to, specific matters.

Registered Interested and Affected Party – All persons who, as a consequence of the Public Participation Process conducted in respect of an application, have submitted written comments or attended meeting with the applicant or environmental assessment practitioner (EAP); all persons who have requested the applicant or the EAP in writing, for their names to be placed on the register and all organs of state which have jurisdiction in respect of the activity to which the application relates.

Scoping process - A procedure for determining the extent of and approach to an EIA, used to focus the EIA to ensure that only the significant issues and reasonable alternatives are examined in detail

Scoping Report – The report describing the issues identified during the scoping process.

Significant impact – Means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Spatial Development Framework (SDF) - A document required by legislation and essential in providing conservation and development guidelines for an urban area, which is situated in an environmentally sensitive area and for which major expansion is expected in the foreseeable future.

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.

Sustainable development - Sustainable development is generally defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. NEMA defines sustainable development as the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

Visibility - The area from which the project components would actually be visible and depends upon topography, vegetation cover, built structures and distance.

Visual Character - The elements that make up the landscape including geology, vegetation and land-use of the area.

Visual Quality - The experience of the environment with its particular natural and cultural attributes.

Visual Receptors - Individuals, groups or communities who are subject to the visual influence of a particular project.

ACRONYMS AND ABBREVIATIONS	
dB re 1 µPa	Underwater source level measurements
BGIS	Biodiversity Geographic Information Systems
DEA	Department of Environmental Affairs: National
DEIR	Draft Environmental Impact Report
D.W.S.	Department of Water & Sanitation
DMS	Dense Media Separation
DMR	Department of Mineral Resources
dSR	Draft Scoping Report
EA	Environmental Authorisation
EAPASA	Environmental Assessment Practitioners Association of South Africa
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme
fSR	Final Scoping Report
GNR	Government Notice Reference
Ha	Hectares
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
kHz	kilohertz
km	Kilometres
km^2	Square kilometres
LN	Listing Notice
L/s	Litres per second
m	Metres
m^2	Metres squared
m^3	Metres cubed
Ma	Megannum
MARPOL	International Convention for the Prevention of Pollution from Ships
MLRA	Marine Living Resources Act 18 of 1998
mm	Millimeters
MPA	Marine Protected Area
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002
PWP	Prospecting Works Programme
NEMA	National Environmental Management Act 107 of 1998 as amended
NEM:BA	National Environmental Management: Biodiversity Act 10 of 2004
NEM: ICMA	National Environmental Management: Integrated Coastal Management Act 24 of 2008 as amended by Act 36 of 2014
NEM: WA	National Environmental Management: Waste Act 59 of 1998
NHRA	National Heritage Resources Act 25 of 1999
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
t	tonnes
µPa	micropascal
WCDM	West Coast District Municipality

CONTENTS

Chapter	Description	Page

Tables

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 CONTACT PERSON & CORRESPONDENCE ADDRESS

1.1 Details of the EAP

Name of The Practitioner: Helene Botha
Company: GroenbergEnviro (Pty) Ltd
Tel No.: 076 509 0785
Fax No. : 086 476 7139
e-mail address: helene@groenbergenviro.co.za

1.2 Expertise of the EAP

1.2.1 The qualifications of the Environmental Assessment Practitioner (EAP)

NAME	Helene Botha	Pieter Badenhorst
QUALIFICATIONS	B. Sc. (Zoology & Genetics) B. SC. Hons. (Animal Behaviour) M. Env. Man (Masters' Degree in Environmental Management)	B. SC. B. Eng. (Civil) M. Eng. (Irrigation) B. Hons. (B&A) MBA
PROFESSIONAL REGISTRATION	Registration with Environmental Assessment Practitioners'' Association of South Africa (EAPASA): Reg. No.: 2019/558	Professional Engineer, member of the Engineering Council of South Africa Member of the South African Institute of Civil Engineers Member of the International Association of Impact Assessment (South Africa) Registration with Environmental Assessment Practitioners' Association of South Africa (EAPASA): Reg. No.: 2019/1108

Refer to **Appendix A, page 267** for the CV of EAP.

1.2.2 Summary of the EAP's past experience

Refer to Part C Appendix A: Attachments as per DMR Template**, page 267** for CV of EAP.

1.3 LOCATION OF THE ACTIVITY

Table 1: Project Location Information

Farm Name:	Sea Concession 12B
Application area (Ha)	11166.9ha
Magisterial district:	Vanrhynsdorp
District Municipality	West Coast District Municipality
Local Municipality	Matzikama Local Municipality
Distance and direction from nearest town	Sea Concession 12(b) is situated approximately 300km north of Cape Town, with the inshore boundary located 1km seaward of the coast between Strandfontein to the south and Namakwa Sands Wet Separation Plant to the north. The offshore boundary is located approximately 4km offshore
21-digit Surveyor General Code for each farm portion	The concession area is located offshore and described as Sea Concession 12(b).
Locality map	Refer **Figure 1 & Figure 2**
Description of the overall activity. (Indicate Mining Right, Mining Permit, Prospecting right, Bulk Sampling, Production Right, Exploration Right, Reconnaissance	**Prospecting right with Bulk Sampling** Nisarox (Pty) Ltd is proposing to prospect within Sea Concession area 12B for Diamonds (General & Alluvial), using both non-invasive and invasive sampling activities, none of which require infrastructure. For the purpose of this study, non-invasive means not physically destructive and invasive means physical

permit, Technical co-operation permit, Additional listed activity)	sampling that is destructive. As the activity is located offshore and comprises prospecting only, no land-based infrastructure will be required. Prospecting will be vessel-based and will take place during spring and/or summer and when weather conditions are suitable, and seas are calm. It is anticipated to be completed within five (5) years. Sampling will be conducted in four phases and include a combination of non-invasive and invasive activities to detect the presence of paleo-beach deposits, which are known from other concessions to contain diamondiferous gravels. Prospecting operations are expected to occur sporadically within the concession area. The non-invasive activities will include geophysical exploration (acoustic survey), data acquisition and analysis, while the invasive activities will include physical sampling (collection of core, drill and grab samples). A possible phase of bulk sampling (remote pump and dredge mining) may also be implemented depending on the results of initial sampling. The principal objective of the proposed prospecting activities is to discover and estimate the potential mineral resources for possible future mining. Prospecting in shallow water up to 50m, that cover most of the concession area, will be conducted by a group owned custom fit survey vessel, normally with an overall length of 45.15m and a gross tonnage of 498t. This will be a multipurpose customised survey vessel capable of High-Resolution geophysical surveys (Phase 1) and small-scale boat sampling programs such as Coring and Van Veen Grab Sampling (Phase 2a) and Remote Pump Mining (Phase 3a). Prospecting in deeper water greater than 50m will be conducted by dedicated sampling vessels. For deeper water drill sampling activities (Phase 2b) a dedicated large diameter drilling sampling vessel, normally with an overall length of 114.4m, and gross tonnage of 4677t. Such a vessel is equipped with a subsea sampling tool, which can be operated in water depths up to 200m. The sampling tool comprises a 2.5m diameter drill bit operated from a drill frame structure. For bulk sampling in deeper areas (Phase 3b), trenching would be undertaken by a seabed crawler, deployed off a dedicated mining vessel, normally with an overall length of 150m and a gross tonnage of 9111t. Such a vessel is equipped with a track-mounted subsea crawler capable of working to depths up to 200m below sea level.

1.3.1 <u>Location</u>

(show nearest town, scale not smaller than 1:250000 attached as **Appendix 3: Locality Map, page 269**.

Sea Concession 12(b) is situated approximately 300km north of Cape Town, with the inshore boundary located 1km seaward of the coast between Strandfontein to the south and Namakwa Sands Wet Separation Plant to the north. The offshore boundary is located approximately 4km offshore.

Refer to the locality plan attached at **Figure 1**.

Figure 2 shows the properties and co-ordinates as detailed in **Table 1** above.

1.3.2 <u>Locality Map</u>

Refer to the locality plan attached in **Figure 1. Figure 2: Layout plan, Sea Concession 12B** shows the properties and coordinates as detailed in **Table 1** above.

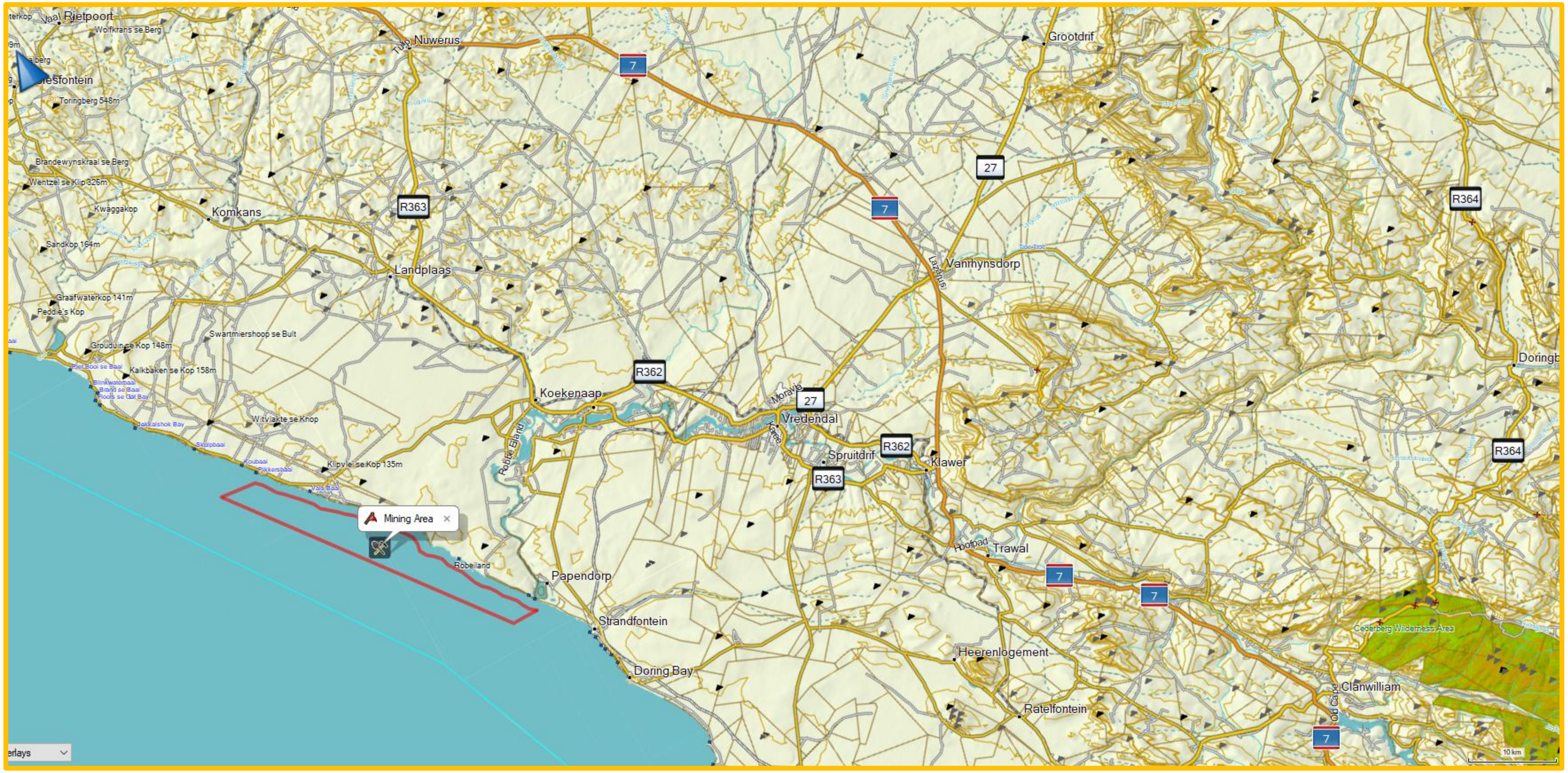


Figure 1: Locality Plan of Project Site Prospecting Right Area showing major routes and towns

1.4 Description of the scope of the proposed overall activity.

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site

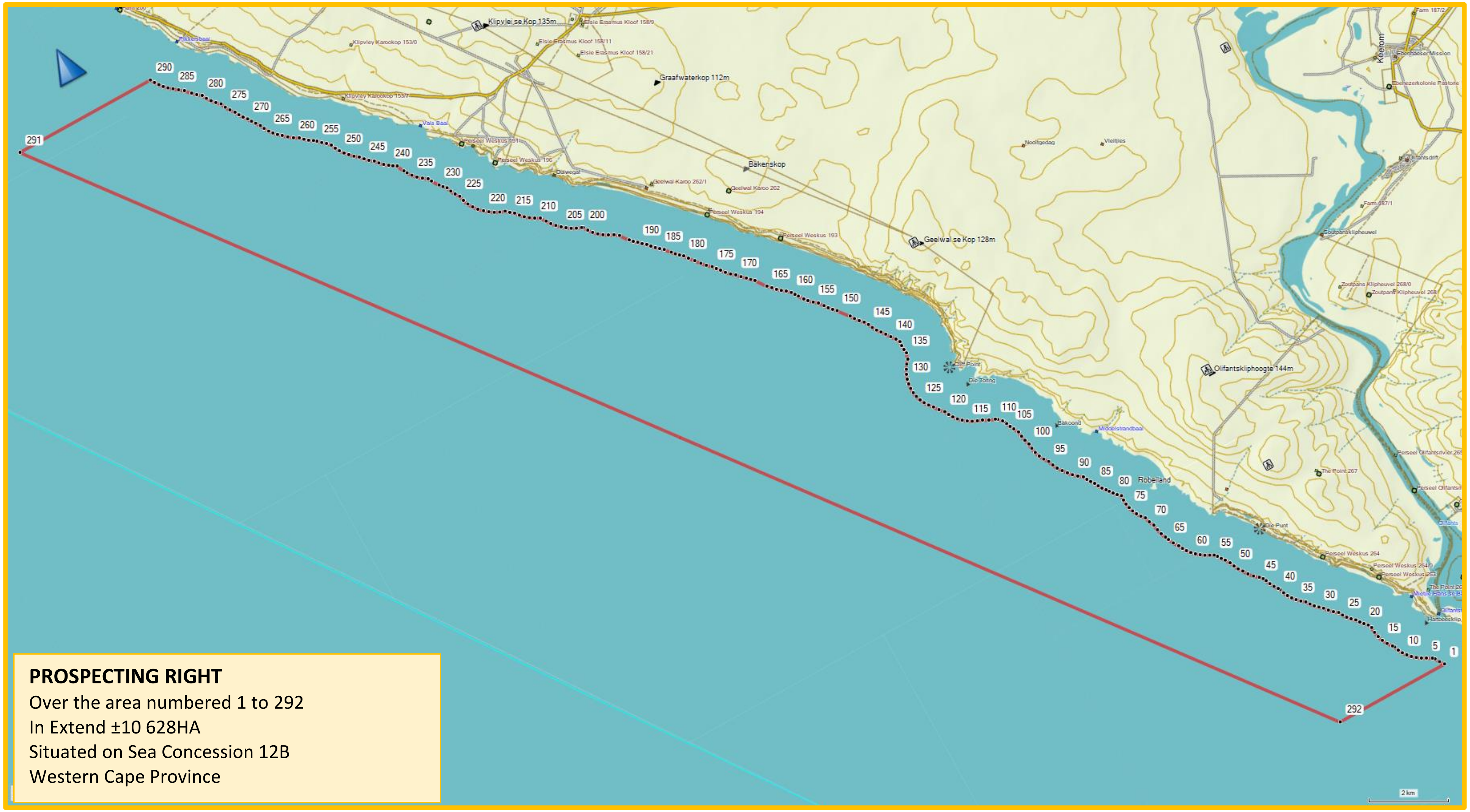


Figure 2: Layout plan, Sea Concession 12B

2 DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY.

2.1 Listed and specified activities

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site and attach **Appendix 3: Locality Map, page 269.**

NAME OF ACTIVITY (All activities including activities not listed) (E.g., Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**Aerial extent of the Activity Ha or m²**	**LISTED ACTIVITY Mark with an X where applicable or affected.**	**APPLICABLE LISTING NOTICE (*GNR 544, GNR 545 or GNR 546)/NOT LISTED***
The operation directly relates to prospecting of an offshore mineral resource (diamonds) and requires a prospecting right in terms of section 16 of the MPRDA. Prospecting is planned within Sea Concession area 12B using both non-invasive and invasive sampling activities, none of which require infrastructure. Sampling will be conducted in four phases to detect the presence of paleo-beach deposits, which are known from other concessions to contain diamondiferous gravels. Prospecting operations are expected to occur sporadically within the concession area. • Geophysical Surveys (Phase 1 Non-Invasive) including Swath bathymetry and sub-bottom profiling • Drill Sampling (Phase 2a Invasive) • Grab Sampling (Phase 2a Invasive) Large Diameter Drilling (Phase 2b Invasive)	Total Area 11166.9Ha Core samples footprint ±1.57m², & volume ±4.71m³. Grab samples footprint ±5m² & volume ±1.5m³ LDD footprint ± 2.4ha	X	GNR 983 Listing Notice 1 of 2014 (dated 8 December 2014), as amended by GN 517 GG 44701 (dated 11 June 2021): Activity 20: Any activity including the operation of that activity which requires a prospecting right in terms of section 16 of the MPRDA, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the prospecting right.”;
This operation requires permission in terms of Section 20 of the MPRDA for the removal and disposal of bulk samples of any minerals. The applicant requires maximum 360 000tons ROM for processing to obtain a representative sample for sufficient statistical analysis to complete a resource statement and to determine a grade (CPHT).	Bulk samples footprint ±3.6Ha & volume ±360 000 tons	X	GNR 984 Listing Notice 2 of 2014 (dated 8 December 2014), as amended by GN 517 GG 44701 (dated 11 June 2021): Activity 19: The removal and disposal of a mineral, which requires a permission in terms of section 20 of the MPRDA, as well as any other applicable activity as contained in Listing Notice 2, in Listing Notice 1 of 2014 or Listing Notice 3 of 2014, required to exercise the permission

3 DESCRIPTION OF THE PROPOSED ACTIVITIES

3.1 Introduction and Background

Nisarox (Pty) Ltd is applying for a prospecting right with bulk sampling on Sea Concession 12 B to prospect for and remove and dispose of diamond (alluvial).

As per the Prospecting Works Programme (2022): Diamonds were introduced to the continental shelf via several river systems draining the interior of southern Africa. The Orange. Buffels and Olifants Rivers and their pre-cursors, have supplied the majority of diamonds to the west coast by eroding the kimberlite pipes from the interior.

The offshore deposits are the product of repeated reworking of material derived from the hinterland during a series of marine regressions and transgressions over the continental shelf.

The formation of the offshore deposits has been controlled by marine coastal and near shore processes (PWP, 2022).

The concession is situated off the Olifants River mouth and extends approximately 25 kilometres northward and two kilometres southward from the river mouth. The shoreward boundary of the concession is one kilometre from the shore, whereas the western boundary is defined by a straight line between two points situated 34.6 kilometres apart as 31 27' 18"S, 17 56' 37'' E and 31 42' 37"S, 18 09' 20"E, and which lie approximately five kilometres from the South African coast. The concession varies in width between 4.3 kilometres and 2.5 kilometres (average 3.5 kilometres) and encompasses an area of approximately 116 square kilometres. The water depth in the concession ranges from 15 meters to 75 meters.

3.2 The Scope of the Proposed Activities

The information in **Table 2** below is referenced from the Prospecting Works Programme (PWP) (2022).

Table 2: Details of the Mineral Resource (PWP; 2022)

ITEM	DETAIL
Type of mineral	Diamonds (General); Diamonds (Alluvial);
Locality (direction and distance from nearest town)	Sea Concession 12(b) is situated ap-proximately 300km north of Cape Town, with the inshore boundary located 1km seaward of the coast be-tween Strandfontein to the south and Namakwa Sands Wet Separation Plant to the north. The offshore boundary is located ap-proximately 4km offshore.
Extent of application	11166.9ha Refer to **Figure 2.**
Extent of the area required for infrastructure	Not applicable
Extent of the area required for prospecting	11166.9ha
Geological formation	The oldest basement rocks of the coastal plain are comprised of metamorphic formations (metasediments), gneisses and granites of the Namaqualand Metamorphic Province (1200Ma to 1000Ma old). These rocks are locally overlain by meta-sediments (quartz-ites, schists, phyllites and marbles) of the Gariep Supergroup, between 770Ma and 550Ma old. Sandstones and shales of the Nama Group and the Vanrhynsdorp Group occur inland below the escarpment. These sediments are generally well-pre-served and deposited during the Precambrian-Cambrian boundary of around 540Ma (PWP, 2022).

3.3 Project Description

Nisarox (Pty) Ltd is proposing to prospect within Sea Concession area 12B using both non-invasive and invasive sampling activities, none of which require infrastructure. For the purpose of this study, non-invasive means not physically destructive and invasive means physical sampling that is destructive. As the activity is located offshore and comprises prospecting only, no land-based infrastructure will be required.

Prospecting will be vessel-based and will take place during spring and/or summer and when weather conditions are suitable, and seas are calm. It is anticipated to be completed within five (5) years. Sampling will be conducted in four phases and include a combination of non-invasive and invasive activities to detect the presence of paleo-beach deposits, which are known from other concessions to contain diamondiferous gravels. Prospecting operations are expected to occur sporadically within the concession area.

The non-invasive activities will include geophysical exploration (acoustic survey), data acquisition and analysis, while the invasive activities will include physical sampling (collection of core, drill and grab samples). A possible phase of bulk sampling (remote pump and dredge mining) may also be implemented depending on the results of initial sampling. The principal objective of the proposed prospecting activities is to discover and estimate the potential mineral resources for possible future mining.

Prospecting in shallow water up to 50m, that cover most of the concession area, will be conducted by a group owned custom fit survey vessel normally with an overall length of 45.15m and a gross tonnage of 498t. This will be a multipurpose customised survey vessel capable of High-Resolution geophysical surveys (Phase 1) and small-scale boat sampling programs such as Coring and Van Veen Grab Sampling (Phase 2a) and Remote Pump Mining (Phase 3a).

Refer **Figure 3** to **Figure 5** of the sampling techniques possible in shallow water with a single custom fit exploration and mining vessel, the vessel can even be modified to handle small scale Remote Dredge Pump Mining (**Figure 6**).

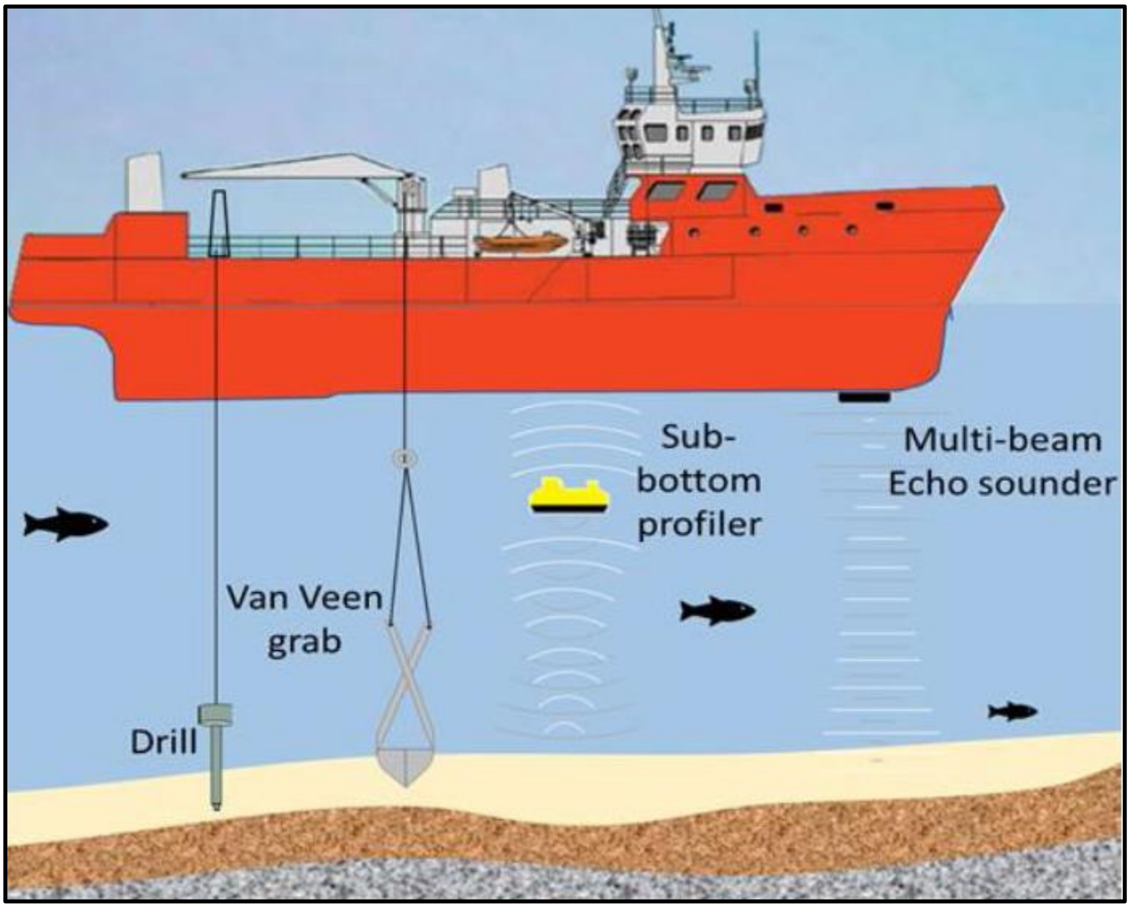


Figure 3: Illustration of sampling techniques possible in shallow water with a single custom fit exploration and mining vessel

Figure 4: An example of a sub-bottom profiler. Source: Seatronics

Figure 5: Left Example of a corer and right a Van Veen grab that works like a claw to grab sediment from the seafloor

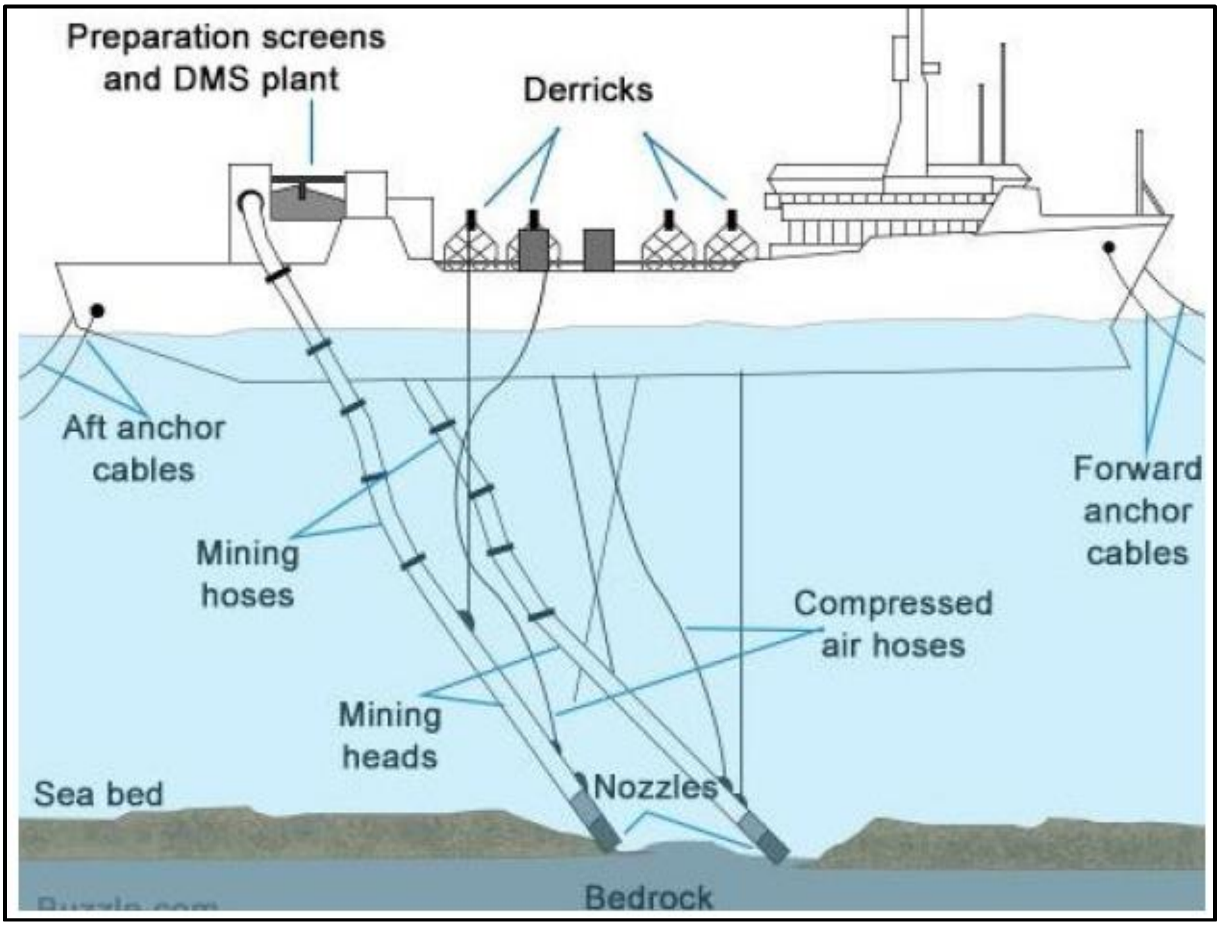


Figure 6: Illustration of remote pump mining (Source: http://globalextractionnetworks.com/about-diamonds/)

Prospecting in water deeper than 50m will be conducted by dedicated sampling vessels. For deeper water drill sampling activities (Phase 2b) a dedicated large diameter drilling sampling vessel, normally with an overall length of 114.4m, and gross tonnage of 4677t (**Figure 7**). Such a vessel is equipped with a subsea sampling tool, which can be operated in water depths up to 200m. The sampling tool comprises a 2.5m diameter drill bit operated from a drill frame structure (**Figure 8**).

For bulk sampling in deeper areas (Phase 3b) trenching would be undertaken by a seabed crawler, deployed off a dedicated mining vessel, normally with an overall length of 150m and a gross tonnage of 9111t (**Figure 9**). Such a vessel is equipped with a track-mounted subsea crawler (**Figure 10)** capable of working to depths up to 200m below sea level.

Figure 7: Example of a dedicated drill sampling vessel

Figure 8: Example of the 2.5 m diameter drill bit within the drill frame structure

Figure 9: Example of a dedicated sampling vessel

Figure 10: Example of a track-mounted sub-sea crawler

3.3.1 Geophysical Surveys Phase 1

Swath bathymetry and sub-bottom profiling will be the geophysical survey techniques employed during the proposed prospecting operations making use of:

- a multibeam echosounder designed to produce high resolution digital terrain models of the seafloor (**Figure 11**) by transmitting a 30kHz sounding in a wide swath below the vessel; and
- a parametric sub-bottom profiler (Topas system), which uses shallow (35 to 45kHz) and medium penetration (1 to 10kHz) "Chirp" seismic pulses to generate profiles up to 60m beneath the seafloor (**Figure 11**), thereby giving a cross section view of the sediment layers.

Sound levels from the acoustic equipment would range between 190 to 220dB re 1µPa at 1m. The proposed surveys would be undertaken in specific priority areas in the concessions, at water depths of between approximately 15 - 75m. The surveys would have a line spacing of between 100 to 1 000m apart. The total line kilometres to be surveyed is estimated at 600km. The planned duration for the proposed geo-physical surveys would be a total of 20 days per year over a four-year period.

In general terms, sound sources that have high sound pressure and low frequency will travel the greatest distances in the marine environment. Conversely, sources that have high frequency will tend to have greater attenuation over distance due to interference and scattering effects. It is for this reason that the acoustic footprint of the above-mentioned sonar survey tools is considered to be much lower than that of deeper penetration low frequency seismic surveys and in addition have lower sound pressure levels. It should be noted that a decibel is a logarithmic scale of pressure where each unit of increase represents a tenfold increase in the quantity being measured.

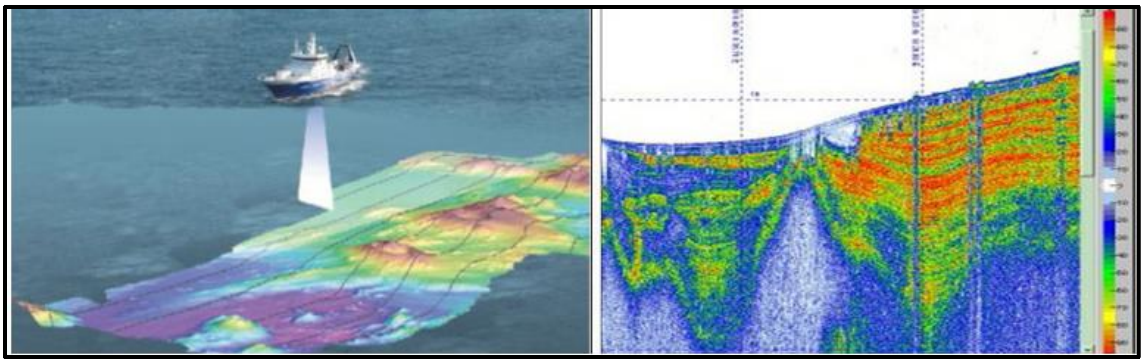


Figure 11: Swath bathymetry (left) and Sub-bottom profiling (right)

3.3.2 Drill Sampling Phase 2

For core samples in water depths less than 30m coring (e.g., vibrocoring) will be done

A vibrocorer consists of a core barrel in a landing frame with a vibrating motor on top.

The vibrocorer is landed on the seafloor, the motor turned on and the barrel penetrates the unconsolidated sediment. Once the core stops penetrating, the motor is turned off and the vibrocorer is raised back up to the deck. A PVC pipe is placed inside the core barrel prior to coring and the core sample is collected in this pipe. Cores can penetrate up to water depths of 50m and core samples up to 3m in length.

Core samples will be collected at 100-200 sites. A corer penetrates the seafloor to collect sediment samples used to determine the structure of the seafloor, sediment layers and types of sediment (i.e., sand, gravel and/ or rock and the hardness of the rock). This information is then used to engineer the drilling tool. Geotechnical sampling is also used to determine whether there are materials that can be mined in the area and whether it will be economically viable. The core samples will disturb a total surface area of 1.57m² and collect a total volume of 4.71m³.

Van Veen Grab sampling may also be used to supplement the vibrocoring: A Van Veen grab (clamshell bucket) collects sediment samples that are analysed to identify sediment types. Sampling will be done at 20-50 sites, disturb a total surface area of 5 square meters (m²) and a total volume of 1.5 cubic meters (m³).

For deeper water drill sampling activities would be undertaken using a dedicated drilling vessel to be sub-contracted. Such a vessel is equipped with a subsea sampling tool that comprises a 2.5m diameter drill bit operated from a drill frame structure, which is launched through the moon pool of the support vessel and positioned on the seabed.

The drill frame structure has a base of 6.5 x 6.5m, stands 23m high and weighs 147tons. The drill bit can penetrate sediments up to 12m depth above the bedrock. The sediments are fluidised with strong water jets and airlifted to the support vessel where they are treated in the onboard mineral recovery plant. All oversized and undersized tailings are discharged back to the sea on site.

A sample spacing of as little as 20m can be achieved by the dynamically positioned vessel. Depending on sea and the sub-seabed geotechnical conditions, up to 60 samples can be successfully taken per day. The samples would be undertaken at intervals of 50 to 500m. The total number of drill samples would be up to a maximum of 4 800. With the drill footprint of 5m², a total area of 2.4ha would be sampled.

3.3.3 Bulk Sampling Phase 3

Following analysis of the drill samples and establishment of a potential resource, bulk trench sampling may be conducted to confirm the economic viability of the resource for mining. It is proposed that up to ten trenches, each 180m long and 20m wide would be excavated within the concession area. Thus, the area to be disturbed would be 3.6 ha. The planned duration of the proposed bulk sampling would be a total of 14 days over a two-year period. It is noted that the trenches will not be contiguous but located in the prospective areas derived from the drill sampling results. The aim of the trench sampling is to determine the geotechnical characteristics of the footwall and overburden which is essential in establishing the optimal approach to mining in these areas.

For trenching in water depths less than 30m Remote Pump Mining may be used. The mining system typically comprises a suspended steel mining tool, suction hoses (10 - 18-inch diameter) and on-board dredge pumps. The mining tool consists of a steel pipe fitted with a mining head (or digging head), which has an opening fitted with grizzly/cross bars to allow sized gravel to pass through and prevent blockages of the suction hose system. The digging head that can also be fitted with high pressure water jetting nozzles to agitate the gravel on the seabed and improve mining efficiency. These jetting nozzles also serve to flush the digging head in the event of it becoming blocked.

The mining tool is suspended from an A-frame situated at the aft end or from davits along either side of the vessel. Some vessels may be fitted with dual mining systems, where mining tools are deployed from both the port and starboard sides. The mining tool suspension cable passes through a hydraulically controlled swell compensator system, which compensates for the vertical movements of the mining tool caused by the digging action. The vessel moves within a four-point anchor mooring system in order to cover the targeted seabed. Once the dredged material is pumped onboard it undergoes processing.

For trenching in deeper water activities would be undertaken using a dedicated sampling vessel to be sub-contracted. Such a vessel is equipped with a track-mounted subsea crawler capable of working to depths up to 200m below sea level. The crawler, which is fitted with highly accurate acoustic seabed navigation and imaging systems, and equipped with an anterior suction system, is lowered to the seabed and is con-trolled remotely from the surface support vessel through power and signal umbilical cables. Water jets in the crawler's suction loosen seabed sediments, and sorting bars filter out oversize boulders. The sampled sediments are pumped to the surface for shipboard processing. The area of the seabed to be sampled by the crawler can only be determined following analysis of drill samples and development of a resource model.

Shipboard processing consists of Primary Screening, Dense Media Separation (DMS) and Recovery Treatment (**Figure 12**).

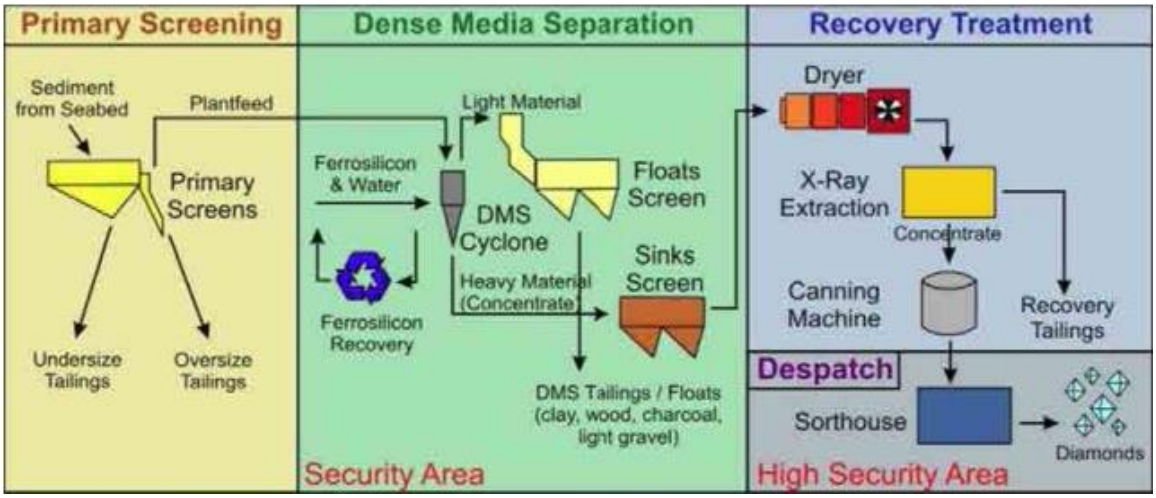


Figure 12: Flowchart of marine diamond gravel processing operations

The incoming slurry from the subsea tool via the slurry hose spooler will end up in the receiving box of the plant, here the velocity and the pressures are reduced, it also starts reducing the water content out of the slurry mass. The slurry mass will then proceed on a primary selection vibrating screen, where the undersize smaller than 1.25mm and particles larger than 19mm is separated.

The under size is transferred directly to the tailings moon-pool, the over size is transferred via a belt feeder which can establish the mass of the oversize if there is no water present in the oversize flow.

The plant feed material is pumped to the storage bins, as from where it can be selectively handled via a belt feeder system to the following treatment options, but depending on the soil conditions:

• Option 1 Transfer direct to the DMS unit.

• Option 2 Transfer to the Barmac crushing system and from there to the DMS unit.

All material from the feed preparation is transferred in the DMS feed hopper, from where it is introduced in the mixing box with the ferrosilicon, passing through the hydro cyclone VC 1220 spigot size 64mm, and the split between the floats and sinks (both over a common wash screen which is treated as restricted area), the floats are routed via a belt feeder to the tailings moon-pool, the sinks are routed to the final recovery section unit.

This final recovery section is a restricted access-controlled area, and only special authorized personnel have access to this area under supervision of security. The material introduced to the recovery module in one batch and passed as a single batch through to the flow sort double pass x-ray machine. Following the x-ray machine treatment, the final high concentrate is guided over a dryer system to the storage container in the glove box container. From here every individual sample is hand sorted, weighed, counted, first appraisal and packed in the drop save. The QA procedure will be followed that for each sample drilled, tracers larger than 4 mm are introduced in the crusher sump and the samples are not classed as clean and acceptable until 90% tracers been recovered in the glove box.

All tailings from the total mineral separation processes are re-introduced to the sea via the tailings moon-pool or conveyors.

Table 3: Bulk Sampling Activities

ACTIVITY		DETAILS		
Number of pits/trenches planned		10		
Dimensions of excavations	Number of excavations	Length	Breadth	Depth
	10	180m	20m	5m
Locality		Can only be determined following analysis of drill samples and development of a resource model		
Volume Overburden (Waste) per bulk sample area		18 000m³		
Volume Ore per bulk sample area		Estimated 10 carats per 100 tons		
Density Overburden		18 000m³ X SG of 2 = 36 000 tons		
Density Ore		NA for Diamonds		
Phase(s) when bulk sampling will be required		Phase 3 Following analysis of drill samples		
Timeframe(s)		Year 3 and 4		

3.3.4 Pre-/feasibility studies Phase 4

The project manager monitors the programme, consolidates and processes the data and amends the programme depending on the results. This is a continuous process throughout the programme and continues even when no prospecting is done on the ground.

Each physical phase of prospecting is followed by desktop studies involving interpretation and modelling of all data gathered. These studies will determine the manner in which the work programme is to proceed in terms of activity, quantity, resources, expenditure and duration.

3.4 Prospecting Works Programme

The different phases that will be exercised during the prospecting works are indicated above in 3.3.1 to 3.3.4. Refer to Table 4 below, which provides an indication of the typical programme followed in prospecting.

3.5 Vessel Emissions and Discharges

This section provides a brief description of the types of emissions and discharges that are expected from the proposed prospecting operations during normal operations. These would include:

- Discharges such as deck drainage, machinery space wastewater, sewage, etc.;
- Disposal of solid waste such as food waste; and
- Vessel machinery emissions.

These are discussed in more detail below.

3.5.1 Discharges to Sea

3.5.1.1 Vessel machinery spaces (bilges), ballast water and deck drainage

The concentration of oil in discharge water from any vessel (bilge and ballast) would comply with the MARPOL Regulation 21 standard of less than 15ppm oil in water. Any oily water would be processed through a suitable separation and treatment system to meet the MARPOL Annex I standard before discharge overboard. Drainage from marine (weather) deck spaces would wash directly overboard.

3.5.1.2 Sewage

South Africa is a signatory to MARPOL Annex IV Regulations for the Prevention of Pollution by Sewage from Ships and contracted vessels would be required to comply with the legislated requirements of this Annex.

3.5.1.3 Food (galley) wastes

The disposal into the sea of food waste is permitted in terms of MARPOL Annex V when it has been comminuted or ground and the vessel is located more than 3 nautical miles (approximately 5.5km) from land. Such comminuted or ground food wastes shall be capable of passing through a screen with openings no greater than 25mm. Disposal overboard without macerating can occur greater than 12 nautical miles (approximately 22km) from the coast. The daily discharge from a vessel is typically about 0.15 m3.

3.5.1.4 Detergents

Detergents used for washing exposed marine deck spaces would be discharged overboard. The toxicity of detergents varies greatly depending on their composition. Water-based detergents are low in toxicity and are preferred for use. Preferentially biodegradable detergents would be used. Detergents used on work deck space would be collected with the deck drainage and treated as described under deck drainage (see **Section 3.5.1.1** above).

3.5.1.5 Other

Vessels used during prospecting activities would have a certified antifouling coating system that is tin free.

3.5.2 Waste disposal to land

A number of other types of waste generated during the bulk sampling activities would not be discharged at sea but would be transported onshore for ultimate disposal. Waste transported to land would be disposed at a licensed municipal landfill facility or at an alternative approved site. Operators would co-operate with local authorities to ensure that waste disposal is carried out in an environmentally acceptable manner. A summary of these waste types generated by a vessel used during typical prospecting operations is given below.

3.5.2.1 General waste

This includes waste, paper, plastics, wood, glass, etc. Waste would be disposed of at an onshore landfill site in accordance with legal requirements.

3.5.2.2 Scrap Metal

Scrap metal would be stored and recycled / disposed of on land in accordance with legal requirements.

3.5.2.3 Drums and Containers

Empty drums containing residues, which may have adverse environmental effects (solvents, lubricating/gear oil, etc.), would be recycled / disposed of in a licensed landfill site in accordance with legal requirements.

3.5.2.4 Used Oil

This includes used lubricating and gear oil, solvents, hydrocarbon-based detergents and machine oil. Toxicity varies depending on oil type. All non-recycled waste oils would be securely stored, transported to shore and disposed of at a licensed landfill site, acceptable to the relevant authorities.

3.5.2.5 Chemicals and hazardous wastes

Disposal of any unexpected chemical and hazardous substance (e.g., fluorescent tubes, toner cartridges, batteries, etc.) would be undertaken on a case-by-case basis and in a manner acceptable to appropriate regulatory authorities.

3.5.2.6 Infectious wastes

Infectious wastes include bandages, dressings, surgical waste, tissues, medical laboratory wastes, needles, and food wastes from persons with infectious diseases. Only minor quantities of medical waste are expected.

Prevention of exposure to contaminated materials is essential, requiring co-operation with local medical facilities to ensure proper disposal. All such waste will be incinerated onboard or stored and brought onshore for disposal via a registered medical waste company.

3.5.2.7 Filters and filter media

This includes air, oil and water filters from machinery. Oily residue and used media in oil filters that may contain metal (e.g., copper) fragments, etc. are possibly toxic. Filters and media would be transported onshore and disposed of at a licensed landfill facility.

3.5.3 Discharges to air

Compliance with the requirements of Marpol Annex VI - Prevention of Air Pollution from Ships will be required for all vessel engines and where vessels are fitted with rubbish incinerators.

Table 4: Prospecting Program as per PWP (2022)

Phase	Activity	Skill(s) required	Timeframe	Outcome	Timeframe for out-come	What technical expert will sign off on the out-come?
1 Non – invasive	Regional scale, High-Resolu-tion geophysical surveys	Geologist Project Manager	20 days per year for 4 years	Maps, plan & report on previous work. Delineation of potential gravel resource.	Year 4	Geologist
2a Invasive	Shallow water Collection of core and grab samples	Geologist Project Manager	8 days per year for 4 years	Diamond Ore Characterization (DOC) study for metallurgical purposes	Year 4	Geologist
2b Invasive	Deep water Large diameter drill sam-pling					
3a Bulk Sampling	Shallow water Remote Pump Mining	Geologist Project Manager	1 month over a two-year period	Diamond Ore Characterization (DOC) study for metallurgical purposes and to allow the suffi-cient recovery of diamonds for evaluation and foot printing pur-poses.	Year 4	Geologist
3b Bulk Sampling	Deep water Remote Dredge (crawler) Mining					
4 Feasibility study	Final analysis, quality con-trol, database update and resource statement Application for mining right or final decommissioning and closure	Geologist Economist	Month 49-60	Feasibility study and decision making if results prove negative then decommissioning and final closure if results prove positive then continue with mining Mining right or Closure certifi-cate	Year 5	Project Manager

4 POLICY AND LEGISLATIVE CONTEXT

4.1 Table of Applicable Legislation and Guidelines

Table 5: Applicable Legislation and Guidelines

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT
Constitution of South Africa, specifically everyone has a right; a. to an environment that is not harmful to their health or wellbeing; and b. to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: i. prevents pollution and ecological degradation; ii. promote conservation; and iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.	Prospecting Right activities	The prospecting right activities shall be conducted in such a manner that significant environmental impacts are avoided, where significant impacts cannot all together be avoided, it will be minimised and mitigated in order to protect the environmental right of South Africans.
Minerals and Petroleum Resources Development Act (No 28 of 2002) [MPRDA] Section 24 (as amended) **MPRDA Regulations as amended by GNR349 of 18 April 2011.**	Application to the DMR for a prospecting right in terms of Sections 16 & 22.	The conditions and requirements attached to the granting of the Prospecting Right will apply to the prospecting activities. DMR is the Competent Authority (CA) for this NEMA application.
National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA]	Application to the DMR for Environmental Authorisation in terms of the 2014 EIA Regulations as amended by the 2021 EIA Regulations. Refer to **Table 6** for list of activities.	An Application for Environmental Authorisation must be submitted to DMR for an Environmental Authorisation (EA). The listed activities in **Table 6** that are triggered determine the Environmental Authorisation (EA) application process to be followed, which is an EIA for this Prospecting Right. The appropriate EA must be obtained before proceeding with any prospecting activities in terms of the prospecting right application. The compilation of this Scoping Report and the Public Participation Process is required in terms of NEMA.
National Environmental Management Act, 1998 (Act No. 107 of 1998): Financial Provisions Regulations in GNR 1147 (dated 20/11/2015), as amended by GNR 991 (dated 21/09/2018)	The Final Rehabilitation, Decommissioning and Mine Closure Plan included in **APPENDIX G: REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN, page 606.**	The purpose of these Regulations is to regulate the determination and making of financial provision as contemplated in the Act for the costs associated with the undertaking of management, rehabilitation, and remediation of environmental impacts from prospecting, exploration, mining, or production operations through the lifespan of such operations and latent or residual environmental impacts that may become known in the future.

		The Final Rehabilitation, Decommissioning and Mine Closure Plan included in **APPENDIX G: REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN, page 606.**
"Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Section 24(5) (a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation" ("the Protocols"), in GG 43110 (dated 20 March 2020 came into effect on 15 May 2020), and GN 320. Themes included in this GN are agriculture; avifauna; terrestrial biodiversity; aquatic biodiversity; noise; defense; and civil aviation. **Protocols in GG 43855 of GN No. 1150 dated 30 October 2020 provide for Terrestrial and Animal Plant Species.**	Screening Tool Report, and Site Sensitivity Verification Report is attached at **APPENDIX C: SCREENING & SITE SENSITIVITY VERIFICATION REPORT, Page 298.**	Refer to Section **8.1**. **APPENDIX C: SCREENING & SITE SENSITIVITY VERIFICATION REPORT, Page 298.** **Section 8.1** details the specialist compliance statements required to inform the EIA Phase, as per the requirements of the Protocols.
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) [NEMBA] **National list of ecosystems that are threatened and in need of protection, 2011 (in GN 1002 dated 2 December 2011)**	Section **8.2.4**.	There are no listed Critically Endangered, Endangered or Vulnerable ecosystems on site as per the screening tool report in **APPENDIX C: SCREENING & SITE SENSITIVITY VERIFICATION REPORT, Page 298..** As per **Marine Fauna Impact Assessment, page 396**, also refer to **section 8.2.4**: *"Despite the development of the offshore MPA network a number of 'Endangered' and 'Vulnerable' ecosystem types are currently 'not well protected' and further effort is needed to improve protection of these threatened ecosystem types (Sink et al. 2019) (Figure 70). Ideally, all highly threatened ('Critically Endangered' and 'Endangered') ecosystem types should be well protected. Currently, however, most of the Namaqua Sandy Mid Shelf and Namaqua Muddy Mid Shelf Mosaic are poorly protected receiving only 0.2-10% protection (Sink et al. 2019). Within concession 12B, the ecosystem types are all considered 'poorly protected'."*
National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)	Section **8.2.9**	In terms of Section 36 of the Act, the metropolitan and district municipalities are charged with implementing the AEL system. However, as the offshore area of activity and the Exclusive Economic Zone (EEZ) do not fall within the borders of any municipality or province of South Africa as set out in the Constitution, there is no formal means in terms of NEM: AQA by which application can be made for incineration from vessels in the offshore. Furthermore, the on-board incineration of waste is permitted in terms of the

		International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL), to which South Africa is a signatory. Thus, there is uncertainty of the applicability of NEM: AQA to offshore operations, given that MARPOL, an international convention, allows for the on-board incineration of waste and there is no formal implementing authority for AEL applications associated with offshore operations.
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Section 8.2.6, 8.2.7, 9.2, 9.3 & **Appendix E**.	A Marine Heritage Impact Assessment and a Palaeontological Report are included in **Appendix E, page 333 & 374**. These will be submitted to SAHRA and HWC for comment
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)	Section 3.5 & 11	MARPOL, an international convention, allows for the on-board incineration of waste and offshore waste management activities, such as those related to sewage.
Hazardous Substances Act (Act No. 15 of 1973)	Storage and control of hazardous substances to be included in EMPr.	The objective of the Act is to provide for the control of substances which may cause injury or ill health to or death of human beings due to their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the generation of pressure. In terms of the Act, substances are divided into schedules, based on their relative degree of toxicity and the Act provides for the control of importation, manufacture, sale, use, operation, application, modification, disposal and dumping of substances in each schedule. The reagent chemicals to be used in the mineral processing plant, as well as chemicals typically found in petroleum products (for example) benzene, are regulated in terms of this Act. The processing plant, chemical storage area, fuel storage facility and refueling bay, with all appropriate controls in place, will not conflict with the Act. The EMPr will provide details in this regard.
Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA)	Safety precautions to be taken into account by the Project Team in the prospecting planning.	The objective of the Act is to cover all aspects relating to health and safety of employees and other persons on the mine property. The Act places the responsibility on the mine owner for ensuring that the mine is designed, constructed and equipped in a manner which allows for a safe and healthy working environment.
Promotion of Administrative Justice Act, 2000 (Act 3 of 2000) [PAJA]	Decision by the Competent Authority	Gives effect to section 33 of the Constitution that requires that "*Everyone has the right to administrative action that is lawful, reasonable and procedurally*

		fair". All administrative actions must be based on the relevant considerations.
Marine Living Resources Act 18 of 1998 (MLRA)	Section 8	Although there are a number of declared MPAs off the West Coast, the Applicant does not intend prospecting in these areas and consequently there will be no impact on these MPAs.
National Environmental Management: Integrated Coastal Management Act 24 of 2008	Section 8	NEM: ICMA provides for the integrated management of the coastal zone, including the promotion of social equity and best economic use, while protecting the coastal environment. Chapter 8 of the Act establishes an integrated system for regulating the disposal of effluent and waste into the sea. Section 70 prohibits incineration at sea and restricts dumping at sea unless done so in terms of a permit and in accordance with South Africa's obligations under international law. As the Applicant does not intend on disposing effluent and waste into the sea, no authorisations are required in terms of NEM: ICMA.
Municipal Plans and Policies		
The sea concession area does not fall within the jurisdiction of any municipality.		
Standards, Guidelines and Spatial Tools		
Specialist Studies, Integrated Environmental Management, Information Series 4 (2002)	Section 12	This guideline was consulted to ensure adequate development of terms of reference for specialist studies.
Criteria for determining Alternatives in EIA, Integrated Environmental Management, Information Series 11 (2004)	Section **6**	This guideline was consulted to inform the consideration of alternatives.
Environmental Management Plans, Integrated Environmental Management, Information Series 12 (2004)	Part B, page 240	To be included in the EIR phase.
Environmental Impact Reporting, Integrated Environmental Management, Information Series 15 (2004)	Sections 9, 12	Sections 9, 12
Mining and Biodiversity Guideline: 2013 Mainstreaming biodiversity into the mining sector. Pretoria.	Section 9	The mitigation measures to address and mitigate the potential impacts of the prospecting will be included in the EMPr.
DEA Guideline on Need & Desirability (2017)	Section 5	Refer to Section 5
DEA Guideline on PPP DMR Guideline on Consultation with Communities and I&APs (undated)	Sections **7 & APPENDIX B: PUBLIC PARTICIPATION REPORT, Page 273**	Sections **7 & APPENDIX B: PUBLIC PARTICIPATION REPORT, Page 273**
DEAT Integrated Environmental Management Information Series 5: Impact Significance (2002)	Section 8, 9	Section 8, 9
DEAT Integrated Environmental Management Information Series 7: Cumulative Effects Assessment (2004)	Section 8, 9	Section 8, 9
SANBI BGIS databases (www.bgis.sanbi.org)	Baseline environmental descriptions in Section **8.2**	Used during desktop research to identify sensitive environments within the prospecting right area.

In addition to the foregoing, the Applicant must also comply with the provisions of other relevant conventions and legislation, which includes, amongst others, the following:

4.2 International Marine Pollution 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); and
- Convention on Biological Diversity (1992).

4.3 Other South African Legislation

- Carriage of Goods by Sea Act, 1986 (No. 1 of 1986);
- Dumping at Sea Control Act, 1980 (No. 73 of 1980);
- Hazardous Substances Act, 1983 and Regulations (No. 85 of 1983);
- Marine Living Resources Act, 1998 (No. 18 of 1998);
- Marine Traffic Act, 1981 (No. 2 of 1981);
- Marine Pollution (Control and Civil Liability) Act, 1981 (No. 6 of 1981);
- Marine Pollution (Prevention of Pollution from Ships) Act, 1986 (No. 2 of 1986);
- Marine Pollution (Intervention) Act, 1987 (No. 65 of 1987);
- Maritime Safety Authority Act, 1998 (No. 5 of 1998);
- Maritime Safety Authority Levies Act, 1998 (No. 6 of 1998);
- Maritime Zones Act 1994 (No. 15 of 1994);
- Merchant Shipping Act, 1951 (No. 57 of 1951);
- Mine Health and Safety Act, 1996 (No. 29 of 1996);
- National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004);
- National Environmental Management: Integrated Coastal Management Act, 2008 (No. 24 of 2008);
- National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003)
- National Heritage Resources Act, 1999 (No. 25 of 1999);
- National Ports Act, 2005 (No. 12 of 2005);
- National Water Act, 1998 (No. 36 of 1998);
- Occupational Health and Safety Act, 1993 (No. 85 of 1993) and Major Hazard Installation Regulations;
- Sea-Shore Act, 1935 (No. 21 of 1935);
- Sea Birds and Seals Protection Act, 1973 (No. 46 of 1973);
- Ship Registration Act, 1998 (No. 58 of 1998);
- South African Maritime Safety Authority Act, 1998 (No. 5 of 1998);
- South African Maritime Safety Authority Levies Act, 1998 (No. 6 of 1998); and
- Wreck and Salvage Act, 1995 (No. 94 of 1995).

4.4 Listed Activities

Table 6: Listed and Specified Activities

NAME OF ACTIVITY	AERIAL EXTENT OF THE ACTIVITY HA OR M²	LISTED ACTIVITY	APPLICABLE LISTING NOTICE	WASTE MANAGEMENT AUTHORISATION
The operation directly relates to prospecting of an offshore mineral resource (diamonds) and requires a prospecting right in terms of section 16 of the MPRDA. Prospecting is planned within Sea Concession area 12B using both non-invasive and invasive sampling activities, none of which require infrastructure. Sampling will be conducted in four phases to detect the presence of paleo-beach deposits, which are known from other concessions to contain diamondiferous gravels. Prospecting operations are expected to occur sporadically within the concession area. • Geophysical Surveys (Phase 1 Non-Invasive) including Swath bathymetry and sub-bottom profiling • Drill Sampling (Phase 2a Invasive) • Grab Sampling (Phase 2a Invasive) • Large Diameter Drilling (Phase 2b Invasive)	Total Area 11166.9Ha Core samples footprint ±1.57m², & volume ±4.71m³. Grab samples footprint ±5m² & volume ±1.5m³ LDD footprint ± 2.4ha	X	GNR 983 Listing Notice 1 of 2014 (dated 8 December 2014), as amended by GN 517 GG 44701 (dated 11 June 2021): Activity 20: Any activity including the operation of that activity which requires a prospecting right in terms of section 16 of the MPRDA, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the prospecting right.	NA
This operation requires permission in terms of Section 20 of the MPRDA for the removal and disposal of bulk samples of any minerals. The applicant requires maximum 360 000tons ROM for processing to obtain a representative sample for sufficient statistical analysis to complete a resource statement and to determine a grade (CPHT).	Bulk samples footprint ±3.6Ha & volume ±360 000 tons	X	GNR 984 Listing Notice 2 of 2014 (dated 8 December 2014), as amended by GN 517 GG 44701 (dated 11 June 2021): Activity 19: The removal and disposal of a mineral, which requires a permission in terms of section 20 of the MPRDA, as well as any other applicable activity as contained in Listing Notice 2, in Listing Notice 1 of 2014 or Listing Notice 3 of 2014, required to exercise the permission	NA
OTHER ACTIVITIES (Associated infrastructure and activities not considered to be listed activities)				
N/A				

5 NEED & DESIRABILITY OF THE PROPOSED ACTIVITIES

5.1 Mining and Biodiversity Guidelines (2013)

The Mining and Biodiversity Guidelines (2013)[1] state that: "*Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act) and is fundamental to the notion of sustainable development. International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa*."

The Department of Mineral Resources (DMR), as custodian of South Africa's mineral resources, is tasked with enabling the sustainable development of these resources. This includes giving effect to the constitutional requirement to "*prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*"[2].

The primary environmental objective of the MPRDA is to give effect to the "*environmental right*"[3] contained in the South African Constitution. The MPRDA further requires the Minister to ensure the sustainable development of South Africa's mineral resources, within the framework of national environmental policies, norms, and standards, while promoting economic and social development.

The Mining and Biodiversity Guidelines (2013) document identifies four categories of biodiversity priority areas in relation to their biodiversity importance and implications for mining & prospecting. The categories are: Category A: Biodiversity priority area which are legally protected and mining is prohibited; Category B: Highest Biodiversity importance – highest risk for mining; Category C: High Biodiversity Importance – high risk to mining; and "Category D: Moderate Biodiversity Importance" – moderate risk for mining. Category B and Category C require an environmental impact assessment process to address the issues of sustainability.

Refer to **Figure 13**, which shows the prospecting right area in relation the Mining and Biodiversity Guidelines database (SANBI BGIS). A section of the Sea Concession 12B is situated in an area classified as highly sensitive for mining.

5.2 Diamond Resources Supply and Employment Benefits

The full labour force is unknown at present but will include unskilled, semi-skilled, and skilled. Some services that will be outsourced and that will provide job security, will be environmental monitoring services and compliance officer, training, mining engineer, surveyor, consultant geologist, and main workshop.

[1] Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria.

[2] Constitution of the Republic of South Africa (No. 108 of 1996).

[3] Section 24 of the Constitution states that "everyone has the right (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

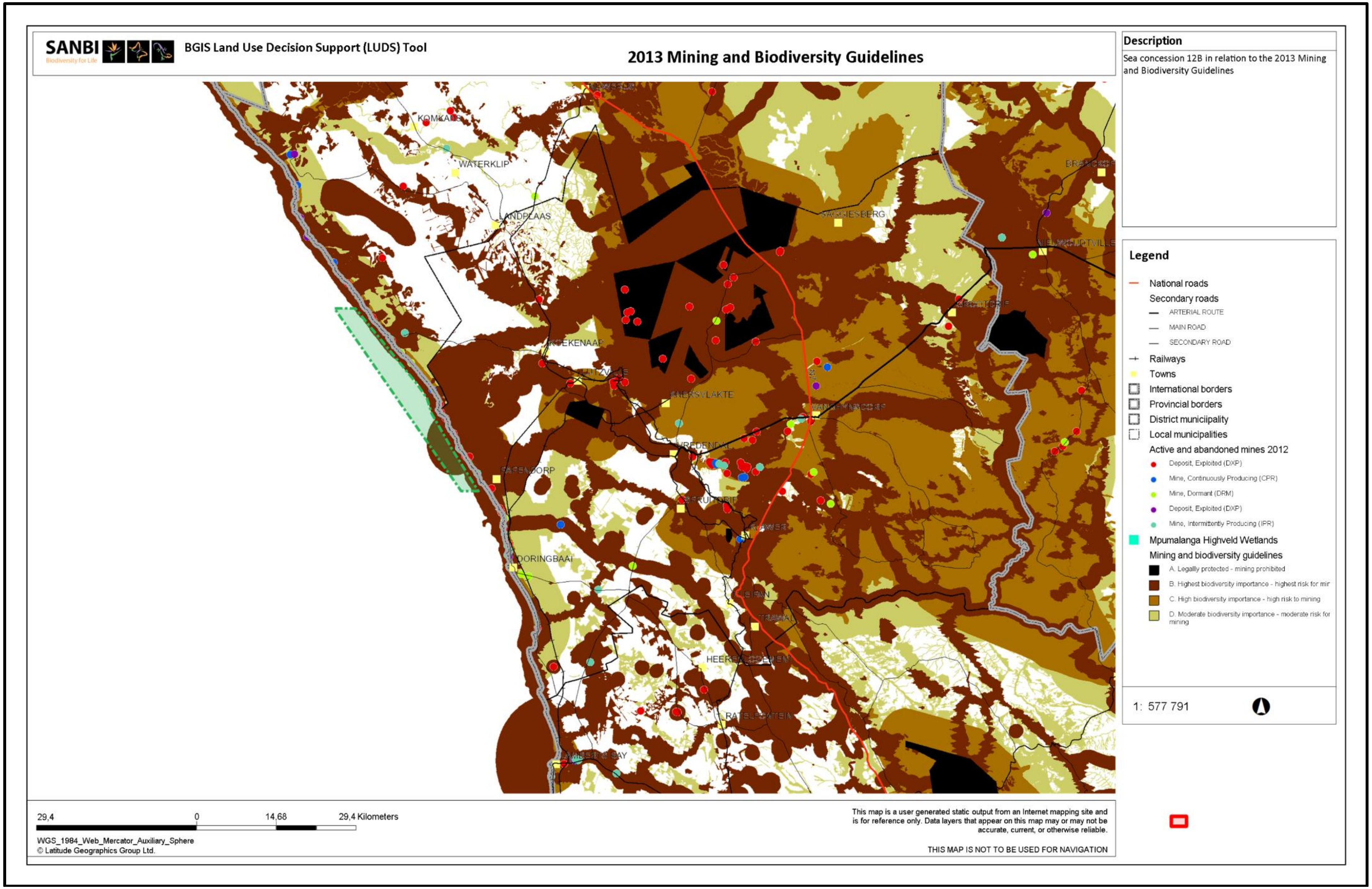


Figure 13: Sea Concession 12B in relation to the 2013 Mining & Biodiversity Guideline areas

5.3 DEA Guideline on Need and Desirability (2017)

As referenced in the DEA Guideline on Need and Desirability (2017), NEMA defines "*evaluation*" as "*the process of ascertaining the relative importance or significance of information, in the light of people's values, preferences and judgements, in order to make a decision.*" In evaluating each impact (negative and positive) in terms of each of the aspects of the environment, "*need and desirability*" must specifically be considered in the analysis of each impact of the proposed activity. However, to determine if the proposed activity is the best option when considering "*need and desirability*," it must also be informed by the sum of all the impacts considered holistically. In this regard "*need and desirability*" also becomes the impact summary with regard to the proposed activity. The impact summary will be included in the EIR.

These Guidelines state that: "*In considering the impact summary it must be remembered that ultimately the aim of EIA is to identify, predict and evaluate the actual and potential risks for and impacts on the geographical, physical, biological, social, economic and cultural aspects of the environment, in order to find the alternatives and options that best avoid negative impacts altogether, or where negative impacts cannot be avoided, to minimise and manage negative impacts to acceptable levels, while optimising positive impacts, to ensure that ecological sustainable development and justifiable social and economic development outcomes are achieved*".

The principles of *Integrated Environmental Management* (IEM) as set out in Section 23 of NEMA have been considered in this EIR, EMPr and Closure Report, as explained below.

- **Environmental management placing people and their needs at forefront of its concern, and serve their physical, physiological, developmental, cultural and social interests equitably** – This process will be undertaken in a transparent manner and all effort will be made to involve all the relevant stakeholders and Interested and Affected Parties. I.e., Public participation will be undertaken to obtain the issues / concerns / comments of the affected people for input into the process.
- **Socially, environmentally, and economically sustainable development** – All aspects of the receiving environment and how this will be impacted has been considered and investigated to ensure a minimum detrimental impact to the environment. Where the impact could not be avoided, suitable and effective mitigation measures were proposed to ensure that the impact is mitigated. i.e., this report along with the EMPr proposes mitigation measures which will minimise the negative impacts of the proposal on the environment.
- **Consideration for ecosystem disturbance and loss of biodiversity** – the prospecting site is located in a marine area, in close proximity to the Olifants River in an area earmarked for mining. Ecosystem disturbance and loss of biodiversity will be considered in the impact assessment. Rehabilitation, where applicable back to the natural state is a key component and will be undertaken in a phased manner as the prospecting activities progress. This report together with the EMPr and Closure Plan proposes mitigation measures which will minimise the impacts of the proposal on the environment.
- **Pollution and environmental degradation** – The implementation of recommendations made and proposed mitigations to be detailed in the EIR and Environmental Management Programme Report (EMPr), and Closure Plan will ensure minimum environmental degradation. Erosion and dust have been identified and detailed mitigation measures will be included in the EMPr in the EIA phase to minimise the impacts.
- **Landscape disturbance** – All aspects of the receiving environment and how this will be impacted has been considered and investigated at a scoping level to ensure a minimum detrimental impact to the environment. Where the impact could not be avoided, suitable and effective mitigation measures will be detailed in the EIR, EMPr and Closure Plan to ensure that the impact is mitigated.
- **Waste avoidance, minimisation, and recycling** – These aspects were considered and incorporated into the operational component of the project, and mitigation measures included in the EMPr.
- **Responsible and equitable use of non-renewable resources** – These aspects have been considered and there is not much scope to reduce the use of non-renewable resources, such as transport or the use of diesel and fuel for marine vessels.
- **Avoidance, minimisation and remedying of environmental impacts** - All aspects of the receiving environment and how this will be impacted have been considered and investigated to ensure a minimum detrimental impact to the environment. Where the impact could not be avoided, suitable and effective

mitigation measures will be proposed to ensure that the impact is mitigated. A number of mitigation measures will be detailed to minimise the impact of the proposal on the environment.

- **Interests, needs and values of Interested and Affected Parties** – This process has been undertaken in a transparent manner and all effort has been made to involve all the relevant stakeholders and Interested and Affected Parties (I&APs). The dSR was made available to all identified I&APs to obtain comments on the proposed development. The dEIAR will also be made available to all identified I&APs to obtain comments.
- **Access of information** – Potential Interested and Affected Parties were notified of the proposal and the availability of the Draft Scoping Report (dSR). They were also notified of having the opportunity to register as an I&AP. Organs of state will be kept informed during the course of the EIA process.
- **Promotion of community well-being and empowerment** – This process is being undertaken in a transparent manner and all effort is being made to involve all the relevant stakeholders and I&APs.

Potential impacts on the biophysical environment and socio-economic conditions have been assessed, and steps have been taken to mitigate negative impacts, and enhance positive impacts. Any mitigation measures from SAHRA will be included in the FEIR. Adequate and appropriate opportunity will be provided for public participation. Environmental attributes have been considered based on the available information, and environmental management practices have been identified and established to ensure that the proposed activities will proceed in accordance with the principles of IEM.

5.4 Minerals and Mining Policies and Plans in South Africa

In order for mining to continue to be a core contributor to the South African economy and in the pursuance of the sustainable development of the nation's mineral resources, it is necessary to identify new resources through prospecting activities, such as bulk sampling in the case of this application. A key intent of the Minerals and Mining Policy of South Africa states that Government will: "*promote exploration and investment leading to increased mining output and employment*" (Minerals and Mining Policy of South Africa, 1998). The Policy states further that:

- "*The South African mining industry, one of the country's few world-class industries, has the capacity to continue to generate wealth and employment opportunities on a large scale;*
- *Mining is an international business and South Africa has to compete against developed and developing countries to attract both foreign and local investment. Many mining projects in South Africa have tended to be unusually large and long term, requiring massive capital and entailing a high degree of risk; and*
- *South Africa has an exceptional minerals endowment, and in several major commodities has the potential to supply far more than the world markets can consume."*

In the more recently published Department of Minerals Resources and Energy (then Department of Mineral Resources) Strategic Plan 2014 – 2019, the foreword by the Minister of Mineral Resources and Energy notes that the Department "*will continue to promote mineral value addition to strengthen the interface between extractive industries and national socio-economic developmental objectives*" and "*contribute towards decent employment, inclusive growth and industrialisation of South Africa*".

The West Coast District Municipality's (WCDM) Integrated Development Plan 2017 – 2022 (2019) notes that it has "*a vast number of mineral resources, of which some are currently not being exploited*" and deems that "*mining could potentially make an increased economic contribution to the WCDM economy when these unexploited resources are utilised in future*".

In terms of the above, it is evident that the proposed prospecting activities are deemed to be important to the current national and provincial economies as future mining projects are a means to assist Government in meeting broader societal needs.

6 DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PREFERRED SITE, ACTIVITY & ALTERNATIVE

6.1 Details of all alternatives considered

With reference to the Site Plan provided as Figure 2 and the location of the individual activities on site, details are provided of the alternatives considered with respect to the:

(a) Property on which or location where it is proposed to undertake the activity;
(b) Type of activity to be undertaken;
(c) Design or layout of the activity;
(d) Technology to be used in the activity;
(e) Operational aspects of the activity; and
(f) Option of not implementing the activity.

Appendix 2 Section 2 (h)(i) of the EIA Regulations, 2014, requires that all S&EIR processes must identify and describe feasible and reasonable alternatives. Alternatives considered during the screening phases of the project are described below.

Alternatives, in relation to a proposed activity, are different ways of meeting the general purposes and requirements of the proposed activity, which may include alternatives to:

- the location where it is proposed to undertake the activity; and
- the technology to be used in the activity or operations alternative.
- No-Go alternative

6.2 Location or Site Alternatives

As the intention of the proposed prospecting operations is to determine the presence of economically viable diamond deposits that occur within Sea Concessions 12B, no further location alternatives are considered in the Scoping and EIA process.

The different prospecting activities being considered in the Scoping and EIA process are described in detail in Section 6.3 below.

6.3 Type of Activity

The Applicant is not the landowner, and therefore it would not be realistic for this company to propose another type of activity as their core business is prospecting or mining. This area has been earmarked as a sea concession area for prospecting/mining. Although the proposed prospecting activity takes place over an extended time period, the best post-mining land use alternative is to return the site to its natural state, where possible. The holder of a prospecting right is required to rehabilitate the environment affected by prospecting to its natural state or to another predetermined land use. Other activity alternatives have therefore not been considered as the purpose of the proposed project is to prospect for diamonds within the Sea Concession 12B application area as shown in **Figure 2**.

The application is for prospecting rights and no alternatives were considered.

6.4 Technology & Operations Alternatives

Nisarox (Pty) Ltd is proposing to prospect within Sea Concession area 12B using both non-invasive and invasive sampling activities, none of which require infrastructure. For the purpose of this study, non-invasive means not physically destructive and invasive means physical sampling that is destructive. As the activity is located offshore and comprises prospecting only, no land-based infrastructure will be required.

Prospecting will be vessel-based and will take place during spring and/or summer and when weather conditions are suitable, and seas are calm. It is anticipated to be completed within five (5) years. Sampling will be conducted in four phases and include a combination of non-invasive and invasive activities to detect the presence of paleo-beach deposits, which are known from other concessions to contain diamondiferous gravels. Prospecting operations are expected to occur sporadically within the concession area.

The non-invasive activities will include geophysical exploration (acoustic survey), data acquisition and analysis, while the invasive activities will include physical sampling (collection of core, drill and grab samples). A possible phase of bulk sampling (remote pump and dredge mining) may also be implemented depending on the results of initial sampling. The principal objective of the proposed prospecting activities is to discover and estimate the potential mineral resources for possible future mining.

Prospecting in shallow water up to 50m, that cover most of the concession area, will be conducted by a group owned custom fit survey vessel normally with an overall length of 45.15m and a gross tonnage of 498t. This will be a multipurpose customised survey vessel capable of High-Resolution geophysical surveys (Phase 1) and small-scale boat sampling programs such as Coring and Van Veen Grab Sampling (Phase 2a) and Remote Pump Mining (Phase 3a).

Refer to Figure 14 of the sampling techniques possible in shallow water with a single custom fit exploration and mining vessel, the vessel can even be modified to handle small scale Remote Dredge Pump Mining (**Figure 14** to **Figure 16**).

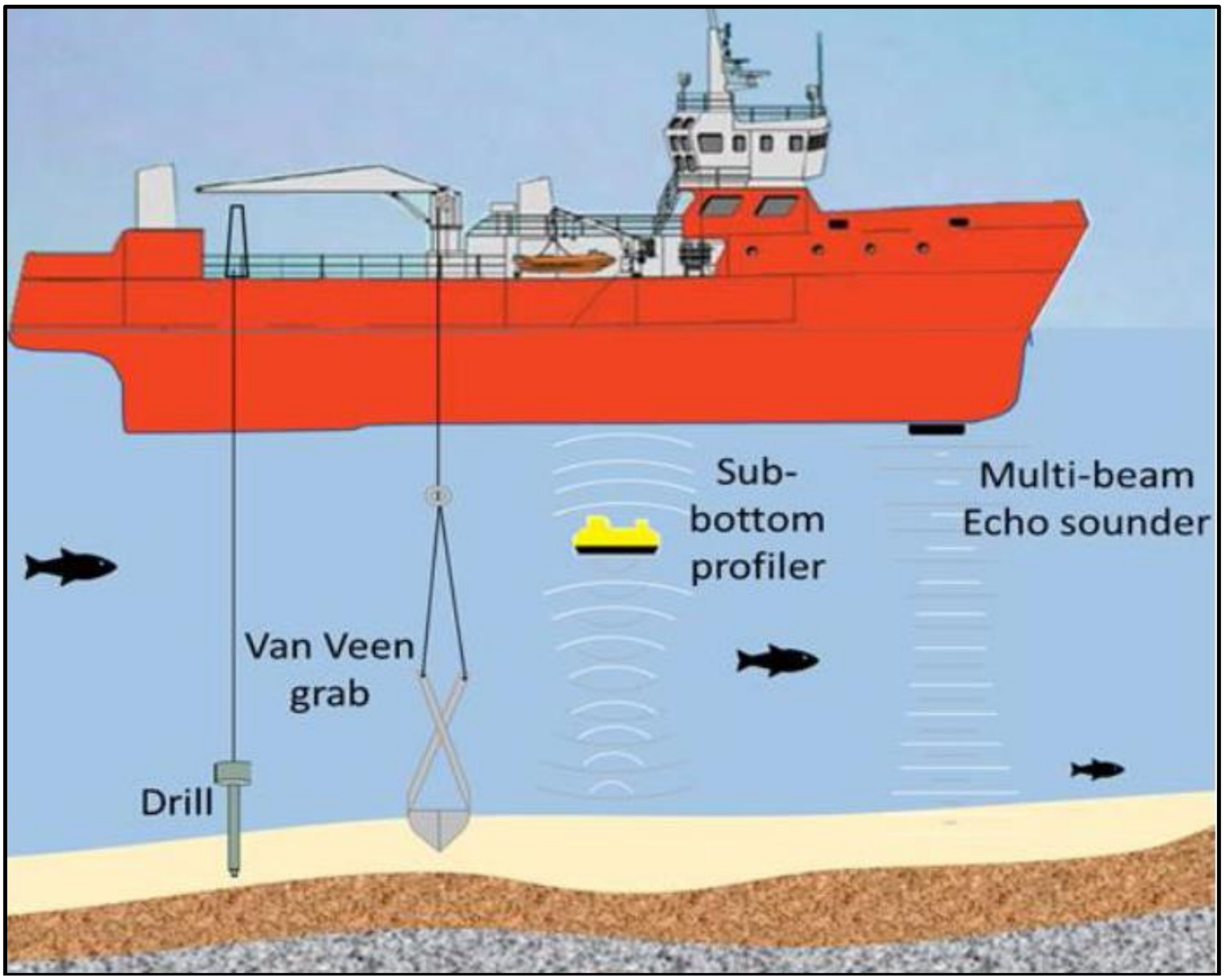


Figure 14: Illustration of sampling techniques possible in shallow water with a single custom fit exploration and mining vessel

Figure 15: An example of a sub-bottom profiler. Source: Seatronics

Figure 16: Left Example of a corer and right a Van Veen grab that works like a claw to grab sediment from the seafloor

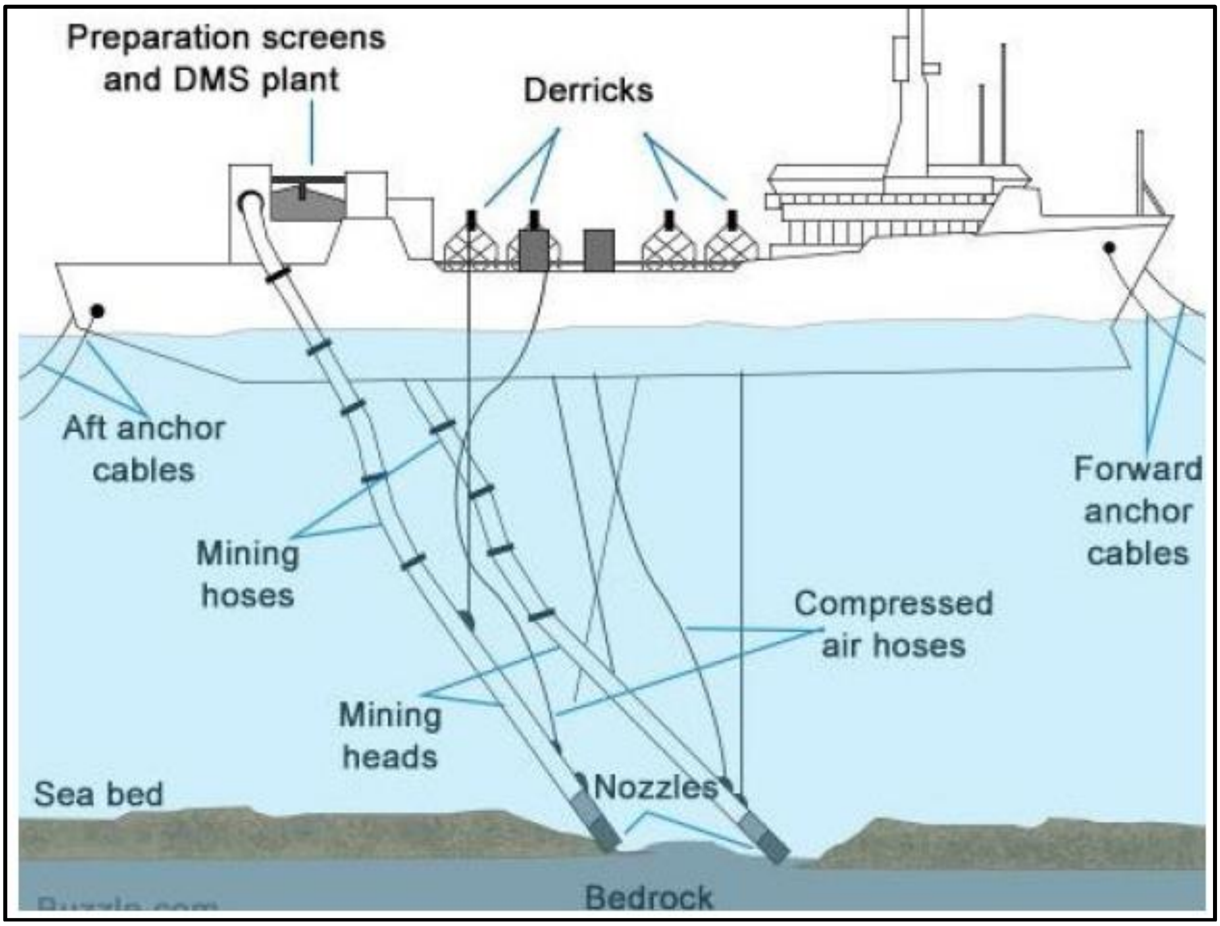


Figure 17: Illustration of remote pump mining (Source: http://globalextractionnetworks.com/about-diamonds/)

Prospecting in water deeper than 50m, will be conducted by dedicated sampling vessels. For deeper water drill sampling activities (Phase 2b) a dedicated large diameter drilling sampling vessel, normally with an overall length of 114.4m, and gross tonnage of 4677t (Figure 17). Such a vessel is equipped with a subsea sampling tool, which can be operated in water depths up to 200m. The sampling tool comprises a 2.5m diameter drill bit operated from a drill frame structure (**Figure 18**).

For bulk sampling in deeper areas (Phase 3b) trenching would be undertaken by a seabed crawler, deployed off a dedicated mining vessel, normally with an overall length of 150m and a gross tonnage of 9111t (**Figure 20**). Such a vessel is equipped with a track-mounted subsea crawler (**Figure 21**) capable of working to depths up to 200m below sea level.

Figure 18: Example of a dedicated drill sampling vessel

Figure 19: Example of the 2.5 m diameter drill bit within the drill frame structure

Figure 20: Example of a dedicated sampling vessel

Figure 21: Example of a track-mounted sub-sea crawler

6.4.1 Geophysical Surveys Phase 1

Swath bathymetry and sub-bottom profiling will be the geophysical survey techniques employed during the proposed prospecting operations making use of:

- a multibeam echosounder designed to produce high resolution digital terrain models of the seafloor (**Figure 22**) by transmitting a 30kHz sounding in a wide swath below the vessel; and
- a parametric sub-bottom profiler (Topas system), which uses shallow (35 to 45kHz) and medium penetration (1 to 10kHz) "Chirp" seismic pulses to generate profiles up to 60m beneath the seafloor (**Figure 22**), thereby giving a cross section view of the sediment layers.

Sound levels from the acoustic equipment would range between 190 to 220dB re 1µPa at 1m. The proposed surveys would be undertaken in specific priority areas in the concessions, at water depths of between approximately 15 - 75m. The surveys would have a line spacing of between 100 to 1 000m apart. The total line kilometres to be surveyed is estimated at 600km. The planned duration for the proposed geo-physical surveys would be a total of 20 days per year over a four-year period.

In general terms, sound sources that have high sound pressure and low frequency will travel the greatest distances in the marine environment. Conversely, sources that have high frequency will tend to have greater attenuation over distance due to interference and scattering effects. It is for this reason that the acoustic footprint of the above-mentioned sonar survey tools is considered to be much lower than that of deeper penetration low frequency seismic surveys and in addition have lower sound pressure levels. It should be noted that a decibel is a logarithmic scale of pressure where each unit of increase represents a tenfold increase in the quantity being measured.

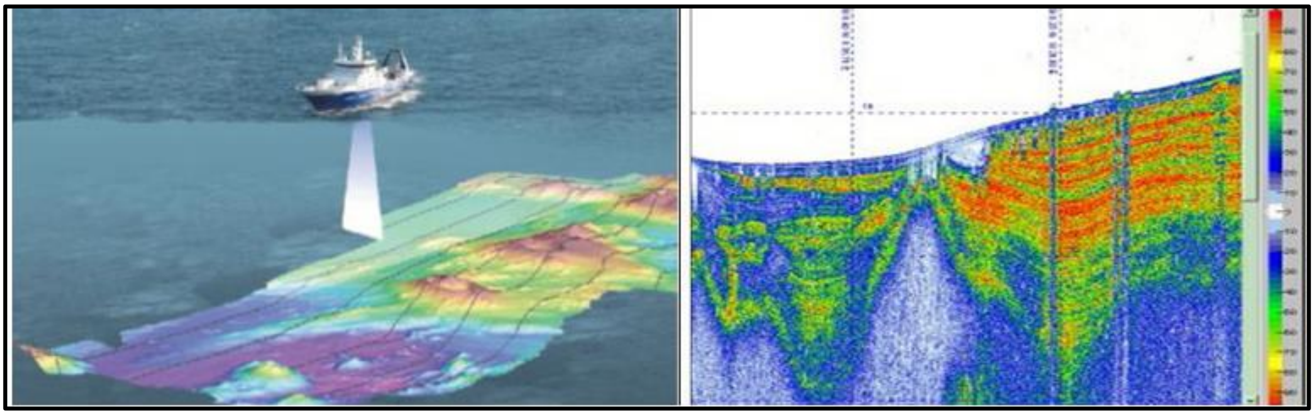


Figure 22: Swath bathymetry (left) and Sub-bottom profiling (right)

6.4.2 Drill Sampling Phase 2

For core samples in water depths less than 30m coring (e.g., vibrocoring) will be done

A vibrocorer consists of a core barrel in a landing frame with a vibrating motor on top.

The vibrocorer is landed on the seafloor, the motor turned on and the barrel penetrates the unconsolidated sediment. Once the core stops penetrating, the motor is turned off and the vibrocorer is raised back up to the deck. A PVC pipe is placed inside the core barrel prior to coring and the core sample is collected in this pipe. Cores can penetrate up to water depths of 50m and core samples up to 3m in length.

Core samples will be collected at 100-200 sites. A corer penetrates the seafloor to collect sediment samples used to determine the structure of the seafloor, sediment layers and types of sediment (i.e., sand, gravel and/ or rock and the hardness of the rock). This information is then used to engineer the drilling tool. Geotechnical sampling is also used to determine whether there are materials that can be mined in the area and whether it will be economically viable. The core samples will disturb a total surface area of 1.57m² and collect a total volume of 4.71m³.

Van Veen Grab sampling may also be used to supplement the vibrocoring: A Van Veen grab (clamshell bucket) collects sediment samples that are analysed to identify sediment types. Sampling will be done at 20-50 sites, disturb a total surface area of 5 square meters (m²) and a total volume of 1.5 cubic meters (m³).

For deeper water drill sampling activities would be undertaken using a dedicated drilling vessel to be sub-contracted. Such a vessel is equipped with a subsea sampling tool that comprises a 2.5m diameter drill bit operated from a drill frame structure, which is launched through the moon pool of the support vessel and positioned on the seabed.

The drill frame structure has a base of 6.5 x 6.5m, stands 23m high and weighs 147tons. The drill bit can penetrate sediments up to 12m depth above the bedrock. The sediments are fluidised with strong water jets and airlifted to the support vessel where they are treated in the onboard mineral recovery plant. All oversized and undersized tailings are discharged back to the sea on site.

A sample spacing of as little as 20m can be achieved by the dynamically positioned vessel. Depending on sea and the sub-seabed geotechnical conditions, up to 60 samples can be successfully taken per day. The samples would be undertaken at intervals of 50 to 500m. The total number of drill samples would be up to a maximum of 4 800. With the drill footprint of 5m², a total area of 2.4ha would be sampled.

6.4.3 Bulk Sampling Phase 3

Following analysis of the drill samples and establishment of a potential resource, bulk trench sampling may be conducted to confirm the economic viability of the resource for mining. It is proposed that up to ten trenches, each 180m long and 20m wide would be excavated within the concession area. Thus, the area to be disturbed would be 3.6ha. The planned duration of the proposed bulk sampling would be a total of 14 days over a two-year period. It is noted that the trenches will not be contiguous but located in the prospective areas derived from the drill sampling results. The aim of the trench sampling is to determine the geotechnical characteristics of the footwall and overburden which is essential in establishing the optimal approach to mining in these areas.

For trenching in water depths less than 30m Remote Pump Mining may be used. The mining system typically comprises a suspended steel mining tool, suction hoses (10 - 18-inch diameter) and on-board dredge pumps. The mining tool consists of a steel pipe fitted with a mining head (or digging head), which has an opening fitted with grizzly/cross bars to allow sized gravel to pass through and prevent blockages of the suction hose system. The digging head can also be fitted with high pressure water jetting nozzles to agitate the gravel on the seabed and improve mining efficiency. These jetting nozzles also serve to flush the digging head in the event of it becoming blocked.

The mining tool is suspended from an A-frame situated at the aft end or from davits along either side of the vessel. Some vessels may be fitted with dual mining systems, where mining tools are deployed from both the port and starboard sides. The mining tool suspension cable passes through a hydraulically controlled swell compensator system, which compensates for the vertical movements of the mining tool caused by the digging action. The vessel moves within a four-point anchor mooring system in order to cover the targeted seabed. Once the dredged material is pumped onboard it undergoes processing.

For trenching in deeper water activities would be undertaken using a dedicated sampling vessel to be sub-contracted. Such a vessel is equipped with a track-mounted subsea crawler capable of working to depths up to 200m below sea level. The crawler, which is fitted with highly accurate acoustic seabed navigation and imaging systems, and equipped with an anterior suction system, is lowered to the seabed and is controlled remotely from the surface support vessel through power and signal umbilical cables. Water jets in the crawler's suction loosen seabed sediments, and sorting bars filter out oversize boulders. The sampled sediments are pumped to the surface for shipboard processing. The area of the seabed to be sampled by the crawler can only be determined following analysis of drill samples and development of a resource model.

Shipboard processing consists of Primary Screening, Dense Media Separation (DMS) and Recovery Treatment (**Figure 23**)

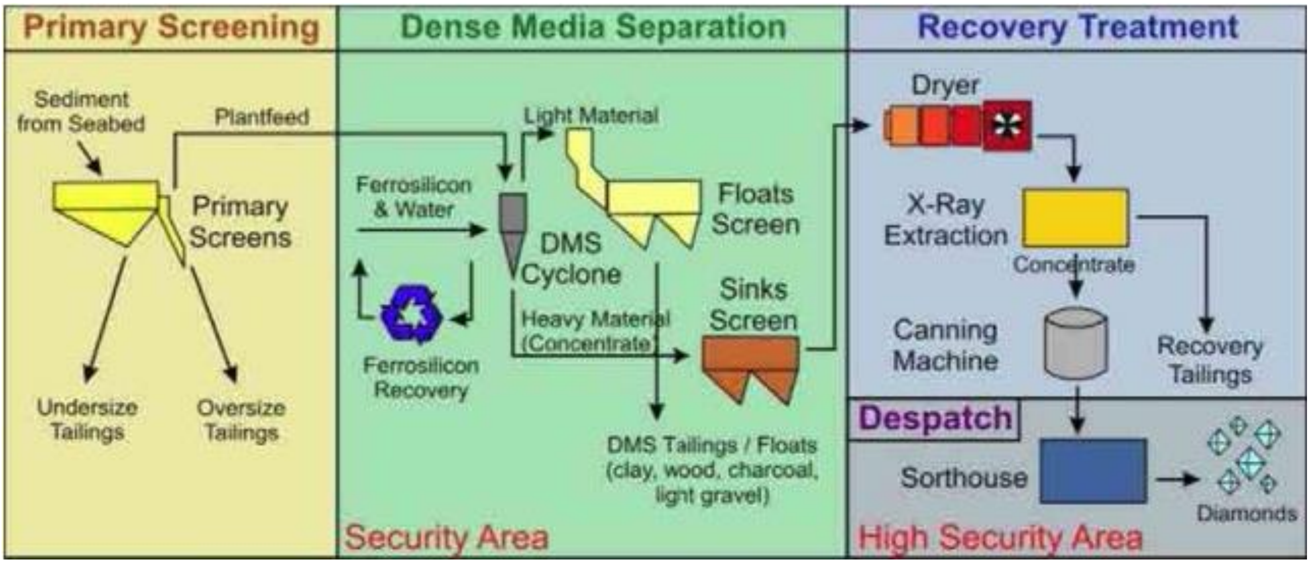


Figure 23: Flowchart of marine diamond gravel processing operations

The incoming slurry from the subsea tool via the slurry hose spooler will end up in the receiving box of the plant, here the velocity and the pressures are reduced, it also starts reducing the water content out of the slurry mass. The slurry mass will then proceed on a primary selection vibrating screen, where the undersize smaller than 1.25mm and particles larger than 19mm is separated.

The under-size particles are transferred directly to the tailings moon-pool, the oversize particles are transferred via a belt feeder which can establish the mass of the oversize if there is no water present in the oversize flow.

The plant feed material is pumped to the storage bins, as from where it can be selectively handled via a belt feeder system to the following treatment options, depending on the soil conditions:

• Option 1 Transfer direct to the DMS unit.

• Option 2 Transfer to the Barmac crushing system and from there to the DMS unit.

All material from the feed preparation is transferred in the DMS feed hopper, from where it is introduced in the mixing box with the ferrosilicon, passing through the hydro cyclone VC 1220 spigot size 64mm, and the split between the floats and sinks (both over a common wash screen which is treated as a restricted area), the floats are routed via a belt feeder to the tailings moonpool, the sinks are routed to the final recovery section unit.

This final recovery section is a restricted access-controlled area, and only authorized personnel have access to this area, under supervision of security. The material introduced to the recovery module in one batch and passed as a single batch through to the flow sort double pass x-ray machine. Following the x-ray machine treatment, the final high concentrate is guided over a dryer system to the storage container in the glove box container. From here every individual sample is hand sorted, weighed, counted, first appraisal and packed in the drop save. The QA procedure will be followed that for each sample drilled, tracers larger than 4mm are introduced in the crusher sump and the samples are not classed as clean and acceptable until 90% tracers have been recovered in the glove box.

All tailings from the total mineral separation processes are re-introduced to the sea via the tailings moonpool or conveyors.

The technology described above is currently used and the most practical option available with good results. There are therefore no other technology or operational alternatives for consideration.

6.5 The No-go Alternative

The No-Go Alternative will mean that the potential for increasing the supply of diamonds will not be realised. There will be no supply of diamonds to the local and international market, and no generation of much needed employment opportunities. South Africa and the Western Cape has a high unemployment rate, with the decline in mining a decade ago. The ongoing flow of revenue and employment security will continue to have a very positive spin-off locally and regionally.

6.6 Summary of Alternatives

The assessment of alternatives must at all times include the “no-go” option as a baseline against which all other alternatives must be measured. The “no go” alternative will therefore be further assessed together with the preferred and only alternative in the impact rating component of the EIA Phase.

The project site has been selected based on the fact that the site has been earmarked for prospecting/mining. The technology or operations of the mining and the associated existing infrastructure comprising the logistics, infrastructure and processing plants has been determined by the position of the mineral resource, and will continue to be applicable for Sea Concession 12B, as shown in Figure 2. The operational approach is practical and based on best practice to ensure a phased prospecting approach.

In summary therefore:

- **The Preferred Alternative is the Prospecting of Diamonds, as per the area depicted by Sea Concession 12B shown in Figure 2.**
- The preferred and only **location** alternative of the prospecting activity is as per **Figure 2**, which indicates the prospecting areas. No electricity powerline connections are required.
- The preferred **technology and operational** alternative are the use of geophysical surveys, drill sampling, bulk sampling.

The preferred alternatives described above will be rated in the impact assessment component in the EIA phase, together with the mandatory “no-go” alternative that must be assessed against as the environmental baseline, for comparison purposes in terms of significance through the life of the project. The public participation process initiated in the scoping phase informed the selection of alternatives for the detailed impact assessment in this EIA Phase.

7 PUBLIC PARTICIPATION PROCESS

7.1 Introduction

The public participation process has been conducted according to the requirements as prescribed in Regulations 40 to 44 of the EIA Regulations, 2014 (as amended). Full details of the public participation process conducted including copies of all supporting documents (e.g., the information provided to Interested & Affected Parties (I&APs) and the comments received) were included in **Appendix B** of the Final Scoping Report submitted to DMR. Any comments received as part of the dEIAR consultation will be included in **APPENDIX B: PUBLIC PARTICIPATION REPORT**, page 273.

The public participation process for the EIA Phase will also comply with the requirements of the Protection of Personal Information Act, 2013 (Act No. 14 of 2013) (POPIA) and the guidance document by the Department of Forestry, Fisheries and the Environment relating to registers of interested and affected parties and the inclusion of comments in reports.

The commencement of the EIA Phase is detailed in section 7.3 below.

7.2 Public Consultation on Draft Scoping Report

The project notification and availability of the Draft Scoping Report was distributed via email to relevant Government Departments, and other Interested and/or Affected Parties (I&APs). Included in the Project Notification Letter was a POPIA consent form, a copy of which is included in **Appendix B of the fSR.** The commenting period of 30 days on the Draft Scoping Report was from 14 September 2022 to 14 October 2022.

Although it was stated that a hard copy could be made available on request, no one requested a hard copy. A link to download the reports was included with the email notification dated 13 September 2022.

All public consultation documents, such as a copy of the advertisement placed in the local newspaper (Ons Kontrei); site notices placed in near towns; project notification; and proof of project notification, is included in **Appendix B of the** Final Scoping Report. Registered I&APs will be notified of the commencement of the EIA Phase.

7.3 The comment period on dEIAR

Registered I&APs (organs of state) will be notified of the commencement of the EIA Phase, via email notification and the notice letter of commencement of the EIA Phase. The letter also contained the following consent note: "*By registering as an Interested and Affected Party, you give your consent to the processing of personal information, as contemplated in the Protection of Personal Information Act, 2013 (Act no. 4 of 2013) for the purposes of this particular project. You also agree that by submitting a comment in response to the application for environmental authorisation, your contact details may be reflected, where required by legislation, in all reports that must be compiled and submitted to the general public, registered stakeholders, as well as the organ(s) of state that is/ are charged with consideration and decision-making in respect of this application."*

The comment period on the dEIAR will be from **24 February 2023 to 27 March 2023.**

A Public Meeting will be held in Ebenhauser on 16 March 2023.

Comments received during the commenting period will be included in sections 7.4 and **APPENDIX B: PUBLIC PARTICIPATION REPORT** and responded to in **Table 8**.

Any additional information and recommendations will be reflected in the relevant sections and indicated in blue.

7.4 Summary of Issues Raised by I&APs

7.4.1 Summary of Issues Raised by I&APs during Scoping Phase

Table 7: Summary of Issues Raised by I&APs during Scoping

Interested and Affected Parties List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated.
AFFECTED PARTIES					
Landowner					
Republic of South Africa	X				
Lawful occupier/s of the land					
N/A					
Landowners or lawful occupiers on adjacent properties					
N/A					
Municipal Councillor					
Municipal Manager: Matzikama Local Municipality	x	12/10/2022 (comments included below)			
Municipal Manager: West Coast District Municipality	x				
Municipality					
Matzikama Local Municipality	X	12/10/2022	Cognisance must be taken by the general Duty of Care, as stated in Section 28 of the National Environmental Management Act, 1998: "*Every person who causes, has caused, or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing, or recurring, or, in so far as such harm cannot reasonably be avoided or stopped, to minimize and rectify such pollution or degradation of the environment*" <u>Your attention is drawn to the Marine Spatial Planning Act (No.16 of 2018)</u> During a virtual Marine Spatial Planning Session held on 9 September 2021 by the Department of Forestry, Fisheries and the Environment stakeholders was sensitised on the Importance of the Marine Spatial Planning Act (No. 16 of 2018) which inter alia provides a framework for Marine Spatial Protected areas in South Africa, provides for the development of marine area plans and provides for the Institutional arrangements for the Marine Spatial Planning to govern the use of the ocean by and across multiple sectors. This act must be read in conjunction with the National MSP Framework (including the spatial management approach) and the National MSP Data and Information Report (NDIR) Therefore, the Department of Forestry, Fisheries, and the Environment (DFFE) has been designated by Cabinet as the lead authority to facilitate the MSP process. DFFE is thus currently busy collaborating with all authorities that have statutory responsibilities / mandates in the South African marine environment. As part of the Institutional Arrangements a MSP National Working Group has been established which is a technical group responsible for practical MSP implementation, particularly for the development of the marine area plans. This group is currently engaging stakeholders to ensure that the MSP process is transparent, coordinated and that stakeholders understand how they can be involved, contribute, and influence the plan's development. Stakeholder expertise and knowledge is used to bring together the best available knowledge base for the MSP		

			process which is prescribed in the MSP Act (Act No. 16 of 2018). The croup consists of officials from National Departments, Agencies, or other statutory bodies with marine mandates in the following sectors: • Transport • Tourism • Environment • Mineral and Petroleum Resources • Energy • Rural Development and Land Reform • Wild fisheries and Aquaculture • Research • Telecommunications • Marine Heritage • Naval Defence The MSP National Working Group engaged with provinces and municipalities during February and September 2021 regarding the development of the MSP. According to the Department (DFFE) the draft sector plans will be made available on the MSP website for stakeholders to comment in October 2021. Stakeholders was given 21 working days to comment on the draft marine sector plans. Following the incorporation of comments, there will be sector specific engagements to present the final draft to stakeholders. Spatial information contained within the draft sector plans (e.g., proposed sector priority zones) will be accessible via the OCIMS MSP Support Viewer. The Directors-General Committee on MSP will be responsible for: • Approving and referring marine area plans and accompanying reports to the Ministerial Committee on MSP • Providing recommendations to resolve user conflicts, including relocations, and trade-offs or other resolutions between sectors • Providing recommendations on facilitating cooperation between sector departments The Ministerial Committee on MSP will be responsible for: • Approving marine area plans submitted by the Directors-General Committee • Approving / providing recommendations to resolve user conflicts, including relocations, and trade-offs or other resolutions between sectors • Approving / providing recommendations on facilitating cooperation between sector departments It should be noted that there is some interconnectedness between the sector plans and some management actions, as they all ultimately contribute to the conservation of ecosystem function and patterns of biodiversity, which in turn leads to the conservation of a sustained supply of ecosystem goods and services delivered by the Olifants River Estuary. Planning for the protection and management of the Olifants River Estuary needs to be undertaken in the broader context of the area, giving due consideration to the links between the estuary and marine environment, as activities taking place in the adjacent marine ecosystem can have a direct impact on the health of the estuarine ecosystem. Referring to the above-mentioned Scoping Report the potential Negative Impacts overshadows the Positive impacts in the light of the above-mentioned information raises concern and should be addressed by the relevant sectors that will be impacted in the Marine Spatial Plan for the Matzikama (Olifants River Estuary area) concerned.	The National Oceans and Coastal Information Management System (OCIMS) Marine Spatial Planning (MSP) Support Viewer Decision Support Tool is not currently available and indicates that the date is not available on the server. If the data becomes available during the application, it will be incorporated into the EIA report. The proposed activities are situated 1km away from the high-watermark and the estuary mouth. Potential impacts on the estuary will be addressed in the Marine Ecology Impact Assessment as part of the EIA phase.	

			Your attention is drawn to the Importance of the conservation of Estuaries as well as a Situation Assessment on the Olifants River Estuary to take note of: Estuaries are recognised as particularly sensitive and dynamic ecosystems, and therefore require above-average care in the planning and control of activities related to their use and management. For this reason, the National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008, as amended by Act 36 of 2014) (ICM Act), via the prescriptions of the National Estuarine Management Protocol (the Protocol), require Estuary Management Plans to be prepared for estuaries to create informed platforms for efficient and coordinated estuarine management. Estuaries can provide a range of services that have economic or welfare value. In the case of the Olifants River estuary, the most important of these are the small-scale fishery, the recreational value, and the nursery value of the estuary. There may be additional values, such as carbon sequestration, but these are not well understood and are probably minor. Estuaries contain freshwater, terrestrial, and marine components, and are heavily influenced by activities in a much broader catchment and adjacent marine area and are affected by many policies and laws. The mouth of the estuary is permanently open. The Lutzville Bridge marks the extent of tidal water level fluctuations. The mean annual runoff reaching the estuary varies around 715 Mm^3/annum, some 33% less than in the natural state. Both low flows and winter flood peaks have been reduced, reducing the input of sediment to the estuary. This is thought to have deepened the channel, allowing tidal penetration further upstream. Unlike under natural conditions, when it was rare, this allows the estuary to experience a marine-dominated state for about six months of the year (November to April), replacing a situation where saline water only extended to the middle reaches. A freshwater-dominated state prevails during winter. However, current observations by local fishermen point to evidence of the expansion of sand banks around the river mouth. This could be the result of reduced river flow not scouring out the mouth area. Dumping / discharging of sediment on a small scale might not have an impact on the seabed but if this become a largescale operation the seabed around the estuary will be disturbed. Harder and estuarine round herring are now the dominant fish species in the estuary and elf also make up a significant proportion of fish numbers. Sardines also interact with the Benguela Current along the coast up to 1 km out to sea therefore the importance of protecting the areas around the Olifants River Estuary. Elevated noise levels will have an impact on fishes and whales when they migrate to the Coastal area of Matzikama from July to December and impact that the proposed prospect application will have on the above should be addressed in a formal study. Most estuary-dependent species are most abundant from 5-20 km from the mouth, in salinities of 0-20 ppt and water clarity less than 100 cm. Adequate management needs to be applied to the estuary, however, to ensure the survival of these species as they are highly mobile moving from the mouth right up to the top of the estuary. <u>Olifants River Estuary Community Conservation Area</u> In addition to adopting the extent of the CPZ and delineating the coastal management line around the Olifants River Estuary, it has been proposed that a portion of the lower estuary, at the mouth of the estuary be demarcated as a protected area in terms of legal mechanisms available in Acts	The proposed activity is for prospecting with bulk sampling. The findings of the Marine Ecology Impact Assessment will influence the position of prospecting as well as provide mitigation measures. These impacts will be addressed in the Marine Ecology Impact Assessment as part of the EIA phase. No activities will take place within the estuary. No activities will take place within the estuary, therefore this is not applicable. The concession area is 1km seawards from the estuary. Noted. It is unclear which Seal Island is referred to. Marine mineral concession zones were established by the Department of Minerals and Energy in 1994 on the west coast of South Africa, stretching from the Orange River mouth to Saldanha. The proposed activity will use on vessel equipment and most activities will take place below the surface 1km from the estuary, thus the visual impact will be minimal The zonation plan has already been set up by the competent authority who is custodian of Estuarine Management, and will be refined with input from the specialist findings.	

			such as NEMA: PAA and/or a Special Management Area (SMA) in terms of the ICM Act. This currently conceived as a Community Conservation Area (CCA) by local stakeholders. The proposed CCA extends from the mouth up to approximately one km upstream and ideally would include the banks of the estuary where sensitive and conservation worthy. This CCA would be zoned as a no-take fishing area and would restrict certain activities and use of mechanised vessels. Zonation will allow for partitioning of activities within the estuary, thus permitting their co-existence without one activity precluding or conflicting with another. However, the traditional fishing activities of the local communities will need to be considered in this zonation process. This zonation plan will need to align with the fisheries management plan that will be prepared in terms of the new Small-scale Fishing Policy. Such a zonation plan will also reduce management costs as it will focus activities in particular geographic areas and hence eliminate the need to always deploy management staff across the whole estuary. Once such a zonation plan has been developed and formally adopted, the boundaries between zones will be clearly demarcated on the ground with beacons and signage, indicating what restrictions are in force in each zone of the estuary. From a marine conservation point it is suggested that the prospecting marker area should be shifted to extend to the Northern bank of the estuary from Seal Island due to the sensitivity southwards of the Oifantsriver Estuary River Mouth. It is to be mentioned that the prospecting methods might disturb movement as there is an intertidal flow into the estuary that influence fish, crayfish, and other small marine species. The visual impact from tourists visiting the Estuary Mouth for recreation purposes and local fishermen catches that might be impacted raises concern. The Proposed way forward: Due to the sensitivity and uniqueness of the Olifantsriver and Estuary an inclusive, consultative process of refining a zonation plan, indicating the protected area, and activities appropriate in different zones, needs to be undertaken. It is imperative that the local fisher community be thoroughly consulted within the whole Public Participation Process and that meetings is held in the two Coastal towns of Ward 2 in the Matzikama area which indicates Papendorp and Doringbaai, as most members of the local community do not have internet access and do not speak English but only Afrikaans. Therefore, information should be given through to the local community in Afrikaans near to their place of residence as most members of the communities do not have means of transportation. The Municipality reserves the right to request further information and revise initial comments based on any additional information that might be received.	Noted. A Public Meeting or Open House is not practical in that area, however, the applicable I&AP's will be contacted where practical to be informed of the EIA Report. Notification letters and notice boards will also be included in Afrikaans..	
West Coast District Municipality	X				
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA)					
N/A	x				
Communities					
N/A					
Dept. Land Affairs	X				
Department of Rural Development and Land Reform					
Traditional Leaders					
N/A					
Dept. Environmental Affairs & Development Planning					

Dept. Environmental Affairs & Development Planning: Directorate: Development Facilitation	x	14/10/2022	1. The email notification of 14 September 2022 informing stakeholders of the availability of the Draft Scoping Report ("dSR") for comments refers. Please find consolidated comment from various directorates within the Department on the dSR and Plan of Study for Environmental Impact Assessment ("EIA") dated September 2022 that was available for download from online links provided by the environmental assessment practitioner ("EAP"). 2. Directorate: Development Management (Region 1) – Mr Ntanganedzeni Mabasa (Email: Ntanganedzeni.Mabasa@westerncape.gov.za; Tel.: (021) 483 2803): 2.1. Comments from all relevant organs of state should be obtained, included and adequately addressed in the Final Scoping Report ("fSR"). 2.2. It is imperative that the relevant fishing industry/associations also be consulted during the public participation process ("PPP"). 2.3. The PPP must comply with the requirements of regulation 41 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA") EIA Regulations, 2014 (as amended) and proof of compliance with all the steps undertaken must be included in the fSR. 3. Directorate: Development Facilitation – Ms Adri La Meyer (Email: Adri.LaMeyer@westerncape.gov.za; Tel.: (021) 483 2887): 3.1. Ongoing objections, interdicts and court cases against prospecting, exploration, reconnaissance and mining activities along the South and West Coasts of South Africa necessitate the need for wider consultation that what is required in terms of the legislative PPP requirements of the NEMA EIA Regulations, 2014 (as amended). Engagement with the local fishing communities is crucial. Since most of the fishing communities along the West Coast is Afrikaans speaking, it is imperative that engagements with the communities occur in both English and Afrikaans and that any future documents be made available in Afrikaans as well. 3.2. Offshore prospecting projects are quite controversial in South Africa, and for many stakeholders it is an emotional matter whilst for others, the potential impact on their livelihood is of great concern. As such, it is strongly recommended that the Plan of Study for EIA be amended to include the undertaking of a Social Impact Assessment during the environmental impact reporting ("EIR") phase. 3.3. A Social Impact Assessment undertaken for a recent reconnaissance permit application along the West Coast (courtesy of Equispectives Research & Consulting Services dated September 2022) noted the following: "A great source of concern for the fishing communities is the effect of cumulative impacts on their livelihoods and sense and spirit of place. There are a number of applications in process as well as approved applications relating to seismic surveys, mining, and oil and gas exploration in the West Coast area. There are also existing mining activities, significant shipping traffic and commercial fishing taking place in the ocean. The concern is that at some stage a tipping point will be reach where the marine life no longer recovers from the activities in the ocean or take a long time to recover to the extent that it would no longer be viable to make a living from the sea in those areas." Furthermore, it is noted that: "Although the marine fauna and fisheries specialists have indicated that the impacts on the marine fauna would be negligible, the communities, with generations of experience in the ocean, fear that the behaviour of the fish will change and that this would affect their catch rates and consequently their livelihoods. What is	2.1 All comments received have been included and addressed in Appendix B of the fSR. 2.2 A Public Meeting or Open House is not practical in that area, however, the applicable I&AP's will be contacted where practical to be informed of the EIA Report. Notification letters and notice boards will also be included in Afrikaans. Noted, refer to Appendix B of the fSR. 3.1 A Public Meeting or Open House is not practical in that area, however, the applicable I&AP's will be contacted where practical to be informed of the EIA Report. Notification letters and notice boards will also be included in Afrikaans. 3.2 Noted. It is not intended to undertake such a study, unless required by DMRE. 3.3 Refer to 3.1 and 3.2 above.	

			seen as a minor impact in a large ecosystem may be experienced as a major impact by an individual. The marine fauna might not be affected greatly, but the fishing community fear that marine fauna might change its behaviour in response and that is a main concern from a social perspective." The need for wider consultation, especially with the local fishing community, and the need for a Social Impact Assessment is thus crucial. 3.4. It is noted that only a Marine Ecology Impact Assessment, Offshore Palaeontological Impact Assessment and a Maritime Archaeology Impact Assessment will be undertaken during the EIR phase. It is strongly recommended that a detailed Underwater Acoustics Modelling Assessment be undertaken for the proposed prospecting activities to assist with the assessment of potential noise impacts on marine faunal species. Alternatively, the Marine Ecology Impact Assessment must include a detailed section on underwater noise impacts. 4. Directorate: Biodiversity and Coastal Management – Mr Ryan Apolles (Email: Ryan.Apolles@westerncape.gov.za; Tel.: (021) 483 2817): 4.1. It is noted that the closest shoreward boundary of Concession Area 12B is approximately 1km seaward from the high watermark of the sea, with the southernmost shoreward boundary adjacent to the Olifants River Estuary mouth, which runs approximately 35km northward and parallel to the coastline. Given the ecological importance and the sensitivities of estuaries, especially the Olifants River Estuary, a precautionary approach must be considered within the southernmost concession portion area closest to the estuary mouth and in areas of proximity to it. 4.2. Presently it seems that the conclusiveness of scientific knowledge is currently being contested, as considered in the Western Cape High court judgement in the case of Christian John Adams & Others v Minister of Mineral Resources and Energy & Others (case number: 1306/22) where applicants in this matter presented the argument that cumulative impacts of seismic surveys have not been studied in South Africa and that the impact on fish assemblages was difficult to interpret. The court case also highlighted the need to adequately engage with impacted communities, which may include smallscale fishing communities in the PPP, using modes of communication that would adequately reach targeted fishing communities. 4.3. The Plan of Study for EIA currently proposes a Marine Ecology Impact Assessment, Offshore Palaeontological Impact Assessment and a Maritime Archaeology Impact Assessment. Consideration should also be given to specifically appoint a specialist to assess the impact on small-scale fishing communities that may be accessing various areas in the Concession Area. 4.4. It is recommended that a Strategic Environmental Assessment ("SEA"), based on spatial planning principles, be undertaken to assess and manage potential cumulative impacts in a holistic manner and to identify and implement regional level mitigation measures. The competent authority must take cognisance of this recommendation to undertake a SEA to assist specialists and EAPs to accurately assess cumulative impacts. 4.5. This Directorate does not support further reconnaissance, exploration, prospecting, or mining activities of the sea floor until such time that sufficient and strategic level information is available on the cumulative impacts of these activities so that this Directorate is able to apply its	3.4 The Marine Ecology Impact Assessment will include a detailed section on underwater noise impacts. This will be included in the EMPr as part of the EIA phase. 4.1 A Public Meeting or Open House is not practical in that area, however, the applicable I&AP's will be contacted where practical to be informed of the EIA Report. Notification letters and notice boards will also be included in Afrikaans. 4.3 Noted. It is not intended to undertake such a study, unless required by DMRE. 4.4 The SEA needs to be compiled by the competent authority. 4.5 Noted.	

			mind and provide informed comments on these applications. This notwithstanding, this Directorate awaits the Draft EIA Report for further comments. The Department reserves the right to revise initial comments and request further information based on any or new information received.		
Other Competent Authorities affected					
Department of Water and Sanitation (DHSW&S)	X				
SAHRA	X				
Cape Nature	X				
Department of Environment, Forestry and Fisheries	X				
SAHRA	X	15/9/2022	The South African Heritage Resources Agency would like to thank you for submitting the Draft Scoping Report for the Proposed Prospecting Right with Bulk Sampling over Sea Concession 12B, Western Cape, South Africa. In terms of the National Heritage Resources Act, No 25 of 1999 (NHRA), Sections 2 and 35 stipulates that any wreck, being any vessel or aircraft or any part thereof older than 60 years old lying in South Africa's territorial waters or maritime cultural zone is protected and falls under the jurisdiction of SAHRA's Maritime and Underwater Cultural Heritage Unit. These heritage sites or objects may not be disturbed without a permit from the relevant heritage resources authority. The proposed work consists of four activities and their associated studies, namely non-intrusive geophysical survey followed by intrusive drilling, core sampling and bulk sampling. The bulk sampling will be the most intrusive phase with up to 10 proposed trenches excavated which will result in the disturbance of approx. 3.6 hectares. The need for specialist studies including an offshore Palaeontological Impact Assessment and Maritime Archaeology Impact Assessment has been identified in the dSR which states that these will be included in the EIA phase. SAHRA supports this recommendation. The maritime archaeology impact assessment must be undertaken by a suitably qualified Maritime Archaeologist and must include mitigation and management measures to address any possible threat. If any shipwrecks are identified during the survey SAHRA must be informed of any such discovery, this management measure must be inserted into all project reports. Survey data is a valuable resource in adding to our knowledge of South Africa's maritime history. Please note that in the Acronyms and Abbreviations table on page viii, SARHA is listed as South African National Heritage Resources Agency, the word national should be removed and it should read South African Heritage Resources Agency. It has also been noted in Section 4, Table 5 Applicable Legislation and Guidelines, that under the National Heritage Resources Act, (Act 25 of 1999) section on page 18 it states that the marine heritage impact assessment and palaeontological report will be sent to SAHRA and HWC for comment. Please note that as the proposed project lies below the High-Water Mark, it falls solely within the mandate of SAHRA and therefore a comment from HWC is not required. All updates and/or changes to the project, supporting documentation, correspondence, reports, or any other work relating to the project must be uploaded to the case on SAHRIS to provide SAHRA with the opportunity to comment. SAHRA does not accept emailed documents or hard-copy documents received via post.	Noted. Noted. SAHRA will be informed if any are identified. This has been amended in the fSR. The dSR was uploaded to SAHRIS and was not distributed to HWC for comment. Noted.	
Department Oceans and Coast	X	18/10/2022 The commenting period	The Oceans & Coasts (O&C) Branch of the Department of Forestry, Fisheries, and the Environment (DFFE) appreciates the opportunity granted to comment on the Draft Scoping Report For The Proposed Prospecting Right And Bulk	As This comment was received on 18/10/2022, after the conclusion of the PPP on 14/10/2022, this comment was not submitted as part of the fSR on 20/10/2022.	

		concluded 14/10/2022, therefore this comment was not included as part of the fSR	Sampling For Diamonds Over Sea Concession 12B, Western Cape.This Branch has provided recommendations in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), ("NEMA") and the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) **("ICM Act**").		
			1. The Branch O&C has the mandate to ensure the holistic management of the coast and estuarine areas as an integrated system and promote coordinated coastal management. It ensures that the ecological integrity, natural character, and the economic, social, and aesthetic value of the coastal zone are maintained to ensure that people, properties, and economic activities are protected against the impacts of dynamic coastal processes.	1. Noted	
			2. Guided by the principles of integrated coastal management, this Branch continues to strive for environmental sustainability and socially justified sharing of benefits derived from a resource-rich coastal area without compromising the ability of future generations to access those benefits. This Branch will come to a decision on this application following the review of the Marine Ecology Impact Assessment, Fisheries Impact Assessment/ Socioeconomic Impact Assessment and Archaeological cultural, and Paleontology Impact Assessment	2. Noted. A Marine Ecology Impact Assessment, Archaeological cultural, and Palaeontology Impact Assessment was conducted for the EIA phase. Refer to Appendix E, page 333.	
			3. Further Clarity is sought from the EAP on the following aspects:		
			3.1 The report stipulates that the concession is situated off the Olifants River mouth and extends approximately 25 kilometers northward and two kilometers southward from the river mouth. The vibracore is landed on the seafloor, the motor turned on and the barrel penetrates the unconsolidated sediment. Therefore, potential impacts of multi-beam bathymetry and or sub-bottom profiler noise / pulses on marine fauna; impacts relating to physiological injury, behavioural avoidance of the survey area, masking of environmental sounds and communication, and indirect impacts due to effects on prey are anticipated.	3.1 Impacts on marine and estuary life have been assessed in the Marine Ecology Impact Assessment. Refer to Appendix E, page 396.	
			(a) While this Branch notes that no Marine Protected areas are in concession 12B, it is worth noting that the Namaqualand coastline has been subjected to decades of disturbance by shore-based diamond mining operations which have resulted in a range of long-term, cumulative, and unintended impacts on marine ecology. Majority of the coastal habitat types in Namaqualand and benthic habitats are rated as 'critically endangered' (Lombard et al. 2004; Sink et al. 2012). To further add to the complexity, the Benguela Current Commission (BCC) and its member states have identified several Ecologically or Biologically Significant Areas (EBSAs) both spanning the border between Namibia and South Africa and along the South African West and South Coasts, with the intention of implementing improved conservation and protection measures within these sites. Therefore, necessitating some rigor in the evaluation of impacts versus the merits of this development proposal. This Branch will make further inputs upon review of the Marine Ecology Impact Assessment.	(a) Noted. A Marine Ecology Impact Assessment, Archaeological cultural, and Palaeontology Impact Assessment was conducted for the EIA phase. Refer to Appendix E, page 333	
			3.2 The report further outlines that it is anticipated that the proposed prospecting would be completed within five (5) years with the planned duration for the proposed geo-physical surveys in a total of 20 days per year over a four-year period. The report further details that the surveys would have a line spacing of between 100 to 1 000m apart, with a total line of about 600 kilometers of an areas space to be surveyed. Therefore, the proposed exploration activities and the	3.2 As per the Marine Ecology Impact Assessment, activities are only active in 2C, 3C, 6C, which are located way North-West of Sea Concession 12C. The report also states: "*There are many other mineral rights holders in the South African nearshore and offshore environment, but most of these are not undertaking any exploration activities at present or would be concurrently with the proposed prospecting operations.* *The most reliable guage of cumulative pressures is provided by Sink et al. (2019) and Harris et al. (2022). The map was generated as part of the NBA 2018 by doing a cumulative pressure assessment in which the impact of both current and historical ocean-based activities on marine biodiversity was determined by spatially evaluating the intensity of each*	

			presence of the drill/bulk sampling vessel with the associated 500m safety zone could interfere with other prospecting, mining, and exploration activities in the area. A comprehensive assessment which details the anticipated advantages and the disadvantage to each sector is required. This could be beneficial for decision-making in terms of quantifying the level of impact to each industry and scope out potential user conflicts that could be resulted by the approval of the proposed activities contained in this application.	*activity and the functional impact to, and recovery time of, the underlying ecosystem types (Figure 96, left). Based on the severity of modification across the marine realm, a map of ecological condition was generated (Figure 96, right). From this it can be determined that the concession area is located in an area experiencing moderate cumulative impacts and that the ecological condition is therefore moderately modified. Coastal and nearshore mining, linefishing, the small pelagic industry, and rock lobster harvesting were identified as the main contributors to cumulative impacts (Harris et al. 2022). "* Therefore the 500m safety zone will not interfere with other prospecting, mining or exploration activities in the area. 3.3 Prospecting will take place outside of the fishing seasons, to ensure impacts to the fishing activities are minimised.	
			3.3 The report correctly identifies that the West Coast boats an active commercial and subsistence fisheries industry of high economic value and overall tonnage of landings in demersal (bottom) trawl and long-line fisheries targeting the cape hakes Merluccius paradoxus and M. capensis, and the pelagic purse-seine fishery targeting pilchard (Sardinops sagax), anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whitheadii*). It further outlines that secondary commercial species in the hake-directed fisheries include an assemblage of demersal (bottom-dwelling) fish of which monk fish (*Lophius vomerinus*) and snoek (Thyrsites atun) are the most important commercial species. Other fisheries active on the West Coast are the pelagic long-line fishery for tunas and swordfish and the tuna pole and traditional linefish sectors. West Coast rock lobster (*Jasus lalandi*) is an important trap fishery exploited close to the shoreline (waters shallower than 100m) including the intertidal zone and kelp beds off the West Coast. However, a Fisheries Impact Assessment to advise on the potential impacts on fisheries and communities primarily dependent on fishing as a livelihood strategy has not been included. A Fisheries Impact Assessment is recommended to advise on this aspect which is equally central to decision-making.	3.4 This will be included as mitigation measures in the EMPR.	
			3.4 The report details that the prospecting will be vessel-based and will take place during spring and/or summer and when weather conditions are suitable, and seas are calm. The timing of seismic survey activity in concession 12B should be confined to seasons when cetaceans are scarce to ensure minimal disturbance.	3.5 These have been assessed by the Marine Ecology Impact Assessment. Refer to Appendix E, page 396.	
			3.5 The report describes that the proposed surveys would be undertaken in specific priority areas in the concessions, at water depths of between approximately 15 - 75m. The report further details that Prospecting operations are expected to occur sporadically within the concession area. The environmental Assessment Practitioner is urged to further report on the anticipated long-term, cumulative impacts and unintended impacts these proposed activities would have on marine ecosystems and the fisheries sector.	3.6 Noted.	
			3.6 The report details that for bulk sampling in deeper areas (Phase 3b), trenching would be undertaken by a seabed crawler, deployed off a dedicated mining vessel, normally with an overall length of 150m and a gross tonnage of 9111t. Such a vessel is equipped with a track-mounted subsea crawler capable of working to depths up to 200m below sea level. Potential impacts relating to physical damage to the seabed, alteration of sediment structure, alteration in benthic		

			faunal community composition and potential reduction in benthic biodiversity due to drill and bulk sampling activities are anticipated. This Branch will provide further comments after the review of the Marine Impact Assessment Report. 3.7 Sounds generated by vessels in addition to the noise from seismic surveys have been related to negative impacts on marine animals (Koper and Plön 2012). These negative impacts include direct effects, such as physical injury (i.e., auditory, and non-auditory), stress, perceptual interference, behavioural changes, and chronic responses, and indirect effects on predator species as prey. The impacts associated with seismic surveys are not yet fully understood. This further presents a challenge as the magnitude of impact cannot be quantified. The marine ecology impact assessment should report on the impacts on marine fauna. 3.8 It is anticipated that normal discharges to the marine environment from a variety of sources, including deck drainage, machinery space drainage, sewage and galley wastes from survey and support vessels would take place. While this Branch notes that all concentration of oil in discharge water from any vessel (bilge and ballast) would comply with the MARPOL Regulation 21, the applicant is urged to engage with this departments Coastal Pollution Management Directorate about the requirements of a Coastal Waters Discharge Permit on and requirements for ballast water discharge on CWDP@dffe.gov.za. 3.9 Section 5.1, titled “Diamond Resources Supply and Employment Benefits” refers to the opportunities that the proposed prospecting will enable like the provision of employment opportunities for unskilled, semi-skilled, and skilled workers. It goes on to describe how some services like security services, environmental monitoring services, compliance officer, training, mining engineer, surveyor, consultant geologist, and main workshop workers will be outsourced which will provide additional employment opportunities. However, this does not talk to the socio-economic aspects and how the development proposal will not further entrench environmental degradation without any socio-economic or community beneficiation once viable deposits are discovered. 3.10 Further to this, when considering the information in section 5.1, the extent of the proposed exploration area, the potential impacts associated with this development proposal, sustainable development goals and the principles of integrated environmental management clearly set out in section 5.3, the need and desirability of this development proposal is unclear. South Africa has an exceptional minerals endowment which requires careful allocation and strategic planning to enable for sustainable development of the nation’s mineral resources and equal beneficiation for all. This further speaks to the key targets of the West Coast District Municipality as identified in their Integrated Development Plan (2017-2022)- *integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources* and *achieve significant improvement in lives of at least 100 million slum dwellers, by 2020.* This Branch strongly maintains that sufficient motivation which provides concrete reasons as to why this proposed exploration is desirable considering the environmental, economic, and socio-economic considerations of the affected areas is required.	3.7 These have been assessed by the Marine Ecology Impact Assessment. Refer to Appendix E, page 396. 3.8 Noted, and included as mitigation measure in the EMPR. 3.9 These aspects will be assessed if and when a mining right application is submitted. 3.10 Noted. Further motivation is provided in Section 9.4 of this dEIAR.	

		Kindly note that the Department reserves the right to revise its comments and request further information based on any additional information received. All correspondence, documentation, and/or requests (hard copy and an electronic copy) should be submitted to our office via **OCEIA@dffe.gov.za / or Physical Address: Department of Forestry, Fisheries & Environment (DFFE), Branch: Oceans and Coast, 2 East Pier Building, East Pier Road, Victoria and Alfred Waterfront, Cape Town, 8001.**		
DAFF: Marine Resources Management: Offshore and High Seas Fisheries Director: Stakeholder Relations				
DAFF: Marine Resources Management: Offshore and High Seas Fisheries Director: Offshore & High Seas Fisheries				
Department of Environmental Affairs and Development Planning: Directorate: Development Facilitation				
Department of Forestry, Fisheries and the Environment (DFFE): Oceans & Coast				
Department of Forestry, Fisheries and the Environment (DFFE)_National				
Department of Public Works Western Cape				
National Department Of Public Works And Infrastructure: Chief Town Planner Projects And Professional Services ¦				
National Department of Public Works and Infrastructure:				
Department of Rural Development and Land Reform				
South Africa Navy Hydrographic Office				
South African Maritime Safety Authority (SAMSA)				
South African National Biodiversity Institute (SANBI)				
Transnet National Ports Authority				
CapeNature Conservation Operations: Landscape Conservation Intelligence Management Unit				
SAHRA				
Department of Water & Sanitation				
Department of Forestry, Fisheries and the Environment, Branch Fisheries Management, Directorate Sustainable Aquaculture Management	12 October 2022	Please include the Dispersion Model as part of the study to see how far the impact on water quality would go to ensure that aquaculture operations are not impacted.	The proposed project will be initiated with non-invasive techniques to establish the best possible areas for prospecting. The impact area, if viable areas have been identified, will be a Bulk sample footprint ±3.6Ha and volume ±360 000 tons.	
OTHER AFFECTED PARTIES				
INTERESTED PARTIES				
Prof. M. Sowman				

7.4.2 Summary of Issues Raised by I&APs during EIA phase

To be updated as part of the fEIAR.

Table 8: Summary of Issues Raised by I&APs during EIA phase

Interested and Affected Parties List the names of persons consulted in this column, and Mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated.
AFFECTED PARTIES					
Landowner					
Republic of South Africa	X				
Lawful occupier/s of the land					
N/A					
Landowners or lawful occupiers on adjacent properties					
N/A					
Municipal Councillor					
Municipality					
Matzikama Local Municipality	X				
West Coast District Municipality	X				
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA)					
N/A	x				
Communities					
N/A					
Dept. Land Affairs	X				
Department of Rural Development and Land Reform					
Traditional Leaders					
N/A					
Dept. Environmental Affairs & Development Planning					
Dept. Environmental Affairs & Development Planning: Directorate: Development Facilitation	x				
Other Competent Authorities affected					
Department of Water and Sanitation (DHSW&S)	X				
SAHRA	X				
Cape Nature	X				
Department of Environment, Forestry and Fisheries	X				
SAHRA	X				
Department Oceans and Coast	X				
DAFF: Marine Resources Management: Offshore and High Seas Fisheries Director: Stakeholder Relations					
DAFF: Marine Resources Management: Offshore and High Seas Fisheries Director: Offshore & High Seas Fisheries					
Department of Environmental Affairs and Development Planning: Directorate: Development Facilitation					
Department of Forestry, Fisheries and the Environment (DFFE): Oceans & Coast					
Department of Forestry, Fisheries and the Environment (DFFE)_National					
Department of Public Works Western Cape					
National Department Of Public Works And Infrastructure: Chief Town Planner Projects And Professional Services ¦					
National Department of Public Works and Infrastructure:					
Department of Rural Development and Land Reform					
South Africa Navy Hydrographic Office					
South African Maritime Safety Authority (SAMSA)					
South African National Biodiversity Institute (SANBI)					
Transnet National Ports Authority					
CapeNature - Conservation Operations: Landscape Conservation Intelligence Management Unit					
SAHRA					
Department of Water & Sanitation					
Department of Forestry, Fisheries and the Environment, Branch Fisheries Management, Directorate Sustainable Aquaculture Management					
OTHER AFFECTED PARTIES					
INTERESTED PARTIES					
Prof. M. Sowman					

8 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PROJECT SITE

This chapter provides a description of the biophysical and socio-economic environment likely to be affected by the proposed project in the study area. The information provided here is based on available baseline information for the area.

8.1 Screening Tool and Site Sensitivity Verification Report

Refer to **APPENDIX C: SCREENING & SITE SENSITIVITY VERIFICATION REPORT, page 298**, which details the findings of the Screening Tool (**Table 9**), and the Site Sensitivity Verification Report.

The sensitivities listed below were identified in the Screening Report for Sea Concession 12B:

Table 9: Summary of Screening Tool Report Sensitivities

THEME	SCREENING TOOL SENSITIVITY RATING
None	None

The "Protocols" require that the EAP or a specialist verify the screening tool report findings. Sea Concession 12B does not overlap with any themes in the screening tool report and thus no results are indicated in the report. The following specialist impact assessment have been identified by the Screening Tool Report and **Table 10** below, provides a summary of the EAP's recommendations.

Table 10: Summary of Recommendations based on Site Sensitivity Verification

SENSITIVITY THEME	FINDINGS OF SITE SENSITIVITY VERIFICATION REPORT & COMMENT ON SPECIALIST INPUT
Agricultural Impact Assessment	Rated as NOT APPLICABLE by the EAP: • The proposed activity is not related to agriculture No further agricultural assessment required.
Terrestrial Biodiversity	Rated as NOT APPLICABLE by the EAP: • The activity is not based terrestrially. • No terrestrial biodiversity assessments are deemed required by the EAP.
Aquatic Biodiversity	Rated as NOT APPLICABLE by the EAP: • The activity is not based in freshwater but in the ocean. • No aquatic biodiversity assessments are deemed required by the EAP, BUT a marine ecology impact assessment was undertaken as part of the EIA phase.
Noise Impact Assessment	Rated as NOT APPLICABLE by the EAP: • The activity will take place in the ocean. No impact assessment is deemed necessary by the EAP.
Radio Activity Impact Assessment	Rated as NOT APPLICABLE by the EAP: • No radioactive materials will be used. • No impact assessment is deemed necessary by the EAP
Archaeological cultural, and Palaeontology	The following will be conducted during the EIA phase - • Offshore Palaeontological Impact Assessment & a Maritime Archaeology Impact Assessment. • Heritage Impact Assessment (HIA), required in terms of National Heritage Act (Act 25 of 1999), to include palaeontological assessment.
Marine Ecology Impact Assessment.	Although not included by the Screening Tool Report, the EAP has identified this as a required impact assessment

8.2 Type of Environment Affected by the Proposed Activity

This section provides a general overview of the physical and biological oceanography and human utilisation (socio-economic environment) of South African West Coast and, where applicable, detailed descriptions of the marine environment that may be directly affected by the proposed prospecting activities.

8.2.1 Geographical

Sea Concession 12(b) is situated ap-proximately 300km north of Cape Town, with the inshore boundary located 1km seaward of the coast between Strandfontein to the south and Namakwa Sands Wet Separation Plant to the north.

The offshore boundary is located approximately 4km offshore.

8.2.2 Geological Setting

As per **Part C, Appendix E: Paleontological Impact Assessment, page 374**

*"The seabed geology of the continental shelf in the surrounding area is depicted in **Figure 24** which shows overall successively younger formations seawards. The Cretaceous and Paleogene units comprise the main bulk of the Olifants Delta and are succeeded by cappings of Miocene and Pliocene units.*

*Sea Concession 12B is on the inner shelf where the Pre-Cretaceous bedrock slopes relatively steeply seawards down to the gentle slope developed on the Cretaceous formations (**Figure 25**). Extrapolating from the seashore exposures, the inner-shelf bedrock is expected to be mainly comprised of highly deformed, metasedimentary schists, quartzites and limestones of the Gifberg Group which were originally deposited in a rifted ocean basin between 780-760 million years ago (Ma) during the late Precambrian Eon. Older crustal basement gneisses occur in the north while in the southern portion it is possible that some minor outliers of basal Table Mountain Group conglomerates, sandstones and shales could be preserved.*

*These bedrock formations comprise the "footwall" to overlying, much younger late Quaternary to present-day deposits which for the most part are a veneer over the continental shelf, but are much thicker where they have accumulated in the accommodation provided by the slope break between the steeper inner shelf and the nearly flat middle shelf (***Figure 26***) where they constitute the "mudbelt", as illustrated in **Figure 25** which shows in excess of 10 m of Holocene mudbelt deposits offshore of 12B. The mudbelt is a composite feature with a lower portion composed of coarse shallow-water sediments deposits during low sea level, overlain by muds accumulated under subsequent deeper water depths.*

*On most of the B-concession inner shelf the sediment distribution is patchy and largely determined by the topography of the bedrock, with gullies and basins with sediment fills interspersed by bedrock high outcrops. The oldest deposits are preserved in deeper and larger bedrock depressions, beneath the latest Quaternary basal gravels which were deposited during the last rise in sea level after the Last Ice Age (***Figure 27***). The larger bedrock depressions are usually palaeochannels in the Precambrian bedrock and are often the seaward extensions of buried palaeochannels and river valleys on land on the coastal plain.*

*For the most part the sediments overlying the inner-shelf bedrock involve only the **Last Transgression Sequence (LTS)** which was deposited during and subsequent to the last rise in sea level from the **Last Glacial Maximum (LGM)** lowstand ~20 ka (**Figure 27**). The shoreface of the rising, advancing shoreline is very effective at eroding and redistributing the previous shoreline and dune deposits it encroaches upon, due to the high wave energy impinging on the West Coast. The lower LTS is comprised of basal gravel units left behind in the deepening shoreface and innermost shelf where they were partly reworked during major storms. With ongoing deepening the basal gravels are overlain by an upward-fining unit of pebbly and shelly shelf sands, fine sands, and finally the bioturbated muds of the modern shelf seabed.*

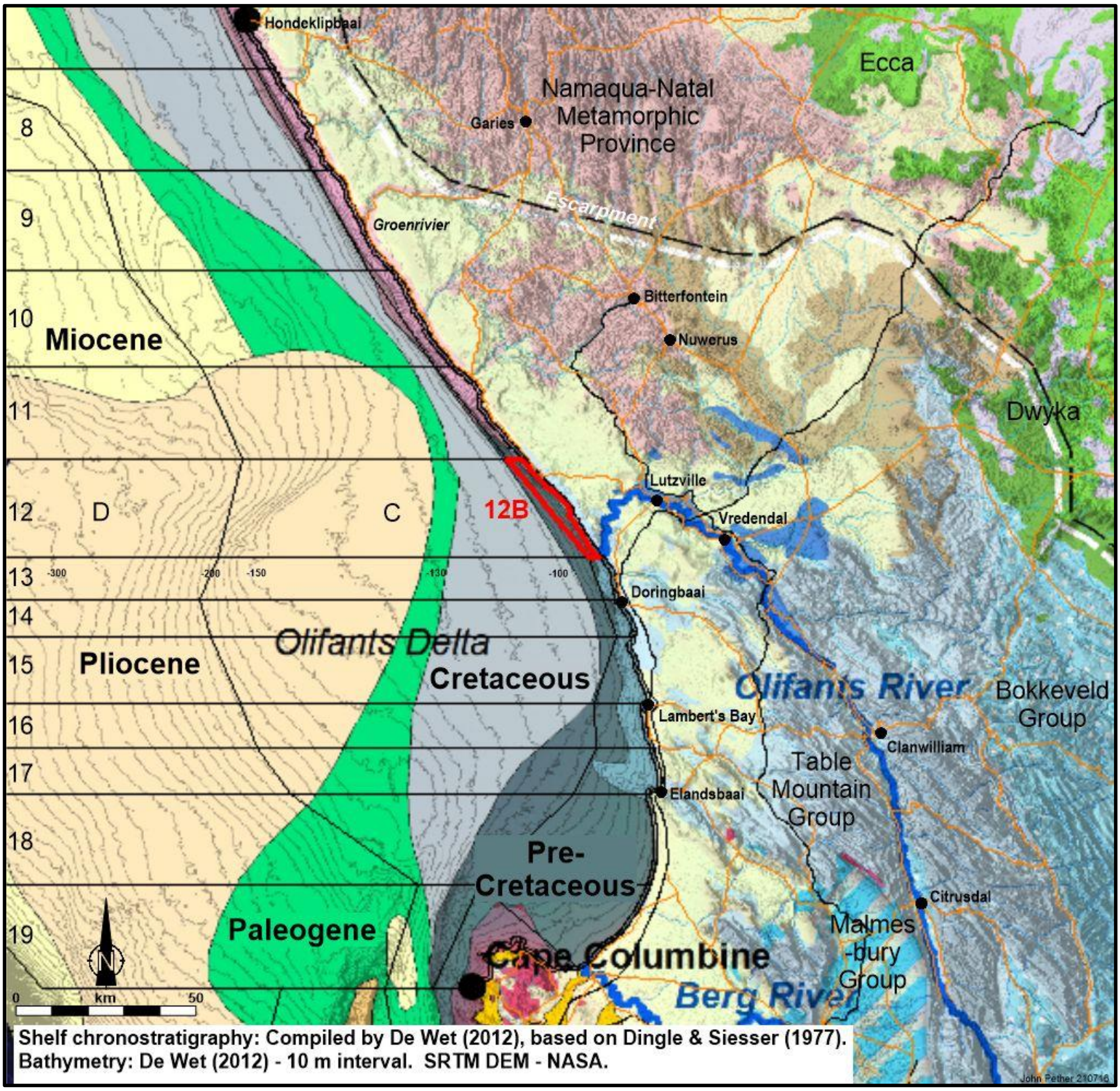


Figure 24: Location of Sea Concession 12B and regional geological context.

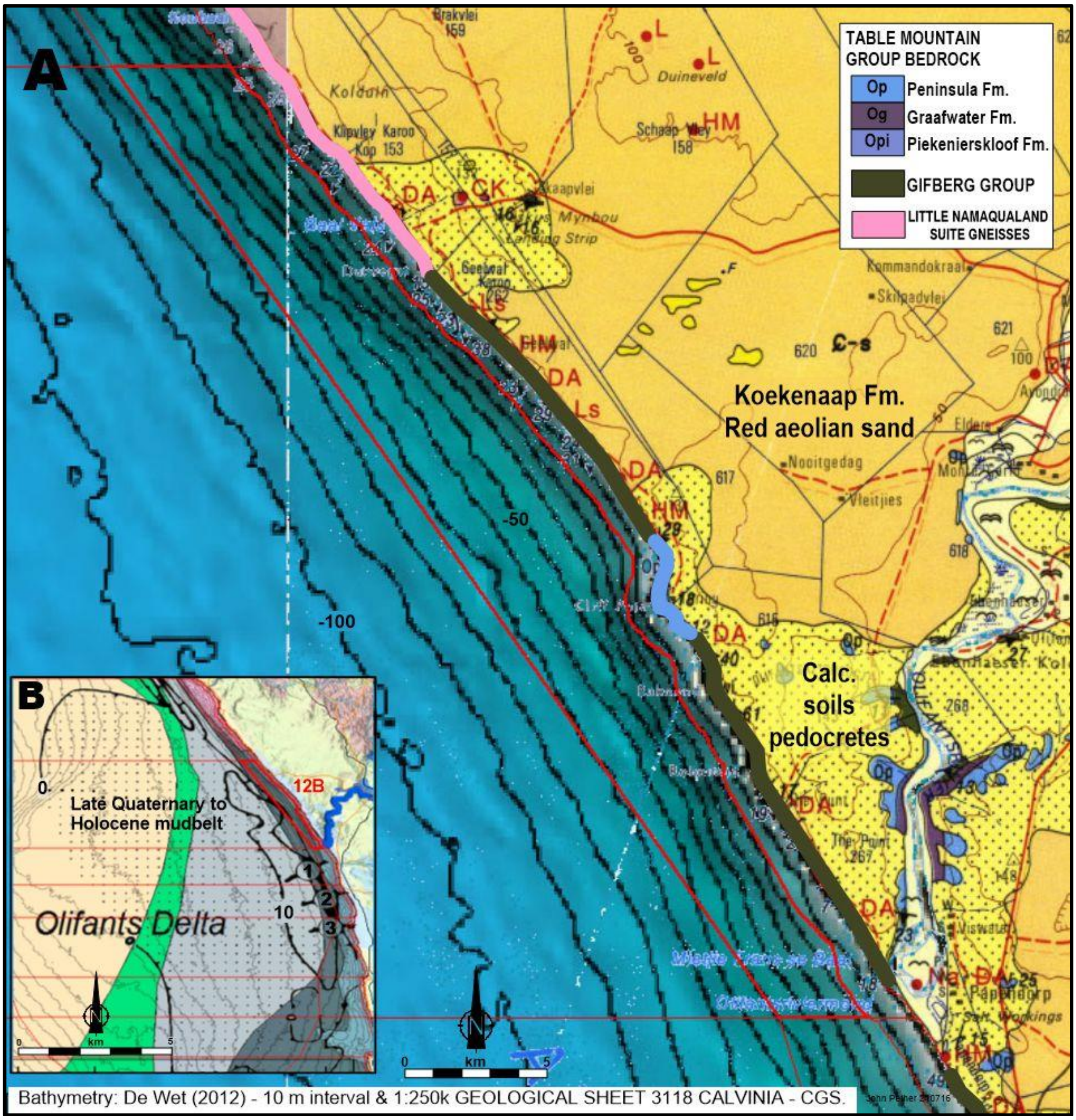


Figure 25: Bathymetry of Sea Concession 12B and coastal bedrock geology. B – Basic Quaternary sediment thickness (stippled area) and locations of Figure 26 seismic profiles.

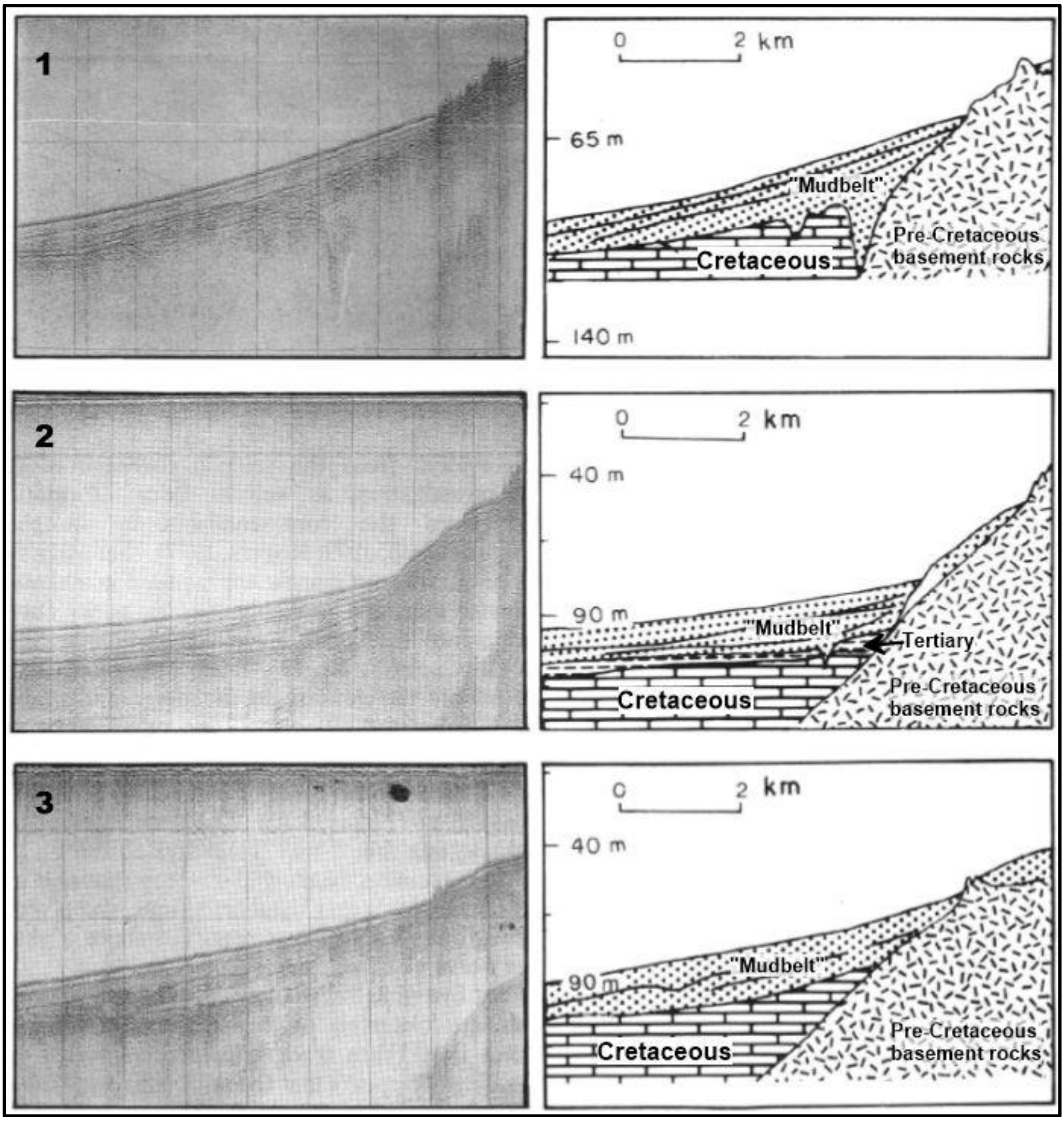


Figure 26: ***Examples of geophysical seismic profiles illustrating the "mudbelt" sediment wedge overlying the inner to midshelf transition. Adapted from Birch et al., 1991.***

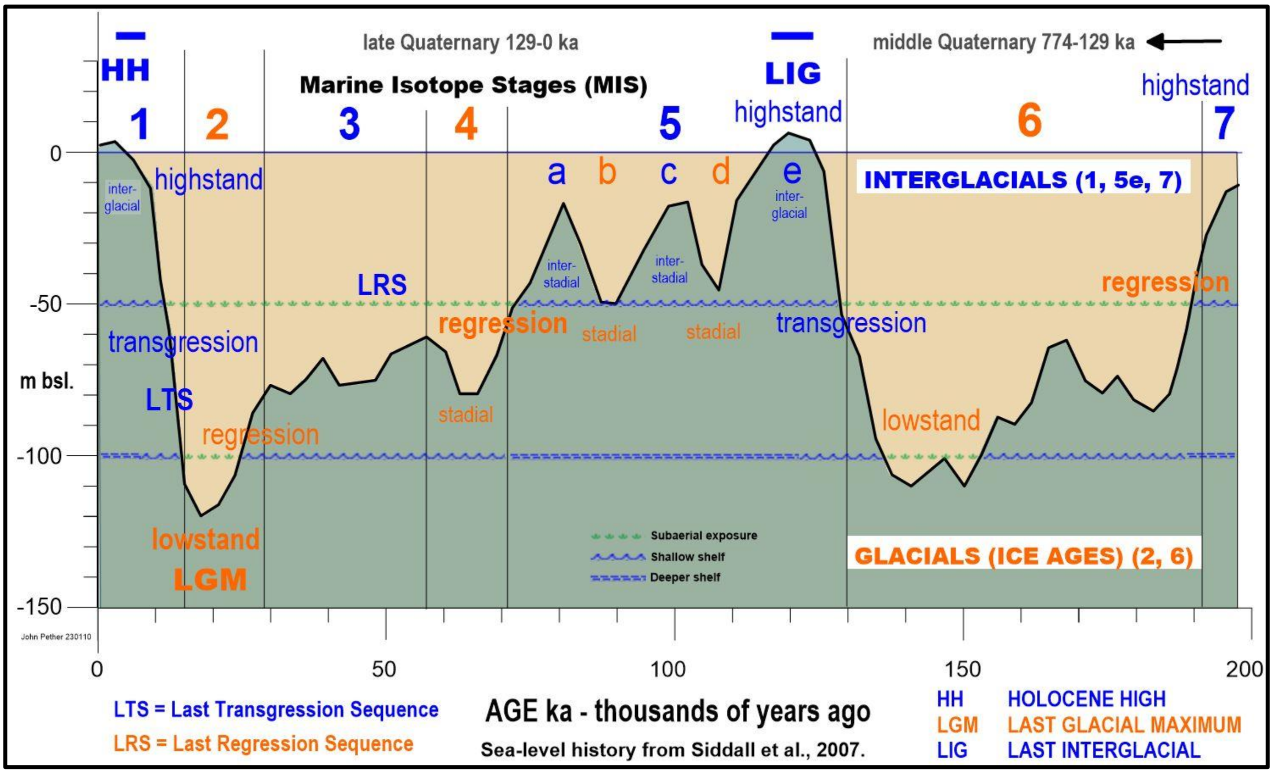


Figure 27: ***Sea level history and palaeoclimatic nomenclature for the last 200 ka.***

Based on personal observations there are several permutations for what type and age of deposits might be preserved, which are dependent on the depth/elevation of the site relative to sea-level history and the space within bedrock depressions. The observed beds are sensible in terms of sea-level history and an idealized, complete sequence in a bedrock depression at a particular depth can be predicted from **Figure 27**. *For example, a site at -100 m depth would have been submerged since 135 ka and was only subaerially exposed as land near the seashore for a short time of ~10 thousand years (10 kyr) during the LGM. In contrast, a site at ~-50 m depth was emergent and terrestrial for much of the last 200 kyr, being terrestrial for ~60 kyr during the MIS 6 ice age, and again for ~60 kyr during MISs 4, 3 and 2* **(Figure 27***). A site at -50 m will likely include land deposits with soils and pedocretes, while a site at -100 m would have more limited evidence of subaerial exposure. An idealized sequence in a deeper bedrock depression around -50 m depth on the inner shelf may include all or part of the following (refer to* **Figure 27***):*

1. *During the* ***MIS5/6 transgression*** *the terrestrial deposits of the shoreline were eroded and shoreface gravels and coarse sands were deposited ~130 ka.*
2. *Succeeding shelf sands deposited during the LIG highstand MIS 5e and the 5c and 5a interstadials would have been reworked during the 5d and 5b regressions and after 5a.*
3. *Shelly gravels and sandstones deposited ~70 ka during the 5a/4 regression, constituting the base of the* ***Last Regression Sequence*** *(LRS).*
4. *Subaerial exposure for ~60 kyr during MISs 4, 3, 2 and early MIS 1, with deposition of upper LRS terrestrial deposits which may include colluvium, pan deposits and dune sands, with land snails, possible animal remains and perhaps archaeological material, capped by a calcrete.*
5. *An erosion surface overlain by the basal gravel of the* ***Last Transgression Sequence*** *(LTS) (early MIS 1, ~12 ka).*
6. *Succeeding shelly sand fining up to muddy shelf sand (current interglacial highstand, later MIS 1).*

On the inner shelf the thickest terrestrial deposits of the Last Regression Sequence are found in larger, deeper palaeochannels and include aeolian dune sands. More commonly the LRS basal gravels are preserved in some *gullies due to cementing under the influence of rain-sourced meteoric groundwater and/or preserved by an overlying calcreted soil, beneath the LTS erosion surface and unconsolidated LTS gravels.*

*The inner shelf of Sea Concession 12B has more extensive sediment cover than is typical of the inner shelf farther north, due to the sediments delivered by the Olifantsrivier (***Figure 26***, profiles 2 & 3). The sediment bodies could include the eroded lower beds of barrier beaches, lagoons and dunes formed on top of the deposits of the previous regression, and occurrences possibly associated with meltwater pulses MWP-1B and 1C (***Figure 28***).*

Bedrock depressions/basins and sheltered sites landward of high bedrock ridges may include earlier Quaternary marine conglomerates and sandstones as local remnants that escaped erosion during the latest transgression from the LGM low sea level. Large deposits of sediments can also cause the preservation of the underlying, older beds. As shown in ***Figure 28*** *the rate of the last deglacial rise in sea level was not uniform, but with periods of slow rise or stillstand succeeded by rapid rises due to pulses of polar meltwaters (MWPs). Provided that sediment is available, barrier beaches with spits, lagoons and dunes form on top of the deposits of the previous regression and these deposits are then overstepped and incompletely eroded by the subsequent Meltwater Pulse rapid rise in sea level (Runds et al., 2019).*

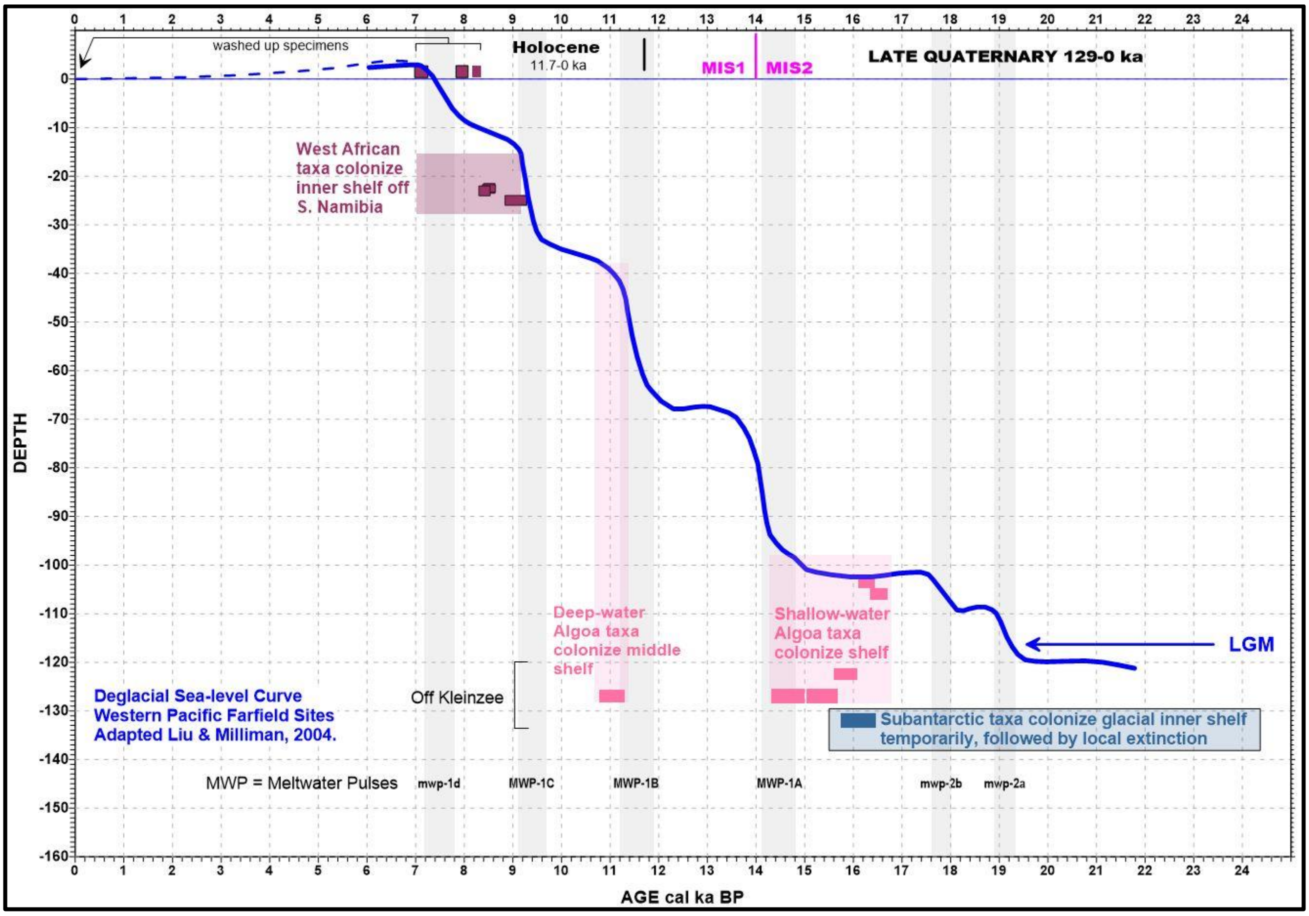


Figure 28: ***Sea-level curve for the last deglaciation, showing contexts of dated shells from the West Coast Shelf.***

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396.**

8.2.3 Baseline Marine Environment

The descriptions of the physical and biological environments along the South African West Coast focus primarily on the study area between Hondeklipbaai and Cape Town. The purpose of this environmental description is to provide the marine baseline environmental context within which the proposed prospecting activities will take place. The summaries presented below are based on information gleaned from Lane & Carter (1999), CCA & CMS (2001) and Penney et al. (2007) and more recent scientific studies undertaken in the general area.

8.2.3.1 Geophysical Characteristics

8.2.3.1.1 Bathymetry

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The continental shelf along the West Coast is generally wide and deep, although large variations in both depth and width occur. The shelf maintains a general NNW trend, widening north of Cape Columbine and reaching its widest (180 km) off the Orange River. The nature of the shelf break varies off the South African West Coast. Between Cape Columbine and the Orange River, there is usually a double shelf break, with the distinct inner and outer slopes, separated by a gently sloping ledge. The immediate nearshore area consists mainly of a narrow (about 8 km wide) rugged rocky zone and slopes steeply seawards to a depth of around 80 m. The middle and outer shelf normally lacks relief and slopes gently seawards reaching the shelf break at a depth of ~300 m.

Banks on the continental shelf include Child's Bank, situated ~150 km offshore at about 31°S and well to the north of concession 12B. Child's Bank is the only known submarine bank within South Africa's Exclusive Economic Zone (EEZ), rising from a depth of 350 - 400 m water to less than 200 m at its shallowest point. The bank area has been estimated to cover some 1 450 km^2 (Sink et al. 2012).

No detailed bathymetry is available for Concession 12B at this stage.

8.2.3.1.2 Coastal and Inner-shelf Geology and Seabed Geomorphology

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The inner shelf is underlain by Precambrian bedrock (Pre-Mesozoic basement), whilst the middle and outer shelf areas are composed of Cretaceous and Tertiary sediments (Dingle 1973; Dingle et al. 1987; Birch et al. 1976; Rogers 1977; Rogers & Bremner 1991). As a result of erosion on the continental shelf, the unconsolidated sediment cover is generally thin, often less than 1 m. Sediments are finer seawards, changing from sand on the inner and outer shelves to muddy sand and sandy mud in deeper water. However, this general pattern has been modified considerably by biological deposition (large areas of shelf sediments contain high levels of calcium carbonate) and localised river input. An ~500-km long mud belt (up to 40 km wide, and of 15 m average thickness) is situated over the innershelf between the Orange River and St Helena Bay (Birch et al. 1976). Further offshore, sediment is dominated by muds and sandy muds. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous ooze.

Present day sedimentation is limited to input from the Orange River. This sediment is generally transported northward. Most of the sediment in the concession area is therefore considered to be relict deposits by now ephemeral rivers active during wetter climates in the past. The Orange River, when in flood, still contributes largely to the mud belt as suspended sediment is carried southward by poleward flow. In this context, the absence of large sediment bodies on the inner shelf reflects on the paucity of terrigenous sediment being introduced by the few rivers that presently drain the South African West Coast coastal plain.

Surveys undertaken in the adjacent 11B and 13B concessions suggest that the majority of concession 12B will likely be characterised by outcropping rocky seabed intersected by large and deep, west-southwest facing, drainage gullies and channels filled with unconsolidated sediments. Rocky clusters are typically either of low *profile or are partially covered by sediment, although south of the Olifants River mouth reefs become prominent high-profile features with pinnacle and hollows. The morphology and orientation of these drainage gullies and channels are considered as favourable environments for potential diamond concentration.*

*The benthic habitat types of the West Coast were classified and mapped in detail through the 2011 National Biodiversity Assessment (NBA) (Sink et al. 2012). These were refined in the 2018 NBA (Sink et al. 2019) to provide substratum types (**Figure 29**).*

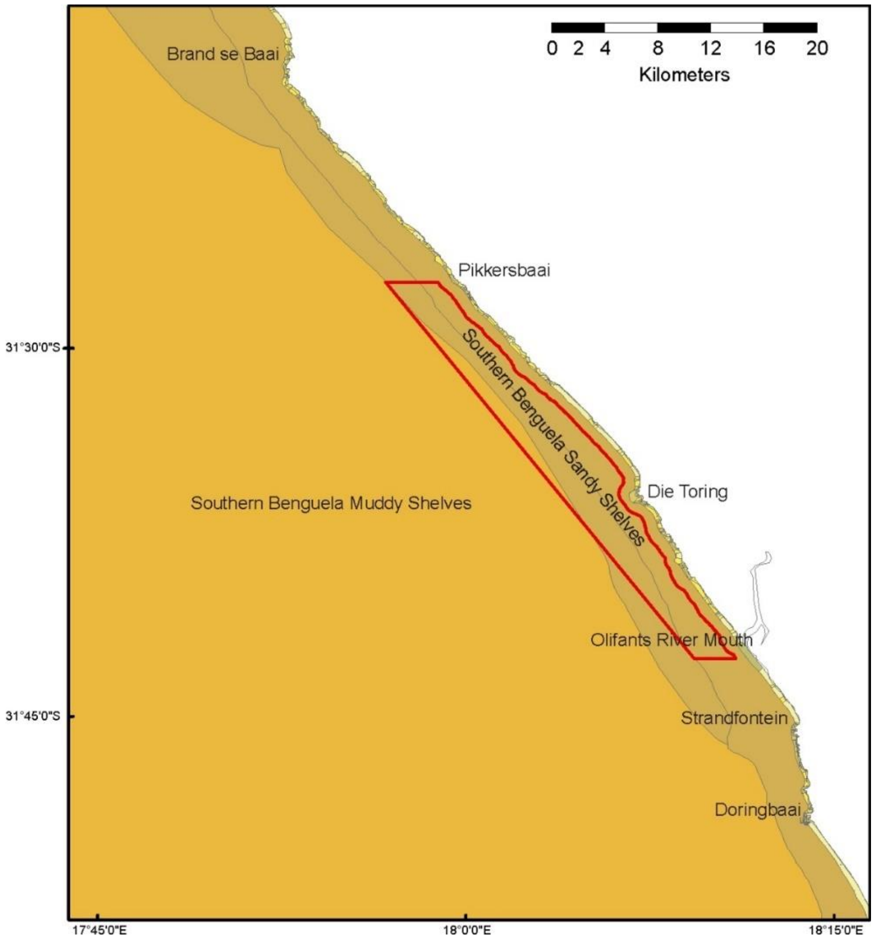


Figure 29: Concession 12B (red polygon) in relation to the distribution of seabed substratum types along the West Coast (adapted from Sink et al. 2019).

8.2.3.2 Biophysical Characteristics

8.2.3.2.1 Wind Patterns

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Winds are one of the main physical drivers of the nearshore Benguela region, both on an oceanic scale, generating the heavy and consistent south-westerly swells that impact this coast, and locally, contributing to the northward-flowing longshore currents, and being the prime mover of sediments in the terrestrial environment. Consequently, physical processes are characterised by the average seasonal wind patterns, and substantial episodic changes in these wind patterns have strong effects on the entire Benguela region.

The prevailing winds in the Benguela region are controlled by the South Atlantic subtropical anticyclone, the eastward moving mid-latitude cyclones south of southern Africa, and the seasonal atmospheric pressure field over the subcontinent. The south Atlantic anticyclone is a perennial feature that forms part of a discontinuous belt of high-pressure systems which encircle the subtropical southern hemisphere. This undergoes seasonal variations, being strongest in the austral summer, when it also attains its southernmost extension, lying south *west and south of the subcontinent. In winter, the south Atlantic anticyclone weakens and migrates north-westwards.*

These seasonal changes result in substantial differences between the typical summer and winter wind patterns in the region, as the southern hemisphere anti-cyclonic high-pressures system, and the associated series of cold fronts, moves northwards in winter, and southwards in summer. The strongest winds occur in summer (October to March), during which winds blow 98% of the time, and gales (winds exceeding 18 m/s or 35 kts) are frequent (CSIR 2006). Virtually all winds in summer come from the south to south-southeast, averaging 20 - 30 kts and reaching speeds in excess of 100 km/h (60 kts). The combination of these southerly/south-easterly winds drives the massive offshore movements of surface water, and the resultant strong upwelling of nutrient-rich bottom waters, which characterise this region in summer.

Winter remains dominated by southerly to south-easterly winds, but the closer proximity of the winter cold-front systems results in a significant south-westerly to north-westerly component. This 'reversal' from the summer condition results in cessation of upwelling, movement of warmer mid-Atlantic water shorewards and breakdown of the strong thermoclines which typically develop in summer. There are also more calms in winter, occurring about 4% of the time, and wind speeds generally do not reach the maximum speeds of summer. However, the westerly winds blow in synchrony with the prevailing south-westerly swell direction, resulting in heavier swell conditions in winter.

During autumn and winter, catabatic, or easterly 'berg' winds can also occur. These powerful offshore winds can exceed 50 km/h, producing sandstorms that considerably reduce visibility at sea and on land. Although they occur intermittently for about a week at a time, they have a strong effect on the coastal temperatures, which often exceed 30°C during 'berg' wind periods (Shannon & O'Toole 1998). The winds also play a significant role in sediment input into the coastal marine environment with transport of the sediments up to 150 km offshore.

8.2.3.2.2 Large-Scale Circulation and Coastal Currents

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The southern African West Coast is strongly influenced by the Benguela Current. Current velocities in continental shelf areas generally range between 10–30 cm/s (Boyd & Oberholster 1994), although localised flows in excess of 50 cm/s occur associated with eddies. On its western side, flow is more transient and characterised by large eddies shed from the retroflection of the Agulhas Current, resulting in considerable variation in current speed and direction over the domain. In the south, the Benguela current has a width of 200 km, widening rapidly northwards to 750 km. The surface flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow (Shillington et al. 1990; Nelson & Hutchings 1983) (Figure 30). Fluctuation periods of these flows are 3 - 10 days, although the long-term mean current residual is in an approximate northwest (alongshore) direction. Current speeds decrease with depth, while directions rotate from predominantly north-westerly at the surface to south-easterly near the seabed. Near bottom shelf flow is mainly poleward with low velocities of typically <5 cm/s (Nelson 1989; Boyd & Oberholster 1994; Shannon & Nelson 1996). The poleward flow becomes more consistent in the southern Benguela.

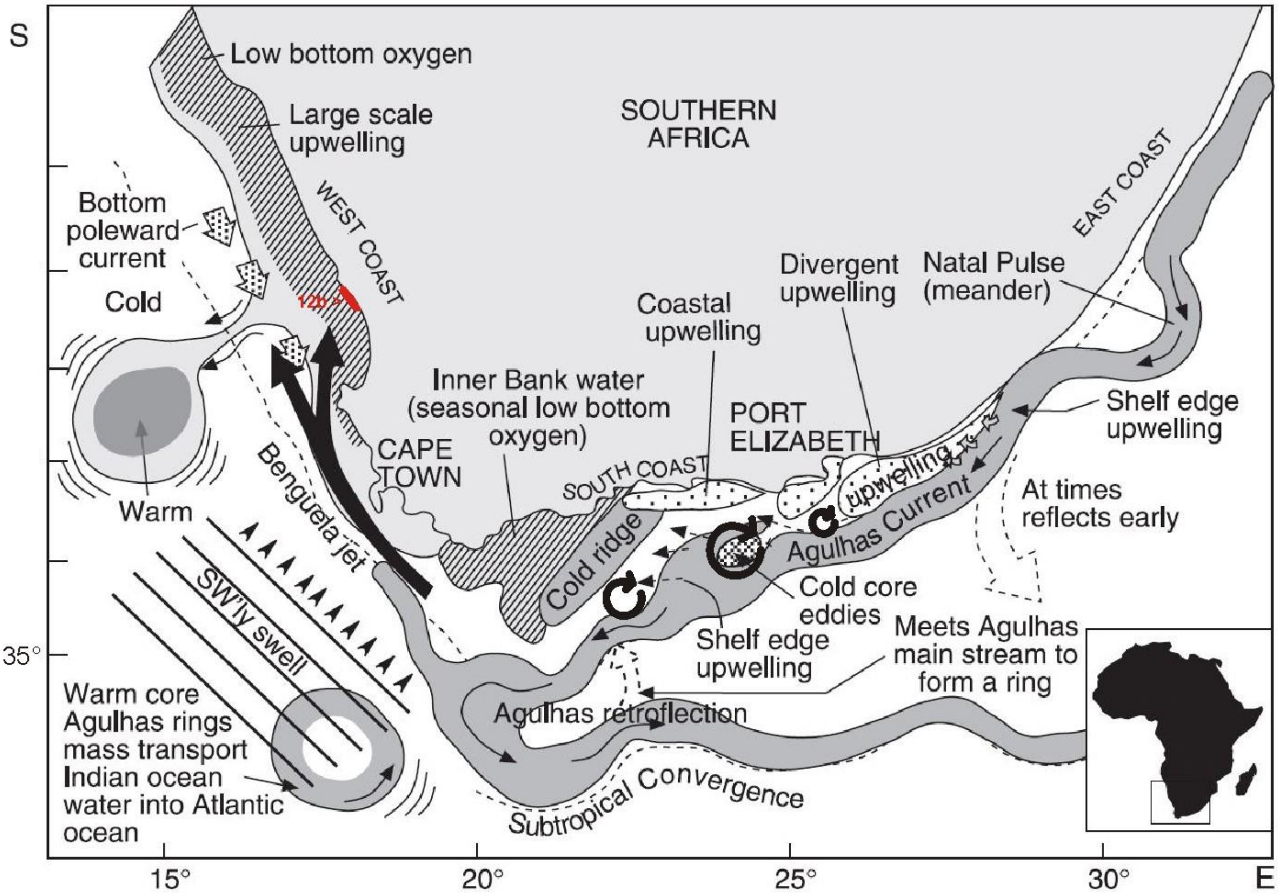


Figure 30: Concession 12B (red polygon) in relation to important physical processes and features associated with the West Coast (adapted from Roberts 2005).

The major feature of the Benguela Current is coastal upwelling and the consequent high nutrient supply to surface waters leads to high biological production and large fish stocks. The prevailing longshore, equatorward winds move nearshore surface water northwards and offshore. To balance the displaced water, cold, deeper water wells up inshore (average sea surface temperature 10 - 14°C). Although the rate and intensity of upwelling fluctuates with seasonal variations in wind patterns, the most intense upwelling tends to occur where the shelf is narrowest and the wind strongest. There are three upwelling centres in the southern Benguela, namely the Cape Point (34°S), Cape Columbine (33°S) and Namaqua (30°S) upwelling cells (Taunton-Clark 1985) (Figure 31; left). The 12B concession fall between the Cape Columbine and Namaqua upwelling cells. Upwelling in these cells is seasonal, with maximum upwelling occurring between September and March. An example of one such strong upwelling event in December 1996, followed by relaxation of upwelling and intrusion of warm Agulhas waters from the south, is shown in the satellite images in Figure 31.

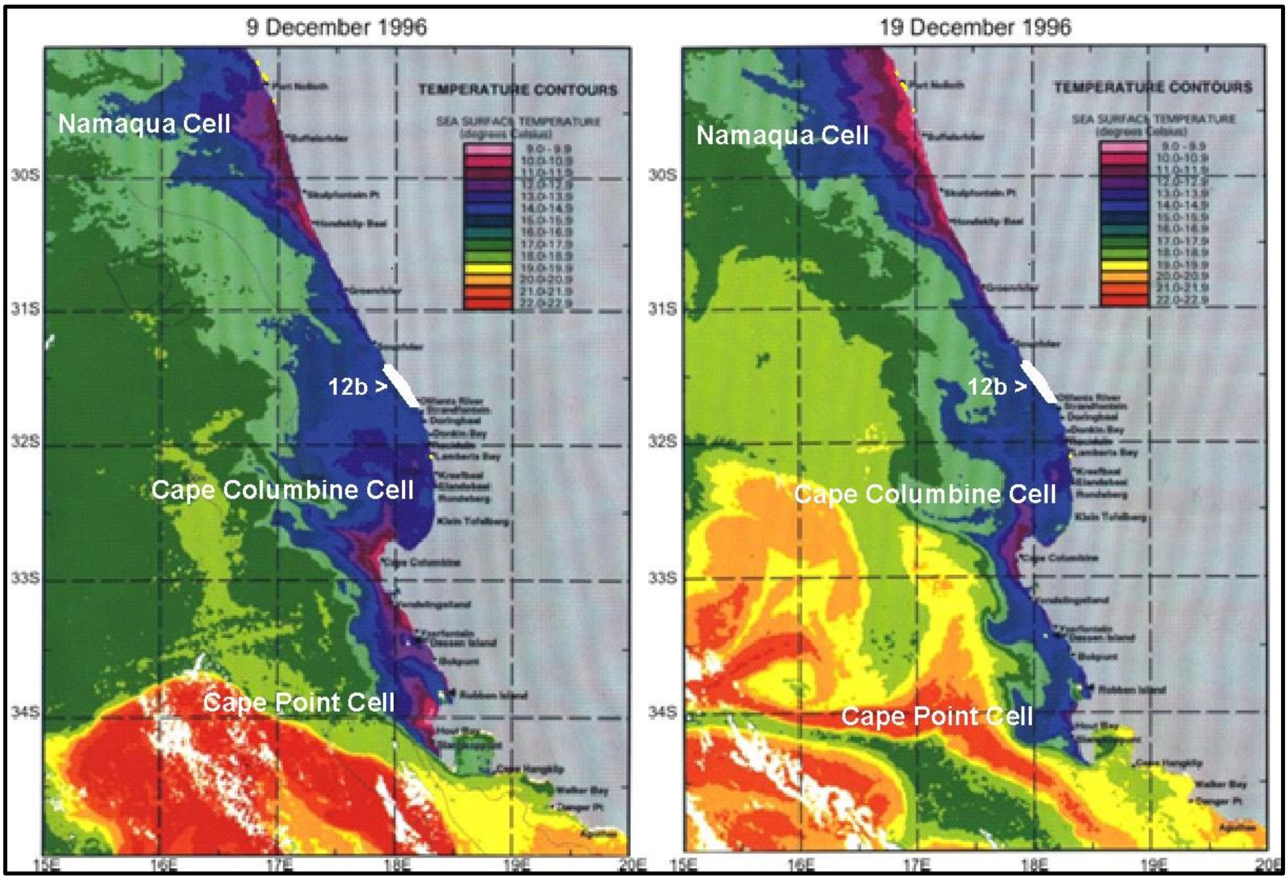


Figure 31: Satellite sea-surface temperature images showing the 12B concession area (white polygons) in relation to upwelling intensity along the South African west coast on two days in December 1996 (from Lane & Carter 1999).

Where the Agulhas Current passes the southern tip of the Agulhas Bank (Agulhas Retroflection area), it may shed a filament of warm surface water that moves north-westward along the shelf edge towards Cape Point, and Agulhas Rings, which similarly move north-westwards into the South Atlantic Ocean (Figure 31, right). These rings may extend to the seafloor and west of Cape Town may split, disperse or join with other rings. The surface water of the Agulhas Current is generally >21°C, and its influence west of Cape Agulhas results in average sea surface temperatures in the southern Benguela of 16 - 20°C (Shannon 1985). During the process of ring formation, intrusions of cold sub-Antarctic water moves into the South Atlantic. The contrast in warm (nutrient-poor) and cold (nutrient-rich) water is thought to be reflected in the presence of cetaceans and large migratory pelagic fish species (Best 2007).

8.2.3.2.3 Waves and Tides

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Most of the west coast of southern Africa is classified as exposed, experiencing strong wave action, rating between 13-17 on the 20 point exposure scale (McLachlan 1980). Much of the coastline is therefore impacted by heavy south-westerly swells generated in the roaring forties, as well as significant sea waves generated locally by the prevailing moderate to strong southerly winds characteristic of the region. The peak wave energy periods fall in the range 9.7 – 15.5 seconds.

The wave regime along the southern African west coast shows only moderate seasonal variation in direction, with virtually all swells throughout the year coming from the S and SSW direction. Winter swells are strongly dominated by those from the S and SSW, which occur almost 80% of the time, and typically exceed 2 m in height, averaging about 3 m, and often attaining over 5 m. With wind speeds capable of reaching 100 km/h during heavy winter south-westerly storms, winter swell heights can exceed 10 m.

In comparison, summer swells tend to be smaller on average, typically around 2 m, not reaching the maximum swell heights of winter. There is also a slightly more pronounced southerly swell component in summer. These southerly swells tend to be wind-induced, with shorter wave periods (~8 seconds), and are generally steeper than swell waves (CSIR 1996). These wind-induced southerly waves are relatively local and, although less powerful, tend to work together with the strong southerly winds of summer to cause the northward-flowing nearshore surface currents, and result in substantial nearshore sediment mobilisation, and northwards transport, by the combined action of currents, wind and waves.

In common with the rest of the southern African coast, tides are semi-diurnal, with a total range of some 1.5 m at spring tide, but only 0.6 m during neap tide periods.

8.2.3.2.4 Water

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

South Atlantic Central Water (SACW) comprises the bulk of the seawater in the study area, either in its pure form in the deeper regions, or mixed with previously upwelled water of the same origin on the continental shelf (Nelson & Hutchings 1983). Salinities range between 34.5 ‰ and 35.5 ‰ (Shannon 1985).

Seawater temperatures on the continental shelf of the southern Benguela typically vary between 6°C and 16°C. Well-developed thermal fronts exist, demarcating the seaward boundary of the upwelled water. Upwelling filaments are characteristic of these offshore thermal fronts, occurring as surface streamers of cold water, typically 50 km wide and extending beyond the normal offshore extent of the upwelling cell. Such fronts typically have a lifespan of a few days to a few weeks, with the filamentous mixing area extending up to 625 km offshore. South and east of Cape Agulhas, the Agulhas retroflection area is a global "hot spot" in terms of temperature variability and water movements.

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, especially on the bottom. SACW itself has depressed oxygen concentrations (~80% saturation value), but lower oxygen concentrations (<40% saturation) frequently occur (Bailey et al. 1985; Chapman & Shannon 1985).

8.2.3.2.5 Upwelling & Plankton Production

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

During upwelling the comparatively nutrient-poor surface waters are displaced by enriched deep water, supporting substantial seasonal primary phytoplankton production. The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman & Shannon 1985). Nutrient concentrations of upwelled water of the Benguela system attain 20 µM nitrate-nitrogen, 1.5 µM phosphate and 15-20 µM silicate, indicating nutrient enrichment (Chapman & Shannon 1985). This is mediated by nutrient regeneration from biogenic material in the sediments (Bailey et al. 1985). Modification of these peak concentrations depends upon phytoplankton uptake which varies according to phytoplankton biomass and production rate. The range of nutrient concentrations can thus be large but, in general, concentrations are high.

High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters. This results in a wind-related cycle of plankton production, mortality, sinking of plankton detritus and eventual nutrient re-enrichment occurring below the thermocline as the phytoplankton decays. Biological decay of plankton blooms can in turn lead to "black tide" events, as the available dissolved oxygen is stripped from the water during the decomposition process (see below). Subsequent anoxic decomposition by sulphur reducing bacteria can result in the formation and release of hydrogen sulphide (Pitcher & Calder 2000).

8.2.3.2.6 Organic Inputs

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The Benguela upwelling region is an area of particularly high natural productivity, with extremely high seasonal production of phytoplankton and zooplankton. These plankton blooms in turn serve as the basis for *a rich food chain up through pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others). All of these species are subject to natural mortality, and a proportion of the annual production of all these trophic levels, particularly the plankton communities, die naturally and sink to the seabed.*

Balanced multispecies ecosystem models have estimated that during the 1990s the Benguela region supported biomasses of 76.9 tons/km^2 of phytoplankton and 31.5 tons/km^2 of zooplankton alone (Shannon et al. 2003). Thirty six percent of the phytoplankton and 5% of the zooplankton are estimated to be lost to the seabed annually. This natural annual input of millions of tons of organic material onto the seabed off the southern African West Coast has a substantial effect on the ecosystems of the Benguela region. It provides most of the food requirements of the particulate and filter-feeding benthic communities that inhabit the sandy-muds of this area, and results in the high organic content of the muds in the region. As most of the organic detritus is not directly consumed, it enters the seabed decomposition cycle, resulting in subsequent depletion of oxygen in deeper waters.

An associated phenomenon ubiquitous to the Benguela system are red tides (dinoflagellate and/or ciliate blooms) (see Shannon & Pillar 1985; Pitcher 1998). Also referred to as Harmful Algal Blooms (HABs), these red tides can reach very large proportions, extending over several square kilometres of ocean (Figure 32, left). Toxic dinoflagellate species can cause extensive mortalities of fish and shellfish through direct poisoning, while degradation of organic-rich material derived from both toxic and non-toxic blooms results in oxygen depletion of subsurface water (Figure 32, right).

Figure 32: Red tides can reach very large proportions (left,Photo: www.e-education.psu.edu) and can lead to mass stranding, or 'walk-out' of rock lobsters, such as occurred at Elands Bay in March 2022 (Photo: www.waterencyclopedia.com).

8.2.3.2.7 Low Oxygen Events

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations with <40% saturation occurring frequently (e.g. Visser 1969; Bailey et al. 1985). The low oxygen concentrations are attributed to nutrient remineralisation in the bottom waters of the system (Chapman & Shannon 1985). The absolute rate of this is dependent upon the net organic material build-up in the sediments, with the carbon rich mud deposits playing an important role. As the mud on the shelf is distributed in discrete patches, there are corresponding preferential areas for the formation of oxygen-poor water. The two main areas of low-oxygen water formation in the southern Benguela region are in the Orange River Bight and St Helena Bay (Chapman & Shannon 1985; Bailey 1991; Shannon & O'Toole 1998; Bailey 1999; Fossing et al. 2000). The spatial distribution of oxygen-poor water in each of the areas is subject to short- and medium-term variability in the volume of hypoxic water that develops. De Decker (1970) showed that the occurrence of low oxygen water off Lambert's Bay is seasonal, with highest development in summer/autumn. Bailey & Chapman (1991), on the other hand, demonstrated that in the St Helena Bay area daily variability exists as a result of downward *flux of oxygen through thermoclines and short-term variations in upwelling intensity. Subsequent upwelling processes can move this low-oxygen water up onto the inner shelf, and into nearshore waters, often with devastating effects on marine communities.*

Periodic low oxygen events in the nearshore region can have catastrophic effects on the marine communities leading to large-scale stranding of rock lobsters, and mass mortalities of marine biota and fish (Newman & Pollock 1974; Matthews & Pitcher 1996; Pitcher 1998; Cockcroft et al. 2000) (see Figure 32, right). The development of anoxic conditions as a result of the decomposition of huge amounts of organic matter generated by phytoplankton blooms is the main cause for these mortalities and walkouts. The most recent walkout occurred in early March 2022 at Elands Bay, when some 500 tons of rocklobster were reported stranded on the beach. The blooms develop over a period of unusually calm wind conditions when sea surface temperatures where high. Algal blooms usually occur during summer-autumn (February to April) but can also develop in winter during the 'berg' wind periods, when similar warm windless conditions occur for extended periods.

8.2.3.2.8 Turbidity

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulate matter. Total Suspended Particulate Matter (TSPM) can be divided into Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM), the ratios between them varying considerably. The POM usually consists of detritus, bacteria, phytoplankton and zooplankton, and serves as a source of food for filter-feeders. Seasonal microphyte production associated with upwelling events will play an important role in determining the concentrations of POM in coastal waters. PIM, on the other hand, is primarily of geological origin consisting of fine sands, silts and clays. Off Namaqualand, the PIM loading in nearshore waters is strongly related to natural inputs from the Orange and Olifants Rivers or from 'berg' wind events. Although highly variable, annual discharge rates of sediments by the Orange River is estimated to vary from 8 - 26 million tons/yr (Rogers 1979). 'Berg' wind events can potentially contribute the same order of magnitude of sediment input as the annual estimated input of sediment by the Orange River (Shannon & Anderson 1982; Zoutendyk 1992, 1995; Shannon & O'Toole 1998; Lane & Carter 1999). For example, a 'berg' wind event in May 1979 described by Shannon and Anderson (1982) was estimated to have transported in the order of 50 million tons of sand out to sea, affecting an area of 20,000 km^2. Although the Berg River and Olifants River (two of only three permanently open river systems on the West Coast) enter the West Coast, annual sediment yields are low due to thin soils and the resistant nature of Table Mountain Sandstones (Clark & Ractliffe 2007). PIM loading in Concession 12B would therefore typically be negligible.

Concentrations of suspended particulate matter in shallow coastal waters can vary both spatially and temporally, typically ranging from a few mg/ℓ to several tens of mg/ℓ (Bricelj & Malouf 1984; Berg & Newell 1986; Fegley et al. 1992). Field measurements of TSPM and PIM concentrations in the Benguela current system have indicated that outside of major flood events, background concentrations of coastal and continental shelf suspended sediments are generally <12 mg/ℓ, showing significant long-shore variation (Zoutendyk 1995). Considerably higher concentrations of PIM have, however, been reported from southern African West Coast waters under stronger wave conditions associated with high tides and storms, or under flood conditions. During storm events, concentrations near the seabed may even reach up to 10,000 mg/ℓ (Miller & Sternberg 1988). In the vicinity of the Orange River mouth, where river outflow strongly influences the turbidity of coastal waters, measured concentrations ranged from 14.3 mg/ℓ at Alexander Bay just south of the mouth (Zoutendyk 1995) to peak values of 7 400 mg/ℓ immediately upstream of the river mouth during the 1988 Orange River flood (Bremner et al. 1990).

The major source of turbidity in the swell-influenced nearshore areas off the West Coast is the redistribution of fine inner shelf sediments by long-period Southern Ocean swells. The current velocities typical of the Benguela (10-30 cm/s) are capable of resuspending and transporting considerable quantities of sediment equatorwards. Under relatively calm wind conditions, however, much of the suspended fraction (silt and clay) *that remains in suspension for longer periods becomes entrained in the slow poleward undercurrent (Shillington et al. 1990; Rogers & Bremner 1991).*

Superimposed on the suspended fine fraction, is the northward littoral drift of coarser bedload sediments, parallel to the coastline. This northward, nearshore transport is generated by the predominantly south-westerly swell and wind-induced waves. Longshore sediment transport varies considerably in the shore-perpendicular dimension, being substantially higher in the surf-zone than at depth, due to high turbulence and convective flows associated with breaking waves, which suspend and mobilise sediment (Smith & Mocke 2002).

On the inner and middle continental shelf, the ambient currents are insufficient to transport coarse sediments typical of those depths, and re-suspension and shoreward movement of these by wave-induced currents occur primarily under storm conditions (see also Drake et al. 1985; Ward 1985). Data from a Waverider buoy at Port Nolloth have indicated that 2-m waves are capable of re-suspending medium sands (200 µm diameter) at ~10 m depth, whilst 6-m waves achieve this at ~42 m depth. Low-amplitude, long-period waves will, however, penetrate even deeper. Most of the sediment shallower than 90 m can therefore be subject to re-suspension and transport by heavy swells (Lane & Carter 1999).

Mean sediment deposition is naturally higher near the seafloor due to constant re-suspension of coarse and fine PIM by tides and wind-induced waves. Aggregation or flocculation of small particles into larger aggregates occurs as a result of cohesive properties of some fine sediments in saline waters. The combination of re-suspension of seabed sediments by heavy swells, and the faster settling rates of larger inorganic particles, typically causes higher sediment concentrations near the seabed. Significant re-suspension of sediments can also occur up into the water column under stronger wave conditions associated with high tides and storms. Re-suspension can result in dramatic increases in PIM concentrations within a few hours (Sheng et al. 1994). Wind speed and direction have also been found to influence the amount of material re-suspended (Ward 1985).

Although natural turbidity of seawater is a global phenomenon, there has been a worldwide increase of water turbidity and sediment load in coastal areas as a consequence of anthropogenic activities. These include dredging associated with the construction of harbours and coastal installations, beach replenishment, accelerated runoff of eroded soils as a result of deforestation or poor agricultural practices, and discharges from terrestrial, coastal and marine mining operations (Airoldi 2003). Such increase of sediment loads has been recognised as a major threat to marine biodiversity at a global scale (UNEP 1995).

8.2.3.3 The Biological Environment

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Biogeographically, the study area falls within the cold temperate Namaqua Bioregion (Emanuel et al. 1992; Lombard et al. 2004) (Figure 33), which in the 2018 NBA (Sink et al. 2019) is referred to as as a subregion of the Southern Benguela Shelf ecoregion. The coastal, wind-induced upwelling characterising the Western Cape coastline, is the principle physical process which shapes the marine ecology of the southern Benguela region. The Benguela system is characterised by the presence of cold surface water, high biological productivity, and highly variable physical, chemical and biological conditions. The West Coast is, however, characterized by low marine species richness and low endemicity (Awad et al. 2002).

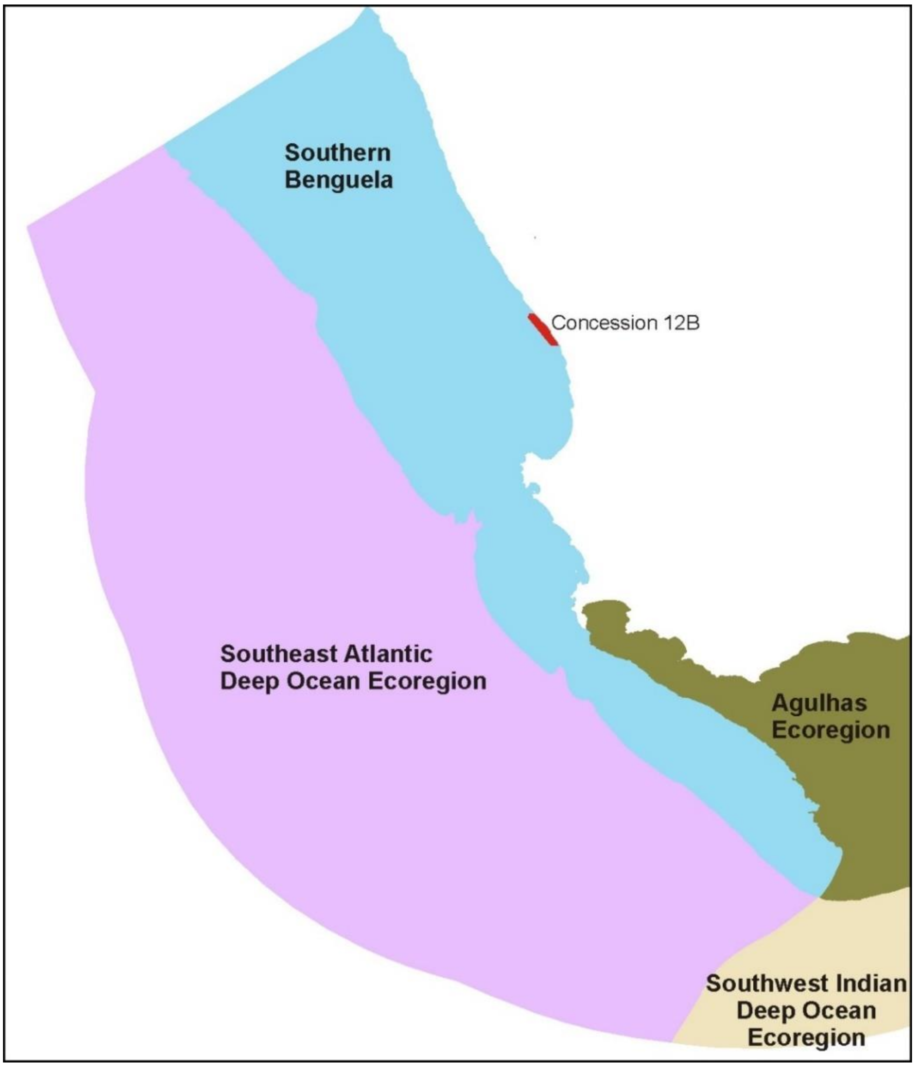


Figure 33: The South African ecoregions in relation to Concession 12B (red polygon) (adapted from Sink et al. 2019).

Communities within marine habitats are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. These biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). Concession 12B extends from the deep-photic (-10 to -30 m) in which light still penetrates to the seabed, into the sub-photic zone (-30 m to shelf edge). The near- and offshore marine ecosystems comprise a limited range of habitats, namely unconsolidated seabed sediments, deep water reefs and the water column. The biological communities 'typical' of these habitats are described briefly below, focussing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed mining activities.

The biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). No rare or endangered species have been recorded (Awad et al. 2002). The biological communities 'typical' of these habitats are described briefly below, focussing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed prospecting activities. The description of benthic macrofaunal communities was provided by Natasha Karenyi of the South African National Biodiversity Institute (SANBI), and the section on marine mammals was provided by Dr Simon Elwen of the Mammal Research Institute (University of Pretoria) for a similar offshore project off the West Coast.

8.2.3.3.1 Offshore Demersal Communities

8.2.3.3.1.1 Benthic Invertebrate Macrofauna

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The seabed communities in Concession 12B lie within the Namaqua Bioregion. The benthic habitats of South Africa were mapped as part of the 2018 National Biodiversity Assessment (Sink et al. 2019) to develop assessments of the ecosystem threat status and ecosystem protection level. The benthic ecosystem types were subsequently mapped (Figure 34) and assigned an ecosystem threat status based on their level of protection (Figure 35).

The benthic biota of unconsolidated marine sediments constitutes invertebrates that live on, or burrow within, the sediments, and are generally divided into megafauna (>10 cm), macrofauna (animals >1 mm) and meiofauna (<1 mm). Numerous studies have been conducted on southern African West Coast continental shelf benthos, mostly focused on mining, pollution or demersal trawling impacts (Christie & Moldan 1977; Moldan 1978; Jackson & McGibbon 1991; Environmental Evaluation Unit 1996; Field & Parkins 1997; Parkins & Field 1997; 1998; Pulfrich & Penney 1999; Goosen et al. 2000; Savage et al. 2001; Steffani & Pulfrich 2004a, 2004b; 2007; Steffani 2007a; 2007b; Steffani 2009a, 2009b, 2010a, 2010b, 2010c; Atkinson et al. 2011; Steffani 2012a, 2012b, 2014; Karenyi 2014; Steffani et al. 2015; Biccard & Clark 2016; Biccard et al. 2016; Duna et al. 2016; Karenyi et al. 2016; Biccard et al. 2017, 2018; Gihwala et al. 2018; Biccard et al. 2019; Giwhala et al. 2019; Biccard et al. 2019). The description below is drawn from these.

Three macro-infauna communities have been identified on the inner- (0-30 m depth) and mid-shelf (30-150 m depth, Karenyi 2014; Karenyi et al. 2016) off the Namaqualand coast. The inner-shelf community, which is affected by wave action, is characterised by various mobile predators (e.g. the gastropod Bullia laevissima and polychaete Nereis sp.), sedentary polychaetes and isopods. The mid-shelf community inhabits the mudbelt and is characterised by the mud prawns Callianassa sp. and Calocaris barnardi. A second mid-shelf sandy community occurring in sandy sediments, is characterised by various polychaetes including deposit-feeding Spiophanes soederstromi and Paraprionospio pinnata. Polychaetes, crustaceans and molluscs make up the largest proportion of individuals, biomass and species on the west coast (Figure 36). The distribution of species within these communities are inherently patchy reflecting the high natural spatial and temporal variability associated with macro-infauna of unconsolidated sediments (e.g. Kenny et al. 1998; Kendall & Widdicombe 1999; van Dalfsen et al. 2000; Zajac et al. 2000; Parry et al. 2003), with evidence of mass mortalities and substantial recruitments recorded on the South African West Coast (Steffani & Pulfrich 2004).

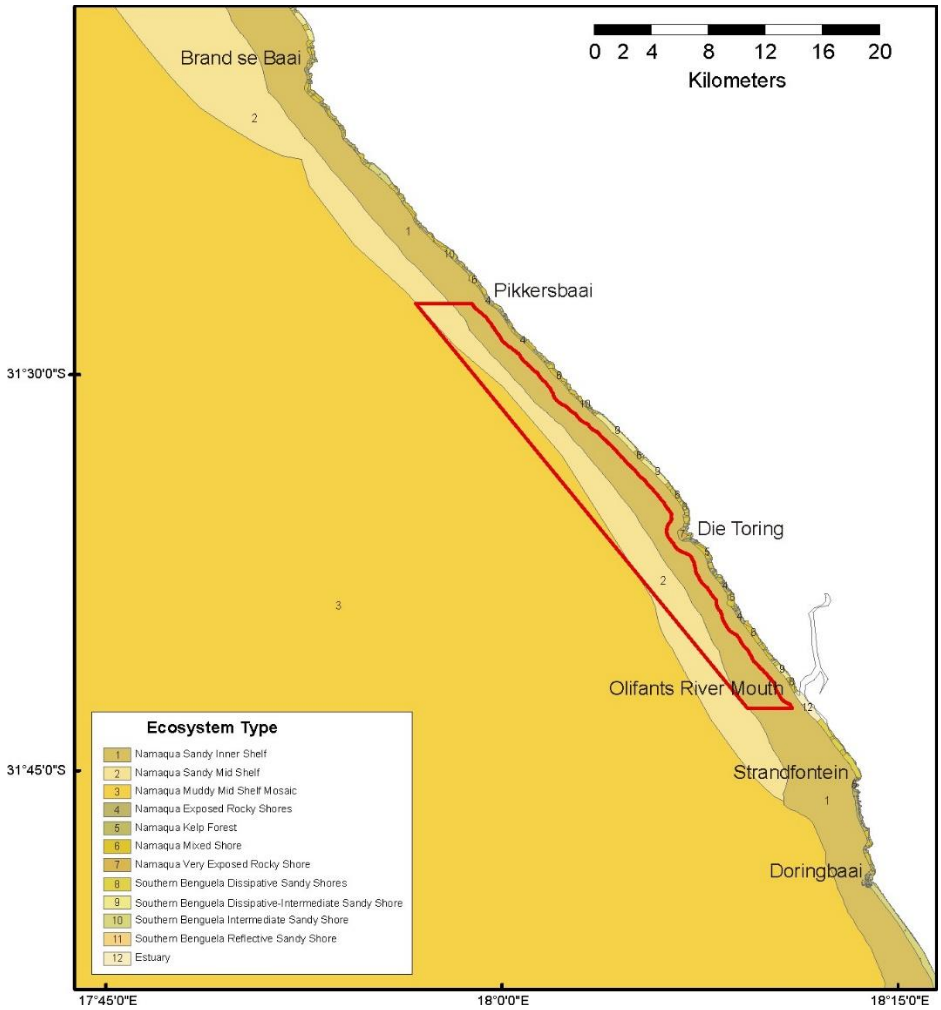


Figure 34: Concession 12B (red polygon) in relation to the marine ecosystem types (adapted from Sink et al. 2019).

Karenyi et al. (2016) found that off Namaqualand, species richness generally increased from the inner-shelf across the mid-shelf and is influenced by sediment type. The highest total abundance and species diversity was measured in sandy sediments of the mid-shelf. Biomass was highest in the inshore (± 50 g/m² wet weight) and decreased across the mid-shelf averaging around 30 g/m² wet weight. This is contrary to Christie (1974, 1976) who found that biomass was greatest in the mudbelt at 80 m depth off Lambert's Bay, where the sediment characteristics and the impact of environmental stressors (such as low oxygen events) are likely to differ from those further offshore or further north.

Given the state of our current knowledge of South African macro-infauna it is not possible to determine the threat status or endemicity of macro-infauna species on the West Coast, although such research is currently underway (pers. comm. N. Karenyi, SANBI and UCT). However, the marine component of the 2018 National Biodiversity Assessment (Sink et al. 2019), rated the inner and mid-shelf areas between Hondeklipbaai and Doringbaai as of 'least concern'.

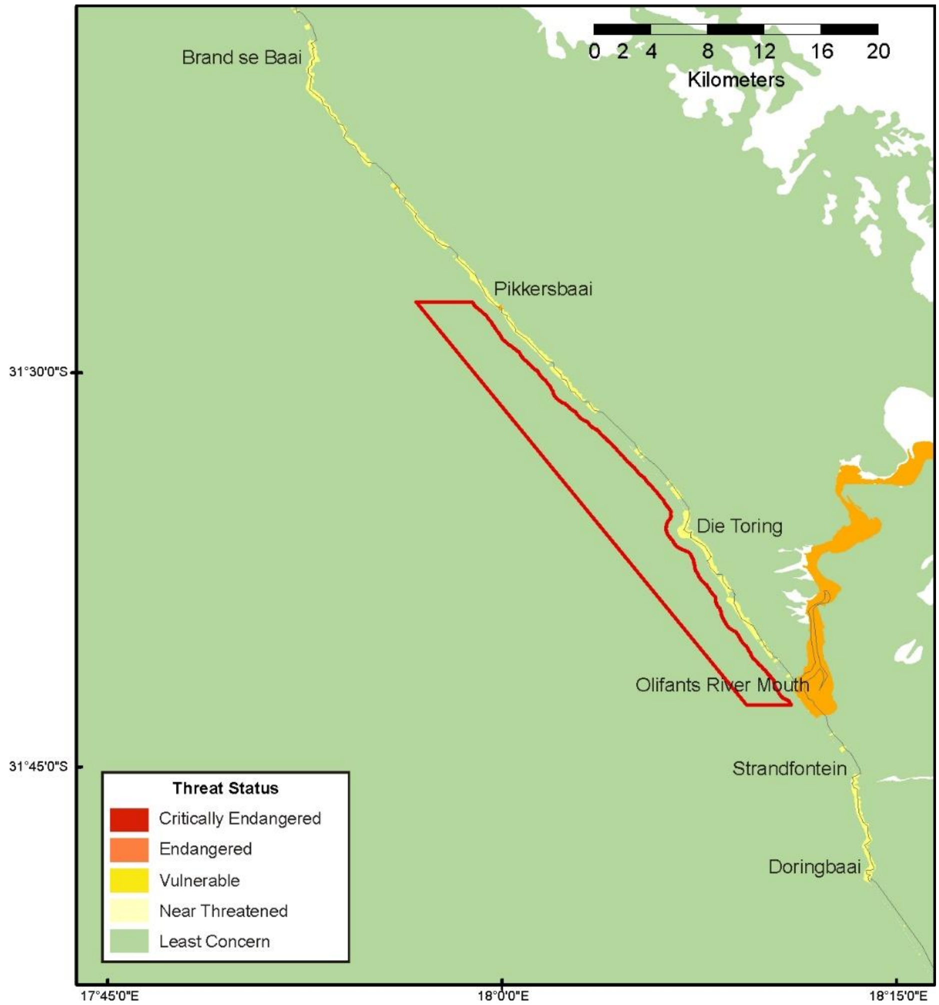


Figure 35: Concession 12B (red polygon) in relation to the ecosystem threat status for coastal and offshore ecosystem types on the South African West Coast (adapted from Sink et al. 2019).

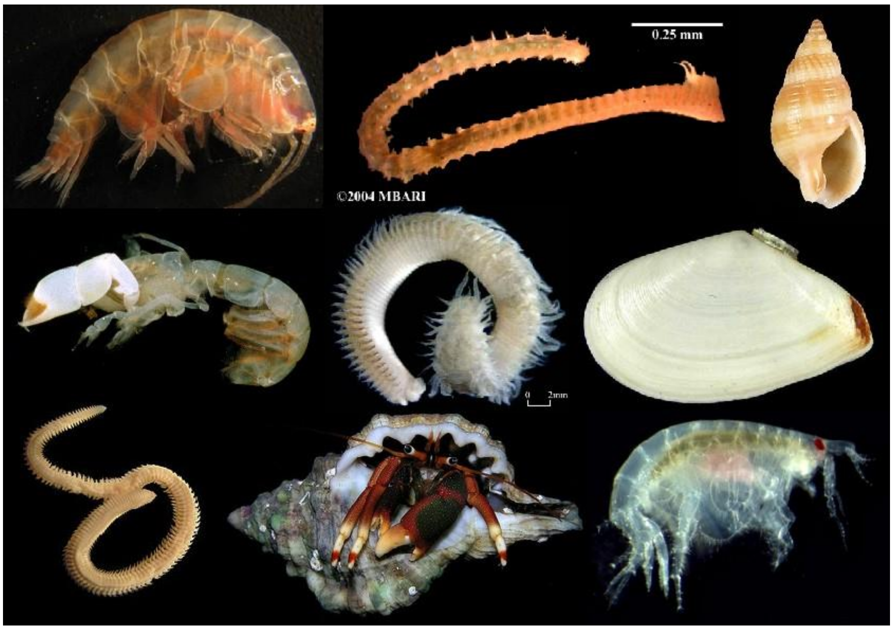


Figure 36: Benthic macrofaunal genera commonly found in nearshore sediments include: (top: left to right) Ampelisca, Prionospio, Nassarius; (middle: left to right) Callianassa, Orbinia, Tellina; (bottom: left to right) Nephtys, hermit crab, Bathyporeia.

Benthic communities are structured by the complex interplay of a large array of environmental factors. Water depth and sediment grain size are considered the two major factors that determine benthic community structure and distribution on the South African west coast (Christie 1974, 1976; Steffani & Pulfrich 2004a, 2004b; 2007; Steffani 2007a; 2007b) and elsewhere in the world (e.g. Gray 1981; Ellingsen 2002; Bergen et al. 2001; Post et al. 2006). However, studies have shown that shear bed stress - a measure of the impact of current velocity on sediment – oxygen concentration (Post et al. 2006; Currie et al. 2009; Zettler et al. 2009), productivity (Escaravage et al. 2009), organic carbon and seafloor temperature (Day et al. 1971) may also strongly influence the structure of benthic communities. There are clearly other natural processes operating in the deepwater shelf areas of the West Coast that can over-ride the suitability of sediments in determining benthic community structure, and it is likely that periodic intrusion of low oxygen water masses is a major cause of this variability (Monteiro & van der Plas 2006; Pulfrich et al. 2006). In areas of frequent oxygen deficiency, benthic communities will be characterised either by species able to survive chronic low oxygen conditions, or colonising and fast-growing species able to rapidly recruit into areas that have suffered oxygen depletion. The combination of local, episodic hydrodynamic conditions and patchy settlement of larvae will tend to generate the observed small-scale variability in benthic community structure.

The invertebrate macrofauna are important in the marine benthic environment as they influence major ecological processes (e.g. remineralisation and flux of organic matter deposited on the sea floor, pollutant metabolism, sediment stability) and serve as important food source for commercially valuable fish species and other higher order consumers. As a result of their comparatively limited mobility and permanence over seasons, these animals provide an indication of historical environmental conditions and provide useful indices with which to measure environmental impacts (Gray 1974; Warwick 1993; Salas et al. 2006).

Also associated with soft-bottom substrates are demersal communities that comprise epifauna and bottom-dwelling vertebrate species, many of which are dependent on the invertebrate benthic macrofauna as a food source. According to Lange (2012) the continental shelf on the West Coast between depths of 100 m and 250 m (and thus beyond the deepest portions of the concession), contained a single epifaunal community characterised by the hermit crabs Sympagurus dimorphus and Parapaguris pilosimanus, the prawn Funchalia woodwardi and the sea urchin Brisaster capensis. Atkinson (2009) also reported numerous species of urchins and burrowing anemones beyond 300 m depth off the West Coast.

8.2.3.3.1.2 Reef Communities

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The following general description of the subtidal reef habitats for the West Coast is based on Field et al. (1980), Branch & Branch (1981), Branch & Griffiths (1988) and Field & Griffiths (1991). The biological communities of rocky subtidal reefs are generally ubiquitous throughout the southern African West Coast region, being particular only to wave exposure, turbulence and/or depth zone. Biological communities of the rocky sublittoral can be broadly grouped into an inshore zone from the sublittoral fringe to a depth of about 10 m dominated by flora, and an offshore zone below 10 m depth dominated by fauna. This shift in communities is not knife-edge, and rather represents a continuum of species distributions, merely with changing abundances.

From the sublittoral fringe to a depth of between 5 and 10 m, the benthos is largely dominated by algae, in particular two species of kelp. The canopy forming kelp Ecklonia maxima extends seawards to a depth of about 10 m. The smaller Laminaria pallida forms a sub-canopy to a height of about 2 m underneath Ecklonia, but continues its seaward extent to about 30 m depth, although further north up the west coast increasing turbidity limits growth to shallower waters (10-20 m) (Velimirov et al. 1977; Jarman & Carter 1981; Branch 2008). Ecklonia maxima is the dominant species in the south forming extensive beds from west of Cape Agulhas to north of Cape Columbine, but decreasing in abundance northwards. Laminaria becomes the dominant kelp north of Cape Columbine and thus in the project area, extending from Danger Point east of Cape Agulhas to Rocky Point in northern Namibia (Stegenga et al. 1997; Rand 2006).

Kelp beds absorb and dissipate much of the typically high wave energy reaching the shore, thereby providing important partially-sheltered habitats for a high diversity of marine flora and fauna, resulting in diverse and *typical kelp-forest communities being established (Figure 37). Through a combination of shelter and provision of food, kelp beds support recruitment and complex trophic food webs of numerous species, including commercially important rock lobster stocks (Branch 2008). There is substantial spatial and temporal variability in the density and biomass of kelp beds, as storms can remove large numbers of plants and recruitment appears to be stochastic and unpredictable (Levitt et al. 2002; Rothman et al. 2006). Some kelp beds are dense, whilst others are less so due to differences in seabed topography, and the presence or absence of sand and grazers.*

Growing beneath the kelp canopy, and epiphytically on the kelps themselves, are a diversity of understorey algae, which provide both food and shelter for predators, grazers and filter-feeders associated with the kelp bed ecosystem. Representative under-storey algae include Botryocarpa prolifera, Neuroglossum binderianum, Botryoglossum platycarpum, Hymenena venosa and Rhodymenia (=Epymenia) obtusa, various coralline algae, as well as subtidal extensions of some algae occurring primarily in the intertidal zones (Bolton 1986). Epiphytic species include Polysiphonia virgata, Gelidium vittatum (=Suhria vittata) and Carpoblepharis flaccida. In particular, encrusting coralline algae are important in the under-storey flora as they are known as settlement attractors for a diversity of invertebrate species. The presence of coralline crusts is thought to be a key factor in supporting a rich shallow-water community by providing substrate, refuge, and food to a wide variety of infaunal and epifaunal invertebrates (Chenelot et al. 2008).

Figure 37: The canopy-forming kelp Ecklonia maxima provides an important habitat for a diversity of marine biota (Photo: Geoff Spiby).

The sublittoral invertebrate fauna is dominated by suspension and filter-feeders, such as the mussels Aulacomya ater and Choromytilus meriodonalis, and the Cape reef worm Gunnarea capensis, and a variety of sponges and sea cucumbers. Grazers are less common, with most herbivory being restricted to grazing of juvenile algae or debris-feeding on detached macrophytes. The dominant herbivore is the sea urchin Parechinus angulosus, with lesser grazing pressure from limpets, the isopod Paridotea reticulata and the amphipod Ampithoe humeralis. The abalone Haliotis midae, an important commercial species present in kelp beds south of Cape Columbine is naturally absent north of Cape Columbine. Key predators in the sub-littoral include the commercially important West Coast rock lobster Jasus lalandii and the octopus Octopus vulgaris. The rock lobster acts as a keystone species as it influences community structure via predation on a wide range of benthic organisms (Mayfield et al. 2000). Relatively abundant rock lobsters can lead to a reduction in density, or even elimination, of black mussel Choromytilus meriodonalis, the preferred prey of the species, and alter the size structure of populations of ribbed mussels Aulacomya ater, reducing the proportion of selected size-classes (Griffiths & Seiderer 1980). Their role as predator can thus reshape benthic communities, resulting in large reductions in taxa such as black mussels, urchins, whelks and barnacles, and in the dominance of algae (Barkai & Branch 1988; Mayfield 1998).

Of lesser importance as predators, although numerically significant, are various starfish, feather and brittle stars, and gastropods, including the whelks Nucella spp. and Burnupena spp. Fish species commonly found in kelp beds off the West Coast include hottentot Pachymetopon blochii, two tone finger fin Chirodactylus brachydactylus, red fingers Cheilodactylus fasciatus, galjoen Dichistius capensis, rock suckers Chorisochismus dentex and the catshark Haploblepharus pictus (Branch et al. 2010).

Further offshore in the sub-photic zone of Concession 12B, the reefs are dominated by a diversity of encrusting and upright sponges, bryozoans, seafans, soft corals, ascidians and hydroids. Community structure is determined by the influence of sand and detritus and the tolerances of the various species to these physical factors. Mobile species include various starfish, urchins, feather and brittle stars, gastropods and crustaceans. Important amongst the crustaceans is the West Coast rock lobster, which although typically associated with shallow-water reefs, has been recorded to depths of 120 m (Branch et al. 2010)

In recent years there has been increasing interest in deep-water corals, bryozoans and sponges because of their likely sensitivity to disturbance and their long generation times. These benthic filter-feeders, however, generally occur at depths below 150 m with some coral species being recorded from as deep as 3,000 m. Some species form reefs while others are smaller and remain solitary. Corals add structural complexity to otherwise uniform seabed habitats thereby creating areas of high biological diversity (Breeze et al. 1997; MacIssac et al. 2001). Deep water corals establish themselves below the thermocline where there is a continuous and regular supply of concentrated particulate organic matter, caused by the flow of a relatively strong current over special topographical formations which cause eddies. In the productive Benguela region, substantial areas on and off the edge of the shelf should thus potentially be capable of supporting rich, cold water, benthic, filter-feeding communities. Deep water corals are known from the iBhubezi Reef to the east of the Gas Field. Evidence from video footage taken on hard-substrate habitats in 100 - 120 m depth off southern Namibia and to the south-east of Child's Bank (De Beers Marine, unpublished data) (Figure 38), and in 190-527 m depth on Child's Bank (Sink et al. 2019) suggest that vulnerable communities including gorgonians, octocorals and reef-building sponges and hard-corals do occur on the continental shelf, some of which are thought to be Vulnerable Marine Ecosystem (VME) indicator species.

The concept of a 'Vulnerable Marine Ecosystem' (VME) centres upon the presence of distinct, diverse benthic assemblages that are limited and fragmented in their spatial extent, and dominated (in terms of biomass and/or spatial cover) by rare, endangered or endemic component species that are physically fragile and vulnerable to damage (or structural/biological alteration) by human activities (Parker et al. 2009; Auster et al. 2011; Hansen et al. 2013). The distribution of 22 potential VME indicator taxa for the South African EEZ were recently mapped, with those from the West Coast listed in Table 11 (Atkinson & Sink 2018; Sink et al. 2019).

Figure 38: Gorgonians and bryozoans communities recorded on deep-water reefs (100-120 m) off the southern African West Coast (Photos: De Beers Marine).

Table 11: Table of Potential VME species from the the continental shelf and shelf edge on the West Coast (Atkinson & Sink 2018)

Phylum	Name	Common Name

Porifera	*Suberites dandelenae*	*Amorphous solid sponge*
	Rossella cf. antarctica	*Glass sponge*
Cnidaria	*Melithaea spp.*	*Colourful sea fan*
	Thouarella spp.	*Bottlebrush sea fan*
Family: Isididae	*?*	*Bamboo coral*
	Anthoptilum grandiflorum	*Large sea pen**
	Lophelia pertusa	*Reef-building cold water coral*
	Stylaster spp.	*Fine-branching hydrocoral*
Bryozoa	*Adeonella spp.*	*Sabre bryozoan*
	Phidoloporidae spp.	*Honeycomb false lace coral*
Hemichordata	*Cephalodiscus gilchristi*	*Agar animal*

The distribution of known and potential VME habitat based on potential VME features, DFFE and SAEON trawl survey data, and many visual surveys indicating the presence of indicator taxa were mapped by Harris et al. 2022 (Figure 39). Some sites need more research to determine their status. Concession 12B lies well inshore of areas identified as potential VME records.

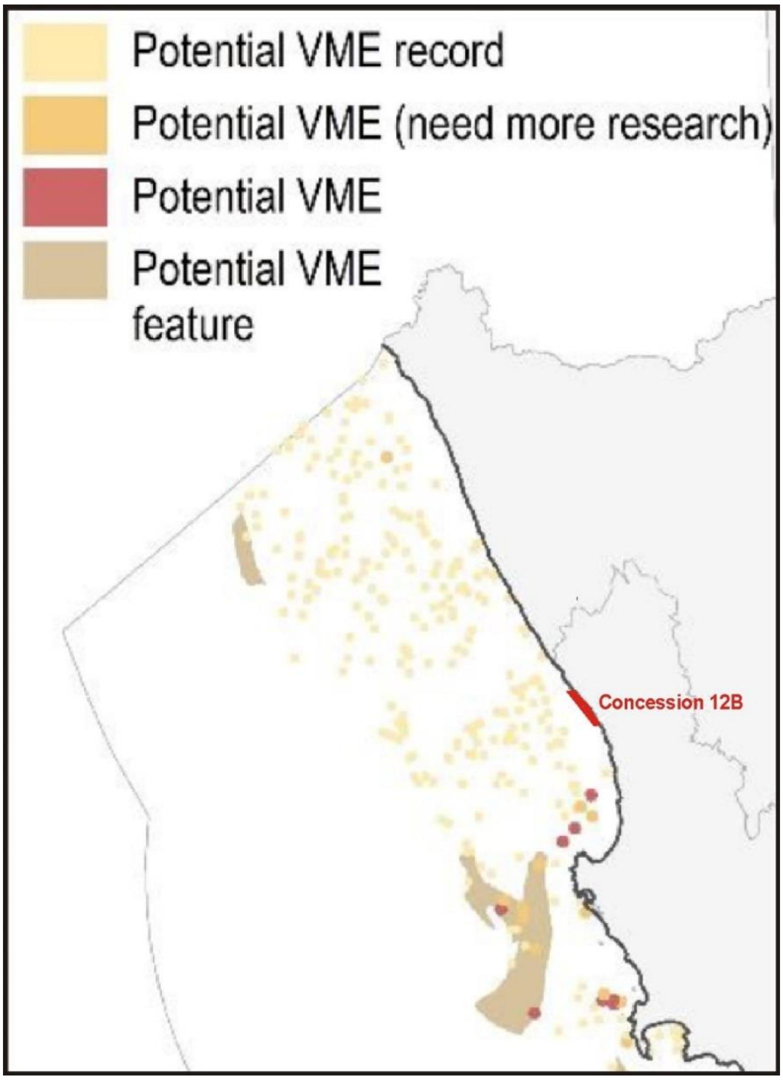


Figure 39: Concession 12B (red polygon) in relation to the distribution of known and potential Vulnerable Marine Ecosystem habitat (adapted from Harris et al. 2022).

8.2.3.3.1.3 Demersal Fish Species

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Demersal fish are those species that live and feed on or near the seabed. As many as 110 species of bony and cartilaginous fish have been identified in the demersal communities on the continental shelf of the West Coast (Roel 1987). Changes in fish communities occur with increasing depth (Roel 1987; Smale et al. 1993; Macpherson & Gordoa 1992; Bianchi et al. 2001; Atkinson 2009), with the most substantial change in species composition occurring in the shelf break region between 300 m and 400 m depth (Roel 1987; Atkinson 2009). The shelf community (<380 m) is dominated by the Cape hake M. capensis, and includes jacopever Helicolenus dactylopterus, Izak catshark Holohalaelurus regain, soupfin shark Galeorhinus galeus and whitespotted houndshark Mustelus palumbes. The more diverse deeper water community is dominated by the deepwater hake Merluccius paradoxus, monkfish Lophius vomerinus, kingklip Genypterus capensis, bronze whiptail Lucigadus ori and hairy conger Bassanago albescens and various squalid shark species. There is some degree of species overlap between the depth zones.

Roel (1987) showed seasonal variations in the distribution ranges shelf communities, with species such as the pelagic goby Sufflogobius bibarbatus, and West Coast sole Austroglossus microlepis occurring in shallow water north of Cape Point during summer only. The deep-sea community was found to be homogenous both spatially and temporally. In a more recent study, however, Atkinson (2009) identified two long-term community shifts in demersal fish communities; the first (early to mid-1990s) being associated with an overall increase in density of many species, whilst many species decreased in density during the second shift (mid-2000s). These community shifts correspond temporally with regime shifts detected in environmental forcing variables (Sea Surface Temperatures and upwelling anomalies) (Howard et al. 2007) and with the eastward shifts observed in small pelagic fish species and rock lobster populations (Coetzee et al. 2008; Cockcroft et al. 2008).

The diversity and distribution of demersal cartilagenous fishes occurring on the West Coast is discussed by Compagno et al. (1991). The species that may occur on the continental shelf in the general project area in waters <1,000 m depth are listed in Table 12. The distribution of some of these species is provided in Harris et al. (2022) (Figure 40).

Table 12: Demersal cartilaginous species found on the continental shelf along the West Coast, with approximate depth range at which the species occurs (Compagno et al. 1991) and their IUCN conservation status. The National Assessment is provided in parentheses where available.

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Bramble shark	Echinorhinus brucus	55-285	EN
Shortnose spiny dogfish	Squalus megalops	75-460	LC
Sixgill sawshark	Pliotrema warreni	60-500	LC
Tigar catshark	Halaelurus natalensis	50-100	VU
Soupfin shark/Vaalhaai	Galeorhinus galeus	<10-300	CR (EN)
Houndshark	Mustelus mustelus	<100	EN (DD)
Thorny skate	Raja radiata	50-600	VU
Slime skate	Raja pullopunctatus	15-460	LC
Rough-belly skate	Raja springeri	85-500	VU
Yellowspot skate	Raja wallacei	70-500	VU
Biscuit skate	Raja clavata	25-500	NT
Spearnose skate	Raja alba	75-260	EN
St Joseph	Callorhinchus capensis	30-380	LC(LC)

LC – Least Concern VU – Vulnerable NT – Near Threatened
EN – Endangered CR – Critically Endangered DD – Data Deficient

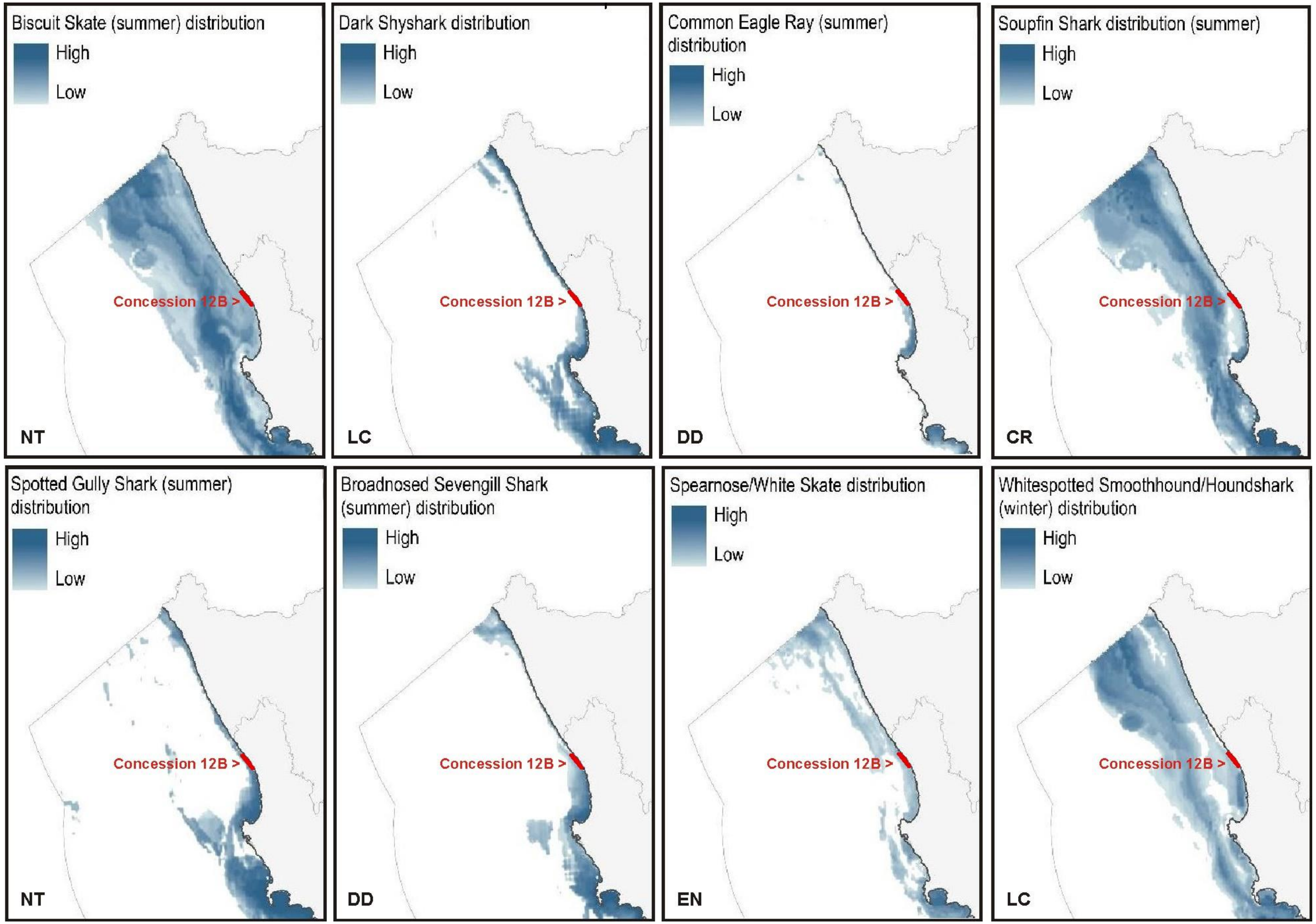


Figure 40: The distribution of various demersal cartilaginous species in relation to Concession 12B (red polygon) (adapted from Harris et al. 2022). The IUCN conservation status is provided.

8.2.3.3.2 Pelagic Communities

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

In contrast to demersal and benthic biota that are associated with the seabed, pelagic species live and feed in the water column. The pelagic communities are typically divided into plankton and fish, and their main predators, marine mammals (seals, dolphins and whales), seabirds and turtles. These are discussed separately below.

8.2.3.3.2.1 Plankton

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Plankton is particularly abundant in the shelf waters off the West Coast, being associated with the upwelling characteristic of the area. Plankton range from single-celled bacteria to jellyfish of 2-m diameter, and include phytoplankton, zooplankton, and ichthyoplankton (Figure 41).

Phytoplankton are the principle primary producers with mean productivity ranging from 2.5 - 3.5 g C/m^2/day for the midshelf region and decreasing to 1 g C/m^2/day inshore of 130 m (Shannon & Field 1985; Mitchell-Innes & Walker 1991; Brown et al. 1991; Walker & Peterson 1991; Brown 1992). The phytoplankton is dominated by large-celled organisms, which are adapted to the turbulent sea conditions. The most common diatom genera are Chaetoceros, Nitschia, Thalassiosira, Skeletonema, Rhizosolenia, Coscinodiscus and Asterionella (Shannon & Pillar 1985). Diatom blooms occur after upwelling events, whereas dinoflagellates (e.g. Prorocentrum, Ceratium and Peridinium) are more common in blooms that occur during quiescent periods, since they can grow rapidly at low nutrient concentrations. In the surf zone, diatoms and dinoflagellates are nearly equally important members of the phytoplankton, and some silicoflagellates are also present.

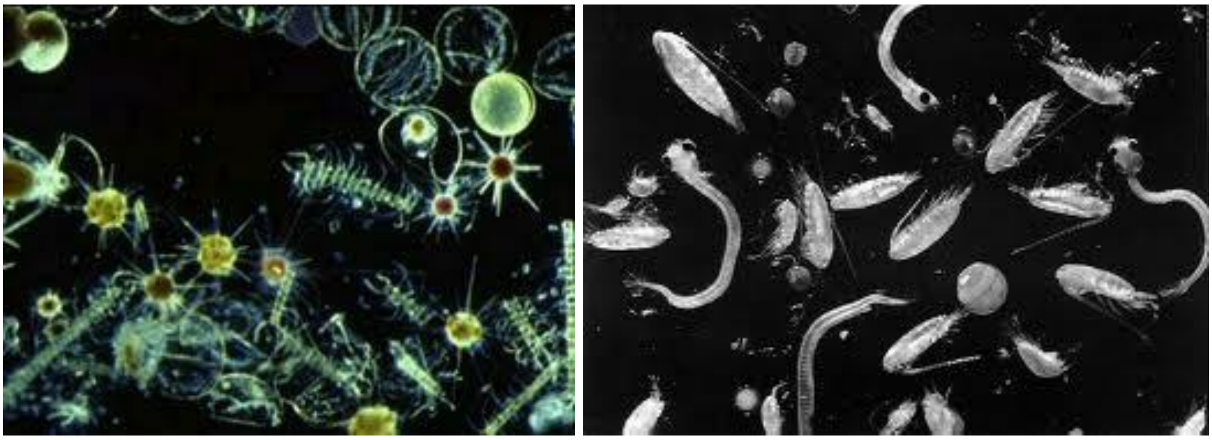


Figure 41: Phytoplankton (left, photo: hymagazine.com) and zooplankton (right, photo: mysciencebox.org) is associated with upwelling cells.

Red-tides are ubiquitous features of the Benguela system (see Shannon & Pillar 1985). The most common species associated with red tides (dinoflagellate and/or ciliate blooms) are Noctiluca scintillans, Gonyaulax tamarensis, G. polygramma and the ciliate Mesodinium rubrum. Gonyaulax and Mesodinium have been linked with toxic red tides. Most of these red-tide events occur quite close inshore although Hutchings et al. (1983) have recorded red-tides 30 km offshore (see Figure 32).

The mesozooplankton (≥200 µm) is dominated by copepods, which are overall the most dominant and diverse group in southern African zooplankton. Important species are Centropages brachiatus, Calanoides carinatus, Metridia lucens, Nannocalanus minor, Clausocalanus arcuicornis, Paracalanus parvus, P. crassirostris and Ctenocalanus vanus. All of the above species typically occur in the phytoplankton rich upper mixed layer of the water column, with the exception of M. lucens which undertakes considerable vertical migration.

The macrozooplankton (≥1 600 µm) are dominated by euphausiids of which 18 species occur in the area. The dominant species occurring in the nearshore are Euphausia lucens and Nyctiphanes capensis, although neither species appears to survive well in waters seaward of oceanic fronts over the continental shelf (Pillar et al. 1991).

Standing stock estimates of mesozooplankton for the southern Benguela area range from 0.2 - 2.0 g C/m^2, with maximum values recorded during upwelling periods. Macrozooplankton biomass ranges from 0.1-1.0 g C/m^2, with production increasing north of Cape Columbine (Pillar 1986). Although it shows no appreciable onshore-offshore gradients, standing stock is highest over the shelf, with accumulation of some mobile zooplankton (euphausiids) known to occur at oceanographic fronts. Beyond the continental slope biomass decreases markedly. Localised peaks in biomass may, however, occur in the vicinity of Child's Bank and Tripp seamount in response to topographically steered upwelling around such seabed features.

Zooplankton biomass varies with phytoplankton abundance and, accordingly, seasonal minima will exist during non-upwelling periods when primary production is lower (Brown 1984; Brown & Henry 1985), and during winter when predation by recruiting anchovy is high. More intense variation will occur in relation to the upwelling cycle; newly upwelled water supporting low zooplankton biomass due to paucity of food, whilst high biomasses develop in aged upwelled water subsequent to significant development of phytoplankton. Irregular pulsing of the upwelling system, combined with seasonal recruitment of pelagic fish species into West Coast shelf waters during winter, thus results in a highly variable and dynamic balance between plankton replenishment and food availability for pelagic fish species.

Although ichthyoplankton (fish eggs and larvae) comprise a minor component of the overall plankton, it remains significant due to the commercial importance of the overall fishery in the region. Various pelagic and demersal fish species are known to spawn in the inshore regions of the southern Benguela, including pilchard, round herring, chub mackerel lanternfish and hakes (Crawford et al. 1987; Hutchings 1994; Hutchings et al. 2002) (Figure 42), and their eggs and larvae form an important contribution to the ichthyoplankton in the region. Spawning of key species is presented below.

- *Sardines spawn on the whole Agulhas Bank during November, but generally have two spawning peaks, in early spring and autumn, on either side of the peak anchovy spawning period (Figure 43, left). There is also sardine spawning on the east coast and even off KwaZulu-Natal, where sardine eggs are found during July–November.*
- *Anchovies spawn on the whole Agulhas Bank (Figure 43, right), with spawning peaking during mid-summer (November–December) and some shifts to the west coast in years when Agulhas Bank water intrudes strongly north of Cape Point.*

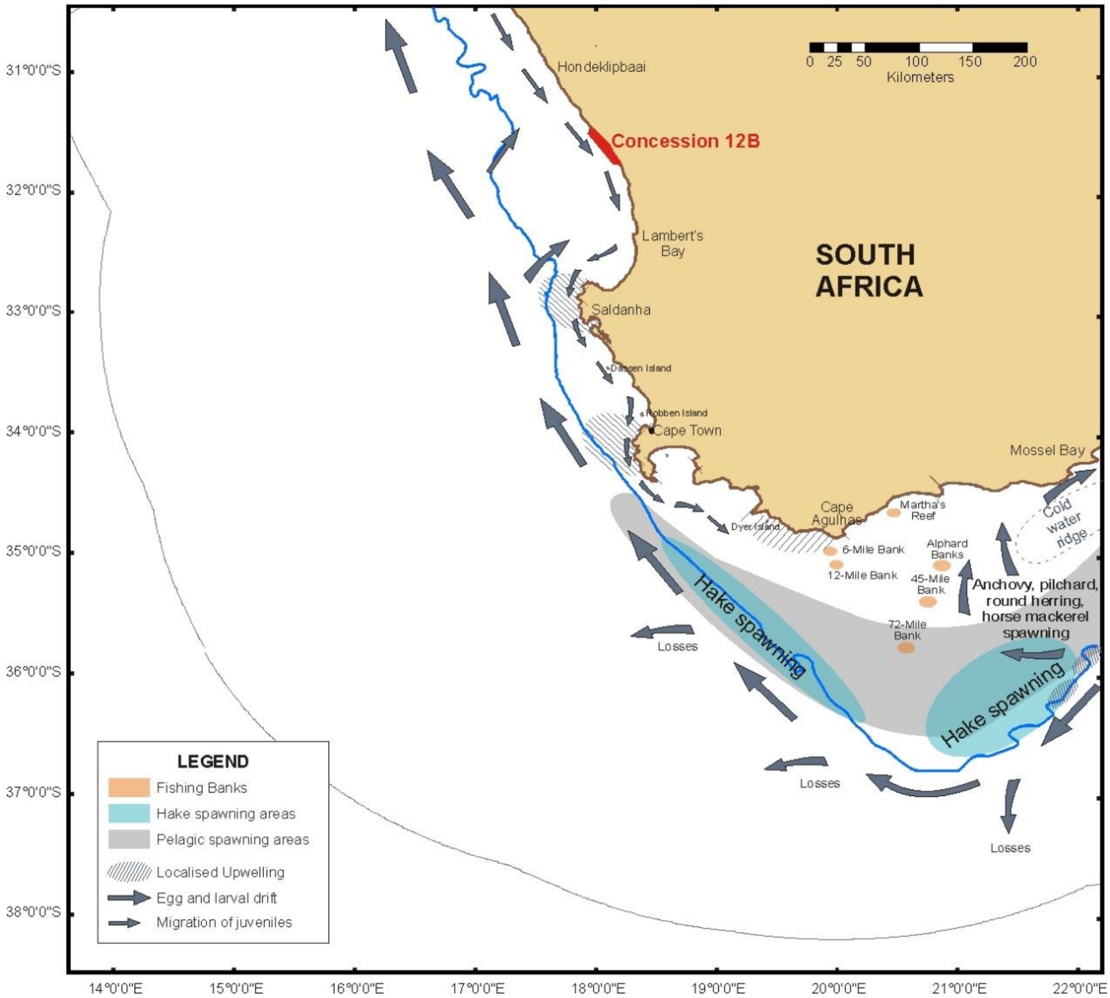


Figure 42: Concession 12B (red polygon) in relation to the major spawning areas in the southern Benguela region (adapted from Cruikshank 1990).

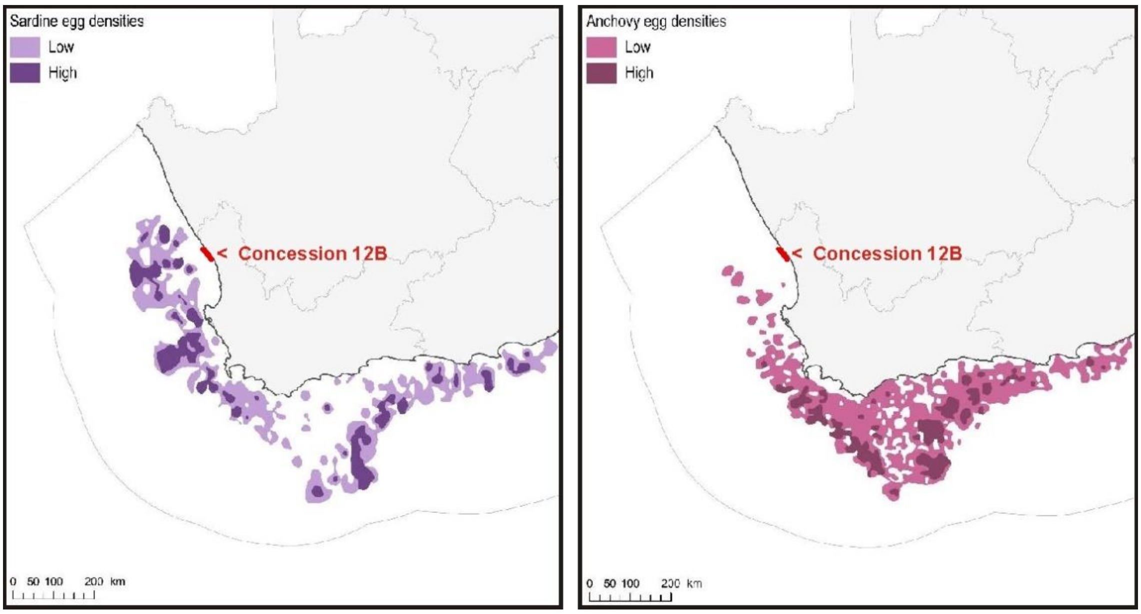


Figure 43: Distribution of sardine (left) and anchovy (right) spawning areas, as measured by egg densities, in relation to Concession 12B (red polygon) (adapted from Harris et al. 2022).

- *Hake, snoek and round herring move to the western Agulhas Bank and southern west coast to spawn in late winter and early spring (key period), when offshore Ekman losses are at a minimum and their eggs and larvae drift northwards and inshore to the west coast nursery grounds. Figure 44a and 22b highlight the temporal variation in hake eggs and larvae with there being a greater concentration of eggs and larvae between September - October compared to March - April. However, hake are reported to spawn throughout the year (Strømme et al. 2015). Snoek spawn along the shelf break (150-400 m) of the western Agulhas Bank and the West Coast between June and October (Griffiths 2002).*
- *Horse mackerel spawn over the east/central Agulhas Bank during winter months.*

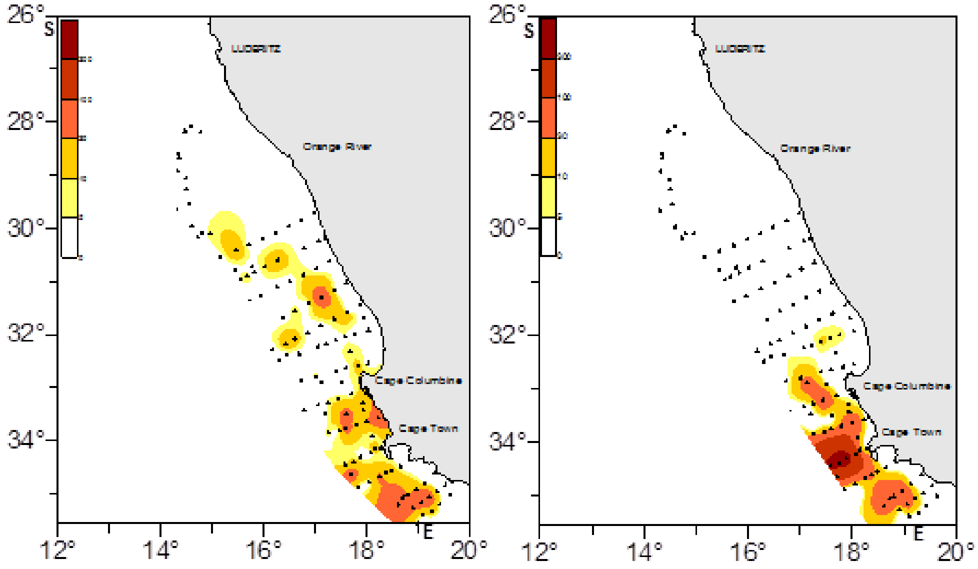


Figure 44a: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between September and October 2005 (adapted from Stenevik et al. 2008)).

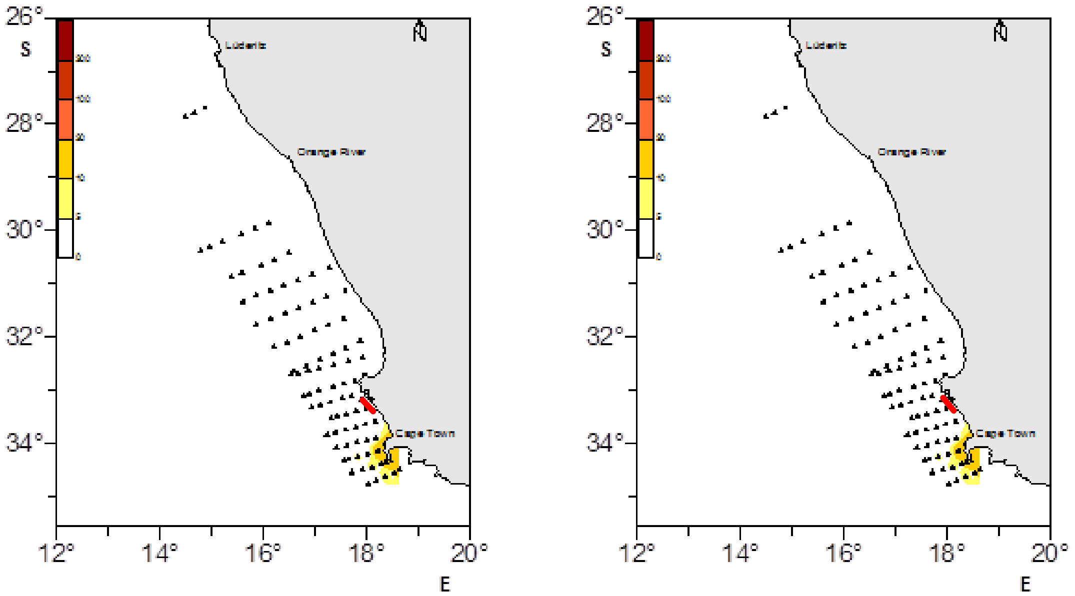


Figure 45: ***Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between March and April 2007 (adapted from Stenevik et al. 2008)).***

The eggs and larvae are carried around Cape Point and up the coast in northward flowing surface waters. At the start of winter every year, the juveniles recruit in large numbers into coastal waters across broad stretches of the shelf between the Orange River and Cape Columbine to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Following spawning, the eggs and larvae of snoek are transported to inshore (<150 m) nursery grounds north of Cape Columbine and east of Danger Point, where the juveniles remain until maturity. There is, therefore, some overlap of Concession 12B with the northward egg and larval drift of commercially important species, and the return migration of recruits (Figure 42). Thus, ichthyoplankton abundance in the concession is likely to be seasonally high.

8.2.3.3.2.2 Cephalopods

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Fourteen species of cephalopds have been recorded in the southern Benguela, the majority of which are sepiods/cuttlefish (Lipinski 1992; Augustyn et al. 1995). Most of the cephalopod resource is distributed on the mid-shelf with Sepia australis being most abundant at depths between 60-190 m, whereas S. hieronis densities were higher at depths between 110-250 m. Rossia enigmatica occurs more commonly on the edge of the shelf to depths of 500 m. Biomass of these species was generally higher in the summer than in winter. Cuttlefish are largely epi-benthic and occur on mud and fine sediments in association with their major prey item; mantis shrimps (Augustyn et al. 1995). They form an important food item for demersal fish.

8.2.3.3.2.3 Pelagic Fish

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The structure of the nearshore and surf zone fish community varies greatly with the degree of wave exposure. Species richness and abundance is generally high in sheltered and semi-exposed areas but typically very low off the more exposed beaches (Clark 1997a, 1997b). The surf-zone and outer turbulent zone habitats of sandy beaches are considered to be important nursery habitats for marine fishes (Modde 1980; Lasiak 1981; Kinoshita & Fujita 1988; Clark et al. 1994). However, the composition and abundance of the individual assemblages seems to be heavily dependent on wave exposure (Blaber & Blaber 1980; Potter et al. 1990; Clark 1997a, b). Surf-zone fish communities off the South African West Coast have relatively high biomass, but low species diversity. Typical surf-zone fish include harders (Liza richardsonii), white stumpnose (Rhabdosargus globiceps) (Figure 46), Cape sole (Heteromycteris capensis), Cape gurnard (Chelidonichthys capensis), False Bay klipfish (Clinus latipennis), sandsharks (Rhinobatos annulatus), eagle ray (Myliobatis aquila), and smooth-hound (Mustelus mustelus) (Clark 1997b).

Fish species commonly found in kelp beds off the West Coast include hottentot Pachymetopon blochii (Figure 47, left), twotone fingerfin Chirodactylus brachydactylus (Figure 47, right), red fingers Cheilodactylus fasciatus, galjoen Dichistius capensis, rock suckers Chorisochismus dentex, maned blennies Scartella emarginata and the catshark Haploblepharus pictus (Sauer et al. 1997; Brouwer et al. 1997; Branch et al. 2010).

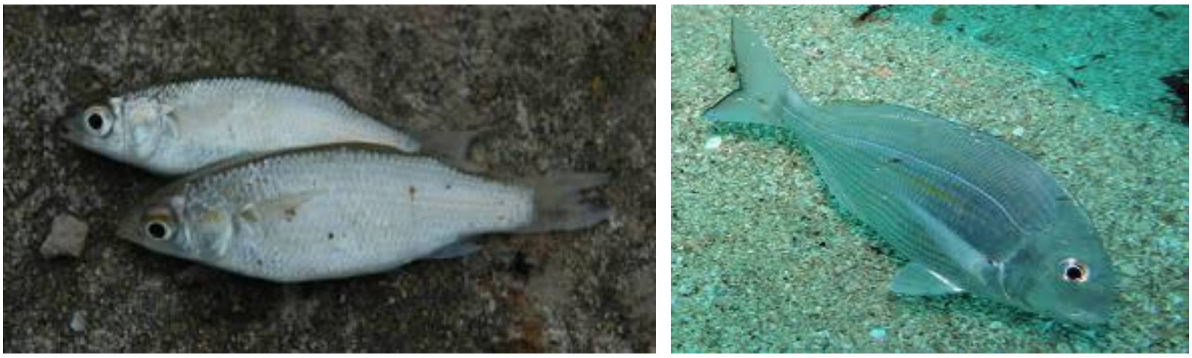


Figure 46: Common surf-zone fish include the harder (left, photo: aquariophil.org) and the white stumpnose (right, photo: easterncapescubadiving.co.za).

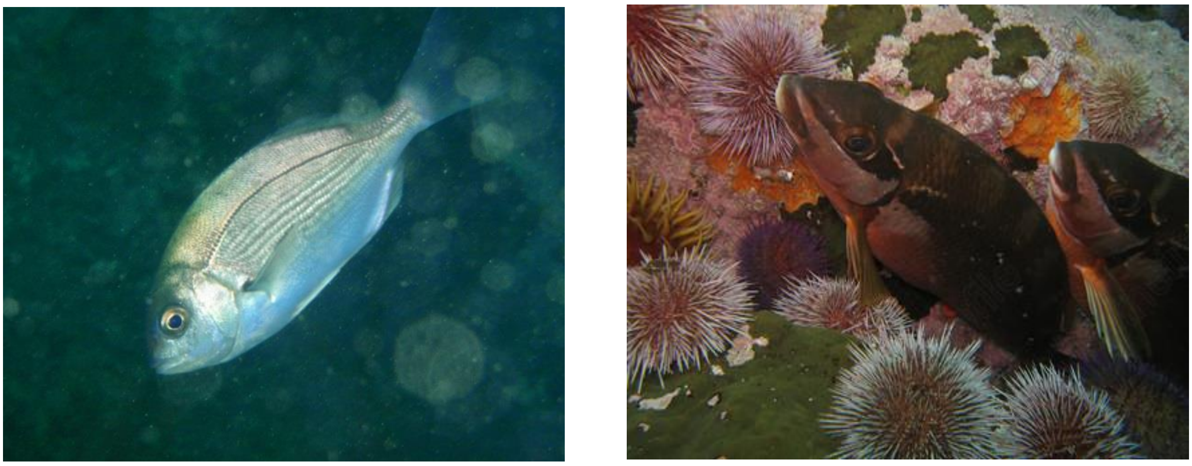


Figure 47: Common fish found in kelp beds include the Hottentot fish (left, photo: commons. wikimedia.org) and the twotone fingerfin (right, photo: www.parrphotographic.com).

Small pelagic species occurring beyond the surf-zone and generally within the 200 m contour include the sardine/pilchard (Sadinops ocellatus) (Figure 48, left), anchovy (Engraulis capensis), chub mackerel (Scomber japonicus), horse mackerel (Trachurus capensis) (Figure 48, right) and round herring (Etrumeus whiteheadi). These species typically occur in mixed shoals of various sizes (Crawford et al. 1987), and exhibit similar life history patterns involving seasonal migrations between the west and south coasts. The spawning areas of the major pelagic species are distributed on the continental shelf and along the shelf edge (30 – 130 km offshore) extending from south of St Helena Bay to Mossel Bay on the South Coast (Shannon & Pillar 1986). They spawn downstream of major upwelling centres in spring and summer (September to February), and their eggs and larvae are subsequently carried around Cape Point and up the coast in northward flowing surface waters.

At the start of winter every year, juveniles of most small pelagic shoaling species recruit into coastal waters in large numbers between the Orange River and Cape Columbine. They recruit in the pelagic stage, across broad stretches of the shelf, to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds on the Agulhas Bank. Recruitment success relies on the interaction of oceanographic events, and is thus subject to spatial and temporal variability. Consequently, the abundance of adults and juveniles of these small, short-lived (1-3 years) pelagic fish is highly variable both within and between species.

Figure 48: Cape fur seal preying on a shoal of pilchards (left). School of horse mackerel (right) (photos: www.underwatervideo.co.za; www.delivery.superstock.com).

Two species that migrate along the West Coast following the shoals of anchovy and pilchards are snoek Thyrsites atun and chub mackerel Scomber japonicas. Both these species have been rated as 'Least concern' on the national assessment (Sink et al. 2019). While the appearance of chub mackerel along the West and South-West coasts is highly seasonal, adult snoek are found throughout their distribution range and longshore movement are random and without a seasonal basis (Griffiths 2002). Initially postulated to be a single stock that undergoes a seasonal longshore migration from southern Angola through Namibia to the South African West Coast (Crawford & De Villiers 1985; Crawford et al. 1987), Benguela snoek are now recognised as two separate sub-populations separated by the Lüderitz upwelling cell (Griffiths 2003). On the West Coast, snoek move offshore to spawn and there is some southward dispersion as the spawning season progresses, with females on the West Coast moving inshore to feed between spawning events as spawning progresses. In contrast, those found further south along the western Agulhas Bank remain on the spawning grounds throughout the spawning season (Griffiths 2002) (Figure 49). They are voracious predators occurring throughout the water column, feeding on both demersal and pelagic invertebrates and fish. Chub mackerel similarly migrate along the southern African West Coast reaching South-Western Cape waters between April and August. They move inshore in June and July to spawn before starting the return northwards offshore migration later in the year. Their abundance and seasonal migrations are thought to be related to the availability of their shoaling prey species (Payne & Crawford 1989).

The fish most likely to be encountered on the shelf, beyond the shelf break and offshore of the concession area are the large migratory pelagic species, including various tunas, billfish and sharks, many of which are considered threatened by the International Union for the Conservation of Nature (IUCN), primarily due to overfishing (Table 4). Tuna and swordfish are targeted by high seas fishing fleets and illegal overfishing has severely damaged the stocks of many of these species. Similarly, pelagic sharks, are either caught as bycatch in the pelagic tuna longline fisheries, or are specifically targeted for their fins, where the fins are removed and the remainder of the body discarded.

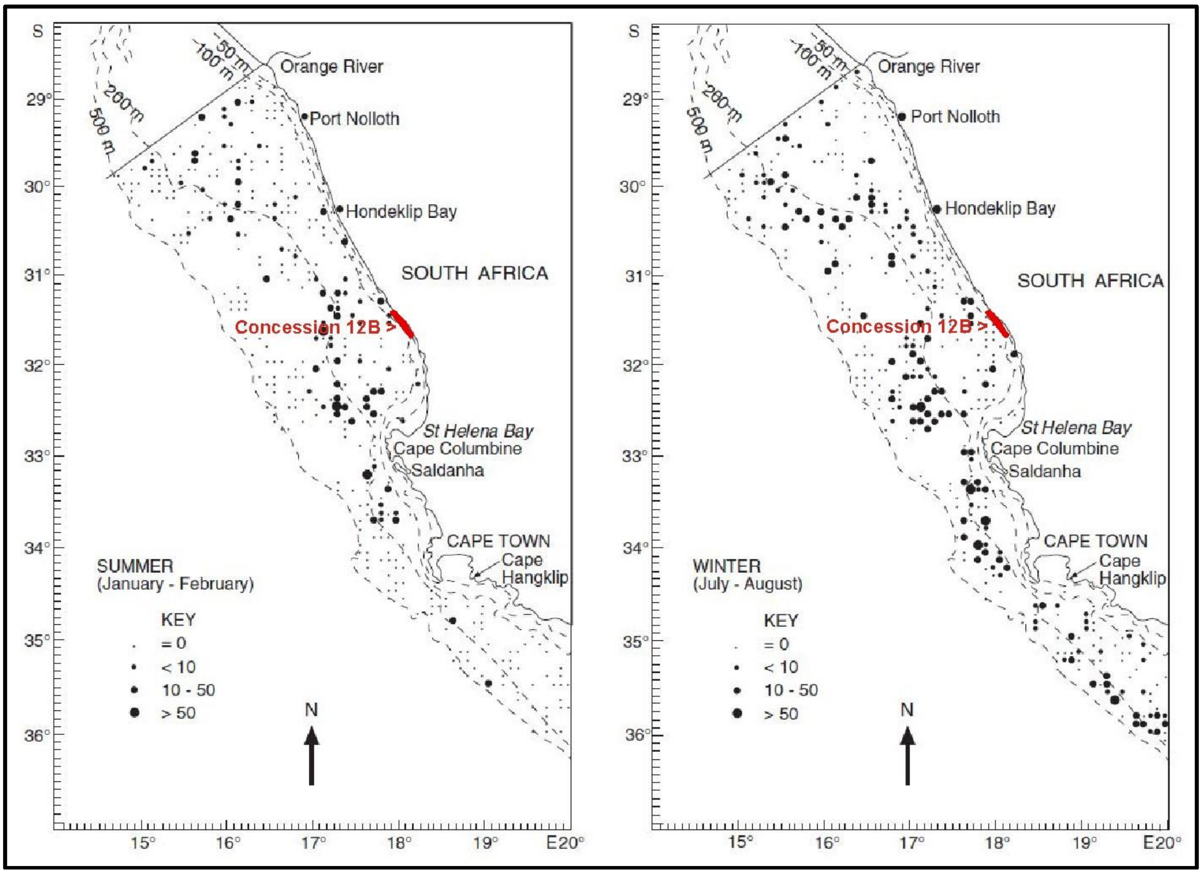


Figure 49: Mean number of snoek per demersal trawl per grid block (5 × 5 Nm) by season for (A) the west coast (July 1985–Jan 1991) and (B) the south coast in relation to Concession 12B (red polygon) (adapted from Griffiths 2002).

These large pelagic species migrate throughout the southern oceans, between surface and deep waters (>300 m) and have a highly seasonal abundance in the Benguela. Species occurring off western southern Africa include the albacore/longfin tuna Thunnus alalunga, yellowfin T. albacares, bigeye T. obesus, and skipjack Katsuwonus pelamis tunas, as well as the Atlantic blue marlin Makaira nigricans, the white marlin Tetrapturus albidus and the broadbill swordfish Xiphias gladius (Payne & Crawford 1989). The distributions of these species are 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 feature such as canyons and seamounts as well as meteorologically induced oceanic fronts (Shannon et al. 1989; Penney et al. 1992). Seasonal association with Child's Bank (off Namaqualand) and Tripp Seamount (off southern Namibia) occurs between October and June, with commercial catches often peaking in March and April (www.fao.org/fi/fcp/en/ NAM/body.htm; see CapMarine 2018 – Fisheries Specialist Study).

Table 13: Some of the more important large migratory pelagic fish likely to occur in the offshore regions of the West Coast. The National and Global IUCN Conservation Status are also provided.

Common Name	*Species*	*National Assessment*	*IUCN Conservation Status*
Tunas			
Southern Bluefin Tuna	*Thunnus maccoyii*	*Not Assessed*	*Endangered**
Bigeye Tuna	*Thunnus obesus*	*Vulnerable*	*Vulnerable*
Longfin Tuna/Albacore	*Thunnus alalunga*	*Near Threatened*	*Least concern*
Yellowfin Tuna	*Thunnus albacares*	*Near Threatened*	*Least concern*
Frigate Tuna	*Auxis thazard*	*Not Assessed*	*Least concern*
Eastern Little Tuna	*Euthynnus affinis*	*Least concern*	*Least concern*

Common Name	Species	National Assessment	IUCN Conservation Status
Skipjack Tuna	*Katsuwonus pelamis*	*Least concern*	*Least concern*
Atlantic Bonito	*Sarda sarda*	*Not Assessed*	*Least concern*
Billfish			
Black Marlin	*Istiompax indica*	*Data deficient*	*Data deficient*
Blue Marlin	*Makaira nigricans*	*Vulnerable*	*Vulnerable*
Striped Marlin	*Kajikia audax*	*Near Threatened*	*Near Threatened*
Sailfish	*Istiophorus platypterus*	*Least concern*	*Least concern*
Swordfish	*Xiphias gladius*	*Data deficient*	*Least concern*
Pelagic Sharks			
Oceanic Whitetip Shark	*Carcharhinus longimanus*	*Not Assessed*	*Vulnerable*
Dusky Shark	*Carcharhinus obscurus*	*Data deficient*	*Vulnerable*
Bronze Whaler Shark	*Carcharhinus brachyurus*	*Data deficient*	*Near Threatened*
Great White Shark	*Carcharodon carcharias*	*Least concern*	*Vulnerable*
Shortfin Mako	*Isurus oxyrinchus*	*Vulnerable*	*Endangered*
Longfin Mako	*Isurus paucus*	*Not Assessed*	*Vulnerable*
Whale Shark	*Rhincodon typus*	*Not Assessed*	*Endangered*
Blue Shark	*Prionace glauca*	*Least concern*	*Near Threatened*

**Until recently Southern Bluefin Tuna was globally assessed as 'Critically Endangered' by the IUCN. Although globally the stock remains at a low state, it is not considered overfished as there have been improvements since previous stock assessments. Consequently, the list of species changing IUCN Red List Status for 2020-2021 now list Southern Bluefin Tuna is globally 'Endangered'. In South Africa the stock is considered collapsed (Sink et al. 2019).*

A number of species of pelagic sharks are also known to occur on the West Coast, including blue Prionace glauca, short-fin mako Isurus oxyrinchus and oceanic whitetip sharks Carcharhinus longimanus. Occurring throughout the world in warm temperate waters, these species are usually found further offshore on the West Coast. Great white Carcharodon carcharias and whale sharks Rhincodon typus may also be encountered in coastal and offshore areas, although the latter occurs more frequently along the South and East coasts.

The recapture of a juvenile blue shark off Uruguay, which had been tagged off the Cape of Good Hope, supports the hypothesis of a single blue shark stock in the South Atlantic (Hazin 2000; Montealegre-Quijano & Vooren 2010) and Indian Oceans (da Silva et al. 2010). Using the Benguela drift in a north-westerly direction, it is likely that juveniles from the parturition off the south-western Cape would migrate through the project area en route to South America (da Silva et al. 2010).

The short-fin mako inhabits offshore temperate and tropical seas worldwide. It can be found from the surface to depths of 500 m, and as one of the few endothermic sharks is seldom found in waters <16 °C (Compagno 2001; Loefer et al. 2005). As the fastest species of shark, shortfin makos have been recorded to reach speeds of 40 km/h with burst of up to 74 km/h, and can jump to a height of 9 m (http://www.elasmo-research.org/education/shark_profiles/ i_oxyrinchus.htm). Most makos caught by longliners off South Africa are immature, with reports of juveniles and sub-adults sharks occurring near the edge of the Agulhas Bank and off the South Coast between June and November (Groeneveld et al. 2014), whereas larger and reproductively mature sharks were more common in the inshore environment along the East Coast (Foulis 2013).

Whale sharks are regarded as a broad ranging species typically occurring in offshore epipelagic areas with sea surface temperatures of 18–32°C (Eckert & Stewart 2001). Adult whale sharks reach an *average size of 9.7 m and 9 tonnes, making them the largest non-cetacean animal in the world. They are slow-moving filter-feeders and therefore particularly vulnerable to ship strikes (Rowat 2007). Although primarily solitary animals, seasonal feeding aggregations occur at several coastal sites all over the world, those closest to the project area being off Sodwana Bay in KwaZulu Natal (KZN) in the Greater St. Lucia Wetland Park (Cliff et al. 2007). Satellite tagging has revealed that individuals may travel distances of tens of 1 000s of kms (Eckert & Stewart 2001; Rowat & Gore 2007; Brunnschweiler et al. 2009). On the West Coast their summer and winter distribution is centred around the Orange River mouth and between Cape Columbine and Cape Point (Harris et al. 2022). The likelihood of an encounter in the concession area is relatively low.*

The whale shark and shortfin mako are listed in Appendix II (species in which trade must be controlled in order to avoid utilization incompatible with their survival) of CITES (Convention on International Trade in Endangered Species) and Appendix I and/or II of the Bonn Convention for the Conservation of Migratory Species (CMS). The whale shark is also listed as 'Vulnerable' in the List of Marine Threatened or Protected Species (TOPS) as part of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA).

The distributions of some of the pelagic sharks (dusky shark, spotted ragged tooth shark, shortfin mako and smooth hammerhead) are provided in Harris et al. (2022) (Figure 50).

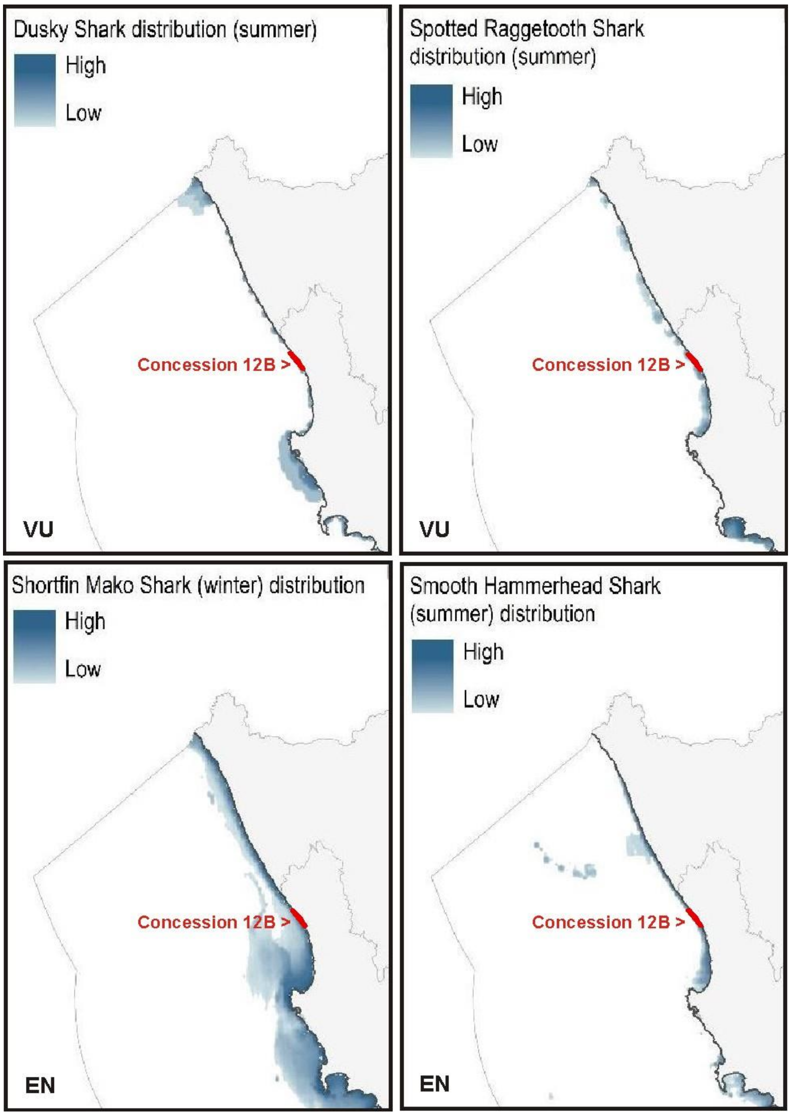


Figure 50: The distribution of various pelagic shark species in relation to Concession 12B (red polygon) (adapted from Harris et al. 2022). The IUCN conservation status is provided.

8.2.3.3.2.4 Turtles

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Three species of turtle occur along the West Coast, namely the Leatherback (Dermochelys coriacea) (Figure 51, left), and occasionally the Loggerhead (Caretta caretta) (Figure 51, right) and the Green (Chelonia mydas) turtle. Green turtles are non-breeding residents often found feeding on inshore reefs on the South and East Coasts and are expected to occur only as occasional visitors along the West Coast. The most recent conservation status, which assessed the species on a sub-regional scale, is provided in

Table 14.

After completion of the nesting season (October to January) both Leatherbacks and Loggerheads undertake long-distance migrations to foraging areas. Loggerhead turtles are coastal specialists keeping inshore, hunting around reefs, bays and rocky estuaries along the African South and East Coast, where they feed on a variety of benthic fauna including crabs, shrimp, sponges, and fish. In the open sea their diet includes jellyfish, flying fish, and squid (www.oceansafrica.com/turtles.htm). Satellite tagging of loggerheads suggests that they seldom occur west of Cape Agulhas (Harris et al. 2018; Robinson et al. 2019).

The Leatherback is the only turtle likely to be encountered in the offshore waters of west South Africa. The Benguela ecosystem, especially the northern Benguela where jelly fish numbers are high, is increasingly being recognized as a potentially important feeding area for leatherback turtles from several globally significant nesting populations in the south Atlantic (Gabon, Brazil) and south east Indian Ocean (South Africa) (Lambardi et al. 2008, Elwen & Leeney 2011; SASTN 2011[4]). Leatherback turtles from the east South Africa population have been satellite tracked swimming around the west coast of South Africa and remaining in the warmer waters west of the Benguela ecosystem (Lambardi et al. 2008) (Figure 52).

Figure 51: Leatherback (left) and loggerhead turtles (right) occur along the West Coast of Southern Africa (Photos: Ketos Ecology 2009; www.aquaworld-crete.com).

[4] *SASTN Meeting – Second meeting of the South Atlantic Sea Turtle Network, Swakopmund, Namibia, 24-30 July 2011.*

Table 14: Global and Regional Conservation Status of the turtles occurring off the South Coast showing variation depending on the listing used.

Listing	*Leatherback*	*Loggerhead*	*Green*
IUCN Red List:			
Species (date)	*V (2013)*	*V (2017)*	*E (2004)*
Population (RMU)	*CR (2013)*	*NT (2017)*	*
Sub-Regional/National			
NEMBA TOPS (2017)	*CR*	*E*	*E*
Sink & Lawrence (2008)	*CR*	*E*	*E*
Hughes & Nel (2014)	*E*	*V*	*NT*

NT – Near Threatened V – Vulnerable E – Endangered CR – Critically Endangered

*DD – Data Deficient UR – Under Review * - not yet assessed*

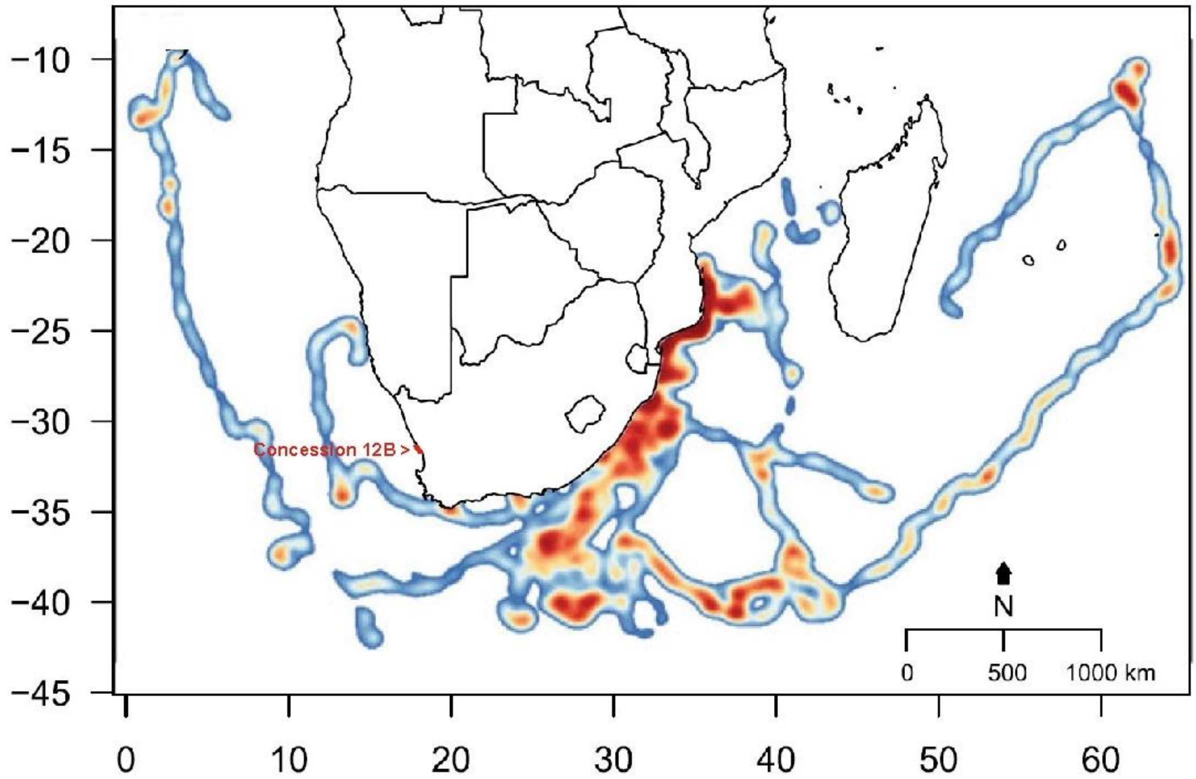


Figure 52: Concession 12B in relation to the migration corridors of Leatherback turtles in the south-western Indian Ocean. Relative use (CUD, cumulative utilization distribution) of corridors is shown through intensity of shading: light, low use; dark, high use (adapted from Harris et al. 2018).

Leatherback turtles inhabit deeper waters and are considered a pelagic species, travelling the ocean currents in search of their prey (primarily jellyfish). While hunting they may dive to over 600 m and remain submerged for up to 54 minutes (Hays et al. 2004). Their abundance in the study area is unknown but expected to be low. Leatherbacks feed on jellyfish and are known to have mistaken plastic marine debris for their natural food. Ingesting this can obstruct the gut, lead to absorption of toxins and reduce the absorption of nutrients from their real food. Leatherback Turtles are listed as 'Critically *endangered' worldwide by the IUCN and are in the highest categories in terms of need for conservation in CITES (Convention on International Trade in Endangered Species), and CMS (Convention on Migratory Species). The 2017 South African list of Threatened and Endangered Species (TOPS) similarly lists the species as 'Critically endangered', whereas on the National Assessment (Hughes & Nel 2014) Leatherbacks were listed as 'Endangered', whereas Loggerhead and green turtles are listed globally as 'Vulnerable' and 'Endangered', respectively, whereas on TOPS both species are listed as 'Endangered'. As a signatory of CMS, South Africa has endorsed and signed a CMS International Memorandum of Understanding specific to the conservation of marine turtles. South Africa is thus committed to conserve these species at an international level.*

8.2.3.3.2.5 Seabirds

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Fifteen species of seabirds breed in southern Africa, including Cape Gannet (Figure 53, left), African Penguin (Figure 53, right), African Black Oystercatcher, four species of Cormorant, White Pelican, three Gull and four Tern species (Figure 54). The breeding areas are distributed around the coast with islands being especially important. The closest breeding islands to concession 12B are Bird Island in Lambert's Bay and the Saldanha Bay Islands approximately 45 km and 155 km to the south of the concession area, respectively. There are breeding colonies of African Penguins at Bird Island (Lambert's Bay), and further south at Dassen Island and Robben Island. In the Western Cape, African Penguins breed mainly from February to October (peak during March to May) when their prey species (anchovy and sardine) are typically most abundant in the area (Crawford et al. 1995). The number of successfully breeding birds at the particular breeding sites varies with food abundance. Most of the breeding seabird species forage at sea with most birds being found relatively close inshore (10-30 km). Cape Gannets, which breed at only three locations in South Africa (Bird Island Lambert's Bay, Malgas Island and Bird Island Algoa Bay) are known to forage within 200 km offshore (Dundee 2006; Ludynia 2007; Grémillet et al. 2008; Crawford et al. 2011), and African Penguins have also been recorded as far as 60 km offshore. Concession 12B lies within the aggregate core home ranges of African Penguins but to the north of aggregate core home ranges of Cape Cormorant and Cape Gannet (Figure 54). There is, however, overlap of the concession with the foraging areas for Cape Cormorant and the core use area for African Penguins from Bird Island (Figure 54).

Figure 53: Cape Gannets Morus capensis (left) (Photo: NACOMA) and African Penguins Spheniscus demersus (right) (Photo: Klaus Jost) breed primarily on the offshore Islands.

Interactions with commercial fishing operations, either through incidental bycatch or competition for food resources, is the greatest threat to southern African seabirds, impacting 56% of seabirds of special concern. Crawford et al. (2014) reported that four of the seabirds assessed as Endangered compete with South Africa's fisheries for food: African Penguins, Cape Gannets and Cape Cormorants for sardines and anchovies, and Bank Cormorants for rock lobsters (Crawford et al. 2015). Populations of seabirds off the West Coast have recently shown significant decreases, with the population numbers of African Penguins currently only 2.5% of what the population was 80 years ago; declining from 1 million *breeding pairs in the 1920s, 25,000 pairs in 2009 and 15,000 in 2018 (Sink et al. 2019). Poor prey availability (Crawford et al. 2006), and a shift in prey biomass eastwards in response to climatic changes has lead to high adult mortality and continued population declines in African Penguins (Sherley et al. 2017). For Cape Gannets, the global population decreased from about 250,000 pairs in the 1950s and 1960s to approximately 130,000 in 2018, primarily as a result of a >90% decrease in Namibia's population in response to the collapse of Namibia's sardine resource. In South Africa, numbers of Cape Gannets have increased since 1956 and South Africa now holds >90% of the global population. However, numbers have recently decreased in the Western Cape but increased in Algoa Bay mirroring the southward and eastward shift sardine and anchovy. Algoa Bay currently holds approximately 75% of the South African Gannet population.*

Table 15: Breeding resident seabirds present along the South-West Coast (adapted from CCA & CMS 2001). IUCN Red List and National Assessment status are provided (Sink et al. 2019). * denotes endemicity.

Common Name	*Species Name*	*Global IUCN*	*National Assessment*
*African Penguin**	*Spheniscus demersus*	*Endangered*	*Endangered*
*African Black Oystercatcher**	*Haematopus moquini*	*Near Threatened*	*Least Concern*
White-breasted	*Phalacrocorax carbo*	*Least Concern*	*Least Concern*
*Cape Cormorant**	*Phalacrocorax capensis*	*Endangered*	*Endangered*
*Bank Cormorant**	*Phalacrocorax neglectus*	*Endangered*	*Endangered*
*Crowned Cormorant**	*Phalacrocorax*	*Near Threatened*	*Near Threatened*
White Pelican	*Pelecanus onocrotalus*	*Least Concern*	*Vulnerable*
*Cape Gannet**	*Morus capensis*	*Endangered*	*Endangered*
Kelp Gull	*Larus dominicanus*	*Least Concern*	*Least Concern*
Greyheaded Gull	*Larus cirrocephalus*	*Least Concern*	*Least Concern*
*Hartlaub's Gull**	*Larus hartlaubii*	*Least Concern*	*Least Concern*
Caspian Tern	*Hydroprogne caspia*	*Least Concern*	*Vulnerable*
Swift Tern	*Sterna bergii*	*Least Concern*	*Least Concern*
Roseate Tern	*Sterna dougallii*	*Least Concern*	*Endangered*
*Damara Tern**	*Sterna balaenarum*	*Vulnerable*	*Vulnerable*

Cape cormorants and Bank cormorants showed a substantial decline from the late 1970s/early 1980s to the late 2000s/early 2010s, with numbers of Cape cormorants dropping from 106,500 to 65,800 breeding pairs, and Bank cormorants from 1,500 to only 800 breeding pairs over that period (Crawford et al. 2015).

Large numbers of pelagic seabirds exploit the pelagic fish stocks of the Benguela system. Of the 49 species of seabirds that occur in the Benguela region, 15 are defined as resident, 10 are visitors from the northern hemisphere and 25 are migrants from the southern Ocean. The species classified as being common in the southern Benguela are listed in Table 16. *The area between Cape Point and the Orange River supports 38% and 33% of the overall population of pelagic seabirds in winter and summer, respectively. Most of the pelagic species in the region reach highest densities offshore of the shelf break (200 – 500 m depth), with highest population levels during their non-breeding season (winter). Pintado petrels and Prion spp. show the most marked variation here. The abundance of pelagic seabirds in concession 12B is expected to be low, as their foraging areas all lie well offshore of the concession (see maps in Harris et al. 2022).*

Demersal and pelagic longlining are key contributors to the mortality of albatrosses (Browed albatross 7%, Indian and Atlantic Yellow-Nosed Albatross 3%), petrels (white-chinned petrel 66%), shearwaters and Cape Gannets (2%) through accidental capture (bycatch and/or entanglement in fishing gear), with *an estimated annual mortality of 450 individuals of 14 species for the period 2006 to 2013 (Rollinson et al. 2017). Other threats include predation by mice on petrel and albatross chicks on sub-Antarctic islands, predation of chicks of Cape, Crowned and Bank Cormorants by Great White Pelicans, and predation of eggs and chicks of African Penguins, Bank, Cape and Crowned Cormorants by Kelp gulls. Disease (avian flu), climate change (heat stress and environmental variability) and oil spills are also considered major contributors to seabird declines (Sink et al. 2019).*

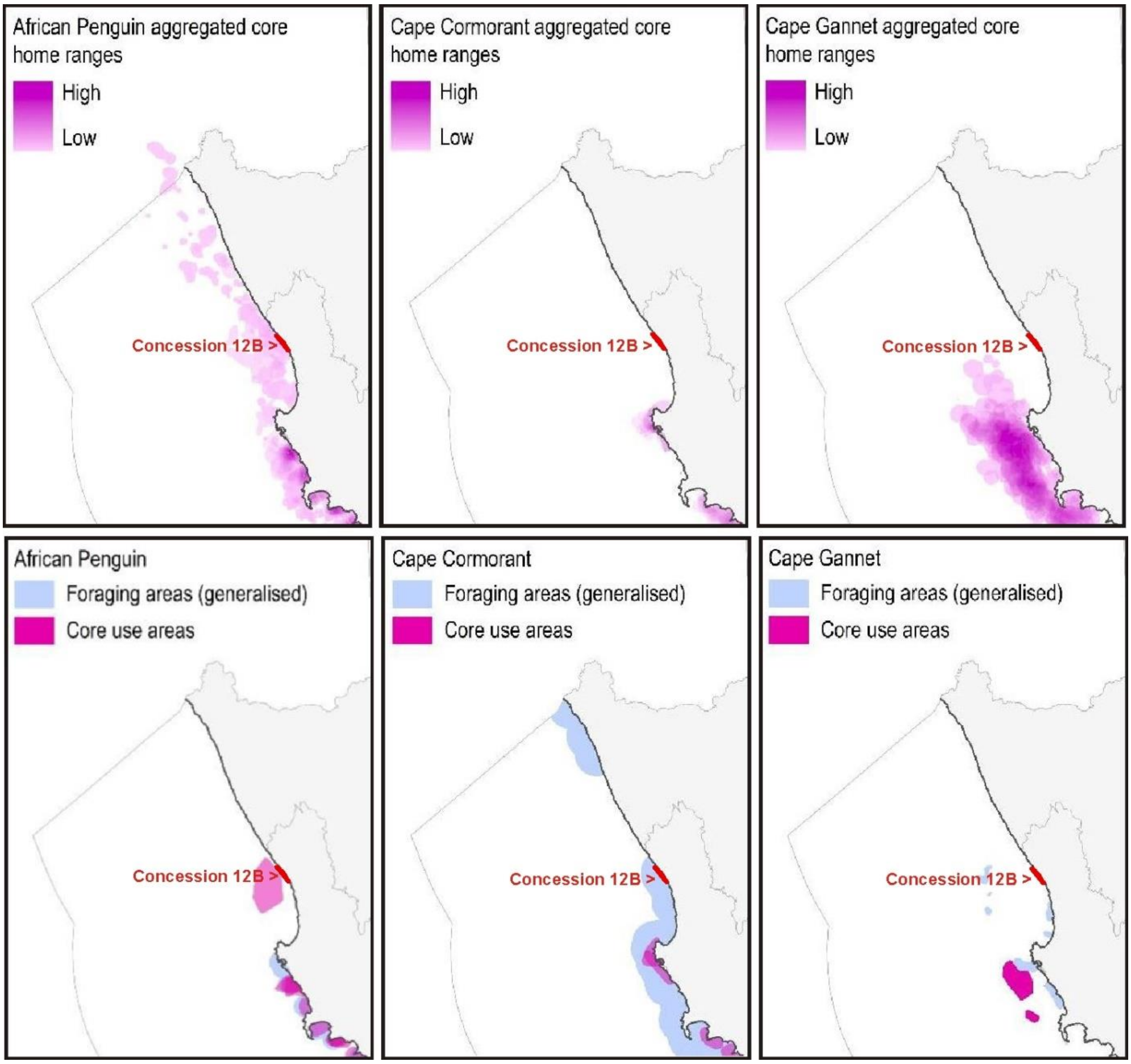


Figure 54: Concession 12B (red polygon) in relation to aggregate core home ranges (top) and generalised foraging areas and core usage areas (bottom) of African Penguins (left), Cape Cormorant (middle) and Cape Gannet (right) (adapted from Harris et al. 2022).

Table 16: Pelagic seabirds common in the southern Benguela region (Crawford et al. 1991). IUCN Red List and Regional Assessment status are provided (Sink et al. 2019).

Common Name	***Species name***	***Global IUCN***	***Regional Assessment***
Shy Albatross	*Thalassarche cauta*	*Near Threatened*	*Near Threatened*
Black-browed Albatross	*Thalassarche melanophrys*	*Least concern*	*Endangered*
Atlantic Yellow-nosed	*Thalassarche*	*Endangered*	*Endangered*
Indian Yellow-nosed	*Thalassarche carteri*	*Endangered*	*Endangered*
Wandering Albatross	*Diomedea exulans*	*Vulnerable*	*Vulnerable*
Southern Royal	*Diomedea epomophora*	*Vulnerable*	*Vulnerable*
Northern Royal	*Diomedea sanfordi*	*Endangered*	*Endangered*

Common Name	Species name	Global IUCN	Regional Assessment
Sooty Albatross	Phoebetria fusca	Endangered	Endangered
Light-mantled Albatross	Phoebetria palpebrata	Near Threatened	Near Threatened
Tristan Albatross	Diomedea dabbenena	Critically Endangered	Critically Endangered
Grey-headed Albatross	Thalassarche chrysostoma	Endangered	Endangered
Giant Petrel sp.	Macronectes	Least concern	Near Threatened
Southern Fulmar	Fulmarus glacialoides	Least concern	Least concern
Pintado Petrel	Daption capense	Least concern	Least concern
Blue Petrel	Halobaena caerulea	Least concern	Near Threatened
Salvin's Prion	Pachyptila salvini	Least concern	Near Threatened
Arctic Prion	Pachyptila desolata	Least concern	Least concern
Slender-billed Prion	Pachyptila belcheri	Least concern	Least concern
Broad-billed Prion	Pachyptila vittata	Least concern	Least concern
Kerguelen Petrel	Aphrodroma brevirostris	Least concern	Near Threatened
Greatwinged Petrel	Pterodroma macroptera	Least concern	Near Threatened
Soft-plumaged Petrel	Pterodroma mollis	Least concern	Near Threatened
White-chinned Petrel	Procellaria aequinoctialis	Vulnerable	Vulnerable
Spectacled Petrel	Procellaria conspicillata	Vulnerable	Vulnerable
Cory's Shearwater	Calonectris diomedea	Least concern	Least concern
Sooty Shearwater	Puffinus griseus	Near Threatened	Near Threatened
Flesh-footed Shearwater	Ardenna carneipes	Near Threatened	Least concern
Great Shearwater	Puffinus gravis	Least concern	Least concern
Manx Shearwater	Puffinus puffinus	Least concern	Least concern
Little Shearwater	Puffinus assimilis	Least concern	Least concern
European Storm Petrel	Hydrobates pelagicus	Least concern	Least concern
Leach's Storm Petrel	Oceanodroma leucorhoa	Vulnerable	Critically Endangered
Wilson's Storm Petrel	Oceanites oceanicus	Least concern	Least concern
Black-bellied Storm	Fregetta tropica	Least concern	Near Threatened
White-bellied Storm	Fregetta grallaria	Least concern	Least concern
Pomarine Jaeger	Stercorarius pomarinus	Least concern	Least concern
Subantarctic Skua	Catharacta antarctica	Least concern	Endangered
Parasitic Jaeger	Stercorarius parasiticus	Least concern	Least concern
Long-tailed Jaeger	Stercorarius longicaudus	Least concern	Least concern
Sabine's Gull	Larus sabini	Least concern	Least concern
Lesser Crested Tern	Thalasseus bengalensis	Least concern	Least concern
Sandwich Tern	Thalasseus sandvicensis	Least concern	Least concern
Little Tern	Sternula albifrons	Least concern	Least concern
Common Tern	Sterna hirundo	Least concern	Least concern
Arctic Tern	Sterna paradisaea	Least concern	Least concern
Antarctic Tern	Sterna vittata	Least concern	Endangered

8.2.3.3.3 Marine Mammals

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The marine mammal fauna occurring off the southern African coast includes several species of whales and dolphins and one resident seal species. Thirty five species of whales and dolphins are known (based on historic sightings or strandings records) or likely (based on habitat projections of known species parameters) to occur in the waters off the West Coast (Table 17). Of the species listed, the blue whale is considered 'Critically Endangered', the sei whale is 'Endangered' and the fin and sperm whales are considered 'Vulnerable' (IUCN Red Data list Categories). Altogether 17 species are listed as 'data deficient' underlining how little is known about cetaceans, their distributions and population trends. Apart from the resident species such as the endemic Heaviside's dolphin and dusky dolphin, the

Benguela also hosts species that migrate between Antarctic feeding grounds and warmer breeding ground waters, as well as species with a global distribution. The offshore areas have been particularly poorly studied with most available information from deeper waters (>200 m) arising from historic whaling records prior to 1970. In the past ten years, passive acoustic monitoring and satellite telemetry have begun to shed light on current patterns of seasonality and movement for some large whale species (Best 2007; Elwen et al. 2011; Rosenbaum et al. 2014; Shabangu et al. 2019; Thomisch et al. 2019) but information on smaller cetaceans in deeper waters remains poor. Records from marine mammal observers on seismic survey vessels have provided valuable data into cetacean presence although these are predominantly during summer months (Purdon et al. 2020). Information on general distribution and seasonality is improving but data population sizes and trends for most cetacean species occurring on the west coast of southern Africa is lacking.

Records from stranded specimens show that the area between St Helena Bay (~32°S) and Cape Agulhas (~34°S, 20°E) is an area of transition between Atlantic and Indian Ocean species, as well as those more commonly associated with colder waters of the west coast (e.g. dusky dolphins and long finned pilot whales) and those of the warmer east coast (e.g. striped and Risso's dolphins) (Findlay et al. 1992). Concession 12B lies north of this transition zone and can be considered to be truly on the 'West Coast'. However, the warmer waters that occur offshore of the Benguela ecosystem (more than ~100 km offshore) provide an entirely different habitat, that despite the relatively high latitude may host some species associated with the more tropical and temperate parts of the Atlantic such as rough toothed dolphins, Pan-tropical spotted dolphins and short finned pilot whales. Owing to the uncertainty of species occurrence offshore, species that may occur there have been included here for the sake of completeness.

The distribution of cetaceans can largely be split into those associated with the continental shelf and those that occur in deep, oceanic water. The continental slope (200-2,000 m) tends to support the highest diversity of cetaceans, as species from both shelf and pelagic environments may be found there (De Rock et al. 2019). Cetacean density (i.e. number of animals encountered) on the continental shelf is usually higher than in pelagic waters as species associated with the pelagic environment tend to be wide ranging across 1,000s of km. The most common species within the project area (in terms of likely encounter rate not total population sizes) are likely to be the long-finned pilot whale, common dolphin and humpback whale. Southern right whales may also be encountered passing through the Concession en route to their coastal breeding grounds.

Cetaceans comprise two taxonomic groups, the mysticetes (filter feeders with baleen) and the odontocetes (predatory whales and dolphins with teeth). The term 'whale' is used to describe species in both groups and is taxonomically meaningless (e.g. the killer whale and pilot whale are members of the Odontoceti, family Delphinidae and are thus dolphins). Due to differences in sociality, communication abilities, ranging behaviour and acoustic behaviour, these two groups are considered separately.

Table 17 lists the cetaceans likely to be found within the project area, based on all available data sources but mainly: Findlay et al. (1992), Best (2007), Weir (2011), De Rock et al. (2019), Purdon et al. (2020a, 2020b, 2020c) and Harris et al. (2022) (see also Figure 57 and Figure 58). The majority of data available on the seasonality and distribution of large whales in the project area is the result of commercial whaling activities mostly dating from the 1960s. Changes in the timing and distribution of migration may have occurred since these data were collected due to extirpation of populations or behaviours (e.g. migration routes may be learnt behaviours). The large whale species for which there are current data available are the humpback and southern right whale, although almost all data is limited to that collected on the continental shelf close to shore. A review of the distribution and seasonality of the key cetacean species likely to be found within the project area is provided below.

Mysticetes (Baleen whales)

The majority of mysticetes whales fall into the family Balaenopeteridae. Those occurring in the area include the blue, fin, sei, Antarctic minke, dwarf minke, humpback and Bryde's whales. The southern right whale (Family Balaenidae) and pygmy right whale (Family Neobalaenidae) are from taxonomically separate groups. The majority of mysticete species occur in pelagic waters with only occasional visits to shelf waters. All of these species show some degree of migration either to or through the latitudes encompassed by the broader project area when en route between higher latitude (Antarctic or Subantarctic) feeding grounds and lower latitude breeding grounds. Depending on the ultimate location of these feeding and breeding grounds, seasonality may be either unimodal, usually in winter months (June-August, e.g. minke and blue whales), or bimodal (e.g. May to July and October to November), reflecting a northward and southward migration through the area. Northward and southward migrations may take place at different distances from the coast due to whales following geographic or oceanographic features, thereby influencing the seasonality of occurrence at different locations. Because of the complexities of the migration patterns, each species is discussed separately below.

BRYDE'S WHALE (BALAENOPTER EDENI) - Two genetically and morphologically distinct populations of Bryde's whales (Figure 55, left) live off the coast of southern Africa (Best 2001; Penry 2010). The "offshore population" lives beyond the shelf (>200 m depth) off west Africa and migrates between wintering grounds off equatorial west Africa (Gabon) and summering grounds off western South Africa. Its seasonality on the west coast is thus opposite to the majority of the balaenopterids with abundance likely to be highest in the broader project area in January - March. The "inshore population" of Bryde's, which lives on the continental shelf and Agulhas Bank, is unique amongst baleen whales in the region by being non-migratory. The inshore population has recently been recognised as its own (yet to be named) sub species (Balaenoptera brydei edeni, Penry et al. 2018) with a total population for this subspecies of likely fewer than 600 individuals. The published range of the population is the continental shelf and Agulhas Bank of South Africa ranging from Durban in the east to at least St Helena Bay off the west coast with possible movements further north up the West Coast and into Namibia during the winter months (Best 2007). Only the offshore form may be encountered in the offshore portions of the concession area.

Table 17: Cetacean occurrence off the West Coast of South Africa, their seasonality, likely encounter frequency with proposed exploration activities and South African (Child et al. 2016) and Global IUCN Red List conservation status.

Common Name	***Species***	***Hearing Frequency***	***Shelf (<200 m)***	***Offshore (>200 m)***	***Seasonality***	***RSA Regional Assessment***	***IUCN Global Assessment***
Delphinids							
Dusky dolphin	*Lagenorhynchus obscurus*	*HF*	*Yes (0- 800 m)*	*No*	*Year round*	*Least Concern*	*Least Concern*
Heaviside's dolphin	*Cephalorhynchus heavisidii*	*VHF*	*Yes (0-200 m)*	*No*	*Year round*	*Least Concern*	*Near Threatened*
Common bottlenose dolphin	*Tursiops truncatus*	*HF*	*Yes*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Common dolphin	*Delphinus delphis*	*HF*	*Yes*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Southern right whale dolphin	*Lissodelphis peronii*	*HF*	*Yes*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Striped dolphin	*Stenella coeruleoalba*	*HF*	*No*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Pantropical spotted dolphin	*Stenella attenuata*	*HF*	*Edge*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Long-finned pilot whale	*Globicephala melas*	*HF*	*Edge*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Short-finned pilot whale	*Globicephala macrorhynchus*	*HF*	*Edge*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Rough-toothed dolphin	*Steno bredanensis*	*HF*	*No*	*Yes*	*Year round*	*Not Assessed*	*Least Concern*
Killer whale	*Orcinus orca*	*HF*	*Occasional*	*Yes*	*Year round*	*Least Concern*	*Data deficient*
False killer whale	*Pseudorca crassidens*	*HF*	*Occasional*	*Yes*	*Year round*	*Least Concern*	*Near Threatened*
Pygmy killer whale	*Feresa attenuata*	*HF*	*No*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Risso's dolphin	*Grampus griseus*	*HF*	*Yes (edge)*	*Yes*	*Year round*	*Data Deficient*	*Least Concern*
Sperm whales							
Pygmy sperm whale	*Kogia breviceps*	*VHF*	*Edge*	*Yes*	*Year round*	*Data Deficient*	*Data Deficient*
Dwarf sperm whale	*Kogia sima*	*VHF*	*Edge*	*Yes*	*Year round*	*Data Deficient*	*Data Deficient*
Sperm whale	*Physeter macrocephalus*	*HF*	*Edge*	*Yes*	*Year round*	*Vulnerable*	*Vulnerable*

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Beaked whales							
Cuvier's	*Ziphius cavirostris*	*HF*	*No*	*Yes*	*Year round*	*Data Deficient*	*Least Concern*
Arnoux's	*Beradius arnouxii*	*HF*	*No*	*Yes*	*Year round*	*Data Deficient*	*Data Deficient*
Southern bottlenose	*Hyperoodon planifrons*	*HF*	*No*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Layard's	*Mesoplodon layardii*	*HF*	*No*	*Yes*	*Year round*	*Data Deficient*	*Data Deficient*
True's	*Mesoplodon mirus*	*HF*	*No*	*Yes*	*Year round*	*Data Deficient*	*Data Deficient*
Gray's	*Mesoplodon grayi*	*HF*	*No*	*Yes*	*Year round*	*Data Deficient*	*Data Deficient*
Blainville's	*Mesoplodon densirostris*	*HF*	*No*	*Yes*	*Year round*	*Data Deficient*	*Data Deficient*
Baleen whales							
Antarctic Minke	*Balaenoptera bonaerensis*	*LF*	*Yes*	*Yes*	*>Winter*	*Least Concern*	*Near Threatened*
Dwarf minke	*B. acutorostrata*	*LF*	*Yes*	*Yes*	*Year round*	*Least Concern*	*Least Concern*
Fin whale	*B. physalus*	*LF*	*Yes*	*Yes*	*MJJ & ON*	*Endangered*	*Vulnerable*
Blue whale (Antarctic)	*B. musculus intermedia*	*LF*	*No*	*Yes*	*Winter peak*	*Critically Endangered*	*Critically Endangered*
Sei whale	*B. borealis*	*LF*	*Yes*	*Yes*	*MJ & ASO*	*Endangered*	*Endangered*
Bryde's (inshore)	*B brydei (subspp)*	*LF*	*Yes*	*Edge*	*Year round*	*Vulnerable*	*Least Concern*
Bryde's (offshore)	*B. brydei*	*LF*	*Edge*	*Yes*	*Summer (JFM)*	*Data Deficient*	*Least Concern*
Pygmy right	*Caperea marginata*	*LF*	*Yes*	*?*	*Year round*	*Least Concern*	*Least Concern*
Humpback sp.	*Megaptera novaeangliae*	*LF*	*Yes*	*Yes*	*Year round, SONDJF*	*Least Concern*	*Least Concern*
Humpback B2 population	*Megaptera novaeangliae*	*LF*	*Yes*	*Yes*	*Spring/Summer peak ONDJF*	*Vulnerable*	*Not Assessed*
Southern Right	*Eubalaena australis*	*LF*	*Yes*	*No*	*Year round, ONDJFMA*	*Least Concern*	*Least Concern*

- *Marine animals do not hear equally well at all frequencies within their functional hearing range. Based on the hearing range and sensitivities, Southall et al. (2019) have categorised noise sensitive marine mammal species into six underwater hearing groups: low-frequency (LF), high-frequency (HF) and very high-frequency (VHF) cetaceans, Sirenians (SI), Phocid carnivores in water (PCW) and other marine carnivores in water (OCW).*

Table 18: Seasonality of baleen whales in the broader project area based on data from multiple sources, predominantly commercial catches (Best 2007 and other sources) and data from stranding events (NDP unpubl data). Values of high (H), Medium (M) and Low (L) of the particular species within each row (species) and not comparable between species. For abundance / likely encounter rate within the broader region see Table 17.

	Jan	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***
Bryde's Inshore	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*
Bryde's Offshore	***H***	***H***	***H***	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*	*L*
Sei	*L*	*L*	*L*	*L*	***H***	***H***	*L*	***H***	***H***	***H***	*L*	*L*
Fin	*M*	*M*	*M*	***H***	***H***	***H***	*M*	***H***	***H***	***H***	*M*	*M*
Blue	*L*	*L*	*L*	*L*	*L*	***H***	***H***	***H***	*L*	*M*	*L*	*L*
Minke	*M*	*M*	*M*	***H***	***H***	***H***	*M*	***H***	***H***	***H***	*M*	*M*
Humpback	*M*	*M*	*L*	*L*	*L*	***H***	***H***	*M*	*M*	*L*	*M*	***H***
Southern Right	***H***	*M*	*L*	***L***	*L*	***H***	***H***	***H***	***M***	***M***	***H***	***H***
Pygmy right	***H***	***H***	***H***	*M*	*L*	*L*	*L*	*L*	*L*	*L*	*M*	*M*

The offshore stock was subjected to heavy whaling in the mid-20th century (Best 2001) and there are no current data on population size or stock recovery therefrom and is currently listed as 'Data deficient' (offshore population) and Vulnerable (inshore population) on the South African Red List. The inshore stock is regarded as extremely vulnerable and listed as such on the South African red list as it regularly suffers losses from entanglement in trap fisheries and has been subject to significant changes in its prey base due to losses and shifts in the sardine and small pelagic stocks around South Africa.

Figure 55: The Bryde's whale Balaenoptera brydei (left) and the Minke whale Balaenoptera bonaerensis (right) (Photos: www.dailymail.co.uk; www.marinebio.org).

SEI WHALE (BALAENOPTERA BOREALIS) - Almost all information is based on whaling records 1958-1963, most from shore-based catchers operating within a few hundred km of Saldanha Bay. At this time the species was not well differentiated from Bryde's whales and records and catches of the two species intertwined. There is no current information on population recovery, abundance or much information on distribution patterns outside of the whaling catches and the species remains listed as 'Endangered' on the South African Red List. Sei whales feed at high latitudes (40-50˚S) during summer months and migrate north through South African waters to unknown breeding grounds further north (Best 2007). Their migration pattern thus shows a bimodal peak with numbers west of Saldanha Bay being highest in May and June, and again in August, September and October. All whales were caught in waters deeper than 200 m with most occurring deeper than 1,000 m (Best & Lockyer 2002). A recent survey to Vema Seamount ~1,000 km west of Cape Town during October to November 2019, encountered a broadly-spread feeding aggregation of over 30 sei and fin whales at around 200 m water depth (Elwen et al. in prep). This poorly surveyed area (roughly 32˚S, 15˚E) is just to the Northwest of the historic whaling grounds suggesting this region remains an important feeding area for the species.

FIN WHALE (BALAENOPTERA PHYSALUS) - Fin whales were historically caught off the West Coast of South Africa, with a bimodal peak in the catch data suggesting animals were migrating further north during May-June to breed, before returning during August-October en route to Antarctic feeding grounds. However, the location of the breeding ground (if any) and how far north it remains a mystery (Best 2007). Some juvenile animals may feed year round in deeper waters off the shelf (Best 2007). The occasional single whale has been reported during humpback whale research in November in the southern Benguela, and a feeding aggregation of ~30 animals was observed in November 2019 ~200 km west of St Helena Bay in ~2,000 m of water. Current sightings records support the bimodal peak in presence observed from whaling data (but with some chance of year-round sightings) with animals apparently feeding in the nutrient rich Benguela during their southward migration as is observed extensively for humpback and right whales (see below) there is clearly is a chance of encounters year round. There are no recent data on abundance or distribution of fin whales off western South Africa, although a sighting in St Helena Bay in 2011 (Mammal Research Institute, unpubl. data) and several sightings in southern Namibia in 2014 and 2015 as well as a number of strandings and acoustic detections (Thomisch et al. 2017) in Namibia, confirm their contemporary occurrence in the region.

BLUE WHALE (BALAENOPTERA MUSCULUS) - Antarctic blue whales were historically caught in high numbers off the South African West Coast. Off Saldanha Bay, they were most abundant from May and July, with a secondary peak sometime in August to October (Best 2007). Although there were only two confirmed sightings of the species in the area between 1973 and 2006 (Branch et al. 2007), evidence of blue whale presence off southern Africa is increasing. Recent acoustic detections of blue whales in the Antarctic peak between December and

January (Tomisch et al. 2016) and off western South Africa (Shanbangu et al. 2019) and in northern Namibia between May and July (Thomisch 2017) support observed timing from whaling records. Several recent (2014-2015) sightings of blue whales during seismic surveys off the southern part of Namibia (water depth >1 000 m) confirm their existence in the area and occurrence in autumn months (April to June). Encounters in the concession area are unlikely.

MINKE WHALE (BALAENOPTERA BONAERENSIS / ACUTOROSTRATA) - Two forms of minke whale (Figure 55, right) occur in the southern Hemisphere, the Antarctic minke whale (Balaenoptera bonaerensis) and the dwarf minke whale (B. acutorostrata subsp.); both species occur in the Benguela (Best 2007). Antarctic minke whales range from the pack ice of Antarctica to tropical waters and are usually seen more than ~50 km offshore. Although adults migrate from the Southern Ocean (summer) to tropical/temperate waters (winter) to breed, some animals, especially juveniles, are known to stay in tropical/temperate waters year round. Recent data available from passive acoustic monitoring over a two-year period off the Walvis Ridge (Namibia) shows acoustic presence in June - August and November - December (Thomisch et al. 2016), supporting a bimodal distribution in the area. The dwarf minke whale has a more temperate distribution than the Antarctic minke and they do not range further south than 60-65°S. Dwarf minkes have a similar migration pattern to Antarctic minkes with at least some animals migrating to the Southern Ocean during summer. Dwarf minke whales occur closer to shore than Antarctic minkes and have been seen <2 km from shore on several occasions around South Africa. Both species are generally solitary and densities are likely to be low in the project area.

PYGMY RIGHT WHALE (CAPEREA MARGINATA) - this is the smallest of the baleen whales reaching only 6 m total length as an adult (Best 2007). The species is typically associated with cool temperate waters between 30°S and 55°S and records from southern and central Namibia are the northern most for the species (Leeney et al. 2013). Its preference for cooler waters, suggests that it is likely to be restricted to the continental shelf areas within the Benguela system, and is may occur in the deeper portions of the concession area.

The most abundant baleen whales in the Benguela are southern right whales and humpback whales (Figure 56). Both species have long been known to feed in the Benguela Ecosystem and numbers since 2000 have grown substantially. The feeding peak in the Benguela is spring and early summer (October – February) and follows the 'traditional' South African breeding season (June – November) and its associated migration (Johnson et al. 2022). Some individual right whales are known to move directly from the south coast breeding area into the west coast feeding area where they remained for several months (Barendse et al. 2011; Mate et al. 2011). Increasing numbers of summer records of both species, from the southern half of Namibia suggest that animals may also be feeding in the Lüderitz upwelling cell (NDP unpubl. data).

Figure 56: The Humpback whale Megaptera novaeangliae (left) and the Southern Right whale Eubalaena australis (right) are the most abundant large cetaceans occurring along the southern African West Coast (Photos: www.divephotoguide.com; www.aad.gov.au).

HUMPBACK WHALES (MEGAPTERA NOVAEANGLIAE): The majority of humpback whales passing through the eastern South Atlantic are migrating to breeding grounds off tropical west Africa, between Angola and the Gulf of Guinea (Rosenbaum et al. 2009; Barendse et al. 2010). Until recently it was believed that that these breeding grounds were functionally separate from those off east (Mozambique-Kenya-Madagascar), with only rare *movements between them (Pomilla & Rosenbaum 2005) and movements to other continental breeding grounds being even more rare. Recent satellite tagging of animals between Plettenberg Bay and Port Alfred during the northward migration, showed them to turn around and end up feeding in the Southern Benguela (Seakamela et al. 2015) before heading offshore and southwards using the same route as whales tracked off Gabon and the West Coast of South Africa. Unexpected results such as this highlight the complexities of understanding whale movements and distribution patterns and the fact that descriptions of broad season peaks in no way captures the wide array of behaviours exhibited by these animals. Furthermore, three separate matches have been made between individuals off South Africa and Brazil by citizen scientist photo-identification (www.happywhale.com). This included whales from the Cape Town and Algoa Bay-Transkei areas. Analysis of humpback whale breeding song on Sub-Antarctic feeding grounds also suggests exchange of singing male whales from western and eastern South Atlantic populations (Darling & Sousa-Lima 2005; Schall et al. 2021; but see also Darling et al. 2019; Tyarks et al. 2021).*

In southern African coastal waters, the northward migration stream is larger than the southward peak (Best & Allison 2010; Elwen et al. 2014), suggesting that animals migrating north strike the coast at varying places north of St Helena Bay, resulting in increasing whale density on shelf waters and into deeper pelagic waters as one moves northwards. On the southward migration, many humpbacks follow the Walvis Ridge offshore then head directly to high latitude feeding grounds, while others follow a more coastal route (including the majority of mother-calf pairs) possibly lingering in the feeding grounds off west South Africa in summer (Elwen et al. 2014; Rosenbaum et al. 2014). Although migrating through the Benguela, there is no existing evidence of a clear 'corridor' and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration (Barendse et al. 2010; Best & Allison 2010; Elwen et al. 2014). The only available abundance estimate put the number of animals in the West African breeding population (Gabon) to be in excess of 9 000 individuals in 2005 (IWC 2012) and it is likely to have increased substantially since this time at about 5% per annum (IWC 2012; see also Wilkinson 2021). The number of humpback whales feeding in the southern Benguela has increased substantially since estimates made in the early 2000s (Barendse et al. 2011). Since ~2011, 'supergroups' of up to 200 individual whales have been observed feeding within 10 km from shore (Findlay et al. 2017) with many hundred more passing through and whales are now seen in all months of the year around Cape Town. It has been suggested that the formation of these super-groups may be in response to anomalous oceanographic conditions in the Southern Benguela, which result in favourable food availability, thereby leading to these unique humpback whale feeding aggregations (Dey et al. 2021; see also Avila et al. 2019; Meynecke et al. 2020; Cade et al. 2021). Humpback whales are thus likely to be the most frequently encountered baleen whale in the project area (see Figure 58), ranging from the coast out beyond the shelf, with year round presence but numbers peaking during the northward migration in June – February and a smaller peak with the southern breeding migration around September – October but with regular encounters until February associated with subsequent feeding in the Benguela ecosystem.

In the first half of 2017 (when numbers are expected to be at their lowest) more than 10 humpback whales were reported stranded along the Namibian and South African west coasts. A similar event was recorded in late 2021-early 2022 when numerous strandings of young humpbacks were reported along the Western Cape Coast and in Namibia (Simon Elwen, Sea Search, pers. comm.). The cause of these deaths is not known, but a similar event off Brazil in 2010 (Siciliano et al. 2013) was linked to possible infectious disease or malnutrition. Unusual mortality events of humpback whales between 2016 and 2022 have similarly been reported along the US Atlantic Coast from Maine to Florida (https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2022-humpback-whale-unusual-mortality-event-along-atlantic-coast). The West African population may be undergoing similar stresses in response to changes in their ecosystem (see for example Kershaw et al. 2021). It is not yet understood what may be driving these ecosystem changes and what the long-term effects to populations could potentially be.

SOUTHERN RIGHT WHALE (EUBALAENA AUSTRALIS) - The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baie dos Tigres) and is considered to be a single population within this range (Roux et al. 2011). While in southern African waters, the vast majority of whales remain with a few kilometers of shore, predominantly in sheltered bays. The most recent abundance estimate for this population (2017), estimated the population at ~6,116 individuals *including all age and sex classes, which is thought to be at least 30% of the original population size with the population growing at ~6.5% per year since monitoring began (Brandaõ et al. 2018). When the population numbers crashed in 1920, the range contracted down to just the south coast of South Africa, but as the population recovers, it is repopulating its historic grounds including Namibia (Roux et al. 2001, 2015; de Rock et al. 2019) and Mozambique (Banks et al. 2011).*

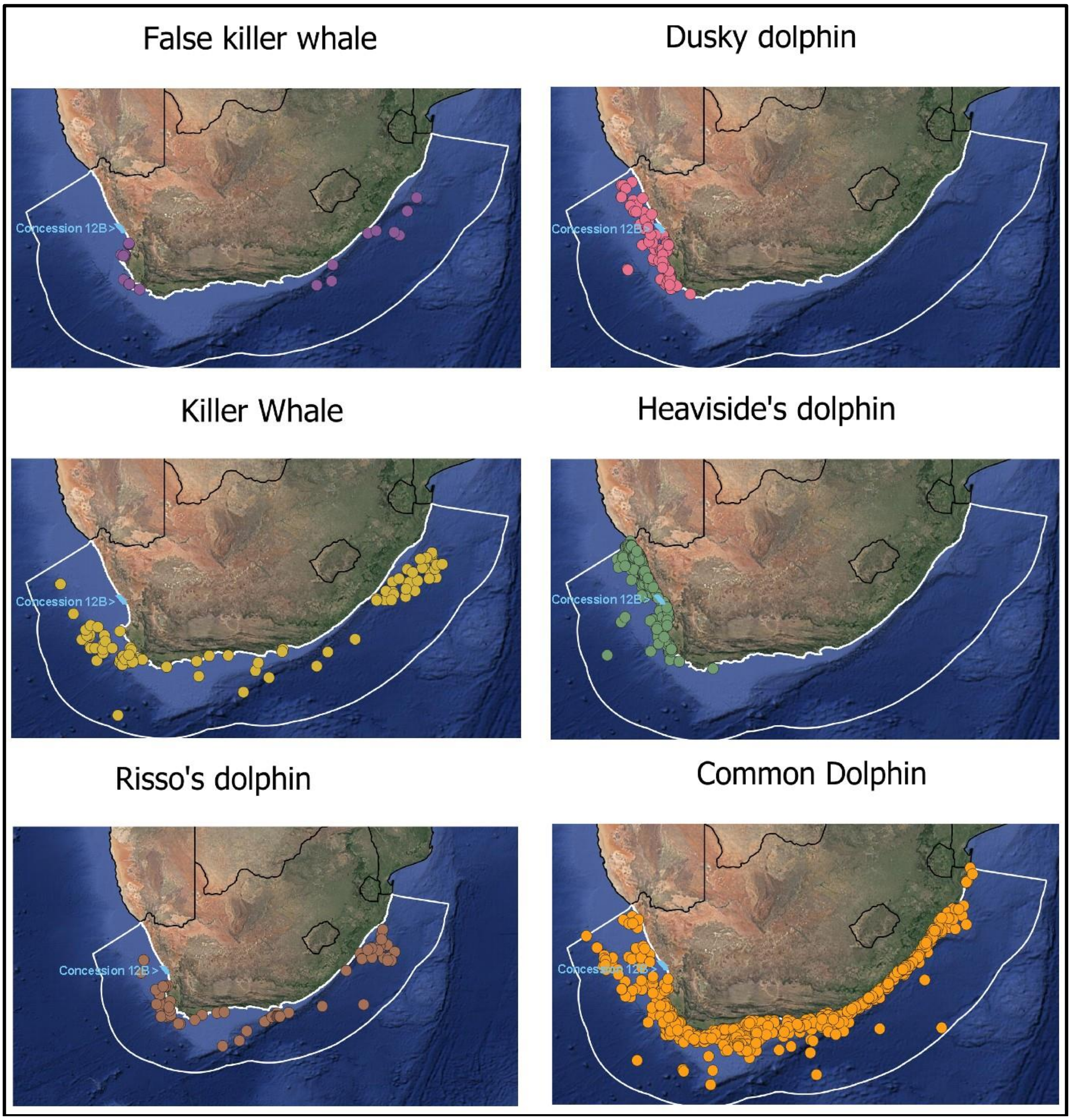


Figure 57: Concession 12B (cyan polygons) in relation to projections of predicted distributions for six odontocete species off the West Coast of South Africa (adapted from: Purdon et al. 2020a).

Some southern right whales move from the South Coast breeding ground directly to the West Coast feeding ground at St Helena Bay (Mate et al. 2011). When departing from feeding ground all satellite tagged animals in that study took a direct south-westward track. Mark-recapture data from 2003-2007 estimated roughly one third of the South African right whale population at that time were using St Helena Bay for feeding (Peters et al. 2005). While annual surveys have revealed a steady population increase since the protection of the species from commercial whaling, the South African right whale population has undergone substantial changes in breeding cycles and feeding areas (Van Den Berg et al. 2020), and numbers of animal using our coast since those studies were done – notably a significant decrease in the numbers of cow-calf-pairs following *the all-time record in 2018, a marked decline of unaccompanied adults since 2010 and variable presence of mother-calf pairs since 2015 (Roux et al. 2015; Vinding et al. 2015; Vermeulen et al. 2020). Analysis of calving intervals suggests that many animals shifted from a 3 year to 4 year calving interval (Brandaõ et al. 2018). The change in demographics are indications of a population undergoing nutritional stress and has been attributed to likely spatial and/or temporal displacement of prey due to climate variability (Vermeulen et al. 2020; see also Derville et al. 2019; Kershaw et al. 2021; van Weelden et al. 2021). Recent sightings (2018-2021) confirm that there is still a clear peak in numbers on the West Coast (Table Bay to St Helena Bay) between February and April. Pelagic concentrations of right whales were recorded in historic whaling records, in a band between 30°S and 40°S between Cape Town and Tristan da Cunha (Best 2007), well offshore of the concession area. These aggregations may be a result of animals feeding in this band, or those migrating south west from the Cape. Given this high proportion of the population known to feed in the southern Benguela, and the historical records, it is highly likely that large numbers of right whales may pass through the concession area between May and June and then again November to January.*

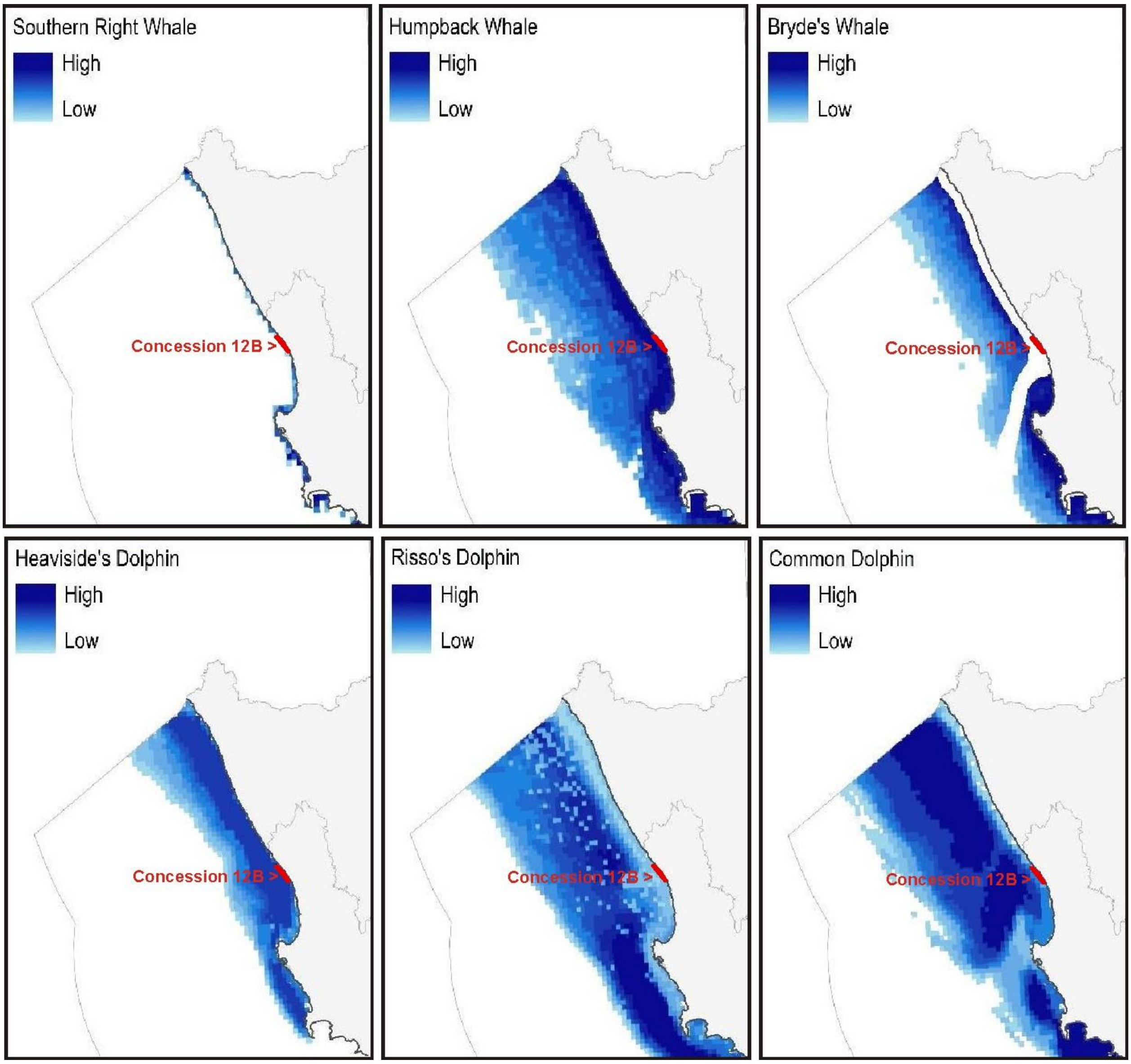


Figure 58: Concession 12B (red polygon) in relation to the predicted distribution of southern right whale (top left), humpback whale (top middle), Bryde's Whale (top right), Heaviside's dolphin (bottom left), Risso's dolphin (bottom middle), and common dolphin (bottom right) and with darker shades of blue indicating highest likelihood of occurrence (adapted from Harris et al. 2022).

Figure 59: The project area (red polygone) in relation to 'blue corridors' or 'whale superhighways' showing tracks of Humpback whales (orange) and Southern Right whales (green) between southern Africa and the Southern Ocean feeding grounds (adapted from Johnson et al. 2022).

Odontocetes (toothed whales and dolphins)

The Odontoceti are a varied group of animals including the dolphins, porpoises, beaked whales and sperm whales. Species occurring within the broader project area display a diversity of features, for example their ranging patterns vary from extremely coastal and highly site specific to oceanic and wide ranging (Figure 57). Those in the region can range in size from 1.6-m long (Heaviside's dolphin) to 17 m (bull sperm whale).

SPERM WHALE (PHYSETER MACROCEPHALUS) - All information about sperm whales in the southern African sub-region results from data collected during commercial whaling activities prior to 1985 (Best 2007). Sperm whales are the largest of the toothed whales and have a complex, structured social system with adult males behaving differently to younger males and female groups. They live in deep ocean waters, usually greater than 1,000 m depth, although they occasionally come onto the shelf in water 500 - 200 m deep (Best 2007) (Figure 60, left). They are considered to be relatively abundant globally (Whitehead 2002), although no estimates are available for South African waters. Seasonality of catches suggests that medium and large *sized males are more abundant in winter months while female groups are more abundant in autumn (March - April), although animals occur year round (Best 2007). Sperm whales are likely to be encountered in relatively high numbers in deeper waters (>500 m) beyond the 12B concession, predominantly in the winter months (April - October). Analysis of recent passive acoustic monitoring data from the edge of the South African continental shelf (800 – 1,000 m water depth, roughly 80 km WSW of Cape Point) confirms year-round presence. Sperm whales feed at great depths during dives in excess of 30 minutes making them difficult to detect visually, however the regular echolocation clicks made by the species when diving make them relatively easy to detect acoustically using monitoring equipment such as Passive Acoustic Monitoring (PAM).*

There are almost no data available on the abundance, distribution or seasonality of the smaller odontocetes (including the beaked whales and dolphins) known to occur in oceanic waters (>200 m) off the shelf of southern Africa. Beaked whales are all considered to be true deep water species usually being seen in waters in excess of 1,000 – 2,000 m deep (see various species accounts in Best 2007). Presence in the concession area may fluctuate seasonally, but insufficient data exist to define this clearly.

PYGMY AND DWARF SPERM WHALES (KOGIA SPP) - The genus Kogia currently contains two recognised species, the pygmy (K. breviceps) and dwarf (K. sima) sperm whales, both of which most frequently occur in pelagic and shelf edge waters. Their abundance and population trends in South African waters are unknown (Seakamela et al. 2021). Due to their small body size, cryptic behaviour, low densities and small school sizes, these whales are difficult to observe at sea, and morphological similarities make field identification to species level problematic, although their narrow-band high frequency echolocation clicks make them detectable and identifiable (at least to the genus) using passive acoustic monitoring equipment. The majority of what is known about the distribution and ecology of Kogiid whales in the southern African subregion is derived mainly from stranding records (e.g. Ross 1979; Findlay et al. 1992; Plön 2004; Elwen et al. 2013, but see also Moura et al. 2016). Dwarf sperm whales are associated with the warmer waters south and west of St Helena Bay. They are recorded from both the Benguela and Agulhas ecosystem (Best 2007) in waters deeper than ~1,000 m, and are thus unlikely to occur in the concession area.

During 2020 the incidence of kogiid strandings between Strandfontein on the West Coast and Groot Brak River on the South Coast (n=17), was considerably higher than the annual average during the previous 10 years (n=7). The dwarf sperm whale (K. sima) accounted for 60% of these strandings, of which most were recorded during autumn and winter. These seasonal stranding patterns are consistent with previously published accounts for the South African coast. In 2020, 40% of the total strandings were recorded in winter and 15% during summer. The occurrence of strandings throughout the year may, however, indicate the presence of a resident population with a seasonal distribution off the South Coast in autumn and winter (Seakamela et al. 2020, 2021). The cause of the strandings is unknown.

KILLER WHALE (ORCINUS ORCA) - Killer whales in South African waters were referred to a single morphotype, Type A, although recently a second 'flat-toothed' morphotype that seems to specialise in an elasmobranch diet has been identified but only 5 records are known all from strandings (Best et al. 2014). Killer whales (Figure 60) have a circum-global distribution being found in all oceans from the equator to the ice edge (Best 2007). Killer whales occur year-round in low densities off South Africa (Best et al. 2010, Elwen et al. in prep), Namibia (Elwen & Leeney 2011) and in the Eastern Tropical Atlantic (Weir et al. 2010). Historically sightings were correlated with that of baleen whales, especially sei whales on their southward migration. In more recent years – their presence in coastal waters (e.g. False Bay) has been strongly linked to the presence and hunting of common dolphins (Best et al. 2010; Sea Search unpublished data). Further from shore, there have been regular reports of killer whales associated with long-line fishing vessels on the southern and eastern Agulhas Bank, and the Cape Canyon to the south-west of Cape Point. Killer whales are found in all depths from the coast to deep open ocean environments and may thus be encountered in the concession area at low levels.

FALSE KILLER WHALE (PSEUDORCA CRASSIDENS) – Although the false killer whale is globally recognized as one species, clear differences in morphological and genetic characteristics between different study sites show that there is substantial difference between populations and a revision of the species taxonomy may be needed (Best 2007). False killer whales are more likely to be confused with the smaller melon-headed or pygmy killer whales with which they share all-black colouring and a similar head-shape, than with killer whales. The species has a tropical to temperate distribution and most sightings off southern Africa have occurred in water *deeper than 1,000 m, but with a few recorded close to shore (Findlay et al. 1992). They usually occur in groups ranging in size from 1 - 100 animals (Best 2007). The strong bonds and matrilineal social structure of this species makes it vulnerable to mass stranding (8 instances of 4 or more animals stranding together have occurred in the Western Cape, all between St Helena Bay and Cape Agulhas). There is no information on population numbers or conservation status and no evidence of seasonality in the region (Best 2007).*

PILOT WHALES (GLOBICEPHALA MELAS) – Long finned pilot whales display a preference for temperate waters and are usually associated with the continental shelf or deep water adjacent to it but moving inshore to follow prey (primarily squid) (Mate et al. 2005; Findlay et al. 1992; Weir 2011; Seakamela et al. 2022). They are regularly seen associated with the shelf edge by MMOs, fisheries observers and researchers. The distinction between long-finned and short finned pilot whales is difficult to make at sea. As the latter are regarded as more tropical species confined to the southwest Indian Ocean (Best 2007), it is likely that the majority of pilot whales encountered in the project area will be long-finned. There are many confirmed sighting of pilot whales along the shelf edge of South Africa and Namibia (de Rock et al. 2019; Sea Search unpublished data, SLR data). Observed group sizes range from 8-100 individuals (Seakamela et al. 2022). A recent tagging study showed long-finned pilot whale movements within latutudes of 33-36°S, along the shelf-edge from offshore of Cape Columbine to the Agulhas Bank, with concentrations in canyon areas, especially around the Cape Point Valley, and to a lesser degree around the Cape Canyon. It is postulated that the pilot whales target prey species in these productive areas (Seakamela et al. 2022).

COMMON DOLPHIN (DELPHINUS SPP.) – Two forms of common dolphins occur around southern Africa, a long-beaked and short-beaked form (Findlay et al. 1992; Best 2007), although they are currently considered part of a single global species (Cunha et al. 2015). The long-beaked common dolphin lives on the continental shelf of South Africa rarely being observed north of St Helena Bay on the west coast or in waters more 500 m deep (Best 2007), although more recent MMO sightings suggest presence to 1,000 m or more (SLR data, Sea Search data). Group sizes of common dolphins can be large, averaging 267 (± SD 287) for the South Africa region (Findlay et al. 1992). Far less is known about the short-beaked form which is challenging to differentiate at sea from the long-beaked form.

Figure 60: Sperm whales Physeter macrocephalus (left) and killer whales Orcinus orca (right) are toothed whales likely to be encountered in offshore waters (Photos: www.onpoint.wbur.org; www.wikipedia.org).

DUSKY DOLPHINS (LAGENORHYNCHUS OBSCURUS) - In water <500 m deep, dusky dolphins (Figure 61, right) are likely to be the most frequently encountered small cetacean as they are very "boat friendly" and often approach vessels to bowride. The species is resident year round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep (Findlay et al. 1992; Sea Search data). Although no information is available on the size of the population, they are regularly encountered in near shore waters between Cape Town and Lambert's Bay (Elwen et al. 2010; Sea Search unpubl. data) with group sizes of up to 800 having been reported (Findlay et al. 1992). A hiatus in sightings (or low density area) is reported between ~27°S and 30°S, associated with the Lüderitz upwelling cell (Findlay et al. 1992).

HEAVISIDE'S DOLPHINS (CEPHALORHYNCHUS HEAVISIDII) – This species (Figure 61, left) is relatively abundant in the Benguela ecosystem region with 10,000 animals estimated to live in the 400 km of coast between Cape Town and Lambert's Bay (Elwen 2008; Elwen et al. 2009a, 2009b). The Heaviside's dolphin occupies waters from *the coast to at least 200 m depth, (Elwen et al. 2006; Best 2007), and may show a diurnal onshore-offshore movement pattern (Elwen et al. 2010b), as they feed offshore at night. Heaviside's dolphins are resident year round and likely to be frequently encountered in the concession area.*

RISSO'S DOLPHIN: A medium sized dolphin with a distinctively high level of scarring and a proportionally large dorsal fin and blunt head. Risso's dolphins are distributed worldwide in tropical and temperate seas and show a general preference for shelf edge waters <1,500 m deep (Best 2007; Purdon et al. 2020a, 2020b). Many sightings in southern Africa have occurred around the Cape Peninsula and along the shelf edge of the Agulhas bank (see also Figure 58).

OTHER DELPHINIDS – Several other species of dolphins that might occur in deeper waters at low levels include the pygmy killer whale, Risso's dolphin, rough toothed dolphin, pan tropical spotted dolphin and striped dolphin (Findlay et al. 1992; Best 2007). Nothing is known about the population size or density of these species in the project area but encounters are likely to be rare.

Figure 61: The endemic Heaviside's Dolphin Cephalorhynchus heavisidii (left) (Photo: De Beers Marine Namibia), and Dusky dolphin Lagenorhynchus obscurus (right) (Photo: scottelowitzphotography.com).

BEAKED WHALES (VARIOUS SPECIES) – These whales were never targeted commercially and their pelagic distribution makes them the most poorly studied group of cetaceans. They are all considered to be true deep water species usually being seen in waters in excess of 1,000 – 2,000 m deep (see various species accounts in Best 2007). With recorded dives of well over an hour and in excess of 2 km deep, beaked whales are amongst the most extreme divers of any air breathing animals (Tyack et al. 2011). All the beaked whales that may be encountered in the project area are pelagic species that tend to occur in small groups usually less than five, although larger aggregations of some species are known (MacLeod & D'Amico 2006; Best 2007). The long, deep dives of beaked whales make them difficult to detect visually, but PAM will increase the probability of detection as animals are frequently echo-locating when on foraging dives. Beaked whales seem to be particularly susceptible to man-made sounds and several strandings and deaths at sea, often en masse, have been recorded in association with mid-frequency naval sonar (Cox et al. 2006; MacLeod & D'Amico 2006) and a seismic survey for hydrocarbons also running a multi-beam echo-sounder and sub bottom profiler (Southall et al. 2008; Cox et al. 2006; DeRuiter et al. 2013). Although the exact reason that beaked whales seem particularly vulnerable to man-made noise is not yet fully understood, existing evidence suggests that animals change their dive behaviour in response to acoustic disturbance (Tyack et al. 2011), showing a fear-response and surfacing too quickly with insufficient time to release nitrogen resulting in a form on decompression sickness. Necropsy of stranded animals has revealed gas embolisms and haemorrhage in the brain, ears and acoustic fat - injuries consistent with decompression sickness (acoustically mediated bubble formation) (Fernandez et al. 2005). Beyond decompression sickness, the fear/flee response may be the first stage in a multi-stage process ultimately resulting in stranding (Southall et al. 2008; Jepson et al. 2013). This type of stranding event has been linked to both naval sonar and multi-beam echosounders used for commercial scale side scan sonar (Southall et al. 2008). Thus, although hard to detect and avoid, beaked whales are amongst the most sensitive marine mammals to noise exposure and all cautions must be taken to reduce impact. Sightings of beaked whales in the project area are expected to be very low.

All whales and dolphins are given protection under the South African Law. The Marine Living Resources Act, 1998 (No. 18 of 1998) states that no whales or dolphins may be harassed, killed or fished. No vessel or aircraft may, without a permit or exemption, approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft.

Pinnepeds

The Cape fur seal (Arctocephalus pusillus pusillus) (Figure 62) is the only species of seal resident along the west coast of Africa, occurring at numerous breeding and non-breeding sites on the mainland and on nearshore islands and reefs. The South African population, which includes the West Coast colonies, was estimated at ca. 725,000 individuals in 2020. This is about 40% of the total southern African population, which has previously been estimated at up to 2 million (Seakamela et al. 2022). Vagrant records from four other species of seal more usually associated with the subantarctic environment have also been recorded: southern elephant seal (Mirounga leoninas), subantarctic fur seal (Arctocephalus tropicalis), crabeater (Lobodon carcinophagus) and leopard seals (Hydrurga leptonyx) (David 1989).

Figure 62: Colony of Cape fur seals Arctocephalus pusillus pusillus (Photo: Jessica Kemper).

There are a number of Cape fur seal breeding colonies within the broader study area: at Bucchu Twins near Alexander Bay, at Cliff Point (~17 km north of Port Nolloth), at Kleinzee (incorporating Robeiland), Strandfontein Point (south of Hondeklipbaai), Elephant Rocks, Paternoster Rocks and Jacobs Reef at Cape Columbine. The colony at Kleinzee has the highest seal population and produces the highest seal pup numbers on the South African Coast (Wickens 1994). The closest breeding colony to concession 12B is at Elephant Rocks inshore of the concession and within the adjacent concession 12A (Figure 63). They are therefore highly likely to be encountered during survey and sampling activities throughout concession 12B.

Non-breeding colonies and haul-out sites occur at Doringbaai south of Cliff Point, Rooiklippies, Swartduin and Noup between Kleinzee and Hondeklipbaai, at Spoeg River and Langklip south of Hondeklip Bay, on Bird Island at Lambert's Bay, at Paternoster Point at Cape Columbine and Duikerklip in Hout Bay. All have important conservation value since they are largely undisturbed at present.

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979), with bulls ranging further out to sea than females. Their diet varies with season and availability and includes pelagic species such as horse mackerel, pilchard, and hake, as well as squid and cuttlefish. Benthic feeding to depths of nearly 200 m for periods of up to 2 minutes has, however, also been recorded (Kirkman et al. 2015).

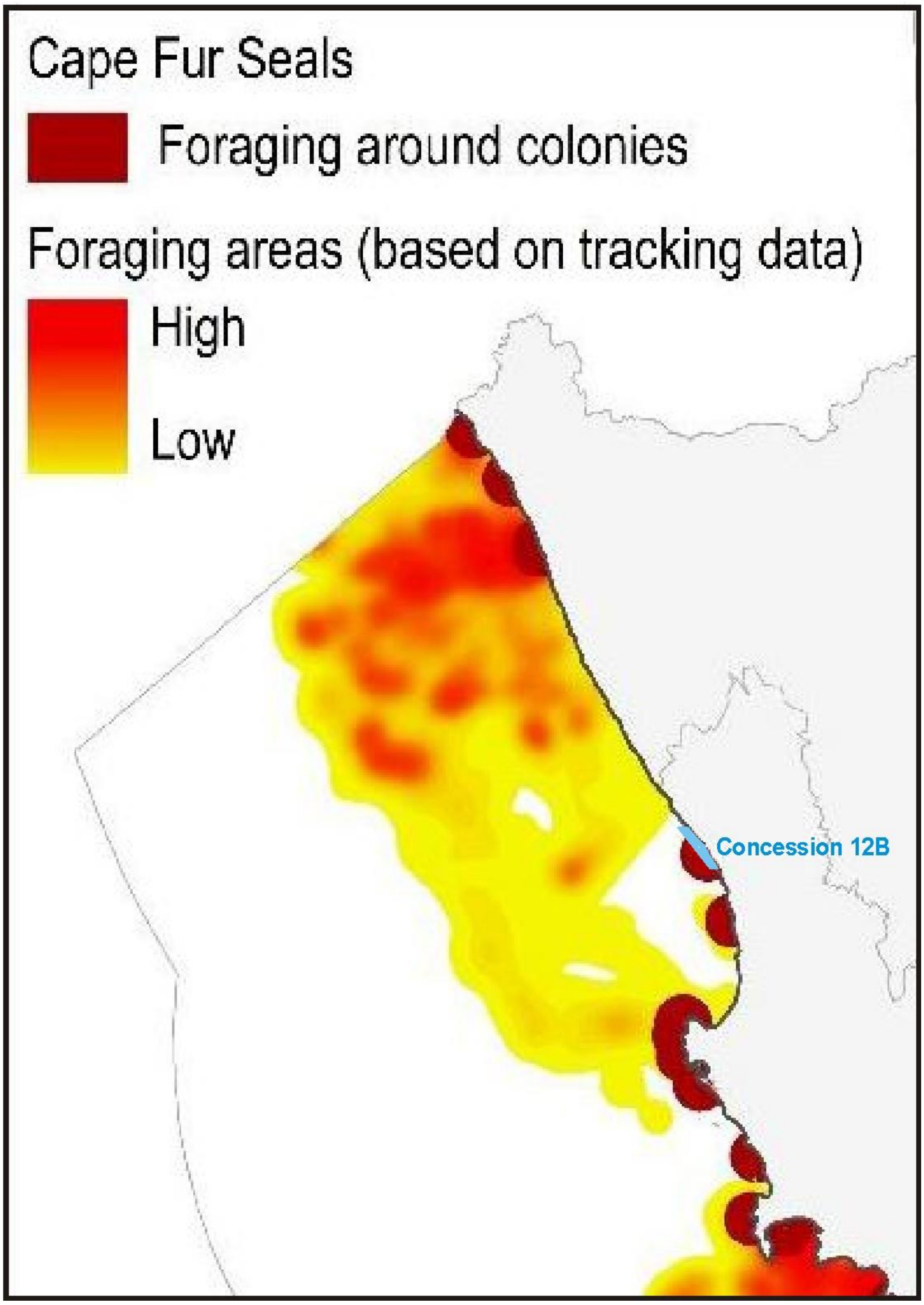


Figure 63: Concession 12B (cyan polygon) in relation to seal foraging areas on the West and South Coasts. Brown areas are generalised foraging areas around colonies, and areas in shades of red are foraging areas based on tracking data. Darker shades of red indicate areas of higher use (Adapted from Harris et al. 2022).

The timing of the annual breeding cycle is very regular, occurring between November and January, after which the breeding colonies break up and disperse. Breeding success is highly dependent on the local abundance of food, territorial bulls and lactating females being most vulnerable to local fluctuations as they feed in the vicinity of the colonies prior to and after the pupping season (Oosthuizen 1991).

Historically the Cape fur seal was heavily exploited for its luxurious pelt. Sealing restrictions were first introduced to southern Africa in 1893, and harvesting was controlled until 1990 when it was finally prohibited. The protection of the species has resulted in the recovery of the populations, and numbers continue to increase. Consequently, their conservation status is not regarded as threatened. The Cape Fur Seal population in South Africa is regularly monitored by the Department of Environment, Forestry and Fisheries (DEFF) (e.g. Kirkman et al. 2013). The overall population is considered healthy and stable in size, although there has been a westward and northward shift in the distribution of the breeding population (Kirkman et al. 2013).

An unprecedented mortality event was recorded in South Africa between September and December 2021 at colonies around the West Coast Peninsula and north to Lambert's Bay and Elands Bay. Primarily pups and juveniles were affected. Post-mortem investigations revealed that seals died in a poor condition with reduced blubber reserves, and protein energy malnutrition was detected for aborted foetuses, for juveniles and subadults. Although no unusual environmental conditions were identified that may have triggered the die-off, or caused it indirectly (e.g. HABs), 2021 was a year of below average recruitment of anchovy and sardine, the main food source for seals. While a lack of food, as a result of possibly climate change and/or overfishing, has been predicted to be the cause of this mass mortality, the underlying causes of the mortality event remain uncertain (Seakamela et al. 2022).

8.2.3.3.4 Coastal Communities

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The coastline of the project area is characterised by intertidal sandy beaches, rocky shores and estuaries. These were categorised into ecosystem types by Sink et al. (2019) and assigned a threat status depending on their geographic extent and extent of ecosystem degradation. Although the eastern boundary of concession 12B lies 1 km seawards of the shore, coastal communities and estuaries in the project area are discussed briefly here for the sake of completeness. Much of the coastline inshore of concession 12B has been assigned a threat status of 'vulnerable' reflecting the condition of the ecosystem types following decades of shore- and vessel-based diamond mining and mining of heavy mineral sands. The only endangered habitat types are two isolated reflective sandy beaches inshore of the northern portion of the concession, and the area around the Olifants Rivver mouth and estuary inshore of the southern portion of the concession. Table 19 *summarises the threat status of these ecosystem types in the broader project area (see also Figure 35).*

A general description of intertidal sandy beach and rocky shore habitats on the West Coast is provided below.

8.2.3.3.4.1 Intertidal Sandy Beaches

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Much of the coastline between Hondeklipbaai and the Olifants River mouth comprises sandy shores. Sandy beaches are one of the most dynamic coastal environments. With the exception of a few beaches in large bay systems (such as St Helena Bay, Saldanha Bay, Table Bay), the beaches along the South African West Coast are typically highly exposed. Exposed sandy shores consists of coupled surf-zone, beach and dune systems, which together form the active littoral sand transport zone (Short & Hesp 1985). The composition of their faunal communities is largely dependent on the interaction of wave energy, beach slope and sand particle size, which is termed beach morphodynamics. Three morphodynamic beach types are described: dissipative, reflective and intermediate beaches (McLachlan et al. 1993). Generally, dissipative beaches are relatively wide and flat with fine sands and low wave energy. Waves start to break far from the shore in a series of spilling breakers that 'dissipate' their energy along a broad surf zone. This generates slow swashes with long periods, resulting in less turbulent conditions on the gently sloping beach face. These beaches usually harbour the richest intertidal faunal communities. Reflective beaches in contrast, have high wave energy, and are coarse grained (>500 µm sand) with narrow and steep intertidal beach faces. The relative absence of a surf-zone causes the waves to break directly on the shore causing a high turnover of sand. The result is depauperate faunal communities. Intermediate beach conditions exist between these extremes and have a very variable species composition (McLachlan et al. 1993; Jaramillo et al. 1995, Soares 2003). This variability is mainly attributable to the amount and quality of food available. Beaches with a high input of e.g. kelp wrack have a rich and diverse drift-line fauna, which is sparse or absent on beaches lacking a drift-line (Branch & Griffiths 1988). As a result of the combination of typical beach characteristics, and the special adaptations of beach fauna to these, beaches act as filters and energy recyclers in the nearshore environment (Brown & McLachlan 2002).

Table 19: Threat status of the intertidal and shallow subtidal ecosystem types in the broader project area and inshore of concession 12B (Sink et al. 2019).

Ecosystem Type	*2019 Threat Status*
Namaqua Exposed Rocky Shore	*Vulnerable*

Namaqua Kelp Forest	*Vulnerable*
Namaqua Mixed Shore	*Vulnerable*
Namaqua Sheltered Rocky Shore	*Vulnerable*
Namaqua Very Exposed Rocky Shore	*Vulnerable*
Southern Benguela Dissipative Intermediate Sandy Shore	*Least Concern*
Southern Benguela Dissipative Sandy Shore	*Least Concern*
Southern Benguela Intermediate Sandy Shore	*Near threatened*
Southern Benguela Reflective Sandy Shore	*Endangered*

Numerous methods of classifying beach zonation have been proposed, based either on physical or biological criteria. The general scheme proposed by Branch & Griffiths (1988) is used below (Figure 64*), supplemented by data from various publications on West Coast sandy beach biota (e.g. Bally 1987; Brown et al. 1989; Soares et al. 1996, 1997; Nel 2001; Nel et al. 2003; Soares 2003; Branch et al. 2010; Harris 2012). The macrofaunal communities of sandy beaches are generally ubiquitous throughout the southern African West Coast region, being particular only to substratum type, wave exposure and/or depth zone. Due to the exposed nature of the coastline in the study area, most beaches are of the intermediate to reflective type. The upper beach dry zone (supralittoral) is situated above the high water spring (HWS) tide level, and receives water input only from large waves at spring high tides or through sea spray. This zone is characterised by a mixture of air breathing terrestrial and semi-terrestrial fauna, often associated with and feeding on kelp deposited near or on the driftline. Terrestrial species include a diverse array of beetles and arachnids and some oligochaetes, while semi-terrestrial fauna include the oniscid isopod Tylos granulatus, and amphipods of the genus Talorchestia. The mid-beach retention zone and low-beachsaturation zone (intertidal zone or mid-littoral zone) has a vertical range of about 2 m. This mid-shore region is characterised by the cirolanid isopods Pontogeloides latipes, Eurydice (longicornis=) kensleyi, and Excirolana natalensis, the polychaetes Scolelepis squamata, Orbinia angrapequensis, Nepthys hombergii and Lumbrineris tetraura, and amphipods of the families Haustoridae and Phoxocephalidae (Figure 65). In some areas, juvenile and adult sand mussels Donax serra may also be present in considerable numbers.*

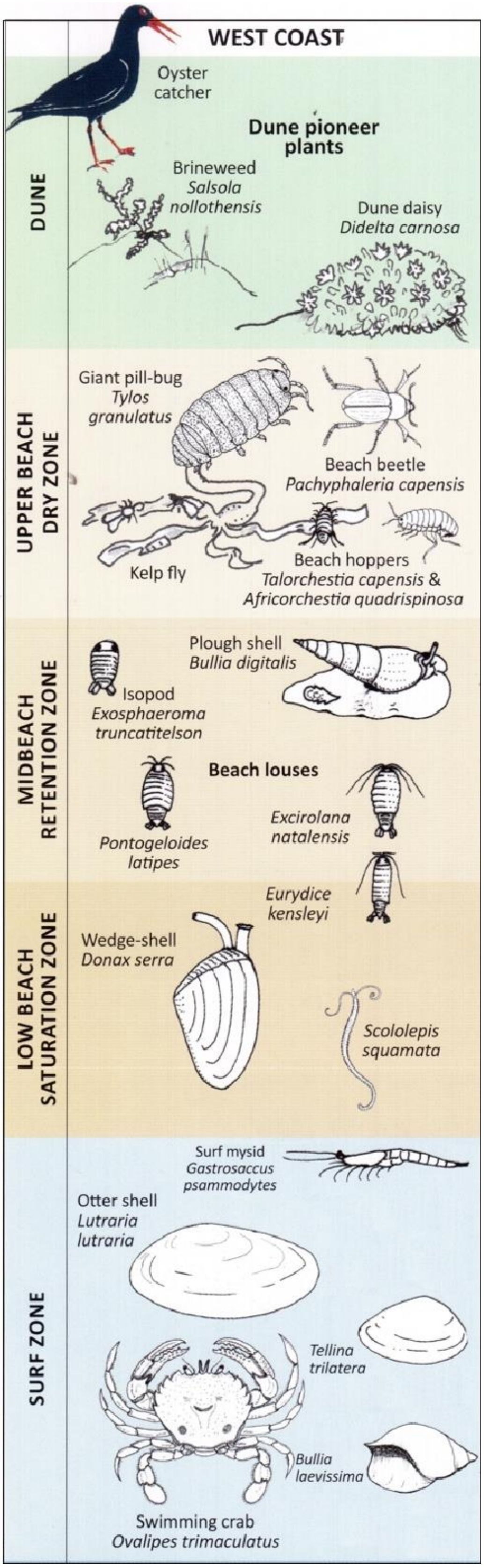


Figure 64: Schematic representation of the West Coast intertidal beach zonation (adapted from Branch & Branch 2018).

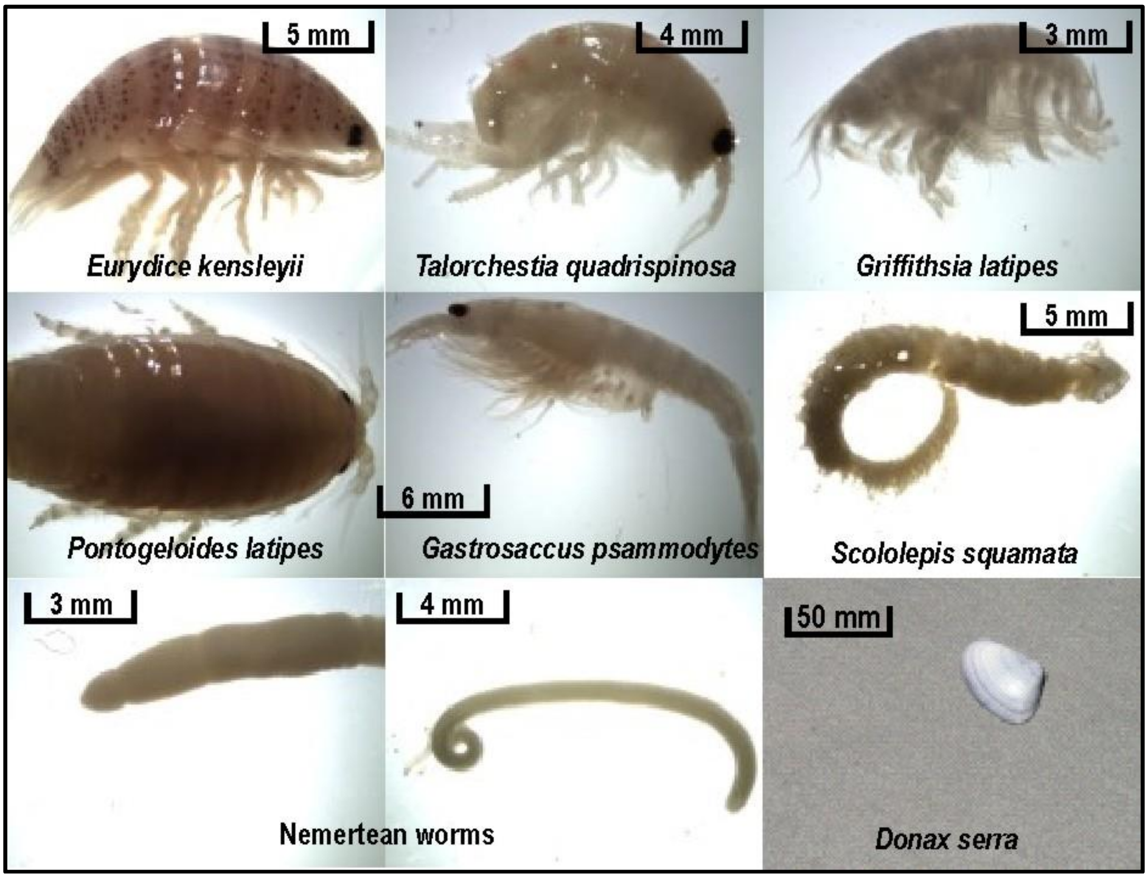


Figure 65: Common beach macrofaunal species occurring on exposed West Coast beaches.

The surf zone (inner turbulent and transition zones) extends from the Low Water Spring mark to about -2 m depth. The mysid Gastrosaccus psammodytes (Mysidacea, Crustacea), the ribbon worm Cerebratulus fuscus (Nemertea), the cumacean Cumopsis robusta (Cumacea) and a variety of polychaetes including Scolelepis squamata and Lumbrineris tetraura, are typical of this zone, although they generally extend partially into the midlittoral above. In areas where a suitable swash climate exists, the gastropod Bullia digitalis (Gastropoda, Mollusca) may also be present in considerable numbers, surfing up and down the beach in search of carrion.

The transition zone spans approximately 2 - 5 m depth beyond the inner turbulent zone. Extreme turbulence is experienced in this zone, and as a consequence this zone typically harbours the lowest diversity on sandy beaches. Typical fauna include amphipods such as Cunicus profundus and burrowing polychaetes such as Cirriformia tentaculata and Lumbrineris tetraura.

The outer turbulent zone extends beyond the surf zone and below 5 m depth, where turbulence is significantly decreased and species diversity is again much higher. In addition to the polychaetes found in the transition zone, other polychaetes in this zone include Pectinaria capensis, and Sabellides ludertizii. The sea pen Virgularia schultzi (Pennatulacea, Cnidaria) is also common as is a host of amphipod species and the three spot swimming crab Ovalipes punctatus (Brachyura, Crustacea).

8.2.3.3.4.2 Intertidal Rocky Shores

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The following general description of the intertidal and subtidal habitats for the West Coast is based on Field et al. (1980), Branch & Griffiths (1988), Field & Griffiths (1991) and Branch & Branch (2018).

Several studies on the west coast of southern Africa have documented the important effects of wave action on the intertidal rocky-shore community. Specifically, wave action enhances filter-feeders by increasing the concentration and turnover of particulate food, leading to an elevation of overall biomass despite low species diversity (McQuaid & Branch 1985; Bustamante & Branch 1995, 1996a; Bustamante et al. 1997). Conversely, sheltered shores are diverse with a relatively low biomass, and only in relatively sheltered embayments does *drift kelp accumulate and provide a vital support for very high densities of kelp trapping limpets, such as Cymbula granatina that occur exclusively there (Bustamante et al. 1995). In the subtidal, these differences diminish as wave exposure is moderated with depth.*

West Coast rocky intertidal shores can be divided into five zones on the basis of their characteristic biological communities: The Littorina, Upper Balanoid, Lower Balanoid, Cochlear/Argenvillei and the Infratidal Zones. These biological zones correspond roughly to zones based on tidal heights (Figure 66 and Figure 67). Tolerance to the physical stresses associated with life on the intertidal, as well as biological interactions such as herbivory, competition and predation interact to produce these five zones.

The uppermost part of the shore is the supralittoral fringe, which is the part of the shore that is most exposed to air, perhaps having more in common with the terrestrial environment. The supralittoral is characterised by low species diversity, with the tiny periwinkle Afrolittorina knysnaensis, and the red alga Porphyra capensis constituting the most common macroscopic life.

The upper mid-littoral is characterised by the limpet Scutellastra granularis, which is present on all shores. The gastropods Oxystele variegata, Nucella dubia, and Helcion pectunculus are variably present, as are low densities of the barnacles Tetraclita serrata, Octomeris angulosa and Chthalamus dentatus. Flora is best represented by the green algae Ulva spp.

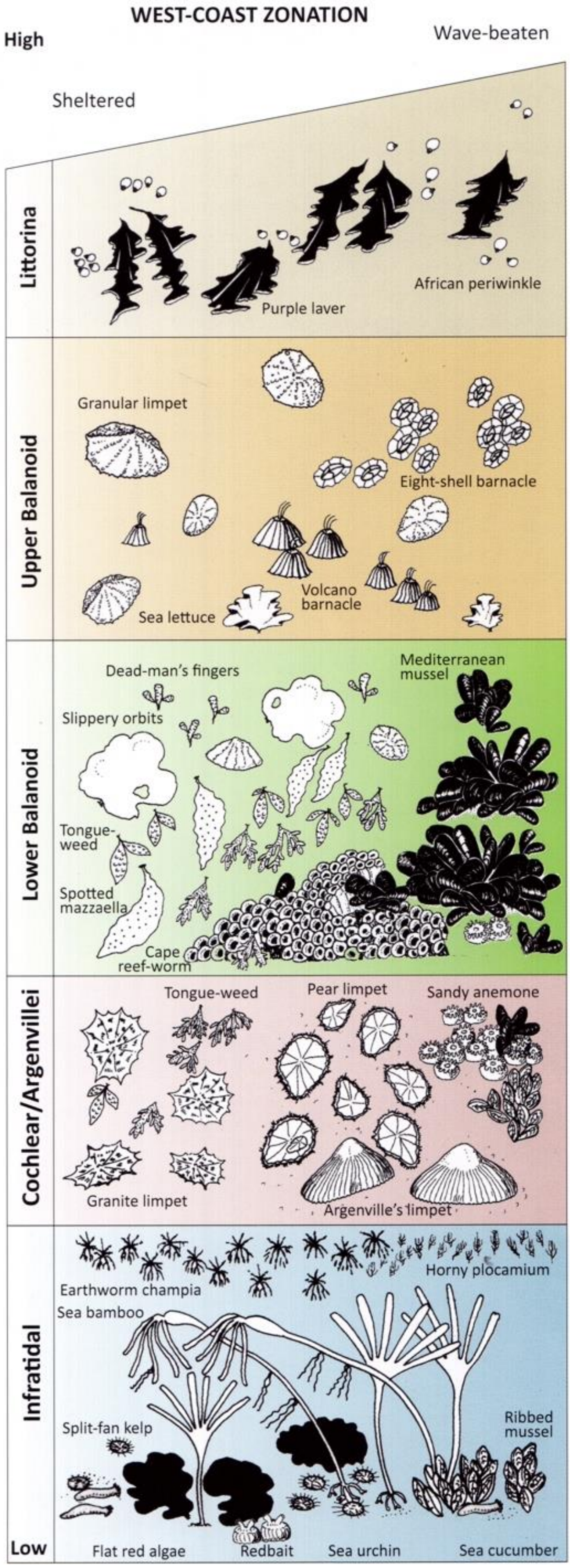


Figure 66: Schematic representation of the West Coast intertidal rocky shore zonation (adapted from Branch & Branch 2018).

Toward the lower Mid-littoral or Lower Balanoid zone, biological communities are determined by exposure to wave action. On sheltered and moderately exposed shores, a diversity of algae abounds with a variable representation of: green algae – Ulva spp, Codium spp.; brown algae – Splachnidium rugosum; and red algae – Aeodes orbitosa, Mazzaella (=Iridaea) capensis, Gigartina polycarpa (=radula), Sarcothalia (=Gigartina) stiriata, and with increasing wave exposure Plocamium rigidum and P. cornutum, and Champia lumbricalis.

The gastropods Cymbula granatina and Burnupena spp. are also common, as is the reef building polychaete Gunnarea capensis, and the small cushion starfish Patiriella exigua. On more exposed shores, almost all of the primary space can be occupied by the dominant alien invasive mussel Mytilus galloprovincialis. First recorded in 1979 (although it is likely to have arrived in the late 1960s), it is now the most abundant and widespread invasive marine species spreading along the entire West Coast and parts of the South Coast (Robinson et al. 2005). M. galloprovincialis has partially displaced the local mussels Choromytilus meridionalis and Aulacomya ater (Hockey & Van Erkom Schurink 1992), and competes with several indigenous limpet species (Griffiths et al. 1992; Steffani & Branch 2003a, b). Recently, another alien invasive has been recorded, the acorn barnacle Balanus glandula, which is native to the west coast of North America where it is the most common intertidal barnacle. The presence of B. glandula in South Africa was only noticed a few years ago as it had always been confused with the native barnacle Cthamalus dentatus (Simon-Blecher et al. 2008). There is, however, evidence that it has been in South Africa since at least 1992 (Laird & Griffith 2008). At the time of its discovery, the barnacle was recorded from 400 km of coastline from Elands Bay to Misty Cliffs near Cape Point (Laird & Griffith 2008). Thus, it is likely that it occurs inshore of concession 12B. When present, the barnacle is typically abundant at the mid zones of semi-exposed shores.

Figure 67: Typical rocky intertidal zonation on the southern African west coast.

Along the sublittoral fringe, the large kelp-trapping limpet Scutellastra argenvillei dominates forming dense, almost monospecific stands achieving densities of up to 200/m^2 (Bustamante et al. 1995). Similarly, C. granatina is the dominant grazer on more sheltered shores, also reaching extremely high densities (Bustamante et al. 1995). On more exposed shores M. galloprovincialis dominates. There is evidence that the arrival of the alien M. palloprovincialis has led to strong competitive interaction with S. argenvillei (Steffani & Branch 2003a, 2003b, 2005). The abundance of the mussel changes with wave exposure, and at wave-exposed locations, the mussel can cover almost the entire primary substratum, whereas in semi-exposed situations it is never abundant. As the cover of M. galloprovincialis increases, the abundance and size of S. argenvillei on rock declines and it becomes confined to patches within a matrix of mussel bed. As a result exposed sites, once dominated by dense populations of the limpet, are now largely covered by the alien mussel. Semi-exposed shores do, however, offer a refuge preventing global extinction of the limpet. In addition to the mussel and limpets, there is variable representation of the flora and fauna described for the lower mid-littoral above, as well as the anemone Aulactinia reynaudi, numerous whelk species and the sea urchin Parechinus angulosus. Some of these species extend into the subtidal below.

The invasion of west coast rocky shores by another mytilid, the small Semimytilus algosus, has been noted (de Greef et al. 2013). It is hypothesized that this species has established itself fairly recently, probably only in the last ten years. Its current range extends from the Groen River mouth in the north to False Bay in the south (Ma et al. 2020). Where present, it occupies the lower intertidal zone, where they completely dominate *primary rock space, while M. galloprovincialis dominates higher up the shore. Many shores on the West Coast have thus now been effectively partitioned by the three introduced species, with B. glandula colonizing the upper intertidal, M. galloprovincialis dominating the mid-shore, and now S. algosus smothering the low-shore (de Greef et al. 2013).*

8.2.3.3.4.3 Estuaries

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Estuaries along the West Coast generally fall within the Cool Temperate bioregion. On the West Coast, there are three perennial river mouths that are always open to the sea and have estuarine systems in their lower reaches: the Orange, Olifants and Berg Rivers. The Berg River Estuary, ~120 km south of concession 12B, has the largest and most diverse associated saline and freshwater wetlands compared to all other permanently open estuaries in South Africa. Langebaan is an estuarine lagoon comprising shallow intertidal sand banks and deeper channels that experience tidally driven input of nutrient rich, upwelled water from the sea and groundwater input in the upper reaches. Together, this creates an ecologically productive system that supports long-standing fisheries. The numerous smaller estuaries along the West Coast are intermittently, or seasonally, open (Holgat, Buffels, Swartlintjies, Bitter, Spoeg, Groen, Brak, Sout and Jakkals Rivers). Those estuaries inshore of concession 12B are the intermittently-open Sout River estuary, which lies ~25 km to the north of the northern boundary of the concession, and the permanently-open Olifants River estuary, which lies inshore of the southern boundary of concession 12B.

Predominantly open estuaries and estuarine lagoons are particularly important for recruitment for some inshore linefish species and are the most vulnerable to marine pollution events as they receive tidal inflows almost constantly. Estuarine habitats are highly variable environments with salinity, temperature pH and other variables change with the tides, seasons and climatic conditions. Changes in the extent of water coverage and flow may alternately expose estuarine organisms to desiccation and scouring floods. This high variability has led to a high degree of specialisation within estuaries.

Under modern conditions of low flows and reduced winter flood peaks, the Olifants River estuary experiences a marine-dominated state for about six months of the year (November to April) with salinities of 5 ppt throughout the water column penetrating some 20 km upstream. The estuary is warmer in summer, with depressed oxygen concentrations, particularly in deeper, slower moving water, in the middle of the estuary. During winter, a freshwater-dominated state prevails and saline water penetrates only a short distance upstream. Water clarity in the estuary is affected by the relative input from the Olifants River Catchment (clear), Doring River Catchment (turbid) and the sea (clear), with the estuary being clearer in summer than winter.

The Olifants River estuary supports a large salt marsh habitat with a combined area of inter- and supratidal habitat of 1,010 ha. The invertebrate community of the Olifants River estuary is characterised by high abundance relative to other South African estuaries, and comparatively high species diversity for the west coast. As many as 38 fish species have been recorded in the estuary, of which 18 can be regarded as being either partially or completely estuarine dependent. The estuary also serves as an important nursery area for many highly-valued linefish species including white steenbras, west coast steenbras, silver kob, and elf. For many of these the stocks are overexploited or have collapsed emphasising the importance of the estuary in maintaining the range and stock integrity of these species along the west coast. There have been significant changes in the fish fauna, with a reduction in diversity and fish sizes occurring in response to changes in freshwater flows and fishing. Harder and estuarine round herring are now the dominant fish species in the estuary. Most of the estuary-dependent species are most abundant 5-20 km from the mouth, in salinities <20 ppt and water clarity <100 cm (Royal HaskoningDHV 2017).

The smaller estuaries on the West Coast are generally wave-dominated, with little freshwater inflow to maintain inlet stability and over 75% of South African estuaries close periodically due to wave-driven sandbar formation. If these periods persist for lengthy time periods, warm, hypersaline conditions can form (van Niekerk et al. 2019), which are unfavourable to most estuarine fauna. Toxic algal blooms are also common under these conditions and increase the likelihood of fish and invertebrate mortality.

There are 64 estuarine systems along the West Coast between the Orange River and Cape Agulhas (SANBI 2018) of which approximately 75% are 'Critically Endangered' or 'Endangered', while 13% are considered 'Vulnerable'. The threat status of the estuaries between the Orange River and Langebaan are provided in Table 20.

Estuaries are highly productive systems and offer rich feeding grounds, warmer temperatures and sheltered habitat for many organisms. The high productivity is exploited by many line-fish and harvested invertebrate species either as a nursery or later in life either directly through habitat availability or indirectly through the contribution to overall coastal productivity (van Niekerk et al. 2019). Turpie et al. (2017) estimated the contribution of the estuarine nursery function as R960 million in 2018 terms (equivalent to over R1 billion in 2020) to the South African economy, with the highest value attributed to the estuaries of the south Western and Eastern Cape.

Table 20: Threat status of the estuaries in the broader project area from the Namibian Border to Saldanha Bay (Van Niekerk et al. 2019). Only true estuaries, not micro-systems are listed.

Estuary	*2018 Threat Status*
Orange	*Endangered*
Buffels	*Endangered*
Swartlintjies	*Endangered*
Spoeg	*Endangered*
Groen	*Endangered*
Sout	*Endangered*
Olifants	*Endangered*
Jakkals	*Critically Endangered*
Wadrift	*Endangered*
Verlorenvlei	*Endangered*
Groot Berg	*Endangered*
Langebaan	*Vulnerable*

8.2.3.3.4.4 Coastal Sensitivity

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The last coastal sensitivity map for the South African coastline was compiled by Jackson & Lipschitz (1984). An updated National Coastal Assessment is currently being established by the CSIR and DFFE based on the biological components of the 2018 National Biodiversity Assessment (Harris et al. 2019). It includes the detection of coastal erosion hotspots and was completed in June 2020 (DEFF & CSIR 2020). A further report on the analysis of hotspots is in draft form and will be released in early 2021 (DEFF & CSIR 2021). This will take the form of a website with customisable GIS layers including natural resources, ecosystem infrastructure and services, human infrastructure, threats etc. Harris et al. (2019) compiled a GIS habitat map for the entire South African coastline, which identified that 60% of coastal ecosystem types are threatened, thereby having proportionally three times more threatened ecosystem types than the rest of the country. The spatial distribution of threatened coastal ecosystem types in the broader project area was illustrated in Figure 35. Coastal sensitivity would need to be taken into consideration in the event of an oil spill following a vessel accident.

8.2.4 Conservation Areas and Marine Protected Areas

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Numerous conservation areas and marine protected areas (MPAs) exist along the West Coast, although these are all located to the north or south of concession 12B. For the sake of completeness, they are briefly described below.

8.2.4.1 Sanctuaries

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Sanctuaries are considered a type of management area within South Africa's multi-purpose expanded MPA network in which access and/or resource use is prohibited. Sanctuaries in the vicinity of the project area in which restrictions apply are the McDougall's Bay, Stompneusbaai and Saldanha Bay rock lobster sanctuaries, which are closed to commercial exploitation of rock lobsters. These sanctuaries were originally proclaimed early in the 20th century under the Sea Fisheries Act of 1988 as a management tool for the protection of the West Coast rock lobster (Mayfield et al. 2005). There is no overlap of concession 12B with any of these sanctuaries.

8.2.4.2 Marine Protected Areas

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

'No-take' MPAs offering protection of the Namaqua biozones (sub-photic, deep-photic, shallow-photic, intertidal and supratidal zones) are absent northwards from Cape Columbine (Emanuel et al. 1992; Lombard et al. 2004). This resulted in substantial portions of the coastal and shelf-edge marine biodiversity in the area being assigned a threat status of 'Critically endangered', 'Endangered' or 'Vulnerable' in the 2011 NBA (Lombard et al. 2004; Sink et al. 2012). Using biodiversity data mapped for the 2004 and 2011 NBAs a systematic biodiversity plan was developed for the West Coast (Majiedt et al. 2013) with the objective of identifying both coastal and offshore priority areas for MPA expansion. Potentially vulnerable marine ecosystems (VMEs) that were explicitly considered during the planning included the shelf break, seamounts, submarine canyons, hard grounds, submarine banks, deep reefs and cold water coral reefs. To this end, nine focus areas were identified for protection on the West Coast between Cape Agulhas and the South African – Namibian border. These focus areas were carried forward during Operation Phakisa, which identified potential offshore MPAs. A network of 20 MPAs was gazetted on 23 May 2019, thereby increasing the ocean protection within the South African EEZ to 5%. The approved MPAs within the broader project area are described briefly below.

*The **Namaqua National Park MPA,** located ~60 km north of concession 12B, provides the first protection to habitats in the Namaqua bioregion, including several 'critically endangered' coastal ecosystem types. The area is a nursery area for Cape hakes, and the coastal areas support kelp forests and deep mussel beds, which serve as important habitats for the West Coast rock lobster. This 500 km^2 MPA was proclaimed in 2019, both to boost tourism to this remote area and to provide an important baseline from which to understand ecological changes (e.g. introduction of invasive alien marine species, climate change) and human impacts (harvesting, mining) along the West Coast. Protecting this stretch of coastline is part of South Africa's climate adaptation strategy.*

*The **Rocher Pan MPA**, located ~100 km south of concession 12B, stretches 500 m offshore of the high water mark of the adjacent Rocher Pan Nature Reserve, was declared in 1966. The MPA primarily protects a stretch of beach important as a breeding area to numerous waders.*

Other offshore MPAs along the West Coast (e.g. Benguela Muds MPA and Cape Canyon MPA) are all located over 110 km offshore and south of concession 12B, with the Child's Bank MPA located ~140 km to the northwest of the concession.

8.2.4.3 Sensitive Areas

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Despite the development of the offshore MPA network a number of 'Endangered' and 'Vulnerable' ecosystem types are currently 'not well protected' and further effort is needed to improve protection of these threatened ecosystem types (Sink et al. 2019) (Figure 69). Ideally, all highly threatened ('Critically Endangered' and 'Endangered') ecosystem types should be well protected. Currently, however, most of the Namaqua Sandy

Mid Shelf and Namaqua Muddy Mid Shelf Mosaic are poorly protected receiving only 0.2-10% protection (Sink et al. 2019). Within concession 12B, the ecosystem types are all considered 'poorly protected'.

8.2.4.4 Ecologically or Biologically Significant Areas

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

As part of a regional Marine Spatial Management and Governance Programme (MARISMA 2014-2020), the Benguela Current Commission (BCC) and its member states have identified a number of Ecologically or Biologically Significant Areas (EBSAs) both spanning the border between Namibia and South Africa and along the South African West, South and East Coasts, with the intention of implementing improved conservation and protection measures within these sites. South Africa currently has 12 EBSAs solely within its national jurisdiction with a further three having recently been proposed. It also shares eight trans-boundary EBSAs with Namibia (3), Mozambique (2) and the high seas (3). The principal objective of these EBSAs is identification of features of higher ecological value that may require enhanced conservation and management measures. They currently carry no legal status. The impact management and conservation zones within the EBSAs are under review and currently constitute a subset of the biodiversity priority areas map (see next section); EBSA conservation zones equate to Critical Biodiversity Areas (CBAs), whereas impact management zones equate to Ecological Support Area (ESAs). The relevant sea-use guidelines accompanying the CBA areas would apply.

The following summaries of the EBSAs in the broader project area are adapted from http://cmr.mandela.ac.za/EBSA-Portal/Namibia/. Concession 12B falls within the transboundary Benguela Upwelling System EBSA and lies south of the southern portion of the Namaqua Coastal Area EBSA (Figure 68). The text and figures below are based on the EBSA status as of October 2020 (MARISMA EBSA Workstream 2020).

*The **Benguela Upwelling System** EBSA is a transboundary EBSA and is globally unique as the only cold-water upwelling system to be bounded in the north and south by warm-water current systems, and is characterized by very high primary production (>1,000 mg $C.m^{-2}.day^{-1}$). It includes important spawning and nursery areas for fish as well as foraging areas for threatened vertebrates, such as sea- and shorebirds, turtles, sharks, and marine mammals. Another key characteristic feature is the diatomaceous mud-belt in the Northern Benguela, which supports regionally unique low-oxygen benthic communities that depend on sulphide oxidising bacteria.*

*The **Namaqua Coastal Area** EBSA encompasses the Namaqua Coastal Area MPA and is characterized by high productivity and community biomass along its shores. The area is important for several threatened ecosystem types represented there, including two 'Endangered' and four 'Vulnerable' ecosystem types, and is important for conservation of estuarine areas and coastal fish species. There is no overlap of concession 12B with this EBSA (see Figure 68).*

*The **Cape Canyon and Associated Islands** EBSA, at its closest point in St Helena Bay, lies ~54 km south of concession 12B. The EBSA includes the Benguela Muds MPA and the Cape Canyon, which is thought to hosts fragile habitat-forming species. The area is considered important for pelagic fish, foraging marine mammals and several threatened seabird species and serves to protect nine 'Endangered' and 12 'Vulnerable' ecosystem types, and two that are 'Near Threatened'. There are several small coastal MPAs within the EBSA.*

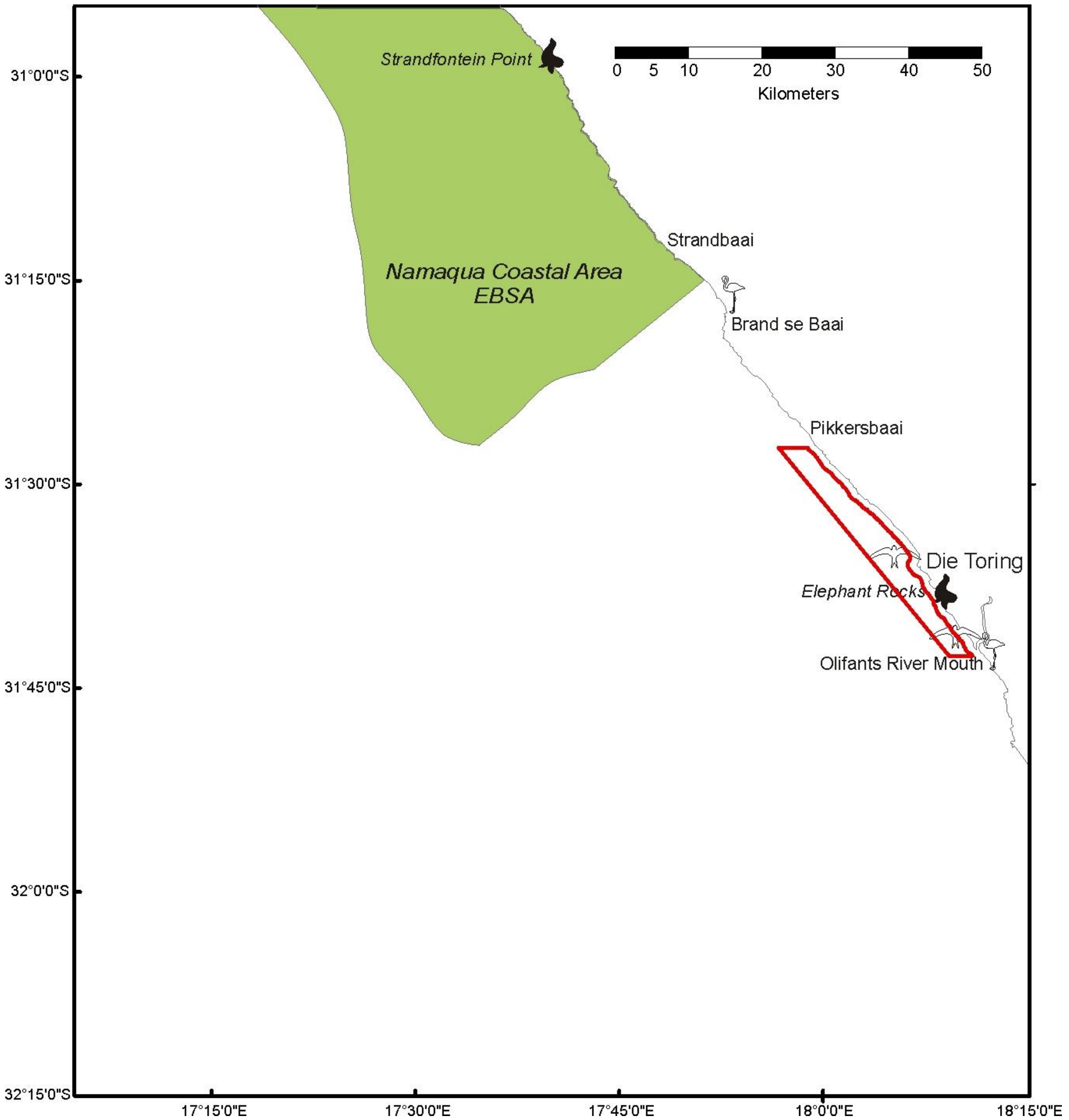


Figure 68: Concession 12B (red polygon) in relation to the location of seabird and seal colonies, seabird and wader breeding colonies and Ecologically and Biologically Significant Areas (EBSAs).

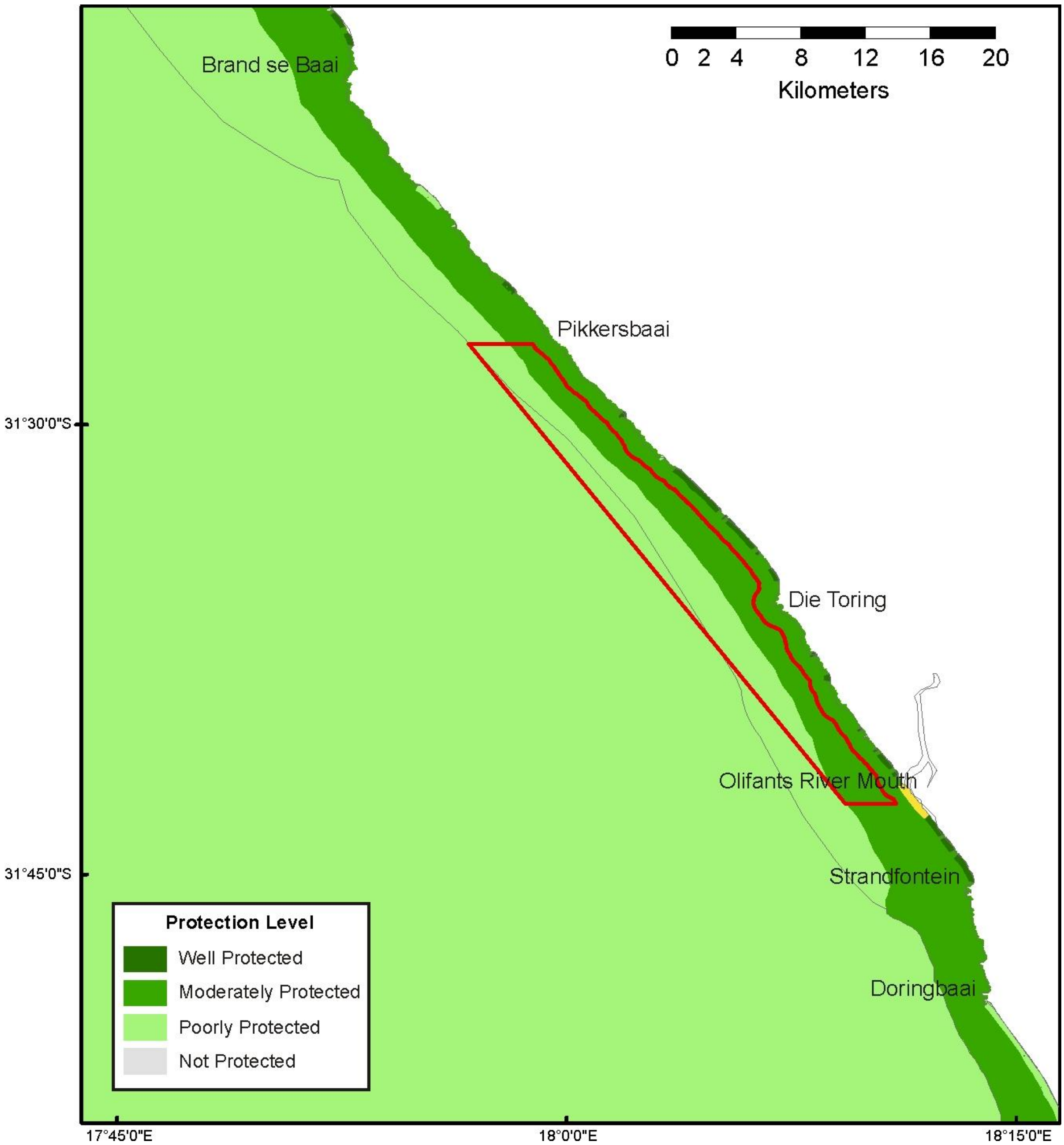


Figure 69: Concession 12B (red polygon) in relation to protection levels of 150 marine ecosystem types as assessed by Sink et al. (2019).

8.2.4.5 Biodiversity Priority Areas

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The National Coastal and Marine Spatial Biodiversity Plan[5] *comprises a map of Critical Biodiversity Areas (CBAs), Ecological Support Area (ESAs) and accompanying sea-use guidelines. The CBA Map presents a spatial plan for the marine environment, designed to inform planning and decision-making in support of sustainable*

[5] The latest version of the National Coastal and Marine Spatial Biodiversity Plan (v1.2 was released in April 2022) (Harris *et al*. 2022). The Plan is intended to be used by managers and decision-makers in those national government departments whose activities occur in the coastal and marine space, e.g., environment, fishing, transport (shipping), petroleum, mining, and others. It is relevant for the Marine Spatial Planning Working Group where many of these departments are participating in developing South Africa's emerging marine spatial plans. It is also intended for use by relevant managers and decision-makers in the coastal provinces and coastal municipalities, EIA practitioners, organisations working in the coast and ocean, civil society, and the private sector.

development. The sea-use guidelines enhance the use of the CBA Map in a range of planning and decision-making processes by indicating the compatibility of various activities with the different biodiversity priority areas so that the broad management objective of each can be maintained. The intention is that the CBA Map (CBAs and ESAs) and sea-use guidelines inform the MSP Conservation Zones and management regulations, respectively.

Concession 12B overlaps with areas mapped as Critical Biodiversity Area 1 (CBA 1) and Critical Biodiversity Area 2 (CBA 2). CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 are "best design sites" and there are often alternative areas where feature targets can be met; however, these will be of higher cost to other sectors and/or will be larger areas.

Regardless of how CBAs are split, CBAs are generally areas of low use and with low levels of human impact on the marine environment, but can also include some moderately to heavily used areas with higher levels of human impact. Given that some CBAs are not in natural or near-natural ecological condition, but still have very high biodiversity importance and are needed to meet biodiversity feature targets, CBA 1 and CBA 2 were split into two types based on their ecological condition. CBA Natural sites have natural / near-natural ecological condition, with the management objective of maintaining the sites in that natural / near natural state; and CBA Restore sites have moderately modified or poorer ecological condition, with the management objective to improve ecological condition and, in the long-term, restore these sites to a natural/near-natural state, or as close to that state as possible. ESAs include all portions of EBSAs that are not already within MPAs or CBAs, and a 5-km buffer area around all MPAs (where these areas are not already CBAs or ESAs), with the exception of the eastern edge of Robben Island MPA in Table Bay where a 1.5-km buffer area was applied (Harris et al. 2022).

Activities within these management zones are classified into those that are "compatible", those that are "not compatible", and those that have "restricted compatibility" subject to certain conditions. Non-destructive prospecting activities are classified as having "restricted compatibility", subject to certain conditions, in CBAs and ESAs. Destructive prospecting activities with localised impact, e.g. bulk sampling, are considered "not compatible" in CBA Natural and CBA Restore areas and as having "restricted compatibility" within ESAs. Mining construction and operations are similarly classified as being "not compatible" in CBA Natural and CBA Restore areas but as having "restricted compatibility" within ESAs (Harris et.al. 2022). These zones have been incorporated into the most recent iteration of the national Coastal and Marine CBA Map (v1.2 released April 2022) (Harris et al. 2020) (Figure 70).

Overlap with CBA 1: Natural and CBA 2: Natural accounts for 0.11% and 2.56% of the concession area, respectively (Figure 70), whereas overlap with CBA 1: Restore and CBA 2: Restore accounts for 1.16% and 4.65%, respectively.

8.2.4.6 Important Bird Areas (IBAs) and RAMSAR Sites

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

There are a number of coastal Important Bird Areas (IBAs) in the general project area (https://maps.birdlife.org/marineIBAs), but none overlap with concession 12B.

Various marine IBAs have also been proposed in South African territorial waters, with a candidate marine IBA suggested off the Orange River mouth and a further candidate marine IBA suggested in international waters west of the Cape Peninsula (Figure 71). Concession 12B overlaps with the proposed Bird Island / Dassen Island / Heuningnes river and estuary system / Lower Berg river wetlands marine IBA.

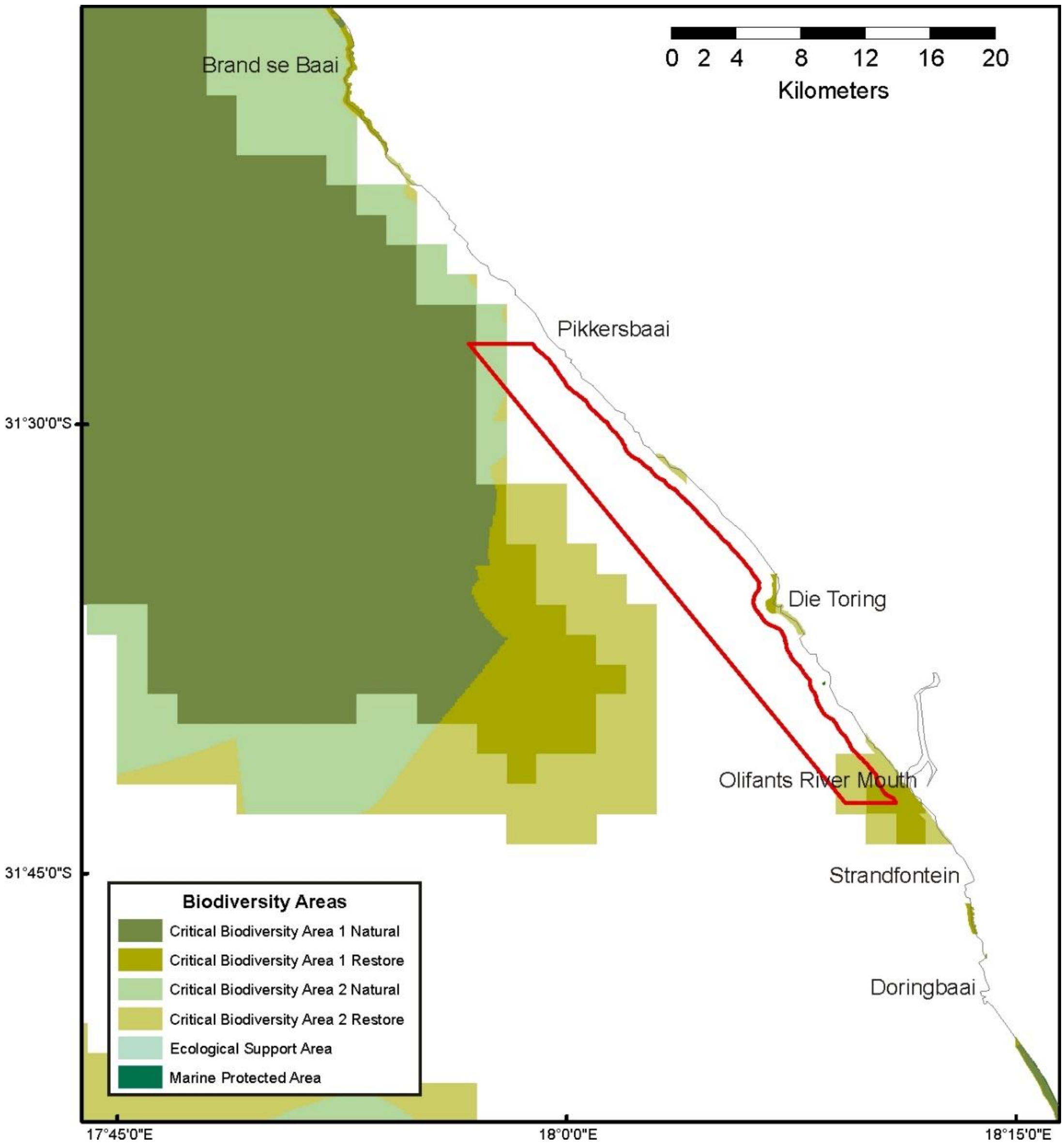


Figure 70: Concession 12B (red polygon) in relation to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Version 1.2) (Harris et al. 2022).

Table 21: List of confirmed coastal Important Bird Areas (IBAs) and their criteria listings. (www.BirdLife.org.za). Those incorporating or listed as RAMSAR sites are shaded.

Site Name	***IBA Criteria***
Orange River Mouth Wetlands (ZA023)	*A1, A3, A4i, A4iii*
Olifants River Estuary (ZA078)	*A3, A4i*
Verlorenvlei Estuary (ZA082)	*A4i*
Berg River Estuary (ZA083)	*A4i*
West Coast National Park and Saldanha Bay Islands (ZA 084) (incorporating Langebaan RAMSAR site)	*A1, A4i, A4ii, A4iii*

***A1**. Globally threatened species*

***A2**. Restricted-range species*

***A3**. Biome-restricted species*

***A4**. Congregations*

- ***i**. applies to 'waterbird' species*
- ***ii**. This includes those seabird species not covered under i.*
- ***iii**. modelled on criterion 5 of the Ramsar Convention for identifying wetlands of international importance. The use of this criterion is discouraged where quantitative data are good enough to permit the application of A4i and A4ii.*

A Ramsar site is considered wetland designated to be of international importance under the Ramsar Convention, also known as "The Convention on Wetlands", an intergovernmental environmental treaty established by UNESCO in 1971. The convention entered into force in South Africa on 21 December 1975. It provides for national action and international cooperation regarding the conservation of wetlands, and wise sustainable use of their resources. South Africa currently has 27 sites designated as Ramsar Sites, with a surface area of 571,089 hectares. The coastal RAMSAR sites in the general project area are provided in Table 22 below.

Table 22: List of coastal RAMSAR sites in the vicinity of Concession 12B.

Name	*Size (ha)*	*Province*	*Description*
Verlorenvlei	*1 500*	*Western Cape*	*Ramsar site no. 525. One of the largest lakes (and one of South Africa's few coastal freshwater lakes), with associated scrub, shrubland, dune systems, marshland and reedbeds representing a transition zone between two plant communities. The site is an important feeding area for rare pelicans and fish, for moulting and breeding birds, as well as for staging wading birds.*
Berg River Estuary	*1 163*	*Western Cape*	*Ramsar site no. 2466. The Berg River Estuary follows the lower stretch of the River, is one of four perennial estuaries on the West Coast and one of the most important coastal wetlands in South Africa. The estuary boasts the third-largest saltmarsh on the Cape Coast and hosts some unique vegetation with rare plant species. About 127 species of waterbird have been recorded since 1975, some of which are globally threatened (e.g. Cape cormorant) or regionally threatened (Caspian tern). The Site is also important for fisheries, with fish such as white steenbras and white stumpnose partially or fully dependent on it for breeding.*
Langebaan	*6 000*	*Western Cape*	*Ramsar site no. 398. National Park. A large, shallow marine lagoon, includes islands, reedbeds, sand flats, saltmarshes and dwarf shrubland. The lagoon is an important nursery area for a number of fish species and supports a diverse and ecologically important algal and shoreline biota. Important for wintering and staging wading birds, and the numerous breeding birds include the largest colony of gulls in South Africa.*

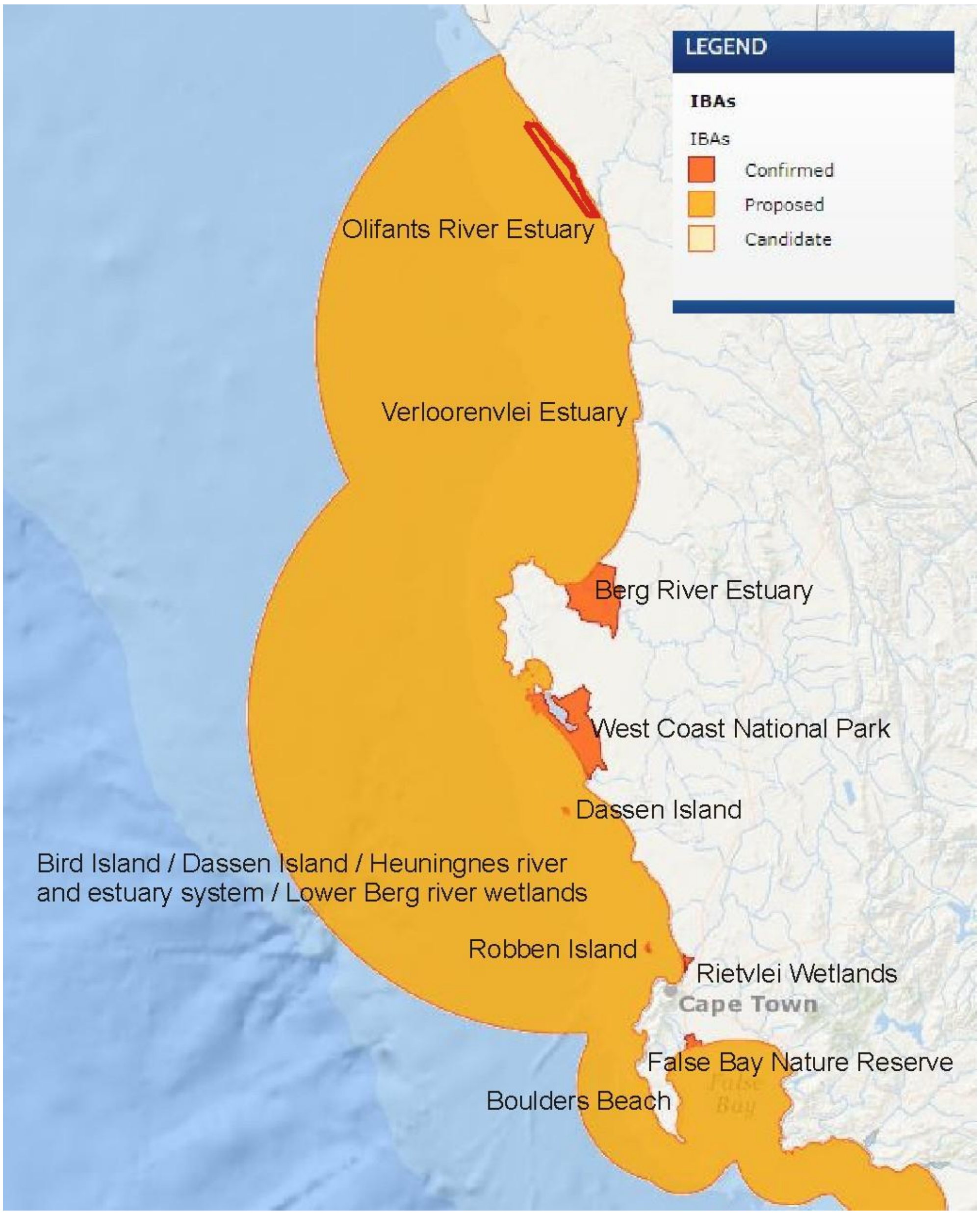


Figure 71: Concession 12B (red polygon) in relation to coastal and marine IBAs (Source: https://maps.birdlife.org/marineIBAs).

8.2.4.7 Important Marine Mammal Areas (IMMAs)

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Important Marine Mammal Areas (IMMAs) were introduced in 2016 by the IUCN Marine Mammal Protected Areas Task Force to support marine mammal and marine biodiversity conservation. Complementing other marine spatial assessment tools, including the EBSAs and Key Biodiversity Areas (KBAs), IMMAs are identified on the basis of four main scientific criteria, namely species or population vulnerability, distribution and abundance, key life cycle activities and special attributes. Designed to capture critical aspects of marine mammal biology, ecology and population structure, they are devised through a biocentric expert process that is independent of any political and socio-economic pressure or concern. IMMAs are not prescriptive but comprise an advisory, expert-based classification of areas that merit monitoring and place-based protection for marine mammals and broader biodiversity.

Modelled on the BirdLife International process for determining IBAs, IMMAs are assessed against a number of criteria and sub-criteria, which are designed to capture critical aspects of marine mammal biology, ecology and population structure. These criteria are:

Criterion A – Species or Population Vulnerability

Areas containing habitat important for the survival and recovery of threatened and declining species.

Criterion B – Distribution and Abundance

Sub-criterion B1 – Small and Resident Populations: Areas supporting at least one resident population, containing an important proportion of that species or population, that are occupied consistently.

Sub-criterion B2 – Aggregations: Areas with underlying qualities that support important concentrations of a species or population.

Criterion C – Key Life Cycle Activities

Sub-criterion C1 – Reproductive Areas: Areas that are important for a species or population to mate, give birth, and/or care for young until weaning.

Sub-criterion C2 – Feeding Areas: Areas and conditions that provide an important nutritional base on which a species or population depends.

Sub-criterion C3 – Migration Routes: Areas used for important migration or other movements, often connecting distinct life-cycle areas or the different parts of the year-round range of a non-migratory population.

Criterion D – Special Attributes

Sub-criterion D1 – Distinctiveness: Areas which sustain populations with important genetic, behavioural or ecologically distinctive characteristics.

Sub-criterion D2 – Diversity: Areas containing habitat that supports an important diversity of marine mammal species

Although much of the West Coast of South Africa has not yet been assessed with respect to its relevance as an IMMA, the coastline from the Olifants River mouth on the West Coast to the Mozambiquan border overlaps with three declared IMMAs (Figure 72) namely the

- *Southern Coastal and Shelf Waters of South Africa IMMA (166,700 km^2),*
- *Cape Coastal Waters IMMA (6,359 km^2), and*
- *South East African Coastal Migration Corridor IMMA (47,060 km^2).*

These are described briefly below based on information provided in IUCN-Marine Mammal Protected Areas Task Force (2021) (www.marinemammalhabitat.org).

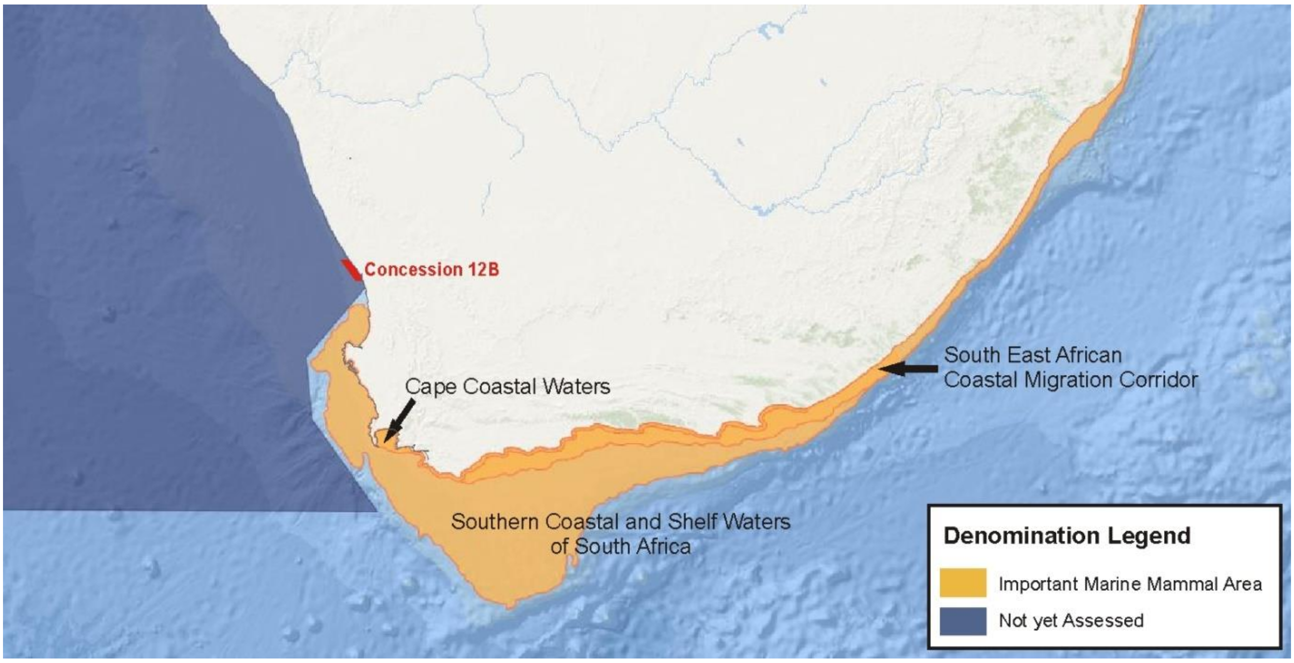


Figure 72: Concession 12B (red polygon) in relation to coastal and marine IMMAs (Source: www.marinemammalhabitat.org/imma-eatlas/).

The 166,700 km² Southern Coastal and Shelf Waters of South Africa IMMA extends from the Olifants River mouth to the mouth of the Cintsa River on the Wild Coast. Qualifying species are the Indian Ocean Humpback dolphin (Criterion A, B1), Bryde's whale (Criterion C2), Indo-Pacific bottlenose dolphin (Criterion B1, C3, D1), Common dolphin (Criterion C2) and Cape fur seal (criterion C2). The IMMA covers the area supporting the important 'sardine run' and the marine predators that follow and feed on the migrating schools (Criterion C2) as well as containing habitat that supports an important diversity of marine mammal species (Criterion D2) including the Indian Ocean humpback dolphin, the inshore form of Bryde's whale, Indo-Pacific bottlenose dolphin, common dolphin, Cape fur seal, humpback whales, killer whales and southern right whales.

The Cape Coastal Waters IMMA extends from Cape Point to Woody Cape at Algoa Bay and extends over some 6,359 km². It serves as one of the world's three most important calving and nursery grounds for southern right whales, which occur in the extreme nearshore waters (within 3 km of the coast) from Cape Agulhas to St. Sebastian Bay between June and November (Criterion B2, C1). Highest densities of cow-calf pairs occur between Cape Agulhas and the Duivenhoks River mouth (Struisbaai, De Hoop, St Sebastian Bay), while unaccompanied adult densities peak in Walker Bay and False Bay. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin and Indo-Pacific bottlenose dolphin.

The South East African Coastal Migration Corridor IMMA extends some 47,060 km² from Cape Agulhas to the Mozambiquan border and serves as the primary migration route for C1 substock of Southern Hemisphere humpback whales (Criterion C3). On their northward migration between June and August, they are driven closer to shore due to the orientation of the coast with the Agulhas Current, whereas during the southward migration from September to November, they remain further offshore (but generally within 15 km of the coast) utilising the southward flowing Agulhas Current as far west as Knysna. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin, Common dolphin, Indo-Pacific bottlenose dolphin, Spinner dolphin, Southern Right whale, and killer whale.

There is no overlap of concession 12B with the IMMAs.

8.2.5 Summary of Features Specific to the Concesssion Area

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Features specific to concession 12B are summarised below:

- *Concession 12B is 111.7 km^2, in extent in water depths ranging from 15 m to 75 m;*
- *The concession area lies on the continental shelf with the eastern boundary located ~1 km offshore of the mean high water mark off the coastline between Pikkersbaai in the north to 2 km south of the Olifants River mouth in the south;*
- *Seabed sediments along the inshore portion of the concession are dominated by sandy sediments of the Southern Benguela Sandy Shelves, with the offshore portions of the concession extending into the Southern Benguela mudbelt;*
- *The majority of the concession will likely be characterised by outcropping rocky seabed intersected by large and deep, west-southwest facing, drainage gullies and channels filled with unconsolidated sediments;*
- *All of the ecosystem types occurring in the concession area have been rates as 'Least Concern';*
- *The sediments are likely to host a range of benthic macrofaunal species including polychaete worms, crustaceans and echinoderms;*
- *The concession is located between the Cape Columbine and Namaqua upwelling cells, and waters are likely to be seasonally cold, nutrient rich and hosting high abundances of phytoplankton, zooplankton and ichthyoplankton;*
- *A wide variety of inshore reef fish, small pelagic and demersal fish species are likely to be encountered, with large pelagic species occurring in the deeper portions of concession 12B;*
- *Migrating leatherback turtles may also occur, as are a variety of pelagic seabirds, African Penguins, Cape Gannets and Cape Cormorants;*
- *Marine mammals likely to be encountered include migrating and resident humpback and southern right whales and small odontocetes known to frequent continental shelf waters;*
- *There is no overlap of concession 12B with coastal or offshore MPAs, but there is overlap with the Benguela Upwelling System transboundary EBSA;*
- *The ecosystem types within the inshore portions of concession 12B are considered moderately protected, while those in deeper waters are considered poorly protected;*
- *A small portion of the concession area (2.67%) lies within CBA1 1: Natural and CBA 2: Natural areas in which non-destructive prospecting activities is considered to have "restricted compatibility" subject to certain conditions and destructive prospecting (bulk sampling) is considered "not compatible".*
- *There is overlap of concession 12B with the proposed Bird Island / Dassen Island / Heuningnes river and estuary system / Lower Berg river wetlands marine IBA.*

8.2.6 Underwater Heritage Impact Assessment

As per **Part C, Appendix E: Heritage Impact Assessment, page 333:**

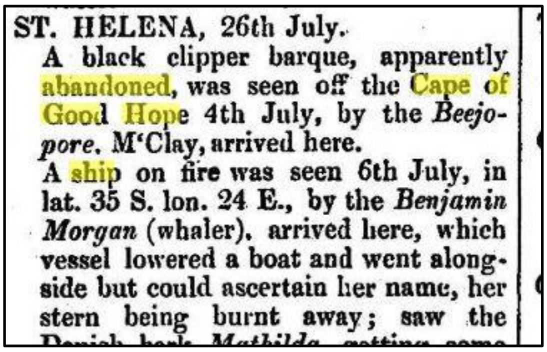
8.2.6.1 Shipwreck Database

As per **Part C, Appendix E: Heritage Impact Assessment, page 333:**

The nature of the environment, poor historical reporting and the length of time since the wrecks occurred means that underwater cultural heritage sites may literally be anywhere and are thus hard to pinpoint with any accuracy beforehand. It is important to have a database because if MUCH sites are uncovered during the project, it will be easier to identify the wreck and thus assess its cultural and historical significance.

There are several points to bear in mind when compiling and making use of any shipwreck database.

- *There are thousands of reported wrecks around the South African coastline and thousands more that disappeared mid-ocean (Figure 74).*
- *The first recorded European voyages down the west coast of Africa were by the Portuguese. When the Portuguese first sent out their explorers, they stuck close to the coastline, in order to map the land. The present-day Cape Voltas may be a survival of the Portuguese name Volta das Angras. Dias and his fleet passed the Orange River Mouth in 1487/1488 (Axelson 1973). Thereafter, the rate of exploration and trade increased exponentially, as is evidenced by the increase in shipwrecks over the centuries.*
  These early voyages were not well documented, and the archives often merely report that a fleet of a certain number of vessels left and only a certain amount returned, with only vague references to their place and manner of loss.
  Therefore, there are many undocumented wrecks. This statement is borne out by the Cabral Fleet of 1500 (#11-14 below).
- *There is some anecdotal evidence that the Phoenicians circumnavigated Africa (Herodotus 1954). However, if this is true, these ships had to stick right to the coastline and therefore are unlikely to be far offshore.*
- *There's increasing evidence that the Chinese voyages of the 1400s explored parts, if not all, of the African coast (Paine 2013). However, once again the archival evidence to date, and availability to Western researchers, limits this knowledge.*
- *Bear in mind when reading the below database, the term "Abandoned", generally means that the vessel was further out to sea. Older ships were sometimes badly maintained. A lifetime of rough seas had a heavy toll on the old vessels. Through storms and possibly bad maintenance, ships could become death traps. If the vessel was leaking badly and running repairs and continuous pumping had little to no effect, the captain would decide to abandon ship. However, sometimes these vessels would not sink but float along in the currents and could end up thousands of miles from where they were abandoned. There are numerous accounts of such derelicts being spotted. Figure 73 is an example of such a sighting. This vessel was spotted off the Cape south coast, it was on fire and had been abandoned. The whaler that spotted it could not read the name.*



ST. HELENA, 26th July.
A black clipper barque, apparently abandoned, was seen off the Cape of Good Hope 4th July, by the *Beejopore*. M'Clay, arrived here.
A ship on fire was seen 6th July, in lat. 35 S. lon. 24 E., by the *Benjamin Morgan* (whaler), arrived here, which vessel lowered a boat and went alongside but could ascertain her name, her stern being burnt away; saw the

Figure 73: London Lloyd's List 13-09-1856

- *The ocean currents could move abandoned vessels hundreds of kilometres away from their reported position, Figure 77 and Figure 78 are examples of seasonal variation in the strength and direction of the ocean currents off the southern tip of Africa.*

The Shipwreck Database uses several conventions to assess the impact of projects on heritage resources (Appendix I). The important ones, in terms of this project are:

Certainty of prediction:

- ***Definite:*** *More than 90% sure of a particular fact. Substantial supportive data to verify assessment*
- ***Probable:*** *More than 70% sure of a particular fact, or of the likelihood of that impact occurring*
- ***Possible:*** *More than 40% sure of a particular fact, or of the likelihood of an impact occurring*
- ***Unlikely:*** *Less than 40% sure of a particular fact, or the likelihood of an impact occurring*

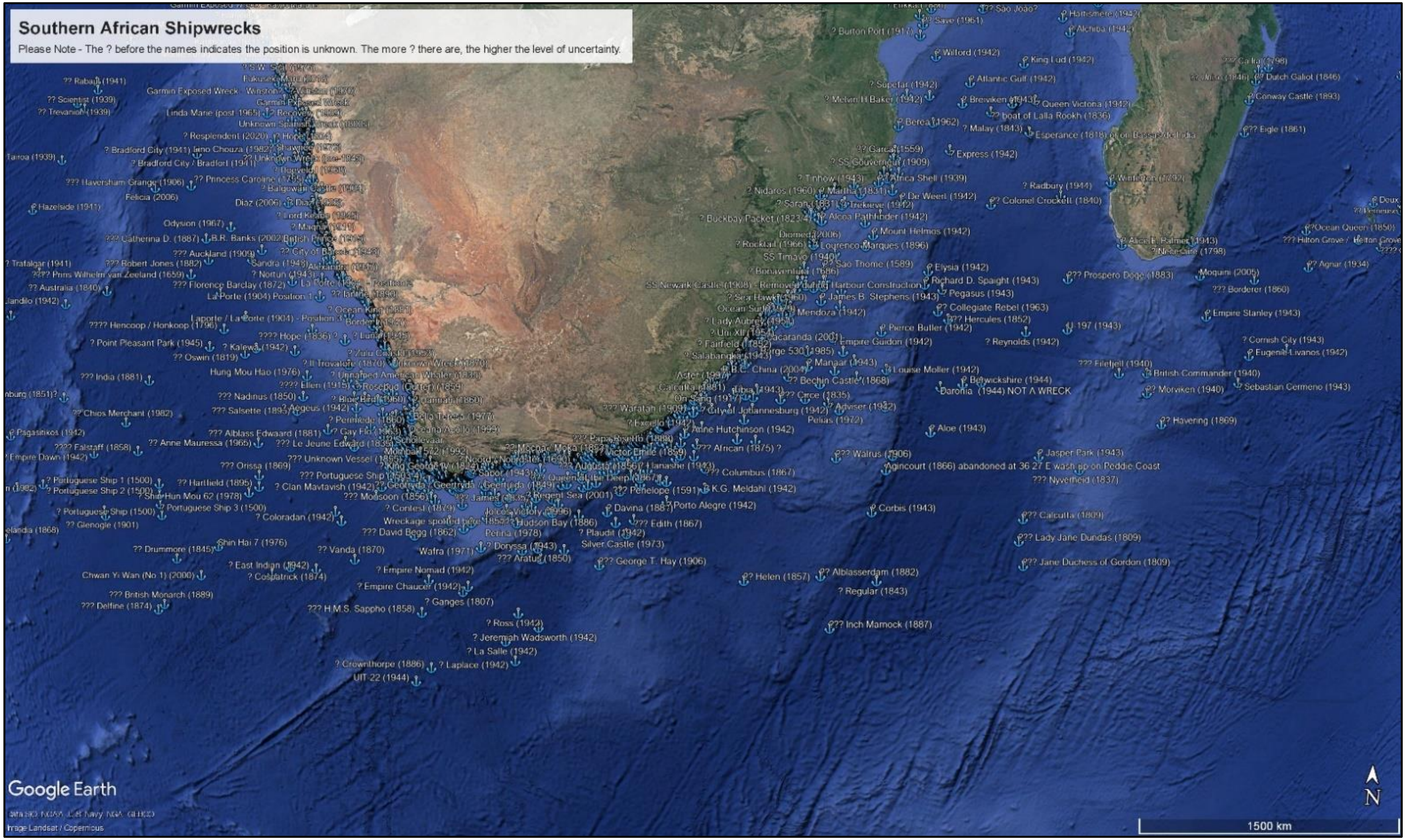


Figure 74: South African Shipwrecks (Google Earth 2023; Hocking 1969; Levine 1989; Maitland 2023; Reocities 2022; SAHRA 2022; Turner 1988; U-boat.net 2022; van den Bosch 2009)

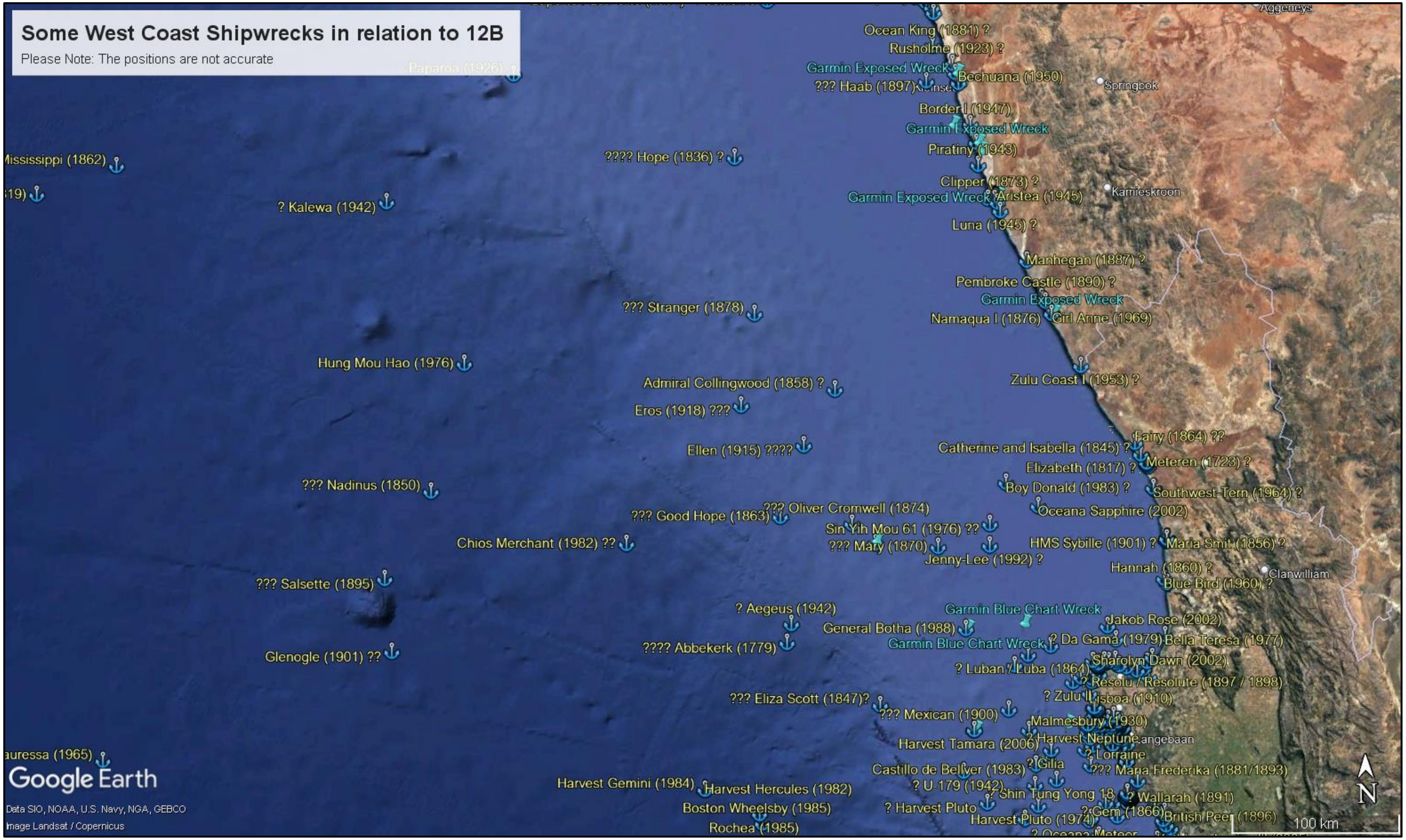


Figure 75: West Coast Shipwrecks (Google Earth 2023; Hocking 1969; Levine 1989; Maitland 2023; Reocities 2022; SAHRA 2022; Turner 1988; U-boat.net 2022; van den Bosch 2009)

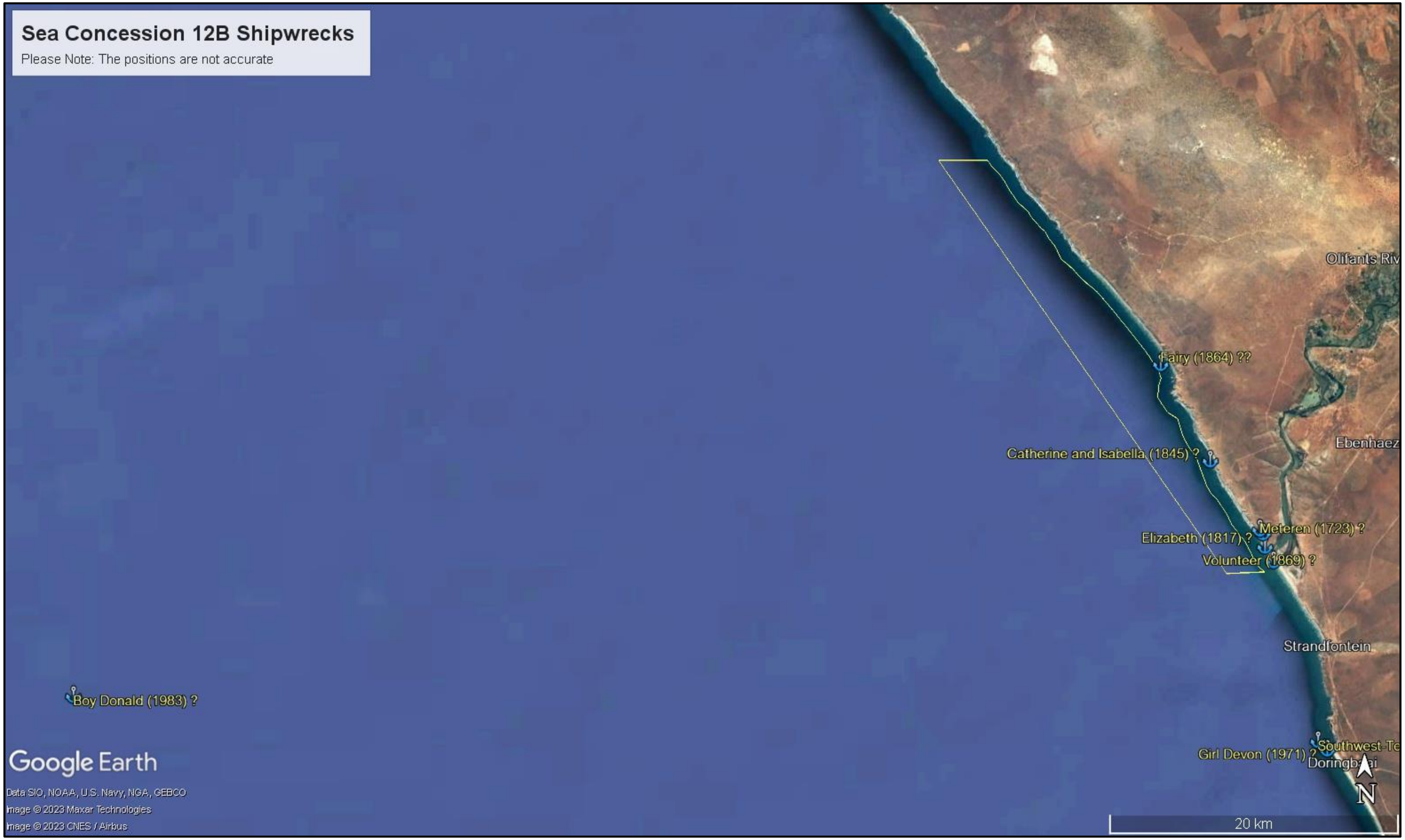


Figure 76: Shipwrecks in and around Sea Concession 12B (Google Earth 2023; Hocking 1969; Levine 1989; Maitland 2023; Reocities 2022; SAHRA 2022; Turner 1988; U-boat.net 2022; van den Bosch 2009)

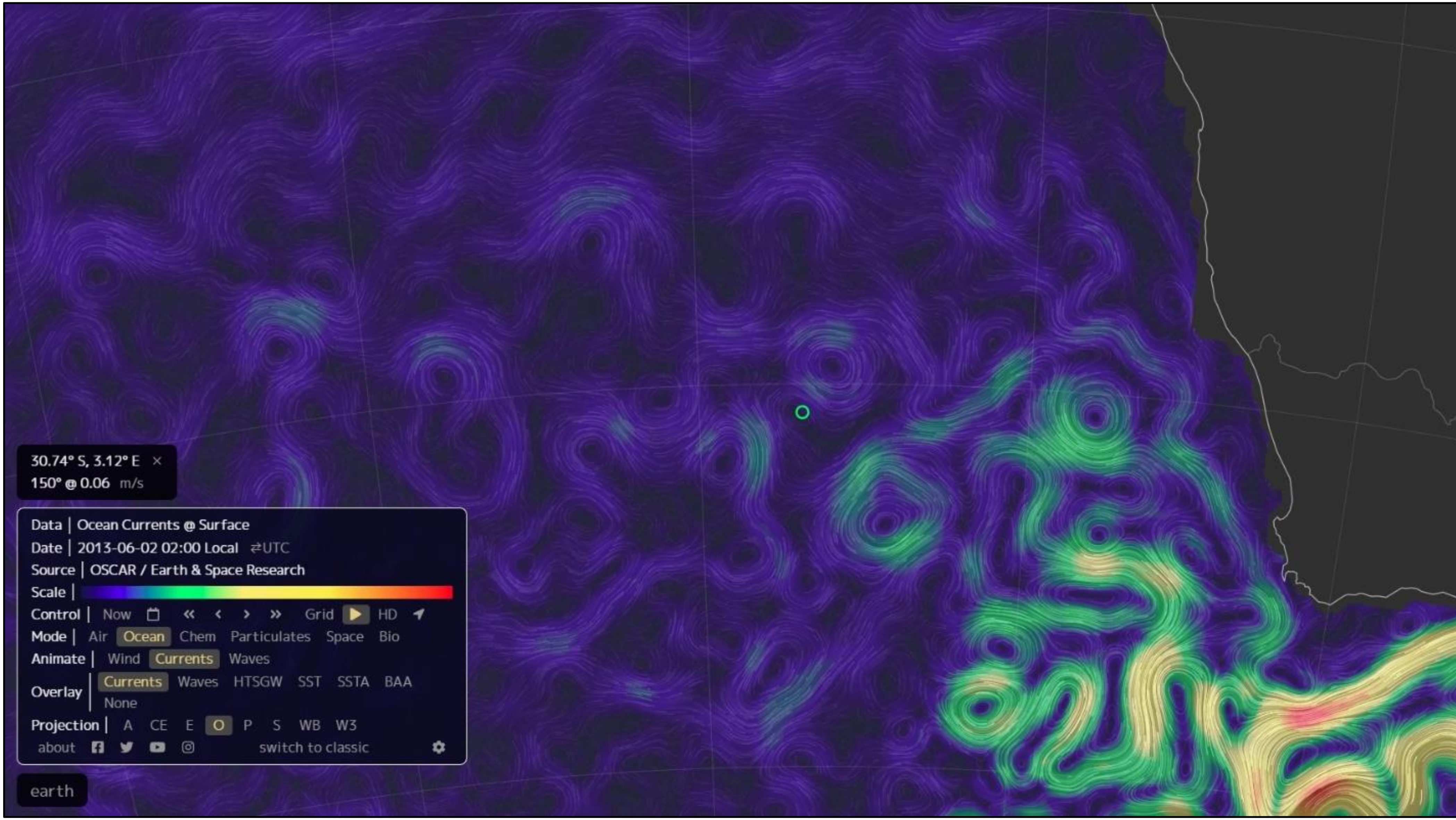


Figure 77: Winter ocean currents around South Africa (Beccario 2022)

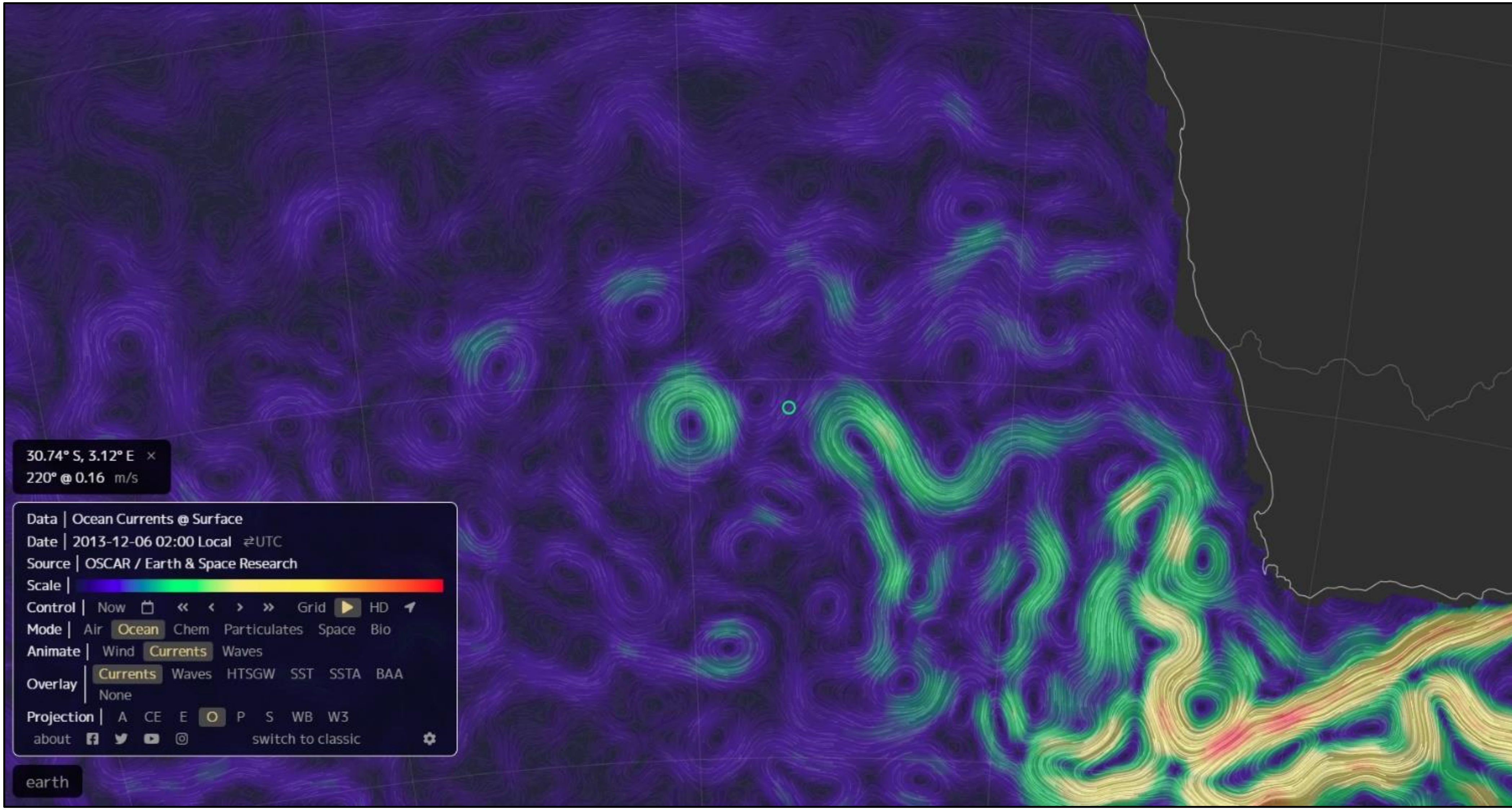


Figure 78: Summer ocean currents around South Africa (Beccario 2022)

8.2.6.2 Shipwrecks definitely in 12B

As per **Part C, Appendix E: Heritage Impact Assessment, page 333:**

There are no definite shipwrecks in Sea Concession 12B.

8.2.6.3 Shipwrecks possibly in 12B

As per **Part C, Appendix E: Heritage Impact Assessment, page 333:**

#	*Name*	*Events*	*Nation*	*Date*	*History*	*Location*
8.2.6.3.1 Shipwrecks with No heritage significance						
1	*Dera*	*Sank*	*RSA*	*1997-11-25*	*This 33-ton crayfish vessel, under Capt. P. Soudens, was built in Cape Town in 1962. It sprang a leak during a storm and sank, three crew members died in the wreck. It is apparently 9.7 NM north of the river mouth and 1 km offshore from Skaapvlei.*	*Past Cliff Point*
8.2.6.3.2 Shipwrecks with a Low heritage significance						
2	*Fairy*	*Aground, wrecked*	*Cape*	*1864-02*	*This wood coasting schooner, was wrecked between Hondeklip Bay and Cape Town (Liverpool Albion 1864-04-11).* *Apparently a 20-ton schooner, this vessel encountered a storm after leaving Hondeklip Bay for Cape Town. Seeking shelter, the Fairy approached a spot known as the Hole-in-the-Wall, a natural bridge, here it ran aground and became a wreck (Levine 1989). This "bridge" may be Cliff Point, which collapsed after 1863.* *Although it is reported as being wrecked on the coast, it may be further off due to environmental stresses. Concession 12B starts approximately 1.5 km from the coast.*	*Near Cliff Point*
8.2.6.3.3 Shipwrecks with a Medium heritage significance						
3	*American Whaler (no name)*	*Wrecked*	*USA*	*Before –* *March 1835*	*An unknown American whaler was wrecked at the mouth of the Olifant River, and eight men died (Levine 1989).* *Although it is reported as being wrecked on the coast, it may be further off due to environmental stresses. Concession 12B starts approximately 1.5 km from the coast.*	*Unknown*

#	Name	Events	Nation	Date	History	Location
4	*Catherine and Isabella*	*Ashore, wrecked*	*Canada*	*1845-05-17*	*This wooden 99-ton schooner, under Capt. Nicolson, was built in Nova Scotia, Canada in 1844 and owned by Nicolson & Co. (Lloyd's Register 1845).* *It left Cape Town on the 29th of April for Paternoster Island (Morning Post 1845-07-01). On the 17th of May, the schooner was anchored near the Olifant's River when three cables parted during a north-westerly gale. It went ashore at about 3 AM and became a total wreck. The crew entered the surf boat at first light, but it capsized in the surf and one crewman drowned. The wreck was put up for sale on the 11th of June (Shipping & Mercantile Gazette 1845-07-30). The wreck was sold on for £75 on the 20th of June (Shipping & Mercantile Gazette 1845-09-16).* *Although it is reported as being wrecked on the coast, it may be further off due to environmental stresses. Concession 12B starts approximately 1.5 km from the coast.*	*Near the Olifant's River Mouth*
8.2.6.3.4 Shipwrecks with a High heritage significance						
5	*Elizabeth*	*Ashore, wrecked*	*Britain*	*1817-12*	*The Elizabeth was a wooden ship of 252-tons (Lloyd's Register 1816), chartered by London merchants for a return voyage to the Cape (General Evening Post 1818-01-15), presumably to transport whale oil. This vessel under Captain Bartholomew White was anchored off the Robben Island at Murray's Whaling Station, loading 200 leagers of whale oil (the equivalent of about 120 000 litres) in casks (General Evening Post 1818-01-15; Theal 1902).* *Desertion from the British army was a big problem in the Cape at the time. It seems that a sentry on the Island released some convicts and armed them. The five soldiers and seven convicts then took a boat off the Island, rowed out to the Elizabeth and boarded it. Locking the crew below deck, the band set sail to the north-west. At some stage the pirates tried to get the crew to join them. All but one crew member, the mate, refused. The crew and captain were then put into one of the ship's boat with water and bread and released. Fifteen hours after the vessel was stolen, the crew managed to row back to the Island where they reported the incident. The authorities sent the HMS Mosquito to follow the ship, but adverse winds delayed them (General Evening Post 1818-01-15; Globe 1818-01-13; Green 1967; Theal 1902).* *The vessel was wrecked in early December just north of the Olifant's River Mouth (Anon. ca. 1972; Levine 1989; Turner 1988). Most of the databases rely on Green's (1967) book, On Wings of Fire and state that there is no account of the fugitives. However, an article in the London Packet & New Lloyd's Evening Post (1818-02-23) states that on the 6th of*	*Possibly Mietjies Bay*

#	Name	Events	Nation	Date	History	Location
					December, 14 of the mutineers and convicts were taken captive by the Khoe-San on the West Coast and returned to the Cape as prisoner. *The remainder of the wreck and its cargo were offered up for sale in the Cape Town Gazette (Green 1967).* *Most the databases or histories (Anon. ca. 1972; Green 1967; Levine 1989), refer to a bay to the north of the mouth as Elizabeth Bay, except for the South African Shipwreck Database (van den Bosch 2009) who states the wreck is in "Mietjie Frans se Baai". Elizabeth Bay is not marked in the Admiralty Chart No. 896 (Archdeacon 1879). These names are often applied locally and then fall out of use as the story is forgotten.* *Although it is reported as being wrecked on the coast, it may be further off due to environmental stresses. Concession 12B starts approximately 1.5 km from the coast.*	
6	*Meteren*	*Aground, wrecked*	*Netherlands*	*1723-11-07*	*This VOC hoeker of 190 tons, under Willem van Turenhout, was built at the Enkhuizen yard in 1719 for the Amsterdam Chamber. She departed the Netherlands on the 24th of May 1723, bound for Asia (Huygens Instituut 2023).* *I have included a transcription of the VOC Day Register or Journal as translated by Leibrandt (1896) below, however it may be summarised as follows:* *The Meteren left at the end of May and at some stage, probably at the end of November, the ship arrives off the west coast. The crew had been at sea for about six months, possibly without fresh for the entire time. All aboard were severely sick from scurvy and were clearly desperate for supplies. While travelling down the coast, possibly looking for water and/or signs of people, they are becalmed. They drop anchor and then the wind picks up. Too weak to quickly lift anchor and get themselves away from the shore, the vessel is driven onto the rocks. Of the 29 still alive on the ship, only 18 make it ashore, here four die shortly. The remaining 14, nine decide to attempt to walk to Cape Town, but only four get there. Of the remainder, it is written that five decided to "remain" presumably at the site because it is reported by a local Khoe man who tried to help one of the survivors but he ran away, the tracks of the survivors were seen both sides of the Olifant's River Mouth.* *It is stated that the wreck was lying seven or eight Dutch miles beyond the Oliphants River, 1 Dutch mile is equal to 5.5 – 6.25 km. If we average that to 6 km, and based on the use of the word "beyond" it may be deduced that the wreck lies 42 – 50 km north of*	*Near the Olifant's River Mouth*

#	Name	Events	Nation	Date	History	Location
					the mouth. However, given that the tracks of weak survivors were seen on both sides of the river mouth, it may be that the wreck is closer to the river. *Unfortunately, we are guided a translation and not the original document.* *In 1963 diamond prospectors found four cannons with VOC markings, two bronze and two iron. It is reported that an "iron cannon still held its gunpowder and cannon ball" (Anon. ca. 1972; Green 1967). Levine (1989) states that two were bronze breech-loading swivel guns. Besides these references I was unable to track down more information on where these were found or where they are today.* *Although it is reported as being wrecked on the coast, it may be further off due to environmental stresses. Concession 12B starts approximately 1.5 km from the coast.* *Leibrandt (1896) translates and transcribes the VOC Day Register or Journal, and writes that on the 16th December 1823:* *The farmer, Frans Haarhof, reports to the Governor that between the "Oliphants River" and "Verloren Vlei" [possibly Elands Bay] a hooker had been wrecked. The skipper, one mate, and seven men saved. Name unknown. Vessel laden with bricks. Supposed to be the "Meteren".* *17th of December that,* *One mate and three men of the hooker arrive [in Cape Town], reporting that … because of sickness on board, they had been obliged to look for land which they found in latitude 31° 20' south, and 35° 20' longitude [the first accurate chronometer was only perfected in the latter half of the 18th century, so all the early longitude readings were off, this reading puts the vessel in the Indian Ocean, 500 km east of the coast] between Alomba [Gabon] and Montes bay [possibly Argentina] on the 9th November last. Becalmed and obliged to anchor. Wind then rose and they were thrown on the rocks. Three sick drowned in their beds. Two were beaten off the raft, six died on the journey, and of the 29 only 18 were on shore under an awning. Four of these died. The rest (14) undertook the land journey, and wandered about miserably before meeting with any people. Five remained on the way. Hendrik Moel ordered by the Government to look for them with his ox-wagon, and proceed to the wreck. Nothing of the cargo expected to be saved. The distance to the wreck is great, and the roads are very inconvenient.* *On 1 January 1724, the entry reads:*	

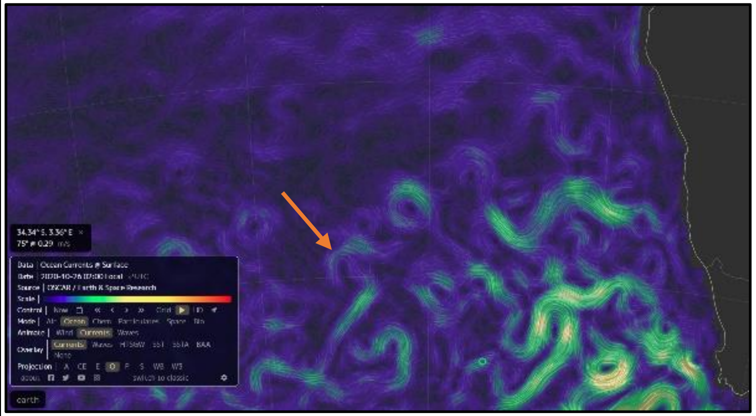
#	Name	Events	Nation	Date	History	Location
					Hendrik Moel returns from the wreck … the wreck was lying seven or eight Dutch [1 Dutch mile = 6.5 – 6.25 km] miles beyond the Oliphants River. He arrived there on the 1st January, but found no crew, only one dead body was lying near a tent which had been pitched on a high sand hill. The body had been buried under staves of casks in the sand, and with a rude cross at the head. Another corpse was found on the beach, very likely one of the two drowned when the raft capsized. A Hottentot whom he met near the Oliphants river on the road coming from the Amaquas, told him on the 5th that he had almost on the same spot met a European carrying three hams on his shoulder on a stick, one of them partly used. He had by signs shown him the road as well as he could, but he could not find him or any of the others, though he searched for miles around and inquired of the neighbouring settlers and the Bushmen. Their spoors went mostly along the beach to this side or that of the Oliphants River. The wreck was still lying on the same spot, the heavy waves washing clean over it. It was surrounded by rocks, with its stern to the shore. Its bottom was entirely knocked out, and the fragments were washed on shore with broken casks, boat, ropes, firelocks, &c. It is presumed that the decks had fallen on the cargo, and so prevented the latter from being washed on shore. He had taken 17 days for the expedition.	

8.2.6.4 Shipwrecks Improbably in 12B

As per **Part C, Appendix E: Heritage Impact Assessment, page 333:**

#	Name	Events	Nation	Date	History	Location
8.2.6.4.1 Shipwrecks with No heritage significance						
7	*Boy Donald*	*Sank*	*RSA*	*1983-03-22*	*This 20 m long fishing vessel was built in 1961 and owned by the Lamberts Bay Fishing Company. The boat was under Capt J. Hunter when it foundered. At least five of the crew were rescued. It sank rapidly and the search was concentrated in an area 55 miles northwest of Lamberts Bay (van den Bosch 2009). Therefore, this vessel may be in the concession area.*	*Off West Coast*

#	Name	Events	Nation	Date	History	Location
8.2.6.4.2 Shipwrecks with a Low heritage significance						
8	*Ellen*	*Capsized*		*1915*	*Capsized by a wave. None of the databases list a location (Pocock 2015; van den Bosch 2009).* *However, the West Coast was a prime fishing area, so it is left in the database.*	*Unknown*
9	*Eros (ex. SS Ceres)*	*Foundered*	*Britain*	*1918-05-26*	*This 174-ton steel steamer, built in 1900 by Selby Shipbuilding & Engineering Co. Ltd in Selby, had been sent to the Cape for the Namaqua Copper Company. After several voyages, it was laid up in order to alter its specifications. On 25 May, it left Table Bay for Port Nolloth under Captain Robert Brooks or Capt Richard Walter Powell (Wrecksite.Eu 2022). However, it foundered en-route. There were 14 crew members on board, and one man died (Levine 1989). In Green (1984), it is stated that all the crew died and the only sign of the wreck was one lifeboat, found adrift, with a crewman that seemed to have died of exposure.* *According to van den Bosch (2009), the vessel is off Port Nolloth and according to the Miramar Ship Index (2017), it is off Lambert's Bay.* *The information is contradictory and further research may show that it grounded on the coast or sank between the two points. However, it is included here for the moment.*	*West Coast*
10	*Glenogle*	*Fire, abandoned*	*Britain*	*1901-10-27*	*This 914-ton steel barque caught fire and was abandoned at 34 38.00S,03 40.00E (Lloyd's Register 1901; van den Bosch 2009).* *The Equatorial current which runs west to east here could have pulled the abandoned vessel into the Benguela current and up the west coast. Using the online current website (Beccario 2022), and placing the reported position on the same month and day, one can see how the currents could pull the vessel towards the coast (Figure 79). Obviously, there are many other factors at play, including wind, swell, drag of the vessel, how quickly it sinks, etc. But this shows how vessels can be moved from their place of abandonment and will not be repeated for every abandoned vessel.*	*Atlantic Ocean*

#	Name	Events	Nation	Date	History	Location
					 **Figure 79: Reported position of the Glenogle and the ocean currents at that time of year**	
11	Ianthe		Britain	1890-07-18	This wooden barque, of 380-tons was built by A. Stephens & Sons in Dundee in 1858 (Lloyd's Register 1845). Under Capt. Clay, the vessel left Port Nolloth for Swansea on 18 July with a copper cargo. She was seen tacking and "well out to sea" when later, the ship's crew arrived at the jetty in one of the boats, apparently wrecked 18 miles up the coast (Whitstable Times 1890-08-23). According to Turner (1988), it was wrecked at Cliff Point, just north of the Olifant's River Mouth and three lives were lost. Therefore, despite some databases placing this wreck at Olifants River, it is more likely near Port Nolloth, this also makes more sense as Port Nolloth is north of Olifant's River and the ship was travelling to Britain.	Reported as near Olifant's River BUT ACTUALLY near Port Nolloth
8.2.6.4.3 Shipwrecks with a Medium heritage significance						
12	Admiral Collingwood	Foundered	Britain	1858	This 360-ton barque under Captain Smith was bound from London for Algoa Bay when it apparently foundered 320km off St Helena Bay (Levine 1989; van den Bosch 2009). This may put her in the West Coast area.	West Coast

#	Name	Events	Nation	Date	History	Location
13	*Australia*	*Fire, sank*	*Britain?*	*1840-12-27*	*This 250-ton brig, under Capt. A. Yule was built in Dundee, Scotland in 1839. It was on its maiden voyage to Australia with passengers and cargo when the vessel caught fire and sank, apparently 9.6 nautical miles (NM), north of the Olifants River Mouth.* *However, it was 4-500 miles (640-800 km) from Cape Town when the fire broke out. One of the long boats contained two bulls that were being shipped from Leith. The noise and fire caused them to break out of the boat, one fell overboard and the other ran down the deck of the brig, until the crew killed it with axes. The long boat could now be launched, and the twenty-eight passengers and crew escaped the burning ship. The burning ship was visible until sunrise the following morning. Two night later, the cable joining the lifeboats broke and they were separated. The following day, they were reunited. A boy died at sea and a man died after they made land, 200 miles northwest of Cape Town after nine nights at sea. The survivors then walked south for four days before reaching the Olifants River where they were assisted by local farmers (Port Phillip Patriot 1841-04-12).* *As the lifeboats came ashore near the concession, there is a remote possibility that the fire was put out by the rising water, but the brig continued to drift into the concession area there are numerous historical reports of this happening.*	*West Coast*
14	*Catterina D / Catherina D.*	*Fire, abandoned*	*Austria*	*1887-10*	*This 610-ton barque from Liverpool for Cape Town with a cargo of coal caught fire. It was apparently abandoned before it sank, 480km west of Hottentot Point. The captain and crew reached Walvis Bay in the lifeboats (Levine 1989; van den Bosch 2009).* *As it was abandoned before it sank and could have drifted south, this vessel is included in the database.*	*West Coast*
15	*Elizabeth Jane*	*Unknown*		*1834-01-20*	*This vessel seems to be a whaler that operated in Tasmania and the southern oceans (van den Bosch 2009).* *Although I can find no further information on its status at this time, I have left it in the database.*	*Unknown*
16	*Florence Barclay*	*Fire, abandoned*	*Britain*	*1872-11-7*	*This 243-ton barque was built in 1866. Under Captain J.H. Voller, it was bound from Hull for Table Bay and Mauritius. Somewhere off the west coast, the vessel caught fire and was abandoned. The crew were in three lifeboats, one of which disappeared during the first night at sea. The other two boats arrived at Pomona*	*West Coast*

#	Name	Events	Nation	Date	History	Location
					Island (Namibia) three days later. The survivors were taken to Table Bay by the Lilla (Levine 1989; van den Bosch 2009). *As the crew beached on the west coast of southern Africa, I have included this vessel.*	
17	*Good Hope*	*Fire, sank*	*Cape?*	*1863-7-31*	*I have very little information on this wreck. Only that it was a Cape trader and burned at sea (van den Bosch 2009).*	*Unknown*
18	*Haab*	*Abandoned*	*Norway*	*1897-10-8*	*This 861-ton wooden barque was according to Levine (1989), grounded on Dassen Island. Van den Bosch (2009), states the vessel was abandoned 260 NM from Table Bay. According to the Brisbane Courier (1897-11-04), the vessel caught fire and was abandoned, the crew, in lifeboats, eventually landed on Dassen Island.* *Dassen Island is only c. 35 NM from Table Bay (i.e., the Port). 260.5 NM means that the vessel was abandoned in the concession areas and may be anywhere between there and Dassen Island.*	*Between Port Nolloth and Dassen Island*
19	*Hartfield*	*Fire, sank*	*Britain*	*1895-9-9*	*According to van den Bosch (2009) and Levine (1989), this 852-ton iron barque caught fire at 34 30.00S,11 30.00E, 259 NM west of Table Bay.* *The Equatorial current which runs west to east here could have pulled the abandoned vessel into the Benguela current and up the west coast.*	*West Coast*
20	*India*	*Abandoned*	*Sweden*	*1881-8-24*	*This British iron barque, under Capt McPhail, was on a voyage from Britain to Australia, when it began leaking after being battered by several gales. From 2 January to 24 February, the barque limped down the west coast of Africa. At this time, as the leak was so serios, the crew abandoned ship at 7º E. Their lifeboats had been smashed in one of the storms, so when they saw a passing ship, they asked for assistance. When they left the distressed vessel, it was still afloat (van den Bosch 2009).* *The currents may have pulled it towards the West Coast or further out into the Atlantic.*	*West Coast / Atlantic Ocean*
21	*Joachim*	*Fire, abandoned*	*German*	*1868-10-10*	*Apparently the 763-ton barque under Captain Helenmeyer was on a voyage from Bremen to Rangoon with a cargo of coal. When it "burnt off the Cape". The crew*	*Off the Cape*

#	Name	Events	Nation	Date	History	Location
22					*were rescued by the American vessel, China and brought to Cape Town (Levine 1989).* *The currents may have pulled it towards the West Coast.*	
22	*Juno*	*Fire, abandoned*	*Sweden*	*1885-4-9*	*The 1274-ton schooner, under Captain T. Keyller was bound from Norway for Melbourne with a cargo of deals (timber). It caught fire and was abandoned at approximately 37 24.00S,11 30.00E. the 22-man crew took to the lifeboats and set off towards the Cape. The currents washed them towards the Orange River. They attempted to beach the lifeboat 32km south of the river but capsized and there were only four survivors. These four were picked up by the Namaqua and taken to Cape Town (Levine 1989; van den Bosch 2009).* *It follows that if the current brought the lifeboat towards the Orange River, that the same principle could apply to the abandoned schooner.*	*Atlantic Ocean*
23	*Luba / Luban*	*Fire, abandoned*	*Cape*	*1864-2-11*	*This barque was on its way from Leith for Cape Town with a cargo of coal and coal tar when it caught fire and sank 86.3 NM off Table Bay. The crew were rescued (Levine 1989; van den Bosch 2009).* *This position is in the general vicinity of the concession.*	*West Coast*
24	*Mary*	*Disappeared*	*Britain*	*1870-07-24*	*Under Captain Anderson, this vessel left Simon's Bay for Falmouth and disappeared (Levine 1989).* *As the intended route goes up the west coast, I have included this vessel.*	*Atlantic Ocean*
25	*Mississippi*	*Abandoned*	*USA*	*1862-08-31*	*This 2030-ton steamship was abandoned about 450 km off the West Coast after severe weather was causing extensive leaks (Daily Southern Cross 1862-11-27).* *It may have drifted closer to land before sinking.*	*Off West Coast*
26	*Mona*	*Fire, abandoned*	*Britain*	*1887-09*	*The 1045-ton barque under Captain Pearson was on a voyage from Grimsby to Durban with coal when it caught fire at 27º 14´ S 24º 55´ W. The following day the crew took to the lifeboats. After a week, the crew were picked up by the German barque, Livingstone and landed at Mossel Bay (Levine 1989).* *The current was clearly pushing the survivors towards the Cape coast and, so it follows that their vessel, abandoned before sinking, may also have been pulled by the currents towards the west coast.*	*Off West Coast*

#	Name	Events	Nation	Date	History	Location
27	*Oliver Cromwell*	*Fire, abandoned*	*Britain*	*1874-8-30*	*This 1112-ton vessel, under Capt. Jack was on a voyage from Newcastle to Aden with a cargo of coal It caught fire 300 miles (482 km) from Table Bay. The 21 crew members entered the lifeboats while the ship was burning. The boat was overloaded and leaking. They had the bail water out the entire trip, and while they did spot one vessel that could have saved them, it did not notice the lifeboat. Three days later they entered Table Bay, and the Saxon took them aboard (London Magnet 1874-10-19).* *As it was abandoned off the west coast, it is included in the database.*	*Off West Coast*
28	*Orissa*	*Fire, abandoned*	*Britain*	*1869-9-27*	*This 634-ton, three-masted, wooden ship was built in 1862. Under Captain R. Adams, bound for Mauritius with a cargo of coal, it caught fire and was abandoned 343.2 NM west of Table Bay (Levine 1989; van den Bosch 2009).* *The Equatorial current which runs west to east here could have pulled the abandoned vessel into the Benguela current and up the west coast.*	*Atlantic Ocean*
29	*Oswin*	*Leaking, abandoned*	*Britain*	*1819-1-27*	*This vessel was en-route to the East. According to Captain Ray, the commander of the vessel, the ship rounded the Cape and sprung a leak in the vicinity of the Agulhas Bank and while the pumps were working 24 hours a day, they were unable to make any headway on the leak. By the next day, there was 1.5m of water in the hold and this was increasing. The crew launched the longboat and filled it with supplies. "Embarking in the boat the commander and crew steered for Saint Helena and were from 31 Jan to 12 Feb exposed to great sufferings and anxiety, until they reached Saint Helena. During this time, they ran about 1400 miles and were particularly fortunate in making the Island to a mile." (The Asiatic Journal and Monthly Register 1820)* *Despite having rounded the Cape, the Benguela current seems to have pulled the vessel back around the Cape while they were attempting to repair it. They state that they travelled 1400 miles after abandoning it.* *Depending on whether this report was using nautical miles or statute miles, makes a difference to the location of the wreck. Statute miles puts the vessel off Lüderitz, nautical miles puts the wreck in the vicinity of the West Coast.*	*Off West Coast*
30	*Stranger*	*Fire, abandoned*	*Britain*	*1878-8-27*	*This 288-ton barque was built in 1872. Under Captain Bendon, it was bound from London to Port Nolloth with a general cargo. The vessel caught on fire and was*	*West Coast*

#	Name	Events	Nation	Date	History	Location
					abandoned at sea. Two days after taking to the lifeboats, the crew arrived at Port Nolloth (Levine 1989). *The location of the abandonment puts this vessel firmly in the West Coast area.*	
8.2.6.4.4 Shipwrecks with a High heritage significance						
31	*Abberkerk*	*Wrecked*	*Netherlands*	*Post – 1779-06-24*	*This vessel was built in 1772 for the van Hoorn Chamber. It was 140 Dutch feet long, 850 tons and had a crew of 174-268 people. Under Capt. Kasper Burger, the ship left China on the 29th of January 1779, reached the Cape on the 26th of May, and departed for the Netherlands on the 24th of June and was not heard from again (De VOC Site 2023)* *This vessel could be on the west coast.*	*Off South Africa*
32	*Aegeus*	*Torpedoed, sank*	*Greece*	*1942-10-31*	*This 3 792-ton steamship left Trinidad for Saldanha Bay and then Durban and never arrived (Hocking 1969). After WWII, German records indicated that it was torpedoed by the U-177 at 32° 30'S, 16° 00'E (U-boat.net 2022).* *These coordinates are just southwest of the concession and are where the U-boat reports torpedoing the vessel, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.*	*West Coast*
33	*Bevalligheid*			*Post – 1759-02-26*	*This VOC 850-ton vessel under Albert Verzaat, was built in 1746 by and for the Rotterdam Chamber. On its return voyage from Batavia, it left the Cape on the 26th of February 1759 and was never seen again (Huygens Instituut 2023).*	*Between Cape Town and the Netherlands*
34 – 37	*Cabral Fleet*	*Lost*	*Portugal*	*1500*	*Levine (1989) states: "Thirteen vessels under command of Pedro Alvares Cabral – the first Portuguese fleet which sailed annually to the Indies – and found Brazil. Twenty days after the fleet sailed from Brazil, it was struck by storms and four ships, including the one under command of Bartolomeu Dias, foundered. Duffy [Shipwrecks and Empire, 1955] writes that the ships were lost off the Cape of Good Hope, but, according to Axelson [Levine cites personal correspondence], the fleet could not have been off the Cape of Good Hope then; they would have been in the vicinity of the shortly-to-be-discovered islands of Tristao da Cunha."*	*Unknown – Atlantic Ocean*

#	Name	Events	Nation	Date	History	Location
					There is such scant and contradictory information regarding the loss of these four vessels that I am including them in this database, even though the chances of them being here is exceedingly slim.	
38	*Columbine*	*Torpedoed, sank*	*South Africa*	*1944-06-16*	*This 3 268-ton steamship owned by the South African government was initially a German vessel. It was seized at the start of WWII. On 16 June 1944, it had 52 people on board when it was torpedoed by the U-198. 23 people died when their lifeboat capsized, including two naval officer wives. The coordinates for its torpedoing are 32° 44'S, 17° 22'E (U-boat.net 2022; van den Bosch 2009).* *These coordinates are south of the concession and is where the U-boat reports torpedoing the vessel, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.*	*West Coast*
39	*Discovery*	*Disappeared*	*Britain*	*1644*	*This ship of 500 tons, was built in 1621 at Woodbridge. Under Capt John Allison. 1640/1 Surat and Persia. Capt John Allison. Its last trading voyage was as follows:* *Depart: Downs 3 Apr 1641* *At: Surat 27 Sep* *At: Bandar Abbas 2 Feb 1642* *At: Surat 13 Apr* *At: Mokha 22 Aug - 31 Oct* *At: Surat 30 Jan 1643 - 18 Feb* *At: Bandar Abbas 27 Apr* *At: Mokha 3 Nov* *At: Surat 29 Jan 1644* *After leaving Surat, India, the ship was not seen again (Wrecksite.Eu 2022).*	*Unknown*
40	*Enkhuizen*	*Disappeared*	*Netherlands*	*Post –* *1742-06-12*	*This VOC vessel of 1850 tons was built by the Amsterdam Chamber at Enkhuizen in 1735. It departed China for the Cape in December 1741 and arrived on the 27th of May 1742 at Robben Island. It departed the Cape on the 12th of June 1742 en route to the Netherlands and was never seen again (Huygens Instituut 2023).*	*Between Cape Town and the Netherlands*

#	Name	Events	Nation	Date	History	Location
41	*Hofvliet*			*Post – 1744-05-19*	*This VOC 1000-ton vessel under Pieter Lakeman, was built in 1729 by and for the Rotterdam Chamber. On its return voyage from Batavia, it left the Cape on 05-03-1744, in a convoy that included the Herstelder, Nieuwerkerk, Eendracht, Schellach, Domburg, Ida, Duinenburg and Drechterland. The Drechterland also disappeared and was last seen on 19-05-1744 (De VOC Site 2023; Huygens Instituut 2023)* *There is a 61-day period from when the vessels left the Cape and when they were last seen. The other vessels arrived in the Netherlands between the 17th of June and 4th of July 1744. So presumably when they went missing, they were two thirds of the way home and were lost somewhere in West Africa.*	*Between Cape Town and the Netherlands – probably West Africa*
42	*Honkoop / Honcoop / Hencoop*	*Disappeared*	*Netherlands / Britain*	*c.1796*	*This Dutch vessel of 1 150 tons and 20 guns, under Capt Alex Landt was built in 1770 for the Zeeland Chamber was taken by the British at The Battle of Saldanha (1871), it was being sailed at a prize back to England when it disappeared (van Niekerk 2015).*	*Atlantic Ocean*
43	*Maria Adriana*			*Post – 1743-09-14*	*This VOC 650-ton vessel under Jan Elswout, was built in 1730 by the Rotterdam Chamber for the Zeeland Chamber. On its return voyage from Batavia, it left the Cape on the 14th of September 1743 and was never seen again (Huygens Instituut 2023).* *There are reports of the wreck being near Ascension Island or the Isle of Scilly, however these are unsubstantiated (MaSS - Stepping Stones of Maritime History 2023)*	*Between Cape Town and the Netherlands*
44	*Muskaatboom / Notenboom (1665) ????*			*1665-02*	*This VOC 600-ton vessel was bought by the Amsterdam Chamber in 1659. On its return voyage from Batavia, was wrecked in a storm off the Cape in February 1665 (Huygens Instituut 2023).*	
45	*Nortun*	*Torpedoed*	*Panama*	*1943-03-20*	*This 3 663-ton ship was bound from Table Bay to Bahia when it was torpedoed and sunk by the U-516 about 130km south-west of Lüderitz at 28º 00´ S 14º 55´ E (Levine 1989; van den Bosch 2009). According to U-boat net (2022) the position is further north at 27° 35'S, 14° 22'E.* *Although these coordinates are well north of the concession, there are conflicting positions, and it is where the U-boat reported torpedoing the vessel, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.*	*Off West Coast* *Approximately:* *28º 00´ S* *14º 55´ E* *Or*

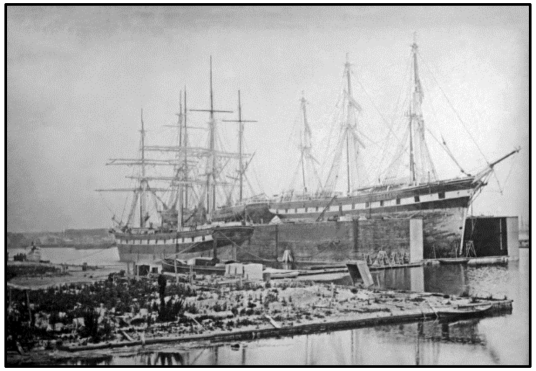
#	Name	Events	Nation	Date	History	Location
						27° 35'S *14° 22'E*
46	*S'-Graveland*			*Post –* *1729-06-18*	*This VOC 600-ton vessel under Gideon Kuiper, was built in 1722 by and for the Amsterdam Chamber. On its return voyage from Batavia, it left the Cape on the 18th of June 1729 and was never seen again (Huygens Instituut 2023).* *However, reports are that she was lost in the Bay of Biscay, Spain (De VOC Site 2023)*	*Possibly Bay of Biscay, Spain*
47	*U-179*	*Depth charges*	*Germany*	*1942-10-8*	*U-179 was responsible for torpedoing the British steamship City of Athens, about 45km to the south-east on the same day as the U-boat was surprised on the surface by H.M.S. Active. As it dived, the British vessel launched depth charges. Van den Bosch (2009) gives its coordinates as 33 25.00S,17 10.00E, U-boat.net (2022) gives the position as 33.28S, 17.05E. All hands were lost (61 crew).* *These coordinates are well south of the concession and is where the vessel reports depth charging the U-boat, not necessarily where it sank. In addition, the coordinates mentioned are subject to the technical limitations of the period.*	*West Coast* *Approximately:* *33 25.00S* *17 10.00E* *Or* *33.28S* *17.05E* ***
48	*Vredejaar*			*Post –* *1771-01-12*	*This VOC 850-ton vessel under Arie Arkebout, was built in 1769 by and for the Enkhuizen Chamber. On its outward bound voyage for China via the Cape, it left the Netherlands on the 12th of January 1771 and was never seen again (Huygens Instituut 2023).*	

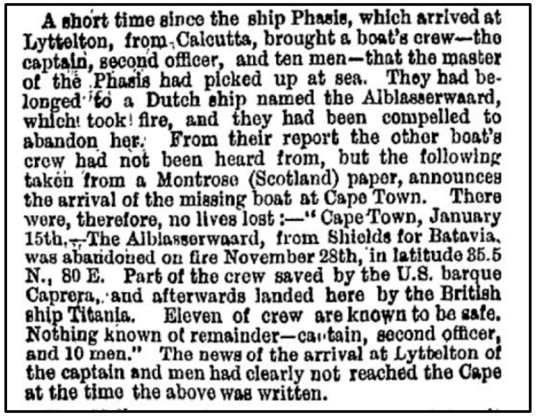
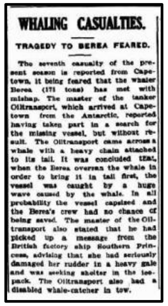
8.2.6.5 Wrecks that should be removed from the West Coast Databases

As per **Part C, Appendix E: Heritage Impact Assessment, page 333:**

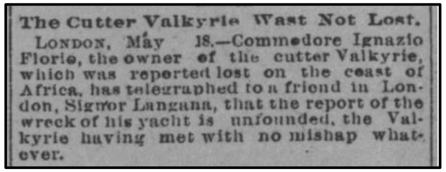
These are included, as they are in many databases and should be removed, for the reasons given below. Their inclusion mitigates against a belief that they were ignored.

#	Name	Events	Nation	Date	History	Location	Significance

1	*Adventurer*	*Wrecked*	*Britain?*	*1843*	*From Sandown Bay (Isle of Wright?) to Table Bay or Algoa Bay. The Reocities (2022) website states the vessel was lost west of Saldanha. But the newspaper states lost in Sandown Port. Ann Barrett (pers. comm. 2017), a researcher from the Isle of Wright stated the wreck is not on their lists. The vessel is not listed in Lloyds as per Levine (1989). The wreck may be in the South African Sandown Bay near Kleinmond, Western Cape.* *Therefore, South African shipwreck database, I believe it needs more research.*	*Sandown Bay (Kleinmond) or* *Isle of Wright*	
2	*Alblasserwaard (in databases as the* *Alblass Edwaard)*	*Fire and abandoned*		*1881-11-28*	*Caught fire and abandoned on 28-11-1881 (van den Bosch 2009).* *This Dutch "fregat" (Figure 80) was built in 1874 by Franz Harms von Lindern in Alblasserdam, South Holland. It is taken off the books in 1882, listed as wrecked or missing (Marhisdata 2022).* *The Otago Witness (1882-04-15) states that the vessel was abandoned midway between Australia and South Africa. One of the lifeboats was picked by and dropped the survivors in New Zealand, the other lifeboat was picked up and the survivors taken to Cape Town (Figure 81).*  *Figure 80: The Alblasserwaard loading ballast in Amsterdam (Marhisdata 2022)*	*Between Australia and South Africa*	*Medium*

					 A short time since the ship Phasis, which arrived at Lyttelton, from Calcutta, brought a boat's crew—the captain, second officer, and ten men—that the master of the Phasis had picked up at sea. They had belonged to a Dutch ship named the Alblasserwaard, which took fire, and they had been compelled to abandon her. From their report the other boat's crew had not been heard from, but the following taken from a Montrose (Scotland) paper, announces the arrival of the missing boat at Cape Town. There were, therefore, no lives lost:—"Cape Town, January 15th.—The Alblasserwaard, from Shields for Batavia, was abandoned on fire November 28th, in latitude 35.5 N., 80 E. Part of the crew saved by the U.S. barque Caprera, and afterwards landed here by the British ship Titania. Eleven of crew are known to be safe. Nothing known of remainder—captain, second officer, and 10 men." The news of the arrival at Lyttelton of the captain and men had clearly not reached the Cape at the time the above was written. *Figure 81: Report on the Alblasserwaard (Otago Witness 1882-04-15)*		
3	*Antoinette*			*1854*	*The only database that mentions this wreck is SAHRIS (SAHRA 2017). I could not find any mention of a vessel with this name wrecking in southern Africa from 1852 – 1856 in any historical newspapers.*		
4	*Berea*	*Disappeared*	*RSA*	*1933-11-4*	*In the databases, this steam whaler disappeared after leaving Table Bay (Levine 1989; van den Bosch 2009). However, a newspaper article (Figure 82) clearly states that the Berea was whaling in the southern Atlantic Ocean when it foundered(Sydney Shipping List 1933-12-23).*  WHALING CASUALTIES. TRAGEDY TO BEREA FEARED. The seventh casualty of the present season is reported from Capetown, it being feared that the whaler Berea (171 tons) has met with mishap. The master of the tanker Oiltransport, which arrived at Capetown from the Antarctic, reported having taken part in a search for the missing vessel, but without result. The Oiltransport came across a whale with a heavy chain attached to its tail. It was concluded that, when the Berea overran the whale in order to bring it in tail first, the vessel was caught by a huge wave caused by the whale. In all probability the vessel capsized and the Berea's crew had no chance of being saved. The master of the Oiltransport also stated that he had picked up a message from the British factory ship Southern Princess, advising that she had seriously damaged her rudder in a heavy gale and was seeking shelter in the ice-pack. The Oiltransport also had a disabled whale-catcher in tow. ***Figure 82: Report on the search of Berea***	*Southern Atlantic Ocean*	*Low*

5	*Earl of Abergavenny*	*Disappeared*	*Britain*	*1805*	*This English East Indiaman, under Captain J. Wordsworth was lost "off the Cape Coast" (van den Bosch 2009). However, removed off the database as it was actually wrecked on The Shambles, Isle of Portland (Cumming 2016).*	*The Shambles, Isle of Portland*	
6	*Hope*			*1836*	*The only reference to this vessel is in van den Bosch's (2009), and therefore in the SAHRIS database. Possibly lost on the West Coast. However, I can't find any other evidence, in the historical newspapers, of this vessel.*		
7	*Leonine Mary*	*Disappeared*	*Cape*	*1859-2*	*This vessel is an entry mistake and confused for the Leontine Mary, a coaster that sank between Algoa Bay and East London in 1859.*		
8	*Prins Wilhelm van Zeeland*		*Netherlands*	*1659?*	*SAHRIS is the only database that has this wreck. The only reference to this vessel I could find was the Prins Willem which sank near Madagascar in 1662. However, as it is from a period with few records, I am leaving it in the database for now.*		
9	*Valkyrie*	*Wrecked*	*Racing cutter*	*1894-5-16*	*This sailing cutter was apparently lost "Off the coast of Africa" (Anglo American Times 1894-05-19; van den Bosch 2009)* *However,* *"Valkyrie was subsequently sold to Mr. Florio, an Italian nobleman, but did not fare well in the Continental regattas. Mr. Florio then engaged William Cranfield's brother Lemon and a crew of Rowhedgers for the 1894 Mediterranean regatta season and Valkyrie competed at Monaco, Monte Carlo, Nice, Cannes etc, but against the much larger and up-to-date Britannia she was outclassed. Valkyrie made the news in May 1894 when it was reported that she had been lost with all hands off the coast of Africa. The story proved to be untrue but Lord Dunraven, in his memoirs, admitted that even he did not know what became of her" (Simons 2020).* *Independent verification of this came from a newspaper report in the Philadelphia Enquirer (Figure 83)*	*NOT A WRECK*	

					 The Cutter Valkyrie Wast Not Lost. LONDON, May 18.—Commodore Ignazio Florie, the owner of the cutter Valkyrie, which was reported lost on the coast of Africa, has telegraphed to a friend in London, Signor Langana, that the report of the wreck of his yacht is unfounded, the Valkyrie having met with no mishap whatever. *Figure 83: Report on the Valkyrie (Philadelphia Inquirer 1894-05-19)*		

*** Please note these coordinates are all approximations. The datums and methods used through time and within various areas, to record latitude and longitude, change. This can cause large deviations in real-world locations. Without knowing the datum and method that was used to record the coordinates, they cannot be converted accurately. In addition, the recording of coordinates has become much more accurate in the 21st century. All coordinates here WGS84.*

8.2.7 Palaeontological Heritage

As per **Part C, Appendix E: Paleontological Impact Assessment, page 374:**

8.2.7.1 Petrified Fossil Wood

Cretaceous fossil wood, mainly dating between 120 to 80 Ma, occurs primarily in the gravels on the flat middle shelf which directly overlie the source Cretaceous formations. Petrified wood is common and includes areas where petrified logs litter the seabed, the "Fossil Forests". Specimens obtained via diamond exploration are providing valuable insights into the palaeo climates of the Cretaceous West Coast, when wide, well-watered coastal plains were covered by forests of primitive yellow wood (podocarp) trees (Bamford & Corbett, 1994; Bamford & Stevenson, 2002; Stevenson & Bamford, 2003). Rounded cobbles and pebbles of petrified wood are sometimes noticed in gravels on the Precambrian inner-shelf bedrock to where they have been transported during rising sea levels, but are quite rare there and far from the source formation.

Petrified fossil wood also occurs on land in the Olifantsrivier river terrace gravels of mid-Miocene age (20-16 Ma) and the forest tree types present indicate tropical conditions in the Cape during those warm-period times (Bamford, 1999). Most of the mid-Miocene deposits which once infilled the Olifantsrivier valley have been flushed out to sea and may be present on the neighbouring inner shelf.

8.2.7.2 Cenozoic Shelly Macrofauna

The Cenozoic shelly macrofauna comprises black phosphatic shell casts and more rarely partly intact shells of various ages, mainly of Eocene and early Miocene ages. During later Neogene and Quaternary times the shelf was dominated by upwelling processes, with high organic productivity and authigenic mineralization of seabed rocks, clays and biogenic particles by phosphatization and glauconization. Extensive cemented crusts or "hardgrounds" formed on formations exposed at the seabed. Sea level oscillated repeatedly, dropping to ice-age palaeoshorelines as much as 140 m below present sea level. The hardgrounds were eroded during the ice-age/glacial shallowing episodes, releasing these fossils for incorporation into the LTS gravels.

8.2.7.3 Fossil Bones and Teeth

Fossil bones and teeth include the bones and teeth of sharks and other fishes, the skulls of extinct whale species and the occasional remains of land-living animals that roamed the ice-age exposed shelf are also phosphatized and reworked into the latest, loose Last Transgression Sequence sediments on the seabed. A sample of this reworked material turns up in bottom-trawl fishnets, scientific dredging and during diamond-mining operations and the specimens which have been donated to scientific institutions have been invaluable contributions (e.g. Bianucci, Lambert & Post, 2007; Bianucci, Post & Lambert, 2007). All such material should be collected.

8.2.7.4 Shells from the Last Transgression Sequence

Shells from the Last Transgression Sequence refers to the "subfossil" shells that occur abundantly in the sediments accumulated on the shelf during the last 20 thousand years as it was submerged to increasing depths. The marine shell fossils which occur in the LTS are predominantly the species expected on the West Coast Shelf, in a deepening-water faunal succession with littoral epifaunal species in the basal gravels, succeeded by infaunal bivalves in clean sands, succeeded by bivalves adapted to dwelling in the capping sulphidic muds. However, unexpected species and "extralimitals" (species beyond their normal home range) are actually quite common.

*For instance, the Last Ice Age palaeoshoreline gravels are dominated by a "Venus shell" clam, Tawera philomela (*Figure 27*). This Subantarctic cold-water species, along with others, reached the Cape coast from the mid-Atlantic islands of Tristan da Cunha and Gough, apparently thrived here and then became extinct locally during the last deglaciation (Pether, 1993).*

*During the subsequent deglaciation/warming, several warm-water species from the south and east coasts "invaded" the western shelf temporarily (***Figure 28***). This shows a more marked influence of Agulhas water rounding the Cape and affecting the Benguela System during the global-warming steps of the last deglaciation (Pether, 1994). These Agulhas extralimitals have mainly been found during diamond exploration sampling off northern Namaqualand off Kleinzee in the inner part of Concession 5C. Exploration sampling in 12B in depths of -40 to -70 m will test for the occurrence of Algoa species associated with the second incursion of warm-water species around 12 to 11 ka (***Figure 28***).*

8.2.8 Socio-economic Environment

The main users of the sea space in Concession 12B are the commercial shipping, mining, oil and gas, marine research and fishing industries.

As Concession 12B is just South of Concessions 10B and 11C, information was used from the socio-economic assessments that were done for these applicants.

The following was taken from the FBAR for the Proposed Prospecting over Sea Concession 10B.

The potential spatial overlap of commercial fisheries with the Concession Area 10B was investigated based on the most recently available published reports, specifically Norman et al. 2018, the Fishing Rights Register (2018), available commercial linefish catch and return data (DFFE 2011), and other EIA reports for the region (SLR 2021a, b).

Data indicates that the small pelagic purse seine fishery is the only fishery that partially overlaps with the concession area.

8.2.8.1 Small Pelagic Purse Seine

*The South African small pelagic fishery targets sardines Sardinops sagax, anchovy Engraulis encrasicolus and, to a lesser extent, red eye Eutremeus whiteheadi. Sardines (Sardinops sagax) are usually frozen or canned for human consumption, used as pet food and bait whereas anchovy, juvenile horse mackerel and redeye round herring (Etrumeus whiteheadi) are reduced to fishmeal, fish oil and fish paste in factories situated predominantly in St Helena bay on the West Coast. This fishery has the largest catch volume for any of the South African fishery sectors and has the second largest annual catch value, estimated at around R2.164 billion in 2017, which is approximately one fifth of the combined value of South African Fisheries (Japp & Wilkinson 2021). At this time, the industry supported around 4 500 full time staff, 2 500 seasonal staff and more than 700 fishers. The support industries contribute an estimated further 2 400 jobs. The small pelagic fishery is managed using an Operational Management Plan (OMP) that involves a trade-off between maximizing overall sardine and anchovy catches, whilst minimizing the risk of resource collapse. This trade-off is required as juvenile anchovy (which form the bulk of the anchovy catch) and juvenile sardine shoal together for much of the year. The 2019 and 2020 OMP, however, required implementation of "exceptional circumstances" allowing large or rapid declines in Total Allowable Catch (TAC) for both sardine and anchovy due to low biomass estimates. Total pelagic catches in 2019 were 226 872 tonnes which was well below the long-term average of around 334 000 tonnes. The small pelagic purse-seine fishery operates between the Orange River and East London mostly in nearshore waters (within 10 km of the coast) and in the late summer mainly during the months of February to July (SAPFIA pers. comm). Data suggests that the 10B Concession Area does not overlap with identified priority fishing areas for anchovy or with the sardine directed fishing ground (***Figure 84***).*

From Figure 84 it is clear that 12B overlaps with fishing grounds for anchovy, but not priority areas. The concession area doesn't overlap with sardine grounds. Prospecting and bulk sampling will take in Spring and Summer and will be planned to no coincide with the Anchovy and Sardine season. Therefore this impact will be very low to insignificant.

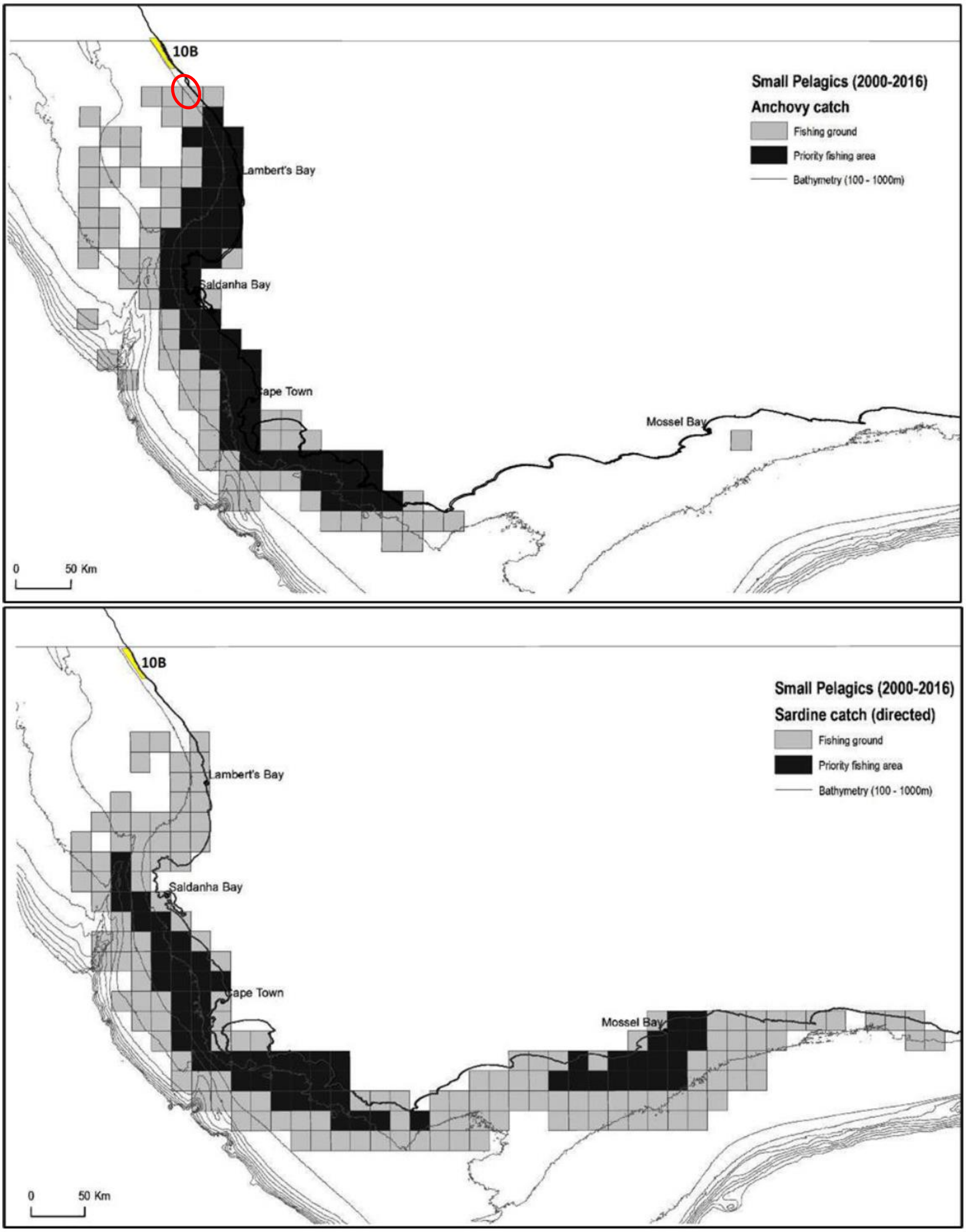


Figure 84: Spatial distribution of anchovy (top) and sardine (bottom) purse seine catch (2000-2016) with identified priority fishing areas (Source: Norman et al. 2018).

*However, commercial catch return data (all small pelagic species combined for the period 2006-2011) shows that Concession Area 10B partially overlaps with a catch area (Figure 8.10). Here, an annual average of 1.75 tonnes of fish were landed over the 2006–2011 period which is equivalent to about 0.0027% of the national total catch (*Figure 85*)(Norman et al. 2018).*

This is not considered a substantial proportion of the national catch, but potential impacts of prospecting within this important small pelagic fishing area may be significantly negative at the individual vessel or right holder level. However, the target species are pelagic, and their distribution is variable, so the fishery as a whole is unlikely to be significantly negatively affected by small temporary closures/exclusion zones around survey vessels and geotechnical survey sites.

Concession Area 12B also overlaps with a catch area. Prospecting and bulk sampling will take in Spring and Summer and will be planned to no coincide with the Anchovy and Sardine season. Therefore this impact will be very low to insignificant.

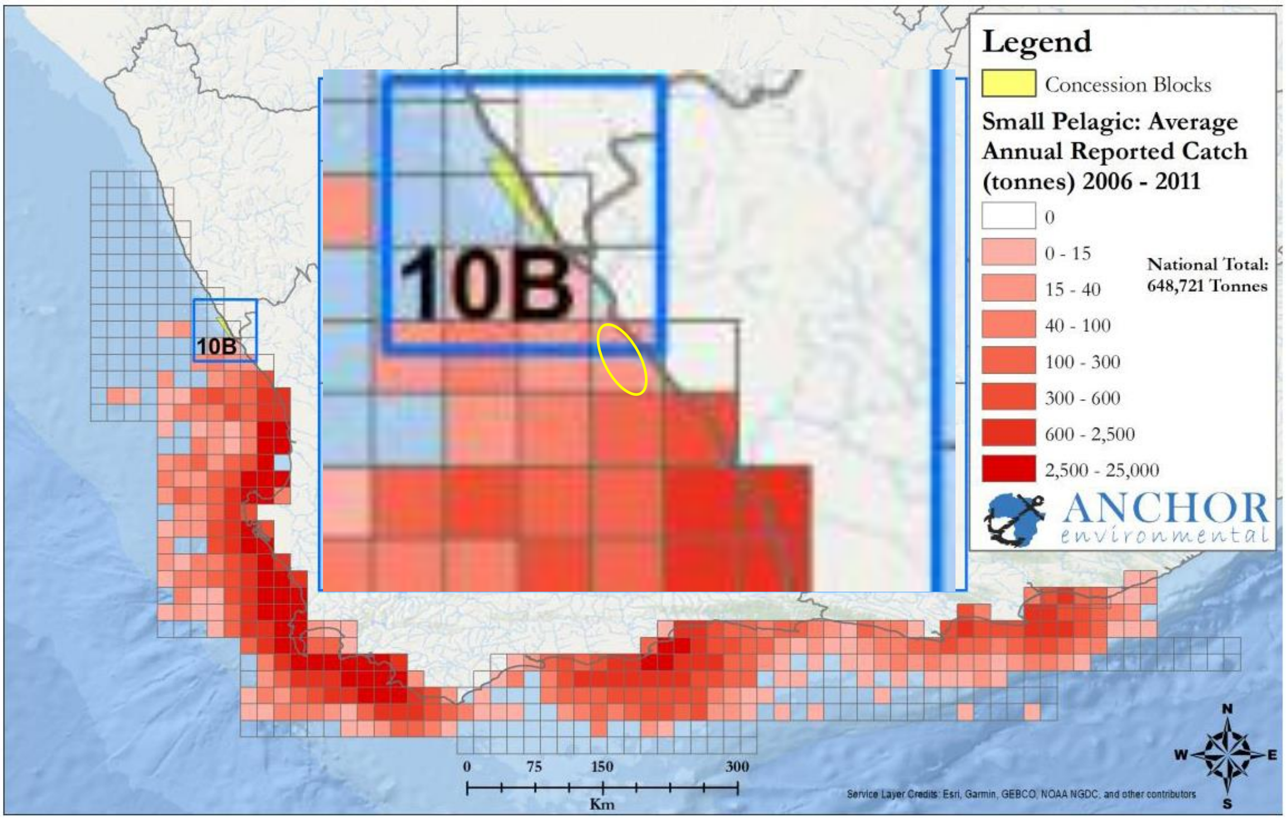


Figure 85: Average annual reported small pelagic catch 2006-2011, Sea Concession 12B indicated by yello oval (Data source: DFFE).

*The 10B Concession Area does lie within an important west coast nursery ground that is utilised by several small pelagic fish species including sardine Sardinops sagax, horse mackerel Trachurus capensis and anchovy Engraulis capensis (Hutchings et al. 2002). The greatest abundance of juvenile small pelagic fish would be present in the West Coast nursery grounds from December to May (Hutchings et al 2002). The area around the 10B concession also overlaps with one of several areas of high juvenile anchovy abundance, with much of the west coast between St Helena Bay and Port Nolloth constituting the anchovy recruit habitat (*Figure 86*).*

Concession Area 12B also overlaps with west coast nursery ground, although not high as concession area 10B, but medium to low in anchovy abundance. Prospecting and bulk sampling will take in Spring and Summer and will be planned to no coincide with the Anchovy and Sardine season. Therefore this impact will be very low to insignificant.

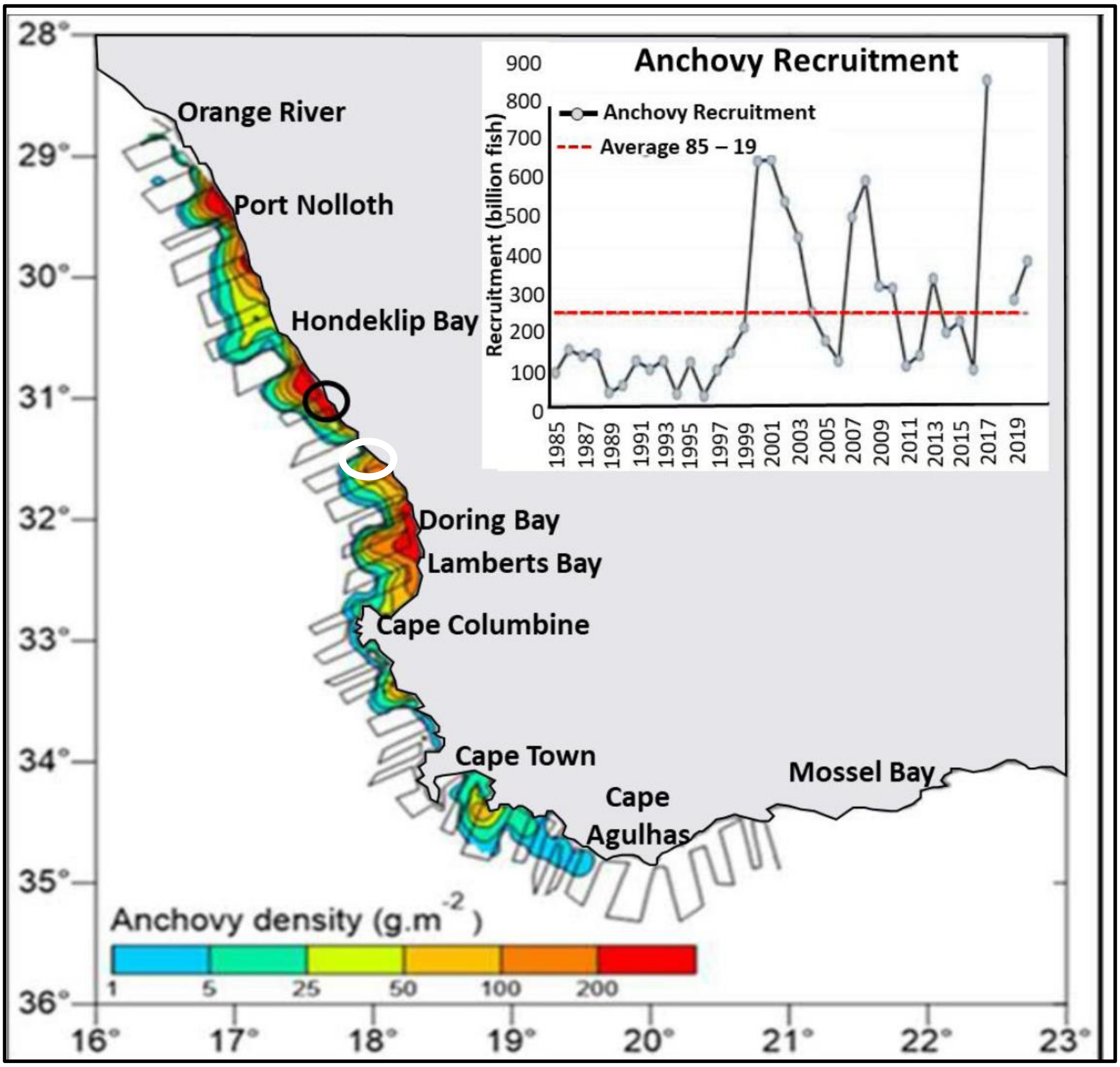


Figure 86: Recruitment survey results (May 2020) for anchovy and recruitment trend (inset). The red dotted line is the running average level of recruitment since 1985. The white circle represents Sea Concession 12B. (information and figure provided by J. Coetzee and D. Merkel of DFFE; Source: SLR 2021).

8.2.8.2 Demersal hake and demersal trawl longline

The demersal longline and demersal trawl (targeting mostly hake) commercial fishing sectors that are active along the west coast all operate far offshore of the 10B Concession Area and were therefore screened out (Figure 87).

The demersal longline and demersal trawl (targeting mostly hake) commercial fishing sectors were also screened out for Sea Concession 12B as per Figure 87**.**

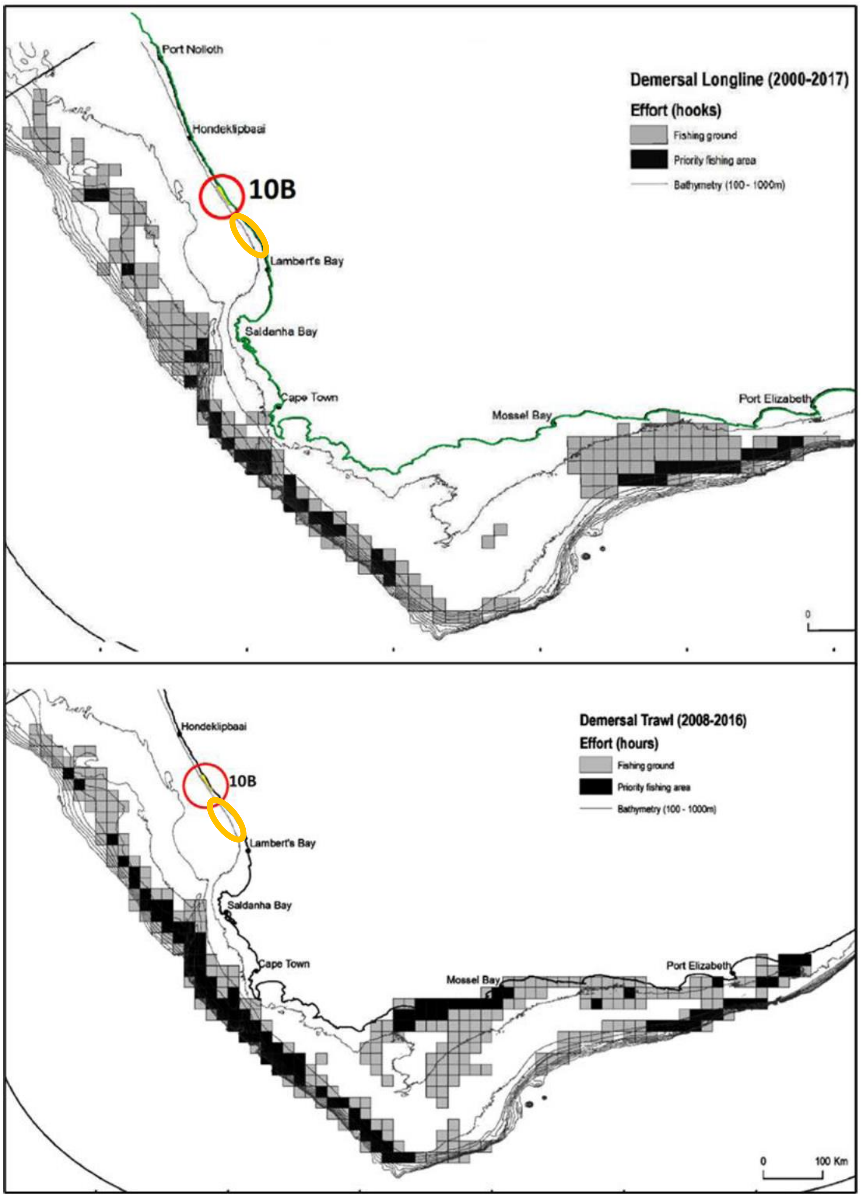


Figure 87: Distribution of demersal longline (top) and trawl (bottom) fishing effort in relation concession area 10B (red circle) and 12B (orange oval). (Source: Norman et al. 2018).

8.2.8.3 Tuna pole and line

The South African tuna pole and line (TPL) sector targets longfin tuna (T. alalunga), yellowfin tuna (T. albacares, bigeye tuna (T. obesus) and skipjack tuna (Katsuwonus pelamis) seasonally between November and May. Due to the seasonality of the TPL fishery, fishers also have access to snoek Thyrsites atun and yellowtail Seriola lalandi that are also important targets of the traditional linefishery. Furthermore, a significant amount of snoek-directed activity by the tuna pole fleet occurs inshore of the 100 m depth contour (SLR 2021). Snoek fishing activity within the area is seasonal with all fishing reported within the period April to May inclusive (SLR 2021).

The commercial tuna pole fishing operates predominantly out of Cape Town and Hout Bay harbours and most fishing effort takes place within 100 nautical miles of these ports (particularly in the Cape Canyon area). Some effort does take place further up the west coast, although this is mostly offshore of, or to the south of concession area 10B.

The tuna pole and line (Figure 88) commercial fishing sectors that are active along the west coast all operate far offshore of the 10B Concession Area and were therefore screened out (Figure 87).

The tuna pole and line (Figure 88) commercial fishing sectors that are active along the west coast all operate far offshore of the 12B Concession Area and were therefore screened out (Figure 87).

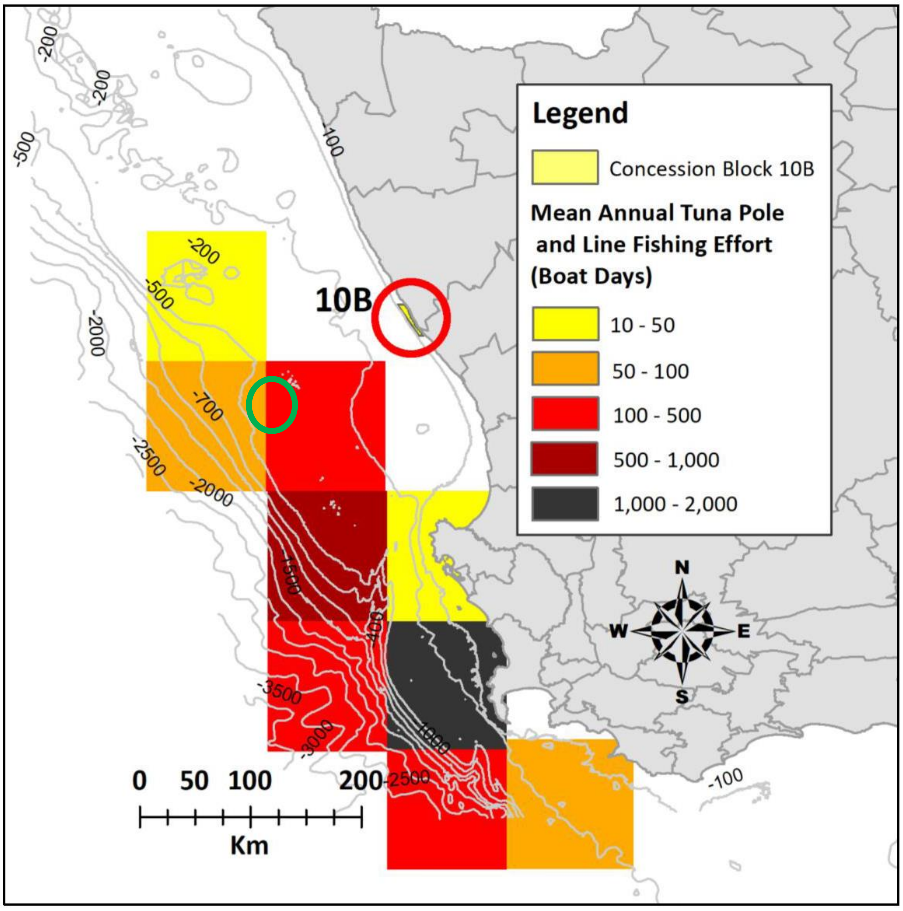


Figure 88: Mean annual tuna pole and line fishing effort (boat days) in relation to concession 10B (red circle) and 12B (green circle)(Source: Norman et al 2018).

8.2.8.4 Traditional Linefish

Commercial, recreational and subsistence linefishers target up to 200 different fish species with the dominant species along the west coast being snoek and hottentot seabream, both from boats and the shore. Linefishers operate in shallow water (generally <100 m depth)and would potentially be negatively impacted by coastal and nearshore seismic exploration and prospecting operations (particularly recreational, small scale and subsistence shore fishing). However, concession area 10B is situated far from any launch sites and is beyond the operational range of skiboats and other small vessels used by traditional and small scale linefishers. A spatial analysis of commercial traditional linefishing effort showed no reported activity rate within or in the vicinity of, Concession 10B, and traditional linefishing was therefore screened out (Figure 8.14).

When using the spatial analysis of commercial traditional linefishing effort showed some reported activity rate within or in the vicinity of, Concession 12B, and therefore there might be an impact traditional linefishing as 2-3 tonnes per year annually is reported here. This is 0.025% of the annual reported catch.

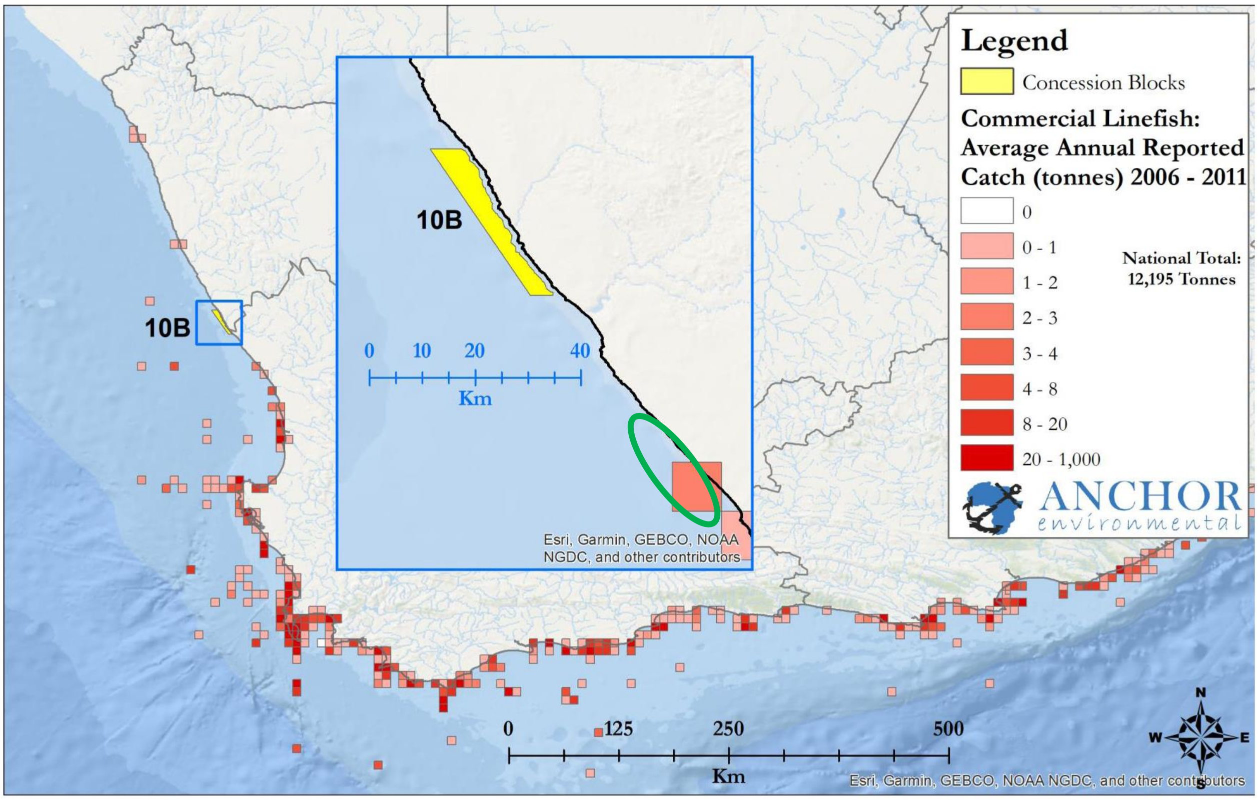


Figure 89: Reported annual commercial line fishing catch the calculated proportion of the average national total catch made within Concession Area 10B (yellow polygon) and 12B (green oval) (Data source: DFFE).

8.7.5 Other small scale fisheries, abalone ranching and harvesting activities

Small scale fishers, including interim relief west coast rock lobster and line fish right holders operates inshore, in waters of 15-30 m which is shallower than most of the concession area (DEFF 2020, Norman et al. 2018). They may, on rare occasions, fish within the inshore areas of concession 10B. However, due to the absence of harbours and fishing settlements close to Concession 10B, coupled with the limited range of small-scale fishing vessels (typically 20 km from the harbour), the probability of such encounters is negligible. Due to the very low probability of interaction with small scale fishers, the low intensity, small spatial scale, and the very short duration, the proposed prospecting activities are expected to have no impact on small scale and interim relief fishers and this impact was therefore screened out. The gill net fishery that targets mullet Chelon richardsonii in near shore waters (<50m depth) in some west-coast areas is not present in 10B due to the absence of any net fishing rights holders in the surrounding area and the lack of any coastal harbours on/ near the adjacent coastline (DFFE 2018),

Kelp harvesting and processing is relatively large industry along the West Coast of South Africa. As kelp grows in the intertidal zone and shallow water down to about 20 m depth, prospecting activities in Concession area 10B will not interfere with or impact upon kelp harvesting as this concession area starts at 70 m depth and is located at least 5 km west (out to sea) of where kelp harvesting occurs. As prospecting activities are unlikely to have an impact on these fisheries and activities, impacts of prospecting on these activities were screened out of impact assessment. No ranching rights for abalone Haliotis midae have been given for this stretch of coastline and, therefore, it is also screened out.

Small scale fishers, including interim relief west coast rock lobster and line fish right holders operates inshore, in waters of 15-30 m which is shallower than most of the concession area.

The 12 small scale harbours identified by Western Cape Government includes Lambert's Bay as the closest small scale harbour, and this harbour is located 45km from 12B. The prospecting activities will also not interfere with kelp harvesting or abalone ranching rights.

Due to the absence of harbours and fishing settlements close to Concession 12B, coupled with the limited range of small-scale fishing vessels (typically 20 km from the harbour), the probability of such encounters is negligible.

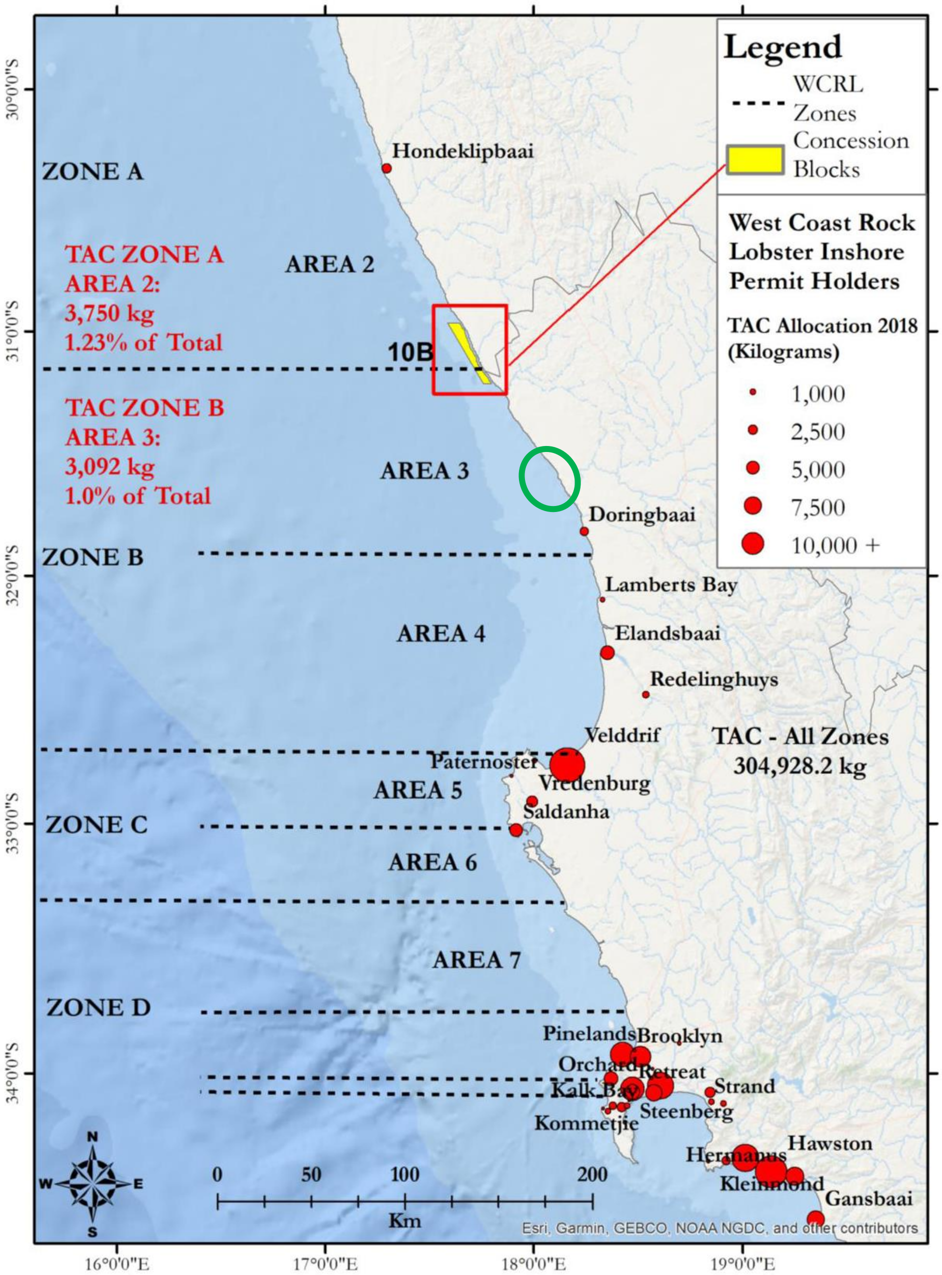


Figure 90: Map showing the proportion of the spatial distribution of quota in the west coast rock lobster nearshore sector by right holders given residential address. Sea Concession 12B is indicated by the green oval. (Source: DFFE, Fishing Right Register for all Commercial Fishing Sectors 2017).

8.2.8.5 Beach-Seine and Gillnet Fisheries

There are a number of active beach-seine and gillnet operators throughout South Africa (collectively referred to as the “netfish” sector). Initial estimates indicate that there are at least 7 000 fishers active in fisheries using beach-seine and gillnets, mostly (86%) along the West and South coasts. These fishers utilise 1 373 registered nets and report an average catch of about 1 600 tons annually, constituting 60% harders (also known as mullet, *Liza richardsonii*), 10% St Joseph shark (*Callorhinchus capensis*) and 30% "bycatch" species such as galjoen (*Dichistius capensis*), yellowtail (*Seriola lalandii*) and white steenbras (*Lithognathus lithognathus*).

The fishery is managed on a Total Allowable Effort (TAE) basis with a fixed number of operators in each of 15 defined areas. The number of Rights Holders for 2014 was listed as 28 for beach-seine and 162 for gill-net (DAFF, 2014a). Permits are issued solely for the capture of Harders, St Joseph and species that appear on the 'bait list.'

The exception is False Bay, where Right Holders are allowed to target line-fish species that they traditionally exploited. The beach-seine fishery operates primarily on the West Coast of South Africa between False Bay and Port Nolloth (Lamberth 2006) with a few permit holders in KwaZulu-Natal targeting mixed shoaling fish during the annual winter migration of sardine (SRK 2021).

Due to the range of beach-seine activities (20m), there would be no overlap with the sea concession areas, however, it is expected that the concession areas do overlap with gillnet fishing areas.

8.2.8.6 Marine or Fisheries Research

Surveys of demersal fish resources are carried out in January (West Coast survey encompassing the area between the Namibian border and Cape Agulhas) and April/May (South Coast survey encompassing the area between Cape Agulhas and Port Alfred) each year by DAFF in order to set the annual TACs for demersal fisheries.

These surveys are conducted at a national level and the probability of an overlap in space and time with the relatively short duration of planned prospecting activities in concession 12B is considered very low. Despite the low probability of an interaction, should the planned prospecting and fisheries survey vessels happen to coincide within the Concession Area 12B, this could be easily managed through consultation with the research managers at DFFE to ensure that the survey vessels to not hinder each other. Implementation of this simple mitigation would result in NO impacts of prospecting on the research activities (i.e., screened out of impact assessment).

8.2.8.7 Shipping Transport

The majority of shipping traffic is located on the outer edge of the continental shelf with traffic inshore of the continental shelf along the West Coast largely comprising fishing and mining vessels, especially between Kleinsee and Oranjemund. The main shipping lanes are located further offshore of Sea Concession areas 12B.

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Other users within and surrounding concession 12B include the commercial fishing industry, neighbouring marine diamond mining concession holders and hydrocarbon exploration and production licences. Recreational use of the offshore areas is negligible.

8.2.8.7.1 Hydrocarbons

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

The South African continental shelf and economic exclusion zone (EEZ) have similarly been partitioned into Licence Blocks for petroleum exploration and production activities. Exploration has included extensive 2D and 3D seismic surveys and the drilling of numerous exploration wells, with ~40 wells having been drilled in the Namaqua Bioregion since 1976. Concession 12B lies inshore of PetroSA's Exploration Right 283.

8.2.8.8 Exploration

Oil and gas exploration and production is currently undertaken in a number of licences blocks off the South and East coasts of South Africa (see **Figure 91**).

As per *The D Concession are the only potential mining areas where offshore mining and petroleum activities might interact. As yet, only prospecting licenses have been issued in D Concessions. There is potential for future user-conflict between these two sectors.*

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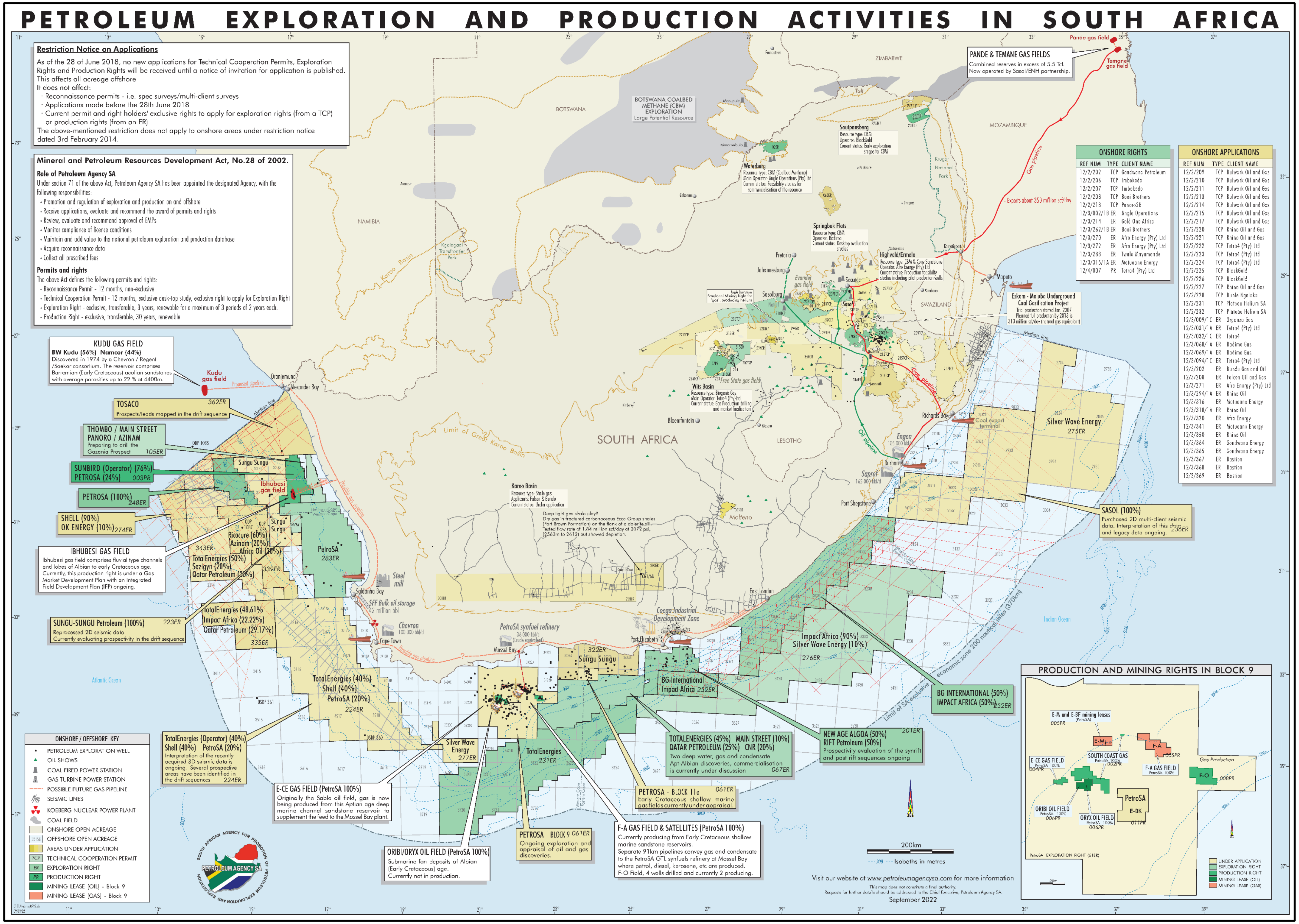

Figure 91: Petroleum licence blocks off the west, south and east coasts of South Africa (After Pasa, 2019).

8.2.8.9 Undersea Cables

There are a number of submarine telecommunications cable systems across the Atlantic and the Indian Ocean as depicted in **Figure 93: African undersea cables**, including the WACS and ACE cables. The SAT3/SAFE cables (SAT-1 [abandoned], SAT-2 and SAT-3) are laid on the seafloor approximately on the 3 000m isobaths, running up the Cape Canyon to land at Melkbosstrand.

8.2.8.10 Diamond Prospecting and Mining

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

Concession 12B lies adjacent to a number of other marine diamond mining concession areas. The marine diamond mining concessions are split into four or five zones (Surf zone and (a) to (c) or (d)-concessions), which together extend from the high water mark out to approximately 500 m depth (Figure 92). On the Namaqualand coast marine diamond mining activity is primarily restricted to the surf-zone and (a)-concessions, which extend to 1,000 m offshore of the high water mark. Nearshore shallow-water mining is typically conducted by divers using small-scale suction hoses operating either directly from the shore in small bays or from converted fishing vessels out to ~30 m depth. However, over the past few years there has been a substantial decline in small-scale diamond mining operations due to the global recession and depressed diamond prices. Some vessels still operate out of Alexander Bay and Port Nolloth, but activity out of Hondeklip Bay and Lambert's Bay has all but ceased. More recently (since 2020) there has been a renewed interest in some of the concessions around the Olifants River mouth, with numerous applications for geophysical surveys, sampling and bulk sampling being submitted. Interference with vessel-based mining or prospecting activities in adjacent concessions during the proposed prospecting and sampling operations is highly unlikely.

Deep-water diamond mining and prospecting is currently limited to operations by Belton Park Trading 127 (Pty) Ltd in concessions 2C and 3C for mining and by De Beers Marine in concessions 4C -6C for prospecting. Other prospecting applications for concessions further south are, however, pending.

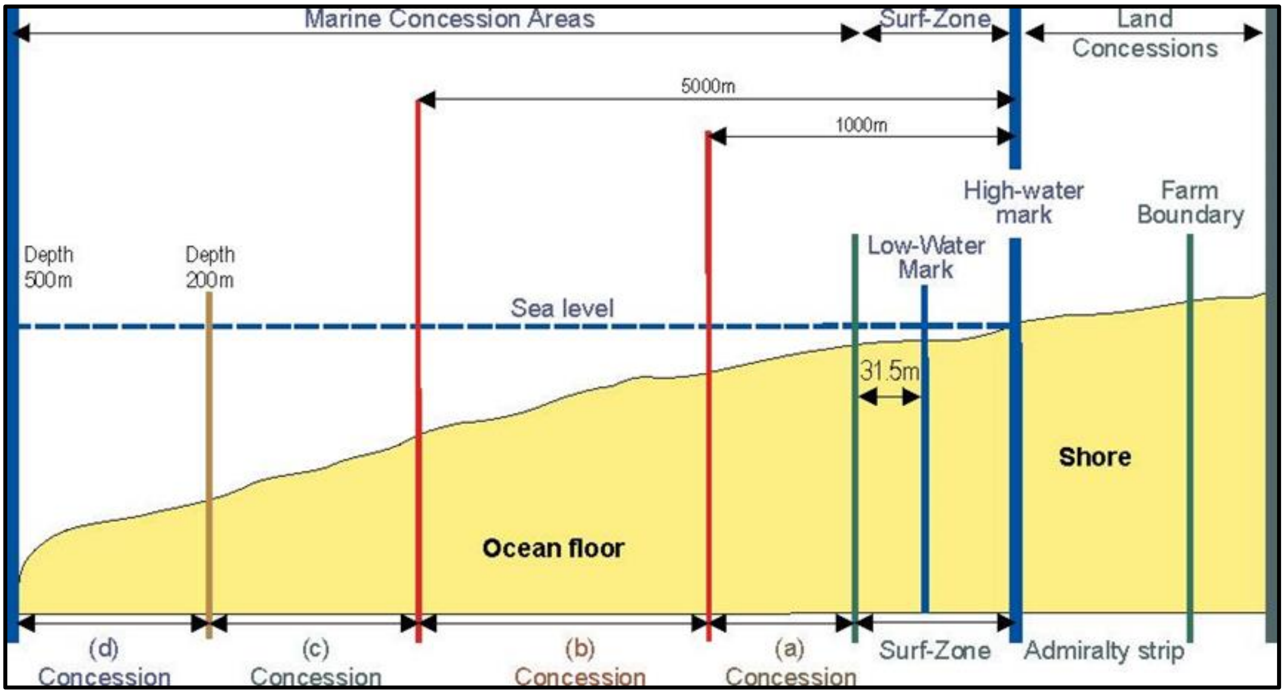

Figure 92: Diagram of the onshore and offshore boundaries of the South African (a) to (d) marine diamond mining concession areas.

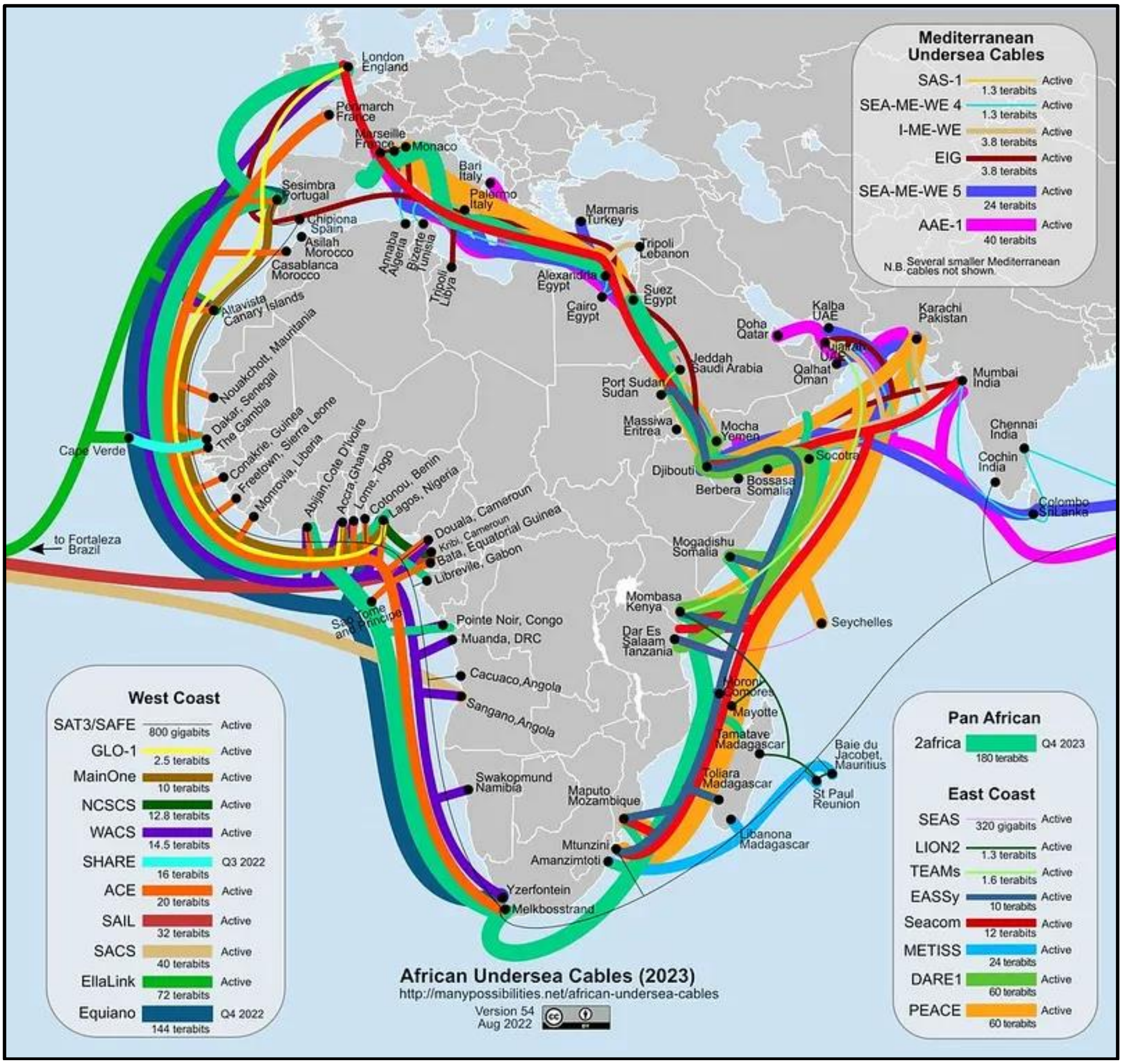

Figure 93: African Undersea Cables. Source: https://manypossibilities.net/african-undersea-cables/

8.2.9 <u>Emissions</u>

Air Quality

- Due to the onboard disposal of waste in some cases compliance with the requirements of Marpol Annex VI - Prevention of Air Pollution from Ships will be required for all vessel engines and where vessels are fitted with rubbish incinerators.

Noise and vibration

- The vessels will generate noise and vibration on the ocean.
- The prospecting activities will generate some noise.

Light Pollution

- The vessel will need to have lighting for security purposes.

8.3 Description of the current land uses

Data indicating the Land Cover 9-class (DEA, 2020) accessed through CapeFarmMapper indicates the area as a natural ocean or coastal area. Also refer to 8.2.8**.**

8.4 Description of specific environmental features and infrastructure on the site

Paragraphs in Section 8, provide a description of the environmental features of the biophysical and socio-economic characteristics of the prospecting right area.

8.5 Environmental and current land use map

Refer to Section 8.

9 IMPACTS AND RISKS IDENTIFIED

Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated).

9.1 Marine Fauna

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 396:**

9.1.1 Acoustic Impacts of Geophysical Prospecting and Sampling

9.1.1.1 Description of Impact

The ocean is a naturally noisy place and marine animals are continually subjected to both physically produced sounds from sources such as wind, rainfall, breaking waves and natural seismic noise, or biologically produced sounds generated during reproductive displays, territorial defence, feeding, or in echolocation (see references in McCauley 1994). Such acoustic cues are thought to be important to many marine animals in the perception of their environment as well as for navigation purposes, predator avoidance, and in mediating social and reproductive behaviour. Anthropogenic sound sources in the ocean may thus interfere directly or indirectly with such activities thereby affecting the physiology and behaviour of marine organisms (NRC 2003). Natural ambient noise will vary considerably with weather and sea state, ranging from about 80 to 120 dB re 1 µPa for the frequency range 10 – 10k Hz (Croft & Li 2017). A comparison of the various noise sources in the ocean is shown in Figure 94.

Of all human-generated sound sources, the most persistent in the ocean is the noise of shipping (Erbe et al. 2018, 2019). Depending on size and speed, the sound levels radiating from vessels range from 160 to 220 dB re 1 µPa at 1 m with main frequencies from 1 to 500 Hz (McCauley 1994; NRC 2003). Especially at low frequencies between 5 to 100 Hz, vessel traffic is a major contributor to noise in the world's oceans, and under the right conditions, these sounds can propagate 100s of kilometres thereby affecting very large geographic areas (Coley 1994, 1995; NRC 2003; Pidcock et al. 2003; Duarte et al. 2021). Shabangu et al. (2022) determined that the noise of vessel traffic dominates the soundscape below 500 Hz off the South African West Coast, while wind-generated noise increased with wind speed above 5 m/s and dominates the soundscape above 500 Hz.

As Concession 12B lies well inshore of the main offshore shipping routes that pass around southern Africa (Figure 95), the shipping noise component of the ambient noise environment is expected to minimal (OceanMind Limited 2020). Given the relatively strong metocean conditions but insignificant local shipping traffic specific to the area, ambient noise levels are expected to be below 80 dB re 1 µPa for the frequency range 10 Hz – 10 kHz (SLR Consulting Australia 2022).

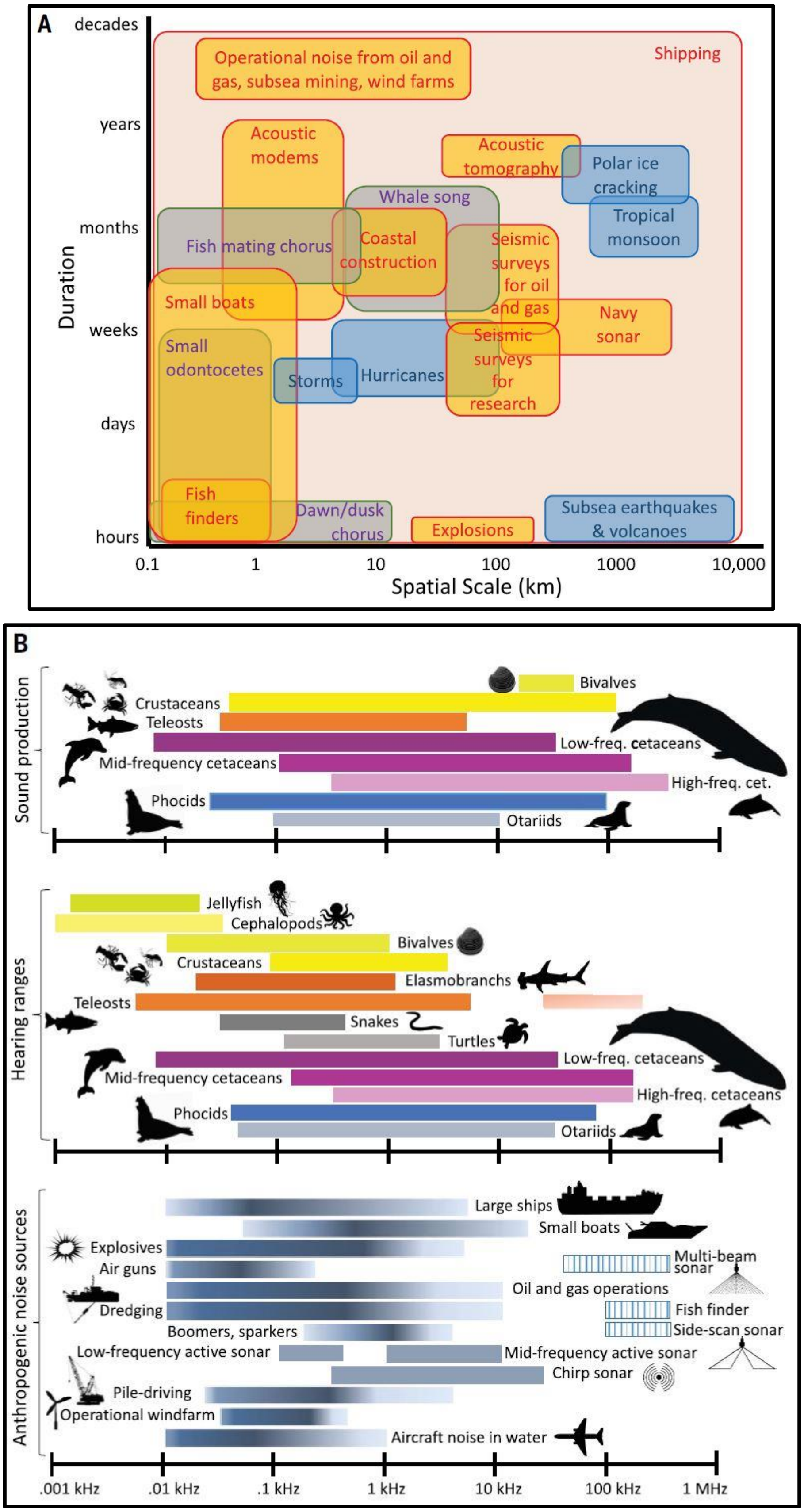

Figure 94: **Sources and animal receivers of sound in the ocean. A) Spatial extent and duration of selected sound producing events, and B) Approximate sound production and hearing ranges of marine taxa and frequency ranges of selected anthropogenic sound sources. (Source: Duarte et al. 2021).**

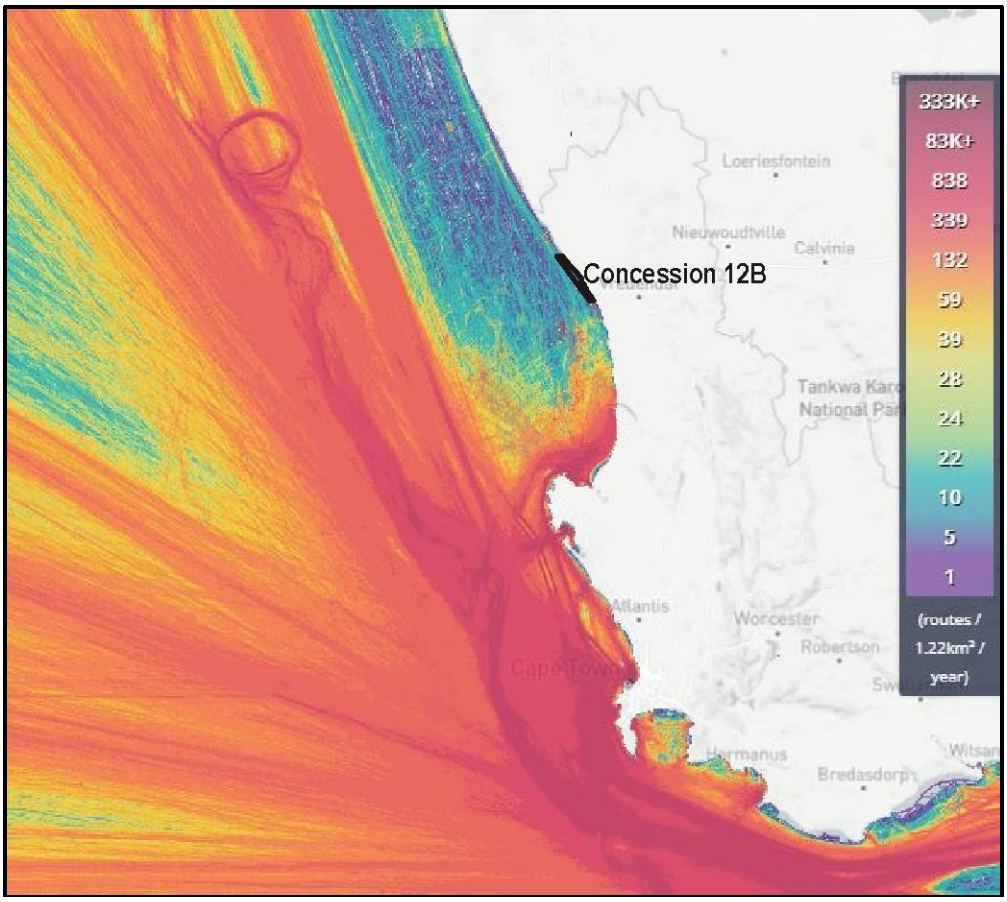

Figure 95: Concession 12B (black polygon) in relation to offshore vessel traffic (adapted from *www.marinetraffic.com/en/ais/home*, accessed October 2022).

The cumulative impact of increased background anthropogenic noise levels in the marine environment is an ongoing and widespread issue of concern (Koper & Plön 2012; Purdon 2020b) as such sound sources interfere directly or indirectly with the animals' biological activities. Reactions of marine mammals to anthropogenic sounds have been reviewed by McCauley (1994), Richardson et al. (1995), Gordon & Moscrop (1996) and Perry (1998), who concluded that anthropogenic sounds could affect marine animals in the surrounding area in the following ways:

- *Physiological injury and/or disorientation;*
- *Behavioural disturbance and subsequent displacement from key habitats;*
- *Masking of important environmental sounds and communication;*
- *Indirect effects due to effects on prey.*

It is the received level of the sound, however, that has the potential to traumatise or cause physiological injury to marine animals. As sound attenuates with distance, the received level depends on the animal's proximity to the sound source and the attenuation characteristics of the sound. The noise generated by the acoustic equipment utilized during geophysical surveys falls within the hearing range of most fish and marine mammals (Table 23), and at sound levels of between 190 to 230 dB re 1 µPa at 1 m, will be audible for considerable distances (in the order of tens of km) before attenuating to below threshold levels (Findlay 2005). However, unlike the noise generated by airguns during seismic surveys, the emission of underwater noise from geophysical surveying and vessel activity is not considered to be of sufficient amplitude to cause auditory or non-auditory trauma in marine animals in the region. An acoustic modelling study undertaken for a similar project identified that only directly below the systems (within <10 m of the sources for most hearing groups of marine mammals, but within <100 m of high frequency cetaceans) would sound levels be in the 230 dB range where exposure results in permanent threshold shifts (PTS). The zones for recoverable injury (temporary threshold shifts – TTS) for most hearing groups of marine mammals falls within a few 10s of *metres, but within <150 m for high frequency cetaceans. As most pelagic species likely to be encountered within the concession are highly mobile, they would be expected to flee and move away from the sound source before trauma could occur. Whereas the underwater noise from the survey systems may induce localised behavioural changes within a few kilometres of the sound source in some marine mammal, there is no evidence of significant behavioural changes that may impact on the wider ecosystem (Perry 2005).*

Similarly, the sound level generated by drilling and seabed crawler operations fall within the 120-190 dB re 1 µPa range at the sampling unit, with main frequencies between 3 – 10 Hz. The noise generated by sampling operations thus falls within the hearing range of most fish and marine mammals, and depending on sea state would be audible for up to 20 km around the vessel before attenuating to below threshold levels (Table 23). In a study evaluating the potential effects of vessel-based diamond mining on the marine mammals community off the southern African West Coast, Findlay (1996) concluded that the significance of the impact is likely to be minimal based on the assumption that the radius of elevated noise level would be restricted to ~20 km around the mining vessel. Whereas the underwater noise from sampling operations may induce localised behavioural changes in some marine mammal, it is unlikely that such behavioural changes would impact on the wider ecosystem (see for example Perry 2005). The responses of cetaceans to noise sources are often also dependent on the perceived motion of the sound source as well as the nature of the sound itself. For example, many whales are more likely to tolerate a stationary source than one that is approaching them (Watkins 1986; Leung-Ng & Leung 2003), or are more likely to respond to a stimulus with a sudden onset than to one that is continuously present (Malme et al. 1985).

Table 23: Known hearing frequency and sound production ranges of various marine taxa (adapted from Koper & Plön 2012).

Taxa	***Order***	***Hearing frequency (kHz)***	***Sound production (kHz)***
Shellfish	*Crustaceans*	*0.1 – 3*	
Snapping shrimp	*Alpheus/ Synalpheus spp.*		*0.1 - >200*
Ghost crabs	*Ocypode spp.*		*0.15 – 0.8*
Fish	*Teleosts*		*0.4 – 4*
Hearing specialists		*0.03 - >3*	
Hearing generalists		*0.03 – 1*	
Sharks and skates	*Elasmobranchs*	*0.1 – 1.5*	*Unknown*
African penguins	*Sphenisciformes*	*0.6 - 15*	*Unknown*
Sea turtles	*Chelonia*	*0.1 – 1*	*Unknown*
Seals	*Pinnipeds*	*0.25 – 10*	*1 – 4*
Northern elephant seal	*Mirounga agurostris*	*0.075 – 10*	
Manatees and dugongs	*Sirenians*	*0.4 – 46*	*4 – 25*
Toothed whales	*Odontocetes*	*0.1 – 180*	*0.05 – 200*
Baleen whales	*Mysticetes*	*0.005 – 30*	*0.01 – 28*

9.1.1.2 Assessment

*The effects of high frequency sonars on marine fauna is considered to be localised, short-term (for duration of survey i.e. weeks) and of medium intensity. The significant of the impact is considered of **LOW** significance without mitigation.*

*The impact of underwater noise generated during sampling operations is considered to be of low intensity in the target area and for the duration of the sampling campaign. The impact of underwater noise is considered of **VERY LOW** significance without mitigation.*

9.1.1.3 Residual Impact Assessment

*With the implementation of the mitigation measures above, the residual impact would reduce to **VERY LOW** significance.*

Impacts of multi-beam and sub-bottom profiling sonar on marine fauna

	Without Mitigation	***Assuming Mitigation***
Intensity	*Medium*	*Low*
Duration	*Short-term: for duration of survey*	*Short-term*
Extent	*Local: limited to survey area*	*Local*
Probability	*Highly likely*	*Highly likely*
Significance	*Low*	*Very Low*
Status	*Direct - Negative*	*Direct - Negative*
Confidence	*High*	*High*
Nature of Cumulative impact	*Considering the number of geophysical surveys conducted in the area by other mineral rights holders, some cumulative impacts can be anticipated. However, any direct impact is likely to be at individual level rather than at species level*	
Reversibility	*Fully reversible – any disturbance of behaviour, auditory "masking" or reductions in hearing sensitivity that may occur as a result of survey noise below 220 dB would be temporary*	
Loss of resources	*Negligible*	
Mitigation potential	*Medium*	

Impacts of noise from sampling operations on marine fauna		
	Without Mitigation	***Assuming Mitigation***
Intensity	***Low***	***No mitigation is proposed***
Duration	***Short-term: for duration of sampling operations***	
Extent	***Local: limited to vicinity of target area***	
Probability	***Likely***	
Significance	***Very Low***	
Status	***Direct - Negative***	
Confidence	***High***	
Nature of Cumulative impact	***None***	
Reversibility	***Fully Reversible - any disturbance of behaviour, auditory "masking" or reductions in hearing sensitivity that may occur would be temporary.***	
Loss of resources	***N/A***	
Mitigation potential	***Low***	

9.1.2 Disturbance and loss of benthic fauna during sampling

9.1.2.1 Description of Impact

The proposed sampling activities are expected to result in the disturbance and loss of benthic macrofauna through removal of sediments by the vibrocorer, grab and drill bit, as well as the crawler and dredge pump suction head. A maximum of 200 core samples, 50 grab samples and 4,800 drill samples would be taken disturbing a maximum total area of ~0.024 km^2. In addition, up to ten bulk samples are proposed, disturbing an area of 0.036 km^2.

As benthic fauna typically inhabit the top 20 - 30 cm of sediment, the sample operations would result in the elimination of the benthic infaunal and epifaunal biota in the sample footprints. As many of the macrofaunal species serve as a food source for demersal and epibenthic fish, cascade effects on higher order consumers may result. However, considering the available area of similar habitat on the continental shelf of the West Coast, this highly localised reduction in benthic biodiversity can be considered negligible and impacts on higher order consumers are thus improbable.

The ecological recovery of the disturbed seafloor is generally defined as the establishment of a successional community of species that achieves a community similar in species composition, population density and biomass to that previously present (Ellis 1996). The rate of recovery (recolonisation) depends largely on the magnitude of the disturbance, the type of community that inhabits the sediments in the sampling area, the extent to which the community is naturally adapted to high levels of sediment disturbances, the sediment character (grain size) that remains following the disturbance, and physical factors such as depth and exposure (waves, currents) (Newell et al. 1998). Generally, recolonisation starts rapidly after a sampling/mining disturbance, and the number of individuals (i.e. species density) may recover within short periods (weeks). Opportunistic species may recover their previous densities within months. Long-lived species like molluscs and echinoderms, however, need longer to re-establish the natural age and size structure of the population. Biomass therefore often remains reduced for several years (Kenny & Rees 1994, 1996; Kenny et al. 1998).

The structure of the recovering communities is typically also highly spatially and temporally variable reflecting the high natural variability in benthic communities at depth. The community developing after an impact depends on (1) the nature of the impacted substrate, (2) differential re-settlement of larvae in different areas, (3) the rate of sediment movement back into the disturbed areas and (4) environmental factors such as near-bottom dissolved oxygen concentrations etc. For the current project, much of the proposed sampling would be undertaken in depths beyond the wave base (>40 m) where near-bottom sediment transport is less than in shallower waters affected by swell. Excavations may therefore have slower infill rates and could persist for several months to several years (depending on depth). Long-term or permanent changes in grain size characteristics of sediments may thus occur, potentially resulting in a shift in community structure if the original community is unable to adapt to the new conditions. Depending on the texture of the sediments at the sampling target sites, slumping of adjacent unconsolidated sediments into the excavations can, however, be expected over the very short-term. Although this may result in localised disturbance of macrofauna associated with these sediments and alteration of sediment structure, it also serves as a means of natural recovery of the excavations.

Natural rehabilitation of the seabed following sampling operations, through a process involving influx of sediments and recruitment of invertebrates, has been demonstrated on the southern African continental shelf (Penney & Pulfrich 2004; Steffani 2007a, 2007b, 2009a, 2010a, 2010b, 2012; Biccard et al 2017, 2018; Gihwala et al. 2018; Biccard et al.2019; Giwhala et al. 2019). Recovery rates of impacted communities were variable and dependent on the sampling /mining approach, sediment influx rates and the influence of natural disturbances on succession communities. Results of on-going research on the southern African West Coast suggest that differences in biomass, biodiversity or community composition following mining with drill ships or crawlers below the wave base may endure beyond the medium term (5 - 15 years) (Parkins & Field 1998; Pulfrich & Penney 1999; Steffani 2012; Biccard et al.2019; Giwhala et al. 2019). Savage et al. (2001), however, noted similarities in apparent levels of disturbance between mined and unmined areas off the southern African west coast, and areas of the Oslofjord in the NE Atlantic Ocean, which is known to be subject to periodic low oxygen events. Similarly, Pulfrich & Penney (1999) provided evidence of significant recruitments and natural disturbances in recovering succession communities off southern Namibia. These authors concluded that the lack of clear separation of impacted from reference samples suggests that physical disturbance resulting from sampling or mining may be no more stressful than the regular naturally occurring anoxic events typical of the West Coast continental shelf area.

9.1.2.2 Assessment

The medium-intensity negative impact of sediment removal during sampling operations and its effects on the associated communities is unavoidable, but as it will be extremely localised amounting to a total of only 0.060 km² should all anticipated 4,800 drill samples and 10 bulk samples be taken. The area disturbed constitutes ~0.05 % of the overall area of Concession 12B. When put in the context of the proportion of available Southern Benguela Sandy Shelves and Southern Benguela Muddy Shelves habitat types disturbed, the area disturbed is considered negligible. The impact can confidently be rated as being of ***VERY LOW*** *significance without mitigation.*

9.1.2.3 Residual Impact Assessment

*With the implementation of the mitigation measures above, the residual impact would remain of **VERY LOW** significance.*

Disturbance and loss of benthic fauna during sampling		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Medium*	*Medium*
Duration	*Short- to Medium-term*	*Short- to Medium-term*
Extent	*Site specific: limited to sampling target area*	*Site specific*
Probability	*Definite*	*Definite*
Significance	*Very Low*	*Very Low*
Status	*Direct - Negative*	*Direct - Negative*
Confidence	*High*	*High*
Nature of Cumulative impact	*No cumulative impacts are anticipated during the sampling phase*	
Reversibility	*Fully Reversible – the highly localised disturbance at each sampling location will recover naturally with time*	
Loss of resources	*Low*	
Mitigation potential	*Low (None)*	

9.1.3 <u>Disturbance to and loss of rock lobsters during sampling operations</u>

9.1.3.1 Description of Impact

The proposed sampling activities will result in the disturbance and removal of sediments by the sampling tools. Following on-board treatment, all oversized and undersized tailings are discharged back to the sea on site.

Concerns have been raised that remote sampling tools may physically suck up rock lobsters migrating between reefs or into deeper water during their seasonal inshore/offshore migrations. The West Coast rock lobster exhibits a strong association with creviced habitats, and avoidance of gravel and sand areas (Beyers & Wilke 1990; Pulfrich & Penney 2001; Pulfrich et al. 2006; see also Cobb 1971; Spanier 1994). Depth distribution and availability of rock lobsters is also strongly influenced by environmental conditions (Newman & Pollock 1971; Pollock 1978; Beyers 1979; Pollock & Beyers 1981; Bailey et al. 1985; Pollock & Shannon 1987; Tomalin 1993, amongst others). During winter lobsters occur in deeper waters, possibly seeking shelter from winter swells, or to feed and release larvae (Pollock & Shannon 1987; Noli & Grobler 1998). During summer (January to April) the lobsters migrate inshore again in response to intrusion off near-bottom low-oxygen water brought inshore by upwelling. This inshore migration and concentration of lobsters in shallower, better-oxygenated water coincides with the commercial fishing season. During such migrations lobsters will leave the shelter of their preferred reef habitats and move across unconsolidated sediments, often in large numbers. This would make them vulnerable both to predation as well as sampling/mining operations targeting areas of unconsolidated sediments in their migration path. Lobsters found on mud or sand are therefore unlikely to be there by preference, but are moving across such areas in response to imposition or relaxation of the near-bottom hypoxia.

The principle impacts of mining activities on rock lobsters relate to alteration of suitable lobster habitat through discharge of tailings. This is discussed further in Section 4.4.7 below.

9.1.3.2 Assessment

The damage to, and survival of rock-lobsters through mining activities was assessed by Barkai & Bergh (1992) in a manipulated lobster pumping experiment using a small shore-based 'walpomp'. Of the 85 animals sucked up the hose and fed through the screening unit, a total of 61 survived. Most of these were below 60 mm *carapace length, and it was found that greater limb and antennae loss resulted in far higher mortality of larger lobsters. In general, however, rock-lobsters are easily able to avoid the pump nozzle and are seldom sucked up during regular diver-assisted mining operations. In the case of trenching using the seabed crawler, where suction pressures are greater, lobsters may not be able to actively avoid the suction head. As the suction head would also create substantial underwater noise and vibrations during operation, it is expected that lobsters would be able to detect this from some distance away and therefore avoid the active mine site. Only in cases where animals are forced to leave an area due to the onset of hypoxia, would the natural flight response to the mining head be overrun by physiological responses.*

During a 26-day bulk sampling operation covering an area of ~3,100 m^2 of unconsolidated seabed in Namibia, Tarras-Wahlberg (1999) recorded only 21 rock-lobster and 6 fish on the sorting screens of the mining vessel. Existing data therefore suggest that numbers captured are insignificant compared to the annual quota landed by the commercial rock lobster industry.

By its nature, marine sampling and mining removes unconsolidated sediments with the larger boulders that have been screened out by the mining tools, remaining on the seabed. Studies investigating the impacts of shallow-water mining operations on rock lobsters concluded that removal of sediment from gullies resulted in temporary creation of areas of suitable habitat for lobsters with resultant localised increases in lobster abundance (Pulfrich & Penney 2001). The abundance, mean sizes or catch rates of lobsters were not negatively affected by the mining operations (Barkai & Bergh 1992; Tomalin 1995, 1996; Parkins & Branch 1996, 1997; Pulfrich 1998a; Pulfrich et al. 2003; Pulfrich & Branch 2014), and benthic communities within metres of the mined gulley remained unaffected by the mining-induced disturbance. Disturbance of rock lobsters as a result of shallow-water mining operations were thus considered negligible, particularly when seen in context with responses to natural disturbances such as low oxygen events. The use of remote sampling/mining systems will obviously have effects on a larger scale, but if sampling operations move progressively from one side of the target area to another, there is no reason why sampled areas dominated by boulders would not provide high-profiled habitat for rock lobsters. This habitat creation would, however, be temporary only as sediments from adjacent unmined areas, as well as tailings released from the vessel, would be redistributed into the sampling excavations by wave action and the long-shore littoral drift.

*Reductions in rock lobster populations through large numbers of animals being sucked up by the sampling tool is highly unlikely and would be highly localised, resulting in only a limited loss of resources. The impact would be of low intensity and is consequently deemed to be of **VERY LOW** significance without mitigation.*

9.1.3.3 Residual Impact Assessment

*With the implementation of the mitigation measures above, the residual impact would remain of **VERY LOW** significance.*

Disturbance to and loss of rock lobsters		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Low*	*Low*
Duration	*Temporary*	*Temporary*
Extent	*Site specific: limited to sampling area*	*Site specific*
Probability	*Possible*	*Improbable*
Significance	*Very Low*	*Very Low*
Status	*Direct - Negative*	*Direct - Negative*
Confidence	*High*	*High*
Nature of Cumulative impact	*The highly localised disturbance and loss of rock lobsters during sampling operations is not expected to result in cumulative impacts*	
Reversibility	*The impact is partially reversible as natural recovery of injured lobsters and the rock lobster populations will occur*	
Loss of resources	*Low*	
Mitigation potential	*Low*	

9.1.4 Crushing of benthic fauna during sampling

9.1.4.1 Description of Impact

Some disturbance or loss of benthic biota adjacent to the sample footprint can also be expected as a result of the placement on the seabed of the drill frame structure (during sampling) and the seabed crawler tracks (during bulk sampling). Epifauna and infauna beneath the footprint of the drill frame would be crushed by the weight of the equipment resulting in a reduction in benthic biodiversity.

9.1.4.2 Assessment

*Crushing is likely to primarily affect soft-bodied species as some molluscs and crustaceans may be robust enough to survive (see for example Savage et al. 2001). Considering the available area of similar habitat on the continental shelf of the West Coast, the reduction in benthic biodiversity through crushing can be considered negligible. The impacts would be of medium intensity but highly localised, and short-term as recolonization would occur rapidly from adjacent undisturbed sediments. The potential impact is consequently deemed to be of **VERY LOW** significance without mitigation.*

9.1.4.3 Residual Impact Assessment

*With the implementation of the mitigation measures above, the residual impact would remain of **VERY LOW** significance.*

Crushing of benthic fauna during sampling		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Medium*	*Medium*
Duration	*Short-term*	*Short-term*
Extent	*Site specific: limited to target area*	*Site specific*
Probability	*Definite*	*Definite*
Significance	*Very Low*	*Very Low*
Status	*Direct - Negative*	*Direct - Negative*
Confidence	*High*	*High*
Nature of Cumulative impact	*No cumulative impacts are anticipated during the sampling phase*	
Reversibility	*Fully Reversible*	
Loss of resources	*N/A*	
Mitigation potential	*Low (None)*	

9.1.5 Increased turbidity due to generation of suspended sediment plumes

9.1.5.1 Description of Impact

During drill sampling, the sampled seabed sediments are pumped to the surface and discharged onto sorting screens on the sampling vessel. The screens separate the fine sandy silt and large gravel, cobbles and boulders from the size fraction of interest, the 'plantfeed' (usually 2 - 20 mm). The fine tailings are immediately discarded overboard where they form a suspended sediment plume in the water column, which is advected away from the sampling vessel by wind and ambient currents and is rapidly diluted. The 'plantfeed' is mixed with a high density ferrosilicon (FeSi) slurry and pumped under pressure into a Dense Medium Separation (DMS) plant resulting in a high density concentrate. The majority of the ferrosilicon is magnetically recovered for re-use in the DMS plant and the fine tailings (-2 mm) from the DMS process are similarly deposited over board. Furthermore, fine sediment re-suspension by the sampling tools will generate suspended sediment plumes near the seabed.

After discharge, the tailings material typically forms a negatively-buoyant sediment plume that either mixes directly with the receiving waters as it sinks (surface plume) or sinks as a density-driven current (dynamic *plume). The dynamic plume undergoes convective descent through the water column until it either reaches the seabed or achieves neutral buoyancy, at which point it collapses and spreads laterally. As the dynamic plume sinks, some fine sediment may be entrained due to wind-generated turbulence; this is mixed through the water column and can contribute to the formation of a surface plume. Surface plumes are visible on the surface and thus likely to have a greater effect on organisms in the upper water column than dynamic plumes. In many cases, both types of plumes develop simultaneously, resulting in a composite plume that possess characteristics of surface and dynamic plumes. These are classified as transitional plumes.*

Various factors influence which types of plume form: outflow velocity of tailings discharged from the vessel; water density and movement; and density of the plume (sand and silt composition of the mined sediments can vary greatly). The sampling/mining method also influences the sediment plume, with air-lift systems, which entrain air in the sediment, making the plume more buoyant and persistent in the upper water column, whereas dredge-pumped sediments have little or no air entrained, enabling the plume to sink much faster.

Potential impacts on the water column associated with sediment plumes from sampling/mining vessels are primarily linked with increased turbidity and its effects on light penetration through the water column, remobilisation of dissolved constituents from seabed sediments (see section 4.4.6), and reduction in oxygen levels in the water column resulting from high levels of primary production.

9.1.5.2 Assessment

The formation, extent and dynamics of turbidity plumes generated by deepwater mining vessels have been comprehensively investigated in numerous studies (Environmental Evaluation Unit 1996; O'Toole 1997; Carter et al. 1998; Carter & Midgley 2000; CSIR 2006; Carter 2008). During continuous discharge of tailings from remote mining vessels, the major source of water column turbidity results from the dynamic collapse of the sediment-laden jet and the subsequent dilution, spreading and settling of the particulate constituents. In all cases, the suspended sediment concentrations generated at the point of discharge, the extent and area over which plumes disperse, and their duration, depend largely on the proportions of silts, muds and clays (<63 µm) in the mined sediments, as well as the sea-surface conditions during disposal. The higher the proportion of silts and clays in the target sediments, the larger and more persistent the suspended sediment plume is likely to be (Newell et al. 1998; Johnson & Parchure 1999; Posford Duvivier Environment 2001). Modelling studies, field measurements and aerial observations of tailings plumes from mining vessels found that concentrations reduce rapidly with distance from the vessel, indicating fairly fast settlement and dilution of even the fine fractions (Shillington & Probyn 1996; CSIR 1998; Carter & Midgley 2000). In their study of tailings plumes from a deepwater mining vessel using an air-lift Wirth drill off Lüderitz, Carter & Midgley (2000) found that local tailings plumes ranged from 700 - 5,500 m in length and 700 - 3,500 m in width. Maximum plume sediment concentrations near the discharge point were found to be 60 mg/l, compared to background levels of <5 mg/l. These reduce rapidly with distance to a mean of <7 mg/l (maximum of 11 mg/l) 2 km downstream of the mining vessel, confirming fairly rapid settlement and dilution. Similarly, Holton (2015) reported on measurements of suspended solids in the plume that extended downstream of the MV Mafuta, which operates a dredge-pump subsea crawler, in the Atlantic 1 MLA. Elevated turbidity (compared to <2 mg/l background levels) was detected in the upper water column extending to a maximum depth of ~70 m in the immediate vicinity of the mining vessel. The depth of the elevated turbidity signal decreased with distance away from the vessel, and the surface and deeper water expression of the signal dissipated almost entirely within ~500 m from the mining vessel. Beyond this point, little to no evidence of a turbidity signal throughout the water column could be detected.

Distribution and re-deposition of suspended sediments are the result of a complex interaction between oceanographic processes, sediment characteristics and engineering variables that ultimately dictate the distribution and dissipation of the plumes in the water column. Ocean currents, both as part of the meso-scale circulation and due to local wind forcing, are important in distribution of suspended sediments. Turbulence generated by surface waves can also increase plume dispersion by maintaining the suspended sediments in the upper water column.

One of the more apparent effects of increased concentrations of suspended sediments and consequent increase in turbidity, is a reduction in light penetration through the water column with potential adverse effects on the photosynthetic capability of phytoplankton (Poopetch 1982; Kirk 1985; Parsons et al. 1986a, 1986b; Monteiro 1998; O'Toole 1997) and the foraging efficiency of visual predators (e.g. pelagic fish, seabirds and marine mammals) (Simmons 2005; Braby 2009; Peterson et al. 2001). However, due to the rapid dilution and widespread dispersion of settling particles, any adverse effects in the water column would be ephemeral and highly localised. Any biological effects on nectonic and planktonic communities would be negligible (Aldredge et al. 1986). Turbid water is a natural occurrence along the Southern African coast, resulting from aeolian and riverine inputs, resuspension of seabed sediments in the wave-influenced nearshore areas and seasonal phytoplankton production in the upwelling zones.

High sediment loading can also impair the egg and/or larval development of fish and invertebrates may be impaired through. Bivalves and crustaceans in particular may be impacted by near-bottom plumes include. Suspended sediment effects on juvenile and adult bivalves occur mainly at the sublethal level with the predominant response being reduced filter-feeding efficiencies at concentrations above about 100 mg/l. Lethal effects are seen at much higher concentrations (>7,000 mg/l) and at exposures of several weeks.

Due to the naturally turbid nearshore waters, kelp is restricted to the immediate subtidal regions to a maximum depth of ~10 m. Those fringing kelp beds along the coastline opposite concession 12B are unlikely to be affected by the turbidity plumes generated as a result of tailings discharges. Similarly, the depths of the proposed sampling areas lie beyond those at which kelp is likely to occur on adjacent reefs and no shading of these canopy forming macrophytes by sampling-related turbidity plumes is expected.

*The unconsolidated sediments in concession 12B comprise primarily medium to fine sands, with a minimal silt and clay fraction. Sediments within the mudbelt are, however, likely to have elevated silt content. Nonetheless, the suspended sediment plumes generated through discharge of tailings during sampling are expected to remain far more localised than those reported from previous studies of deepwater mining vessels. Furthermore, the sediments will be dredge-pumped at a rate orders of magnitude lower than the mining vessels for which the previous studies have been undertaken. The low-intensity, negative impact of suspended sediments generated during sampling and onboard processing operations and its effects on the associated communities will therefore be extremely localised and very short-term. The plumes will be localised to within a few 100 m of the sampling vessel and as they will be ephemeral, negative effects of increased suspended sediment concentrations on marine communities are highly unlikely as biota would be well adapted to naturally high suspended sediment concentrations. Even the highest concentrations in the immediate discharge are unlikely to reach concentrations that would have lethal or sub-lethal effects on marine fauna or inhibit primary productivity of phytoplankton or nearshore algae. Similarly, due to their highly localised and ephemeral nature, any tailings plumes discharge during sampling operations in the southern portion of concession 12B and in proximity to the mouth of the Olifants River, are highly unlikely to penetrate the river mouth and influence the estuary, even during summer months when the waters of the estuary are clear and marine-dominated. In the unlikely event that tailings plumes enter the estuary, suspended sediment concentrations are unlikely to reach levels that would have lethal or sub-lethat effects on marine biota. Coastal and estuarine communities located over 1 km inshore of the eastern boundary of concession 12B would therefore not be affected by the tailings discharge. The impacts from suspended sediment plumes can confidently be rated as being of **VERY LOW** significance without mitigation.*

9.1.5.3 Residual Impact Assessment

*As no mitigation is possible or deemed necessary, the residual impact would remain of **VERY LOW** significance.*

Increased turbidity in suspended sediment plumes and at the seabed		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Low*	*No mitigation is proposed*
Duration	*Temporary: plumes will rapidly dilute and disperse*	

Extent	*Local: limited to around the vessel and sampling tool*	
Probability	*Improbable: lethal or sublethal effects on biota are highly unlikely*	
Significance	*Very Low*	
Status	*Direct/Indirect - Negative*	
Confidence	*High*	
Nature of Cumulative impact	*Increased turbidity in suspended sediment plumes would not result in cumulative impacts*	
Reversibility	*Suspended sediment plumes are short-lived and any effects will be fully reversible*	
Loss of resources	*N/A*	
Mitigation potential	*Low (None)*	

9.1.6 <u>Remobilisation of contaminants and nutrients</u>

9.1.6.1 Description of Impact

Recently deposited sediments in specific areas on the shelf of the southern African West Coast may be characterised by high levels of heavy metals of marine and/or terrestrial origin (Calvert & Price 1970; Chapman & Shannon 1985). In the Atlantic 1 Mining Licence Area off Oranjemund, Namibia, high metal concentrations have been measured in samples of surficial sediments (Environmental Evaluation Unit 1996; Biccard et al. 2020), some of which exceeded the Recommended Guideline Values (RGV) and in some cases Probable Effects Concentrations (PEC) published by the Benguela Current Commission (BCC). Geographic variation in the levels of trace metals tested in that area was considerable and it is considered likely that inputs from terrestrial sources (principally the Orange River) are responsible for elevated trace metal levels in proximity to the river mouth. Indeed, on the Namibian shelf, there appears to be a consistent relationship between trace metal concentrations and elevated organic carbon concentrations in the sediments. From this it can be inferred that the distribution of trace metal concentrations will follow that of the high Particulate Organic Carbon (POC) mud belts and that concentrations outside of these will be relatively low. This is consistent with general and widespread observations on sediment trace metals in that they are largely associated with silt and clay sized particles and generally have lower concentrations in coarser sediments (e.g. ANZECC 2000).

Changes in nutrient concentrations off the West Coast are strongly driven by large-scale wind induced upwelling, which brings nutrient-rich waters to the surface. The shelf waters off the West Coast are characterised by elevated concentrations of nutrients in comparison with those in the surface mixed layer of adjacent oceanic waters, and with concentrations in the SACW source waters. Local nutrient regeneration processes within the sediments and water column are thus important throughout the Benguela (Shannon & O'Toole 1998).

The re-suspension of sediments during sampling can release these trace metals and nutrients into the water column. Metal bio-availability and eco-toxicology is complex and depends on the partitioning of metals between dissolved and particulate phases and the speciation of the dissolved phase into bound or free forms (Rainbow 1995; Galvin 1996). Although dissolved forms are regarded as the most bio-available, many of these are not readily utilisable by aquatic organisms. Consequently those forms that are ultimately bio-available and potentially toxic to marine organisms usually constitute only a fraction of the total concentration. Trace metal uptake by organisms may occur through direct absorption from solution, by uptake of suspended matter and/or via their food source. Toxic effects on organisms may be exerted over the short term (acute toxicity), or through bioaccumulation.

9.1.6.2 Assessment

*Chemical analyses of tailings samples from mining vessels in the Atlantic 1 MLA in southern Namibia and in the SASA 2C-5C concessions found that heavy metal concentrations did not exceeded the South African chronic water-quality guidelines or the "prohibition limit" as imposed by the London Convention, for any of the measured contaminants (Steffani & Pulfrich 2004; CSIR 2006; Carter 2008). In some cases, however, concentrations were in the category which requires some form of "action or special care" (CSIR 2006). Despite concentrations within surficial sediments in the Atlantic 1 MLA being high (Biccard et al. 2020), it appears that those contaminants released during the mining process are rapidly diluted and their concentrations in the water column following discharge of tailings is very low. Furthermore, as plumes generated during sampling are highly dynamic, neither acute effects nor bioaccumulation are likely to be of concern. In concession 12B, organic carbon concentrations in the sediments of the mudbelt may, however, be elevated. Nonetheless, trace metal concentrations are likely to be negligible and potential chemical contamination of the water column and bio-accumulation in the sediments or in biological receptors is highly unlikely. The impacts associated with the potential release of contaminants from disturbed sediments are therefore considered of **VERY LOW** significance.*

Similarly, the introduction of nutrients into the upper layers of the water column as a result of tailing discharge is considered negligible given the highly localised area affected by the suspended sediment plumes generated during sampling operations, relative to that influenced by upwelling (Schloemann 1996).

9.1.6.3 Mitigation

No mitigation measures are possible, or considered necessary for the possible remobilisation of contaminants and nutrients in the sediments.

Remobilisation of Contaminants and Nutrients		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Low*	*No mitigation is proposed*
Duration	*Temporary: plumes will rapidly dilute and disperse*	
Extent	*Local: limited to around the vessel and sampling tool*	
Probability	*Improbable: lethal or sublethal effects on biota are highly unlikely*	
Significance	*Very Low*	
Status	*Indirect - Negative*	
Confidence	*High*	

Nature of Cumulative impact	*Remobilised contaminants and nutrients in discharged tailings would not result in cumulative impacts*
Reversibility	*Suspended sediment plumes are short-lived and any effects will be fully reversible*
Loss of resources	*N/A*
Mitigation potential	*Low (None)*

9.1.7 Smothering of benthos in redepositing tailings

9.1.7.1 Description of Impact

During drill sampling, the sampled seabed sediments are pumped to the surface and discharged onto sorting screens, which separate the large gravel, cobbles and boulders and fine silts from the 'plantfeed'. The oversize tailings are discarded overboard and settle back onto the seabed beneath the vessel.

9.1.7.2 Assessment

Following discharge overboard of the fine and coarse tailings, these settle back onto the seabed where they can result in smothering of benthic communities adjacent to the sampled areas. Smothering involves physical crushing or smothering, a reduction in nutrients and oxygen, clogging of feeding apparatus, as well as affecting choice of settlement site, and post-settlement survival. In general terms, the rapid deposition of the coarser fraction from the water column is likely to have more of an impact on the soft-bottom benthic community than gradual sedimentation of fine sediments to which benthic organisms are adapted and able to respond. However, this response depends to a large extent on the nature of the receiving community. Studies have shown that some mobile benthic animals are capable of actively migrating vertically through overlying sediment thereby significantly affecting the recolonization of impacted areas and the subsequent recovery of disturbed areas of seabed (Maurer et al. 1979, 1981a, 1981b, 1982, 1986; Ellis 2000; Schratzberger et al. 2000; but see Harvey et al. 1998; Blanchard & Feder 2003). In contrast, sedentary communities may be adversely affected by both rapid and gradual deposition of sediment. Filter-feeders are generally more sensitive to suspended solids than deposit-feeders, since heavy sedimentation may clog the gills. Impacts on highly mobile invertebrates and fish are likely to be negligible since they can move away from areas subject to redeposition.

Of greater concern is that sediments discarded during sampling operations may impact rocky outcrop communities adjacent to sampling target areas potentially hosting sensitive slow-growing benthic communities and commercially important species such as rock lobsters. Such communities would be expected only in the shallowest portions of concession 12B. Rocky seabed outcrops in deeper water may also host fragile, habitat forming scleractinian corals, gorgonians and bryozoans. As deep-water corals tend to occur in areas with lower sedimentation rates than typical of nearshore habitats (Mortensen et al. 2001), these benthic suspension-feeders and their associated faunal communities are likely to be more sensitive to increased turbidity and sediment deposition associated with tailings discharges. Exposure of elevated suspended sediment concentrations could result in mortality of the colony due to smothering, alteration of feeding behaviour and consequently growth rate, disruption of polyp expansion and retraction, physiological and morphological changes, and disruption of calcification. While tolerances to increased suspended sediment concentrations will be species specific, concentrations as low as 100 mg/ℓ have been shown to have noticeable effects on coral function (Rogers 1999). Due to the naturally elevated suspended sediment concentrations along the Benguela coast, those species occurring on the inner and mid shelf off the West Coast are expected to be more tolerant to elevated turbidity levels.

Studies investigating the discard of the oversize tailings during diver-assisted mining found that benthic communities characterising tailings dump sites on reefs were significantly different from those of unaffected reef areas as a result of the change in seabed type, being dominated by detritus feeders. However, the effects remained highly localised and persisted over the short-term only as tailings were rapidly redistributed by wave action (Barkai & Bergh 1992; Parkins & Branch 1995, 1996, 1997; Pulfrich 1998b; Pulfrich & Penney 2001). Excessive and repetitive dumping on the same area may, however, preclude dispersion and thus induce persistent change by reducing biodiversity, changing community structure, potentially altering preferred rock lobster habitat and smothering of benthic organisms, thereby reducing food availability for lobsters.

The abundance of lobsters within a habitat, however, also depends on the availability and suitability of food (Parrish & Polovina 1994; Hudon 1987; Branch & Griffiths 1988; Wahle & Steneck 1991, 1992). Off the West Coast, rock lobsters feed primarily on ribbed mussels, barnacles, urchins and algae (Mayfield et al. 2000). Smothering of reef areas and their associated benthic communities adjacent to sampling targets through the discharge of oversize tailings may therefore indirectly affect rock lobster abundance in an area as well as reducing growth and reproductive rates of the animals.

The impacts would be of low intensity but highly localised extending only a few 10s of metres from the sampling footprint, and short-term as recolonization from adjacent areas or upward migration through deposited sediments would occur rapidly. Considering the available area of unconsolidated seabed habitat on the continental shelf of the West Coast, the reduction in biodiversity of macrofauna associated with *unconsolidated sediments through smothering can be considered negligible. The potential impact of smothering on communities in unconsolidated habitats is consequently deemed to be of* ***VERY LOW*** *significance. In the case of rocky outcrop communities, however, impacts would be of medium intensity and highly localised, but potentially enduring over the medium-term due to their slow recovery rates. As the shallower portions of concession 12B, where outcropping reefs may be expected, are located within the (storm) wave base, any fine sediments settling on adjacent reefs would be periodically resuspended and redistributed by near-bottom currents. Smothering effects would therefore likely be ephemeral. The potential impact of smothering on rocky outcrop communities is consequently deemed to be of* ***LOW to MEDIUM*** *significance.*

9.1.7.3 Residual Impact Assessment

With the implementation of the mitigation measures above, the residual impact would remain of ***VERY LOW*** *significance in the case of unconsolidated sediments and of* ***LOW*** *significance for rocky outcrops.*

Redeposition of discarded sediments on soft-sediment macrofauna		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Low*	*No mitigation is proposed*
Duration	*Temporary*	
Extent	*Local*	
Probability	*Likely*	
Significance	*Very Low*	
Status	*Direct - Negative*	
Confidence	*High*	
Nature of Cumulative impact	*Deposition of tailings on unconsolidated seabed would not result in cumulative impacts*	
Reversibility	*The impact is fully reversible as natural recovery of affected communities will occur from adjacent areas and deposited sediments will be redistributed by swell action*	
Loss of resources	*Low*	
Mitigation potential	*Low (None)*	

Redeposition of discarded sediments: smothering effects on rocky outcrop communities		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Medium*	*Low*
Duration	*Medium-term*	*Short-term*
Extent	*Local*	*Local*
Probability	*Possible*	*Improbable*
Significance	*Low to Medium*	*Low*
Status	*Direct - Negative*	*Negative*
Confidence	*High*	*High*
Nature of Cumulative impact	*Deposition of tailings on rocky outcrops would not result in cumulative impacts*	
Reversibility	*The impact is fully reversible as natural recovery of affected communities will occur from adjacent areas and deposited sediments will be redistributed by swell action*	
Loss of resources	*Low*	
Mitigation potential	*Low*	

9.1.8 Loss of Ferrosilicon

9.1.8.1 Description of Impact

The only additive used in the diamond extraction process onboard the sampling vessels is Ferrosilicon (FeSi). Although most of the FeSi is magnetically recovered for re-use, recovery is lower when sampling sediments with a high shell content, as the FeSi becomes trapped in the shells. On average ~10 tons are lost annually per vessel of this magnitude during sampling operations.

9.1.8.2 Assessment

*Ferrosilicon is made up of sand (silicon) and iron oxides, with small amounts of trace elements. It therefore oxidises rapidly in seawater and has no detrimental effect of marine life. There is, however, a risk of exceeding established water quality guidelines by the heavy metal constituents of the FeSi. Dilution of these trace elements would be rapid, and any effects are likely to be brief. The potential impact would thus be of low intensity, persisting only locally over the short-term and can confidently be considered of **VERY LOW** significance.*

9.1.8.3 Residual Impact Assessment

*With the implementation of the mitigation measures above, the residual impact would remain of **VERY LOW** significance.*

Loss of Ferrosilicon		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Low*	*Low*
Duration	*Short-term*	*Short-term*
Extent	*Site specific: limited to around the vessel*	*Site Specific*
Probability	*Likely*	*Possible*
Significance	*Very Low*	*Very Low*
Status	*Direct - Negative*	*Direct - Negative*
Confidence	*High*	*High*
Nature of Cumulative impact	*Loss of FeSi would not result in cumulative impacts*	
Reversibility	*Fully Reversible*	
Loss of resources	*Low*	
Mitigation potential	*Medium to High*	

9.1.9 Pollution of the marine environment through Operational Discharges from the Sampling Vessel(s)

9.1.9.1 Description of Impact

During the geophysical surveying and seabed sampling, normal discharges to the sea can come from a variety of sources (from sampling unit and sampling vessel) potentially leading to reduced water quality in the receiving environment. These discharges are regulated by onboard waste management plans and shall be MARPOL compliant. For the sake of completeness they are listed and briefly discussed below:

- ***Deck drainage**: all deck drainage from work spaces is collected and piped into a sump tank on board the drilling unit to ensure MARPOL compliance (15 ppm oil in water). The fluid would be analysed and any hydrocarbons skimmed off the top prior to discharge. The oily substances would be added to the waste (oil) lubricants and disposed of on land.*
- ***Sewage**: sewage discharges would be comminuted and disinfected. In accordance with MARPOL Annex IV, the effluent must not produce visible floating solids in, nor causes discolouration of, the surrounding water. The treatment system must provide primary settling, chlorination and*

dechlorination before the treated effluent can be discharged into the sea. The discharge depth is variable, depending upon the draught of the drilling unit / support vessel at the time, but would not be less than 5 m below the surface.

- ***Vessel machinery spaces and ballast water**: the concentration of oil in discharge water from vessel machinery space or ballast tanks may not exceed 15 ppm oil in water. If the vessel intends to discharge bilge or ballast water at sea, this is achieved through use of an oily-water separation system. Oily waste substances must be shipped to land for treatment and disposal.*
- ***Food (galley) wastes**: food wastes may be discharged after they have been passed through a comminuter or grinder, and when the vessel is located more than 12 nautical miles from land. For vessels outside of special areas, discharge of comminuted food wastes is permitted when >3 nautical miles from land and en route. Discharge of food wastes not comminuted may be discharged from vessels en route when >12 nautical miles from shore. The ground wastes must be capable of passing through a screen with openings <25 mm. The daily volume of discharge from a standard exploration vessel is expected to be <0.5 m^3.*
- ***Detergents**: detergents used for washing exposed marine deck spaces are discharged overboard. The toxicity of detergents varies greatly depending on their composition, but low-toxicity, biodegradable detergents are preferentially used. Those used on work deck spaces would be collected with the deck drainage and treated as described for deck drainage above.*
- ***Cooling Water:** electrical generation on sampling vessels is typically provided by large diesel-fired engines and generators, which are cooled by pumping water through a set of heat exchangers. The cooling water is then discharged overboard. Other equipment is cooled through a closed loop system, which may use chlorine as a disinfectant. Such water would be tested prior to discharge and would comply with relevant Water Quality Guidelines[6].*

Deck and machinery space drainage may result in small volumes of oils, detergents, lubricants and grease, the toxicity of which varies depending on their composition, being introduced into the marine environment. Sewage and gallery waste will place a small organic and bacterial loading on the marine environment, resulting in an increased biological oxygen demand.

These discharges will result in a local reduction in water quality, which could impact marine fauna in a number of different ways:

- *Physiological effects: Ingestion of hydrocarbons, detergents and other waste could have adverse effects on marine fauna, which could ultimately result in mortality.*
- *Increased food source: The discharge of galley waste and sewage will result in an additional food source for opportunistic feeders, speciality pelagic fish species.*
- *Increased predator - prey interactions: Predatory species, such as sharks and pelagic seabirds, may be attracted to the aggregation of pelagic fish attracted by the increased food source.*

9.1.9.2 Assessment

The contracted vessels will have the necessary sewage treatment systems in place, and will have oil/water separators and food waste macerators to ensure compliance with MARPOL 73/78 standards. MARPOL compliant discharges would therefore introduce relatively small amounts of nutrients and organic material to oxygenated surface waters, which will result in a minor contribution to local marine productivity and possibly of attracting opportunistic feeders. The intermittent discharge of sewage is likely to contain a low

[6] No South African guideline exists for residual chlorine in coastal waters. The Australian/New Zealand (ANZECC 2000) guidelines give a value of 3 µg Cl/ℓ, wheras the World Bank (1998) guidelines stipulate 0.2 mg/ℓ at the point of discharge prior to dilution

level of residual chlorine following treatment, but given the relatively low total discharge and rapid dilution in surface waters this is expected to have a minimal effect on seawater quality.

Furthermore the concession area is suitably far removed from sensitive coastal receptors and the dominant wind and current direction will ensure that any discharges are rapidly dispersed north-westwards and away from the coast. The transit route to the concession area may pass through offshore MPAs, however, the habitat and biota are unlikely to be impacted by intermittent surface discharges, which rapidly disperse to very low concentrations. There is no potential for accumulation of substances discharged leading to any detectable long-term impact.

Due to the distance offshore, it is only pelagic fish, birds, turtles and cetaceans that may be affected by the discharges, and these are unlikely to respond to the minor changes in water quality resulting from vessel discharges. The most likely animal to be attracted to project vessels will be large pelagic fish species, as well as sharks and odontocetes (toothed whales). Pelagic seabirds that feed primarily by scavenging would also be attracted.

Other types of wastes generated during the prospecting activities will be segregated, duly identified transported to shore for ultimate valorisation and/or disposal at a licensed onshore waste management facility. The disposal of all waste onshore will be fully traceable.

*Based on the relatively small discharge volumes and compliance with MARPOL 73/78 standards, offshore location and high energy sea conditions, the potential impact of normal discharges from the project vessels will be of low intensity, short duration and mainly limited to the immediate area around the vessels. The impact is therefore considered to be of **VERY LOW** significance, both without or with mitigation.*

9.1.9.3 Residual Impact Assessment

*This potential impact cannot be eliminated because project vessels are needed to undertake the prospecting activities and will generate routine discharges during operations. With the implementation of the project controls and mitigation measures, the residual impact will remain of **VERY LOW** significance.*

Impacts of operational discharges to the sea from the sampling vessel		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Low*	*Low*
Duration	*Short-term*	*Short-term*
Extent	*Local: limited to immediate area around vessel*	*Local*
Probability	*Likely*	*Probable*
Significance	*Very Low*	*Very Low*
Status	*Direct - Negative*	*Direct - Negative*
Confidence	*High*	*High*

Nature of Cumulative impact	*None*
Reversibility	*Fully Reversible*
Loss of resources	*N/A*
Mitigation potential	*High*

9.1.10 <u>Lighting from Survey and Sampling Vessels</u>

9.1.10.1 Description of Impact

The strong operational lighting used to illuminate the project vessels at night may disturb and disorientate pelagic seabirds feeding in the area. Operational lights may also result in physiological and behavioural effects of fish and cephalopods as these may be drawn to the lights at night where they may be more easily preyed upon by other fish and seabirds.

9.1.10.2 Assessment

Although little can be done on the project vessels to prevent seabird collisions, reports of collisions or death of seabirds on vessels are rare. Should they occur, the light impacts would primarily take place in the survey/sampling area and along the route taken by the vessels between the concession area and Cape Town. Most of the seabird species breeding along the West Coast feed relatively close inshore (10-30 km), with African Penguins recorded as far as 60 km offshore and Cape Gannets up to 140 km offshore. These species could thus be expected in the concession area, which lies 1 km from the coastline. Pelagic species occurring further offshore would be unfamiliar with artificial lighting and may be attracted to the vessels. Fish and squid may also be attracted to the light sources potentially resulting in increased predation on these species by higher order consumers. It is expected, however, that seabirds and marine mammals in the area would become accustomed to the presence of the project vessels within a few days.

Operational lights may also result in physiological and behavioural effects on fish and cephalopods, as these may be drawn to the lights at night where they may be more easily preyed upon by other fish, marine mammals and seabirds. This would be more of an issue for a stationary sampling vessel unit than for a survey vessel, which would be constantly moving. As seals are known to forage up to 120 nautical miles (~220 km) offshore, the concession area falls within the foraging range of seals from the nearby colonies. Odontocetes, however, are also highly mobile, supporting the notion that various species are likely to occur in the project area and thus potentially be attracted to the survey/sampling operations.

*As the concession lies some distance from nearby coastal towns (Hondeklipbaai & Lambert's Bay), the increase in ambient lighting in the offshore environment would be of medium intensity and limited to the area in the immediate vicinity of the vessels (site specific) within the concession area (local) over the short-term (weeks). The potential for behavioural disturbance as a result of vessel lighting would thus be of **VERY LOW** significance.*

9.1.10.3 Residual Impact Assessment

*With the implementation of the mitigation measures above, the residual impact would remain **VERY LOW**.*

Disturbance and behavioural changes in pelagic fauna due to vessel lighting		
	Without Mitigation	***Assuming Mitigation***
Intensity	*Low*	*Low*
Duration	*Short-term*	*Short-term*
Extent	*Local: limited to immediate area around vessel*	*Local*
Probability	*Possible*	*Possible*
Significance	*Very Low*	*Very Low*
Status	*Direct - Negative*	*Direct - Negative*
Confidence	*High*	*High*

Nature of Cumulative impact	*None*
Reversibility	*Fully Reversible*
Loss of resources	*N/A*
Mitigation potential	*Low*

9.1.11 <u>Cumulative Impacts</u>

Cumulative effects are the combined potential impacts from different actions that result in a significant change larger than the sum of all the impacts. Consideration of 'cumulative impact' should include "past, present and reasonably foreseeable future developments or impacts". This requires a holistic view, interpretation and analysis of the biophysical, social and economic systems (DEAT 2004).

Cumulative impact assessment is limited and constrained by the method used for identifying and analysing cumulative effects. As it is not practical to analyse the cumulative effects of an action on every environmental *receptor, the list of environmental effects being considered to inform decision makes and stakeholders should focus on those that can be meaningfully (DEAT 2004).*

While it is foreseeable that further geophysical exploration for mineral resources and future mining activities could arise if the current Environmental Authorisation is granted, there is not currently sufficient information available to make reasonable assertions as to scale of such future activities. This is primarily due to the current lack of relevant geological information, which the proposed geophysical exploration and sampling process aims to address. There are many other mineral rights holders in the South African nearshore and offshore environment, but most of these are not undertaking any exploration activities at present or would be concurrently with the proposed prospecting operations. Thus, the possible range of the future exploration, prospecting and mining, activities that could arise will vary significantly in scope, location, extent, and duration depending on whether a resource(s) is discovered, its size, properties and location, etc. As these cannot at this stage be reasonably defined, it is not possible to undertake a reliable assessment of the potential cumulative environmental impacts. It is also possible that the proposed, or future, prospecting and sampling fails to identify an economic mineral resource, in which case the potential impacts associated with the mining phase would not be realised. Possible cumulative impacts from hydrocarbon exploration also need to be kept in mind, although these are typically located further offshore in waters beyond 500 m depth.

*Table 24 summarise the applications for for mineral prospecting rights in the South African Sea Areas (SASA) submitted to the Department of Minerals and Energy, indicating which of these have been successfully taken through to completion. Applications for hydrocarbon exploration off the South African West Coast submitted to the Petroleum Agency of South Africa (PASA) are also shown. The purpose of this table, which may not be complete, is to emphasise two things. Firstly, that a large number of applications are submitted annually and secondly, that only a small percentage of those applications submitted (and potentially approved) are taken through to completion. The number of applications submitted and/or approved can therefore **not** be used as an indication of cumulative impacts.*

Furthermore, the assessment methodology used in the EIA by its nature already considers past and current activities and impacts. In particular, the sensitivity of the receptors, the status of the receiving environment (benthic ecosystem threat status, protection level, protected areas, etc.) or threat status of individual species are taken into consideration, based to some degree on past and current actions and impacts (e.g. the IUCN conservation rating is determined based on criteria such as population size and rate of decline, area of geographic range / distribution, and degree of population and distribution fragmentation).

The most reliable guage of cumulative pressures is provided by Sink et al. (2019) and Harris et al. (2022). The map was generated as part of the NBA 2018 by doing a cumulative pressure assessment in which the impact of both current and historical ocean-based activities on marine biodiversity was determined by spatially evaluating the intensity of each activity and the functional impact to, and recovery time of, the underlying ecosystem types (Figure 96, left). Based on the severity of modification across the marine realm, a map of ecological condition was generated (Figure 96, right). From this it can be determined that the concession area is located in an area experiencing moderate cumulative impacts and that the ecological condition is therefore moderately modified. Coastal and nearshore mining, linefishing, the small pelagic industry, and rock lobster harvesting were identified as the main contributors to cumulative impacts (Harris et al. 2022).

Table 24: Applications for hydrocarbon exploration on the South African West Coast and southern Namibia (grey shading) since 2007, indicating which of these have been undertaken. Applications for mineral prospecting rights are also shown (blue shading).

Year	*Right Holder/Operator*	*Block*	*Activity*	*Approval*	*Conducted*
Minerals Prospecting and Mining					
2011	*Aurumar*	*SASA 1C-9C* *SASA 12B,14C-18C, 20C*	*Heavy Minerals coring*	*Yes*	*Jan-Mar 2011* *2C-5C: Geophysical & coring* *7C-10C: Geophysical & coring* *12B, 14c-18c &20c : Only desktop*
2013-2014	*Belton Park Trading*	*SASA 2C-5C*	*Geophysical surveys, coring, bulk sampling*	*Yes*	*Survey: ongoing in 2C and 3C* *Sampling: ongoing in 2C and 3C* *Various prospecting operations undertaken over duration of prospecting right*
2017	*Belton Park Trading*	*SASA 2C* *(3C was incorporated into mining right area in 2019).*	*Mining*	*Yes*	*Ongoing prospecting and mining has taken place over various campaigns to date:* • *SASA 2C: 9 Aug - 7 Nov 2018;* • *SASA 2C: 13 Mar - 5 May 2019;* • *SASA 2C: 9 Jul - 25 Oct 2019; and* • *SASA 2C & 3C: 27 Feb -to 31 Aug 2020.* *Mining is currently ongoing.*
2018	*De Beers Marine*	*SASA 6C*	*Geophysical surveys, coring, bulk sampling*	*Yes*	*Survey: May-Jul 2021* *Sampling: Dec 2021 – Jan 2022*
2020	*Belton Park Trading*	*SASA 14b, 15b, 17b*	*Geophysical surveys, coring, bulk sampling*	*Yes but appeal still under review*	
2020	*Belton Park Trading*	*SASA 13C,15C, 16C, 17C, 18C*	*Geophysical surveys, coring, bulk sampling*	*Yes but appeal still under review*	
2021	*De Beers Marine*	*SASA 4C & 5C*	*Geophysical surveys, coring, bulk sampling*	*Application in prep.*	
2021	*Samara Mining*	*SASA 4C & 5C*	*Geophysical surveys, coring, bulk sampling*	*Application contested*	

Year	*Right Holder/Operator*	*Block*	*Activity*	*Approval*	*Conducted*
				and withdrawn	
2021-2022	*Moonstone Diamond Marketing*	*SASA 11b, 13b*	*Geophysical surveys, coring, bulk sampling*	*Applications delayed Second round EIAs in prep.*	
2022	*Trans-Atlantic Diamonds*	*SASA 14A*	*Geophysical surveys, coring, sampling*	*Yes*	
2022	*Trans-Atlantic Diamonds*	*SASA 11C*	*Geophysical surveys, coring, sampling*	*FBAR submitted to DMRE on 2 March 2022*	
2022	*Aqua Marine Diamonds*	*SASA 12C*	*Geophysical surveys, coring, sampling*	*FBAR in prep.*	
Hydrocarbon Exploration					
2007	*PASA*	*Orange Basin*	*2D seismics*	*Yes*	*2D: Nov-Dec 2007*
2008	*PASA*	*West Coast*	*2D seismics*	*Yes*	*2D Sep 2008*
2008	*PetroSA*	*Block 1*	*3D seismic*	*Yes*	*3D: Jan-Apr 2009*
2011	*Forest Oil (Ibhubesi)*	*Block 2A*	*3D seismic survey*	*Yes*	*3D: May – Jul 2011*
2011	*PetroSA*	*Block 5/6 (ER224)* *Block 7 (ER228)*	*3D seismics and CSEM*	*Yes*	*2D: Dec 2012 – Feb 2013* *3D: Jan 2020 – Apr 2020*
2011	*PetroSA*	*Block 1*	*Exploration drilling*	*Yes (June 2011)*	*??*
2012	*BHP Billiton* *(now Ricocure, Azinam & Africa Oil)*	*Block 3B/4B*	*2D and 3D seismics*		
2013	*Spectrum*	*West Coast Multiclient*	*2D seismics*	*Yes*	*2D: April 2015*
2013	*PetroSA*	*Block 1*	*2D and 3D seismics*	*Yes*	*3D: Feb - May 2013 (conducted by Cairn)*
2013	*Anadarko*	*Block 2C*	*2D and 3D seismics, MBES, heatflow, seabed sampling*	*Yes (2013)*	*??*
2013	*Anadarko*	*Block 5/6/7*	*MBES, heatflow, coring*	*Yes*	*MBES: Jan – Mar 2013*
2014	*OK/Shell*	*Northern Cape Ultra Deep ER274*	*2D and 3D seismics, MBES, gradiometry and magnetics, seabed sampling*	*Yes*	*Shell audit in 2020* *2D : Feb-Mar 2021*
2014	*Shell*	*Deep Water Orange Basin*	*Exploration drilling*	*Yes*	*Shell relinquished block to TEEPSA*
2014	*Cairn*	*ER 12/3/083*	*2D seismics*	*Yes*	*2D: Feb-Mar 2014*

Year	***Right Holder/Operator***	***Block***	***Activity***	***Approval***	***Conducted***
				(obtained by PetroSA)	
2014	*Cairn*	*Block 1*	*Seabed sampling*	*Yes*	
2014-15	*Thombo*	*Block 2B (ER105)*	*Exploration drilling*	*Yes*	*Africa Energy preparing to drill in late 2022/23*
2014	*New Age Energy*	*Southwest Orange Basin*	*2D seismics*		
2015	*Cairn*	*Block 1*	*Exploration drilling*		
2015	*Sunbird*	*West Coast*	*Ibhubesi pipeline*	*Yes*	*No activities undertaken. The EA was renewed for an additional 5 years on 30 June 2022*
2015	*Rhino*	*SW Coast Inshore*	*2D seismics and MBES*		
2015	*Rhino*	*Block 3617, 3717*	*2D and 3D seismics, MBES*	*Yes (Feb 2017)*	*??*
2017	*Impact Africa/TEEPSA (ER335)*	*SW Orange Deep (portion of New Age Energy Block)*	*2D and 3D seismics*		
2018	*PGS*	*West Coast Multiclient*	*2D and 3D seismics*	*Unknown*	
2019	*Anadarko*	*Block 5/6/7*	*2D seismics*	*Yes (issued to PetroSA in 2013)*	
2021	*Searcher*	*West Coast multiclient*	*2D and 3D seismics*	*Yes (Dec 2021) Appealed*	*2D: Jan 2022*
2021	*TGS*	*West Coast multiclient*	*2D seismics*	*Yes*	*Decided not to survey*
2021	*Tosaco*	*Block 1 ER362*	*3D seismics*	*EIA not completed*	
2022	*Ion*	*Deep Water Orange Basin*	*3D seismics*	*Application in prep.*	*EIA not completed*
2022	*Searcher*	*Deep Water Orange Basin*	*3D seismics*	*Application in prep.*	
2022	*Shearwater*	*Deep Water Orange Basin*	*3D seismics*	*Application put on hold*	
2022	*TGS*	*Deep Water Orange Basin*	*3D seismics*	*Application in prep.*	

Year	*Right Holder/Operator*	*Block*	*Activity*	*Approval*	*Conducted*
2022	*PGS*	*Deep Water Orange Basin*	*3D seismics*	*Application in prep.*	
2022	*TEEPSA*	*Block 567*	*Exploration drilling*	*EIA in prep.*	
2022	*TEEPSA*	*Deep Water Orange Basin*	*Exploration drilling*	*EIA in prep.*	

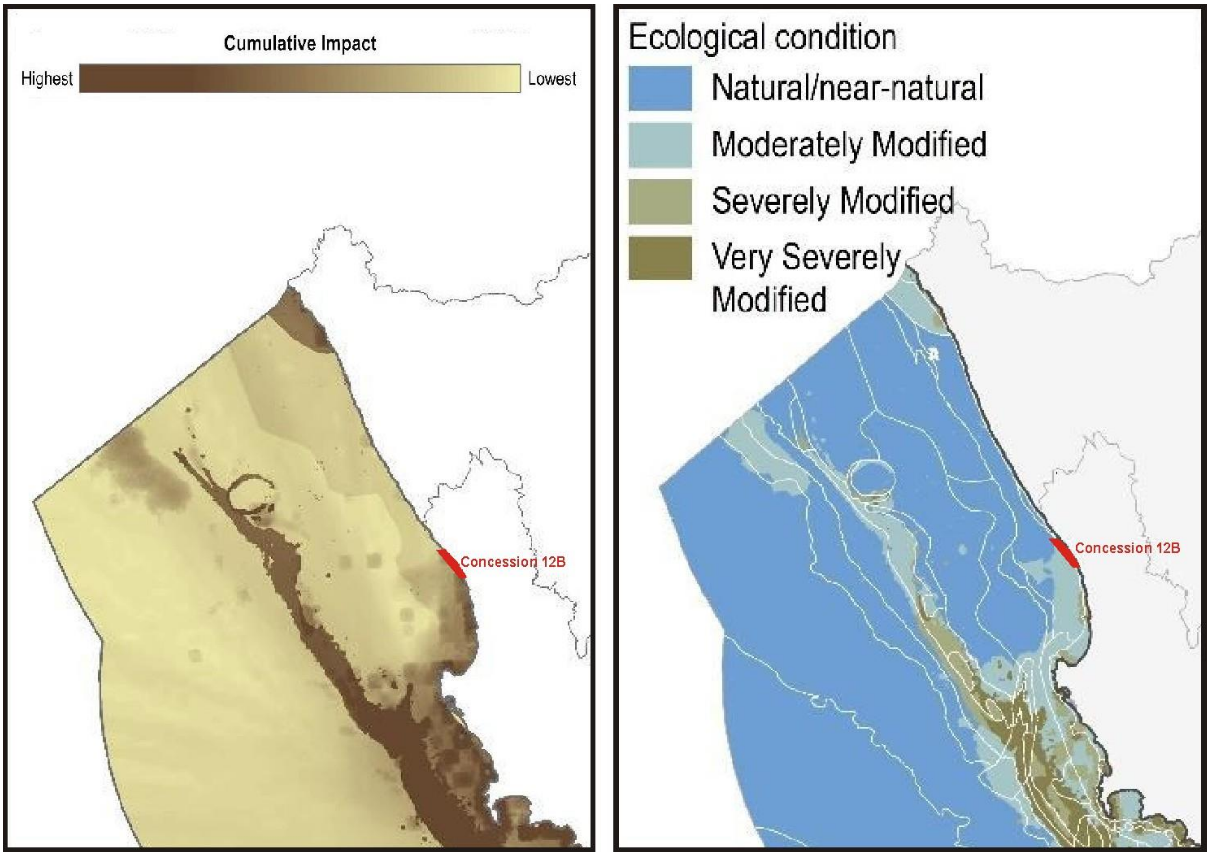

Figure 96: Concession 12B (red polygon) in relation to cumulative impact on marine biodiversity, based the intensity of all cumulative pressures and the sensitivity of the underlying ecosystem types to each of those pressures (left) and the ecological condition of the marine realm based on the severity of modification as a result of the cumulative impacts (adapted from Sink et al. 2019 and Harris et al. 2022).

The primary impacts associated with the geophysical surveying and sediment sampling in the Namaqua Bioregion on the West Coast of South Africa, relate to cumulative anthropogenic noise, physical disturbance of the seabed, discharges of tailings to the benthic environment, and associated vessel presence.

9.1.11.1 Underwater Noise

Noise associated with the proposed geophysical surveying would have cumulative impact on marine fauna. Due to the concession being located well inshore of the main vessel traffic routes that pass around southern Africa, ambient noise levels will be comparatively low. Sensitive receptors and faunal species (cetaceans, turtles and certain fish) may thus be affected as faunal behaviour may be influenced to within a few kilometres of the sound source during surveying operations. The duration of the impact would be very short (days to weeks), however, and noise levels would return back to ambient after surveying is complete.

The assessments of impacts of underwater sounds provided in the scientific literature usually consider short-term responses at the level of individual animals only, as our understanding of how such short-term effects relate to adverse residual effects at the population level are limited. Data on behavioural reactions to noise acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term and with multiple exposures, i.e. what is initially interpreted as an impact not having a detrimental effect and thus being of low significance, may turn out to result in a long-term decline in the population, particularly when combined with other acoustic and non-acoustic stressors stressors (e.g. temperature, competition for food, climate change, shipping noise) (Przeslawski et al. 2015; Erbe et al. 2018, 2019; Booth et al. 2020; Derous et al. 2020). Physiological stress, for example, may not be easily detectable in marine fauna, but can affect reproduction, immune systems, growth, health, and other important life functions (Rolland et al. 2012; Lemos et al. 2021). Confounding effects are, however, difficult to separate from those due to geophysical prospecting operations.

Similarly, potential cumulative impacts on individuals and populations as a result of other geophysical or seismic surveys undertaken either previously, concurrently or subsequently are difficult to assess. Considering the number of seismic surveys recently conducted along the West Coast by the hydrocarbon industry, some cumulative impacts can be anticipated. A significant adverse residual environmental effect is considered one that affects marine biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. Natural recruitment may not re-establish the population(s) to its original level within several generations or avoidance of the area becomes permanent.

Reactions to sound by marine fauna depend on a multitude of factors including species, state of maturity, experience, current activity, reproductive state, time of day (Wartzok et al. 2004; Southall et al. 2019). If a marine animal does react briefly to an underwater sound by changing its behaviour or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the population as a whole (NRC 2005). However, if a sound source displaces a species from an important feeding or breeding area for a prolonged period, impacts at the population level could be significant. Despite the density of seismic survey coverage over the past decades years ((there have been 21 seismic surveys in South African waters between the 2007/2008 and 2020/2021 financial years (data provided by PASA Jan 2022)), and the ongoing geophysical prospecting by mineral rights holders on the West Coast (see Table 24), the southern right whale population is reported to be increasing by 6.5% per year (Brandaõ et al. 2018), and the humpback whale by at least 5% per annum (IWC 2012) over a time when geophysical and seismic surveying frequency has increased, suggesting that, for these population at least, there is no evidence of long-term negative change to population size or irreparable harm as a direct result of acoustic survey activities. Although monitoring surveys have revealed a steady population increase since the protection of the species from commercial whaling, more recent results, however, indicate changes in the prevalence of southern rights on the South African breeding ground, including a marked decline of unaccompanied adults since 2010 and extreme fluctuations in the number of cow-calf pairs since 2015. The authors, however, contribute the change in demographics to likely spatial and/or temporal displacement of prey due to climate variability, and not acoustic surveys. To date no trophic cascades off the South African coast have been documented despite a number of seismic and geophysical surveys having been completed. Information on the population trends of resident species of baleen and toothed whales is unfortunately lacking, and the potential effects of seismic surveys on such populations remains unknown.

Consequently, suitable mitigation measures must be implemented during acoustic data acquisition to ensure the least possible disturbance of marine fauna in an environment where the cumulative impact of increased background anthropogenic noise levels has been recognised as an ongoing and widespread issue of concern (Koper & Plön 2012). In the case of this project, the proposed geophysical survey will be undertaken over a comparatively short period (40 days) and well inshore of proposed seismic surveys on the West Coast. Nonetheless, if the geophysical survey is undertaken concurrently with offshore seismic surveys, cumulative impacts can be expected. However, any direct noise impact is likely to be at individual level rather than at species level.

9.1.11.2 Impacts of Noise at Ecosystem Level

The structure and function of nearshore and offshore marine ecosystems is influenced both by natural environmental variation (e.g. El Niño Southern Oscillation (ENSO)) and multiple human uses, such as hydrocarbon developments, marine prospecting and mining, and the harvest of marine living resources. The review provided in the impact assessment illustrates that the impacts of anthropogenic noise, at various scales surrounding the stressor, have been recorded in a diverse range of faunal groups. Studies on acoustic impacts, however, largely deal with effects upon individual animals or species, with impacts across large spatial scales, cumulative effects (both of ocean noise and factors other than sound pollution) or multiple species and/or food web levels having rarely been considered.

Below follows a brief discussion of potential population-level and ecosystem-wide effects of disturbance and the application of the integrated ecosystem assessment framework for evaluating the cumulative impacts of multiple pressures on multiple ecosystem components.

With growing evidence of the ecosystem-wide effects of seismic noise (Nieukirk et al. 2012; Kavanagh et al. 2019; Kyhn et al. 2019) and the potential consequences of sub-lethal anthropogenic sounds affecting marine animals at multiple levels (e.g. behaviour, physiology, and in extreme cases survival), there is increasing recognition for the need to consider the effects of anthropogenic noise at population and ecosystem level. The sub-lethal effects of sound exposure may seem subtle, but small changes in behaviour can lead to significant changes in feeding behaviour, reductions in growth and reproduction of individuals (Pirotta et al. 2018), but can have effects that go beyond a single species and may cause changes in food web interactions (Francis et al. 2009; Hubert et al. 2018; Slabbekoorn & Halfwerk 2009).

For example, the intensified upwelling events associated with the Cape Canyon, provide highly productive surface waters, which power feeding grounds for cetaceans and seabirds (www.environment.gov.za/dearesearchteamreturnfromdeepseaexpedition). Roman & McCarthy (2010) demonstrated the importance of marine mammal faecal matter in replenishing nutrients in the euphotic zone, thereby locally enhancing primary productivity in areas where whales and/or seals gather to feed (see also Kanwisher & Ridgeway 1983; Nicol et al. 2010). Surface excretion may also extend seasonal plankton productivity after a thermocline has formed, and where diving and surfacing of deep-feeding marine mammals (e.g. pilot whales, seals) transcends stratification, the vertical movement of these air-breathing predators may act as a pump bringing nutrients below the thermocline to the surface thereby potentially increasing the carrying capacity for other marine consumers, including commercial fish species and pelagic and coastal seabirds (Roman & McCarthy 2010). Behavioural avoidance of marine mammals from such seasonal feeding areas in response to increasing anthropogenic disturbance may thus alter the nutrient fluxes in these zones, with possible ecosystem repercussions.

Likewise, long-lived, slow-reproducing species play important stabilizing roles in the marine ecosystem, especially through predation, as they play a vital role in balancing and structuring food webs, thereby maintaining their functioning and productivity. Should such predators be impacted by hydrocarbon exploration at population level (either directly on individuals or indirectly through loss of prey) and this have repercussions across multiple parts of a food web, top-down trophic cascades in the marine ecosystem could result (Ripple et al. 2016).

At the other end of the scale, significant impacts on plankton by anthropogenic sources can have significant bottom-up ripple effects on ocean ecosystem structure and health as phytoplankton and their zooplankton grazers underpin marine productivity. Healthy populations of fish, top predators and marine mammals are not possible without viable planktonic productivity. Furthermore, as a significant component of zooplankton communities comprises the egg and larval stages of many commercial fisheries species, large-scale disturbances (both natural and anthropogenic) on plankton communities can therefore have knock-on effects on ecosystem services across multiple levels of the food web.

Due to the difficulties in observing population-level and/or ecosystem impacts, numerical models are needed to provide information on the extent to which sound or other anthropogenic disturbances may affect the structure and functioning of populations and ecosystems. Attempts to model noise-induced changes in population parameters were first undertaken for marine mammals using the population consequences of acoustic disturbance (PCAD) or Population Consequences of Disturbance (PCoD) approach (NRC 2005). The PCAD/PCoD framework assesses how observed behavioural responses on the health of an individual translates into changes in critical life-history traits (e.g. growth, reproduction, and survival) to estimate population-level effects. Since then various frameworks have been developed to enhance our understanding of the consequences of behavioural responses of individuals at a population level. This is typically done through development of bio-energetics models that quantify the reduction in bio-energy intake as a function of disturbance and assess this reduction against the bio-energetic need for critical life-history traits (Costa et al. 2016; Keen et al. 2021). The consequences of changes in life-history traits on the development of a population are then assessed through population modelling. These frameworks are usually complex and under continual development, but have been successfully used to assess the population consequences and ecosystem effects of disturbance in real-life conditions both for marine mammals (Villegas-Amtmann 2015, 2017; Costa et al. 2016; Ellison et al. 2016; McHuron et al. 2018; Pirotta et al. 2018; Dunlop et al. 2021), fish (Slabbekoorn & Halfwerk 2009; Hawkins et al. 2014; Slabbekoorn et al. 2019) and invertebrates (Hubert et al.

2018). The PCAD/PCoD models use and synthesize data from behavioural monitoring programs, ecological studies on animal movement, bio-energetics, prey availability and mitigation effectiveness to assess the population-level effects of multiple disturbances over time (Bröker 2019).

Ecosystem-based management is a holistic living resource management approach that concurrently addresses multiple human uses and the effect such stressors may have on the ability of marine ecosystems to provide ecosystem services and processes (e.g. recreational opportunities, consumption of seafood, coastal developments) (Holsman et al. 2017; Spooner et al. 2021). Within complex marine ecosystems, the integrated ecosystem assessment framework, which incorporates ecosystem risk assessments, provides a method for evaluating the cumulative impacts of multiple pressures on multiple ecosystem components (Levin et al. 2009, 2014; Holsman et al. 2017; Spooner et al. 2021). It therefore has the potential to address cumulative impacts and balance multiple, often conflicting, objectives across ocean management sectors and explicitly evaluate tradeoffs. It has been repeatedly explored in fisheries management (Large et al. 2015) and more recently in marine spatial planning (Hammar et al. 2020; Carlucci et al. 2021; Jonsson et al. 2021; Harris et al. 2022).

However, due primarily to the multi-dimensional nature of both ecosystem pressures and ecosystem responses, quantifying ecosystem-based reference points or thresholds has proven difficult (Large et al. 2015). Ecosystem thresholds occur when a small change in a pressure causes either a large response or an abrupt change in the direction of ecosystem state or function. Complex numerical modelling that concurrently identifies thresholds for a suite of ecological indicator responses to multiple pressures is required to evaluate ecosystem reference points to support ecosystem-based management (Large et al. 2015).

The required data inputs into such models are currently limited in southern Africa. Slabbekoorn et al. (2019) point out that in such cases expert elicitation would be a useful method to synthesize existing knowledge, potentially extending the reach of explicitly quantitative methods to data-poor situations.

9.1.11.3 Disturbance of Sediments

The sampling operations as part of the proposed prospecting activities would impact a maximum area of <0.043 km^2 in the Namaqua Bioregion, which can be considered an insignificant percentage (0.001 %) of the Namaqua Sandy Inner Shelf and Namaqua Sandy Mid Shelf ecoregions as a whole. Sampling on the inner and mid shelf region south of Hondeklipbaai is currently extremely limited and any cumulative effects from other diamond mining ventures in the region are highly unlikely. The heavy minerals mining being undertaken at Brand-se Baai and in the surf-zone concessions adjacent to concession 12A, is located well inshore of the 12B concession, and no cumulative impacts with beach mining operations are expected.

Cumulative impacts to the benthic environment also include the development of hydrocarbon wells. Since 1976, ~40 wells have been drilled in the Namaqua Bioregion of which 35 wellheads remain on the seabed impacting a combined estimated area of ~10 km^2. The majority of these occur in the iBhubesi Gas field in Block 2A, which lies well to the north and offshore of concession 12B. Although cumulative impacts from other hydrocarbon ventures are likely to increase in future, these would not affect the habitats in concession 12B.

9.1.11.4 Vessel lighting and Operational Discharges

There are numerous light sources and operational discharges from vessels operating within and transiting through the area, although each is isolated in space and most are mobile. Given the extent of the ocean and the point source nature of the lighting, the prevalence of sensitive receptors and faunal species interactions with the light sources is expected to be very low. Light levels would return back to ambient once operations are completed.

Each of the vessels (fishing, shipping, prospecting) operating within the area will make routine discharges to the ocean, each with potential to cause a local reduction in water quality, which could impact marine fauna. However, each point source is isolated in time and widely distributed within the very large extent of the open ocean. At levels compliant with MARPOL conventions no detectable cumulative effects are anticipated.

9.2 Underwater Heritage

As per **Part C, Appendix E: Heritage Impact Assessment, page 212**:

9.2.1 Pre-Colonial Sites and Artefacts

Table 25: Pre-Colonial Sites and Artefacts

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Low* ***2***	*Long-term* ***3***	*Medium* ***6***	*Improbable*	*Low*	***– ve***	*Medium*
Mitigation measures: *Induction for site managers on archaeological site and artefact recognition.* *Reporting of sites to the heritage practitioner for assessment and evaluation.*								
With mitigation	*Local 1*	*Low 2*	*Long-term 3*	*Medium* ***6***	*Improbable*	*LOW*	***+ ve***	*Medium*

9.2.2 Shipwrecks possibly in 12B

Table 26: Shipwrecks with No heritage significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Low* ***1***	*Long-term* ***3***	*Low* ***5***	*Improbable*	*Very Low*	***– ve***	*Medium*
Mitigation measures: *There is no heritage significance currently.* *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would pinpoint the wrecks to avoid damaging equipment.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources for future generations.*								
With mitigation	*Local 1*	*Low 1*	*Long-term 3*	*Low* ***5***	*Improbable*	*VERY LOW*	***+ ve***	*Medium*

Table 27: Shipwrecks With A Low Heritage Significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Low* ***1***	*Long-term* ***3***	*Low* ***5***	*Improbable*	*Very Low*	***– ve***	*Medium*
Mitigation measures: *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would possibly identify wrecks and wreck debris.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources.*								
With mitigation	*Local 1*	*Low 1*	*Long-term 3*	*Low* ***5***	*Probable*	*LOW*	***+ ve***	*Medium*

Table 28: Shipwrecks With A Medium Heritage Significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Medium* ***2***	*Long-term* ***3***	*Medium* ***6***	*Improbable*	*Low*	***– ve***	*Medium*
Mitigation measures: *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would possibly identify wrecks and wreck debris.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources.*								
With mitigation	*Local 1*	*Medium 2*	*Long-term 3*	*Medium* ***6***	*Possible*	*LOW*	***+ ve***	*Medium*

Table 29: Shipwrecks With A High Heritage Significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Low* ***3***	*Long-term* ***3***	*High* ***7***	*Improbable*	*Medium*	***– ve***	*Medium*
Mitigation measures: *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would possibly identify wrecks and wreck debris.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources.*								
With mitigation	*Local 1*	*Low 3*	*Long-term 3*	*High* ***7***	*Possible*	*MEDIUM*	***+ ve***	*Medium*

9.2.3 Shipwrecks Improbably In 12b

Table 30: Shipwrecks With No Heritage Significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Low* ***1***	*Long-term* ***3***	*Low* ***5***	*Improbable*	*Very Low*	***– ve***	*Medium*
Mitigation measures: *There is no heritage significance currently.* *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would pinpoint the wrecks to avoid damaging equipment.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources for future generations.*								
With mitigation	*Local 1*	*Low 1*	*Long-term 3*	*Low* ***5***	*Improbable*	*VERY LOW*	***+ ve***	*Medium*

Table 31: Shipwrecks with a Low heritage significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Low* ***1***	*Long-term* ***3***	*Low* ***5***	*Improbable*	*Very Low*	***– ve***	*Medium*
Mitigation measures: *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would possibly identify wrecks and wreck debris.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources.*								
With mitigation	*Local 1*	*Low 1*	*Long-term 3*	*Low* ***5***	*Probable*	*LOW*	***+ ve***	*Medium*

Table 32: Shipwrecks With A Medium Heritage Significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Medium* ***2***	*Long-term* ***3***	*Medium* ***6***	*Improbable*	*Low*	***– ve***	*Medium*
Mitigation measures: *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would possibly identify wrecks and wreck debris.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources.*								
With mitigation	*Local 1*	*Medium 2*	*Long-term 3*	*Medium* ***6***	*Possible*	*LOW*	***+ ve***	*Medium*

Table 33: Shipwrecks With A High Heritage Significance

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	*Local* ***1***	*Low* ***3***	*Long-term* ***3***	*High* ***7***	*Improbable*	*Medium*	***– ve***	*Medium*
Mitigation measures: *Induction for site managers on archaeological site and artefact recognition.* *Geophysical surveys would possibly identify wrecks and wreck debris.* *Reporting of sites to the heritage practitioner for assessment and evaluation.* *Avoiding the wrecks would preserve these MUCH resources.*								
With mitigation	*Local 1*	*Low 3*	*Long-term 3*	*High* ***7***	*Possible*	*MEDIUM*	***+ ve***	*Medium*

Table 34: Summary Table

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Impact Pre-Colonial Sites	*Medium*	*Possible*	*LOW*	*–ve*	*Medium*
With Mitigation	*Medium*	*Possible*	*LOW*	*+ve*	*Medium*
SHIPWRECKS POSSIBLY IN 12B					
Impact 5.2.2.1	*Low*	*Possible*	*VERY LOW*	*–ve*	*Medium*
With Mitigation	*Low*	*Possible*	*VERY LOW*	*+ve*	*Medium*
Impact 5.2.2.2	*Low*	*Improbable*	*VERY LOW*	*-ve*	*Medium*

With Mitigation	*Low*	*Probable*	*LOW*	*+ve*	*Medium*
Impact 5.2.2.3	*Medium*	*Improbable*	*LOW*	*-ve*	*Medium*
With Mitigation	*Medium*	*Possible*	*LOW*	*+ve*	*Medium*
Impact 5.2.2.4	*High*	*Improbable*	*MEDIUM*	*-ve*	*Medium*
With Mitigation	*High*	*Possible*	*MEDIUM*	*+ve*	*Medium*
SHIPWRECKS POSSIBLY IN 12B					
Impact 5.2.3.1	*Low*	*Improbable*	*VERY LOW*	*–ve*	*Medium*
With Mitigation	*Low*	*Improbable*	*VERY LOW*	*+ve*	*Medium*
Impact 5.2.3.2	*Low*	*Improbable*	*VERY LOW*	*-ve*	*Medium*
With Mitigation	*Low*	*Probable*	*LOW*	*+ve*	*Medium*
Impact 5.2.3.3	*Medium*	*Improbable*	*LOW*	*-ve*	*Medium*
With Mitigation	*Medium*	*Possible*	*LOW*	*+ve*	*Medium*
Impact 5.2.3.4	*High*	*Improbable*	*MEDIUM*	*-ve*	*Medium*
With Mitigation	*High*	*Possible*	*MEDIUM*	*+ve*	*Medium*

9.2.4 Cumulative Impacts

As per **Part C, Appendix E: Heritage Impact Assessment, page 212:**

There has been a recent increase in applications for prospecting and exploration rights along the west coast and increased prospecting/survey activity in the short term and marine mining in the long-term is anticipated. This means that cumulative impacts of marine prospecting and mining should be considered at a broader spatial scale in a strategic manner.

The value and significance of heritage resources is a highly emotive and subjective field. Certain sites are deemed significant due to their age, or the activity they were engaged in at the time of the event, these include slave and war ships, others may be unique in respect of their construction and rarity in the archaeological record. Some wrecks are not unique or even very old but may have spiritual significance to a local fishing community due to fatalities at the time of wrecking. One must be careful to not to project one's own values and belief systems onto the heritage resources and think about future generations. While some wrecks are not necessarily deemed important now, destruction without due diligence can have a negative future impact.

The wreck databases are built on reported wrecks. Ergo, the confidence in the historical reporting around inhabited port areas is generally higher. The west coast's low population density means that confidence in the historical reports is lower. There are, no doubt, many unreported wrecks, particularly older ones. Shipwreck sites are not always easily located. There are generally three stages to the formation of a wreck site. The first stage, the wreck event is precipitated by environmental conditions (storms) interacting with anthropogenic factors (captain's response to the environmental challenge). The second stage is a dynamic stage where the wreck interacts with and is transformed by the environment. The third stage is where the remains are assimilated with the environment. These stages do not necessarily progress linearly, and the stages may cycle, for example a second wreck can occur on the initial wreck and the process starts again; the second and third stages may be cyclical as storms could disturb the assimilated wreck site and transform the site further. Over hundreds of years, the site can be virtually indistinguishable from the surrounding seabed or reef. With the mitigation measures mentioned within this report, and assuming a best-case scenario, wrecks should be located during prospecting phases.

It is not possible to assess cumulative impacts with any level of confidence due to the unknown nature of the heritage resources in the region. Each wreck must be assessed as it is found, and if it is treated with the knowledge that we do not always know if is significant, whether locally or internationally, we can mitigate against high, negative cumulative impacts.

9.3 Palaeontology Impacts

As per **Part C, Appendix E: Paleontological Impact Assessment, page 374:**

9.3.1 Anticipated Impact

Fossils are rare objects, often preserved due to unusual circumstances. This is particularly applicable to vertebrate fossils (bones), which tend to be sporadically preserved and have high value with respect to palaeoecological and biostratigraphic (dating) information. Such fossils are non-renewable resources. Provided that no subsurface disturbance occurs, the fossils remain sequestered. The absence of management and operator mitigatory actions to be alert for fossils and retrieve them will result in their loss. This loss of the opportunity to recover fossils and record their contexts when exposed at a particular site is a negative, irreversible impact.

If mitigatory efforts are made to watch out for and rescue the fossils then the impact is positive for palaeontology. However, there remains a medium to high risk of valuable fossils being lost in spite of management actions to mitigate such loss. The fossils may simply not be noticed or not recognized. Even the most diligent attempts at mitigation can only hope to acquire some fraction of the fossils. This is particularly the case if the fossils are sparsely distributed in the deposits, which is generally the case for scientifically-valuable fossil bone material. A misperception exists that if fossils are sparse in a deposit then the intensity of impact will be low. This is not the case as it is the valuable fossils that are usually scarce, such as fossil bones. The very scarcity of such fossils makes for the added importance of watching for them.

The palaeontological impact of the coring and grab sampling in Concession 12B is considered to be negligible, in view of the minimal volumes of sediment affected. In the vibracores the small volumes involved greatly reduce to likelihood of capturing the sparse fossils reworked from the older, pre- late Quaternary formations and the "extralimitals" in the Last Transgression Sequence. However, should extralimital Subantarctic and Agulhas species occur in the cores they are more important specimens than those selected from the loose, mixed shells crossing the oversize screens on sampling/mining vessels, as they have context in the geological and faunal succession in the core and the expense to have specimens radiocarbon dated is more worthwhile. The grab samples are purposed for obtaining the upper, modern fauna and are unlikely to capture fossils which are usually lower down.

The target areas and number of drillship sample sites will be determined on the basis of interpretation of the geophysical survey. For each metre drilled a 5 m² drill footprint delivers ~5 m³ of material to the gravel screening plant on the vessel. Ignoring the variable thickness of "overburden", each drill hole includes a basal, potentially fossiliferous 5 m³ of material and up to 24 000 m³ for up to 4 800 holes.

The bulk sampling involves a considerable volume of the inner shelf deposits and the 10 sampling trenches are "trial mining blocks", each of which involves 180 X 20 m = 3 600 m² which, at an average sediment depth of 5 m, entails 18 000 m³ and 180 000 m³ for 10 trenches. Ignoring the variable thickness of "overburden", each trench includes a basal, potentially fossiliferous 3 600 m³ of material and 36 000 m³ in total.

For the most part the excavated material is the Last Transgression Sequence deposits with expected "subfossil" extant shell species and a 'sprinkling" of scientifically important extralimital species and rare fossil wood, reworked old fossil shells, bones and teeth in the gravels. Older Quaternary deposits of the Last Regression Sequence may be preserved in places.

9.3.2 Extents

In sampling and mining the fossil content of a prescribed volume of deposit is destroyed which is the physical extent of the impact. i.e. the extent is local. On the other hand, fossils uncovered during sampling and mining of the coastal plain and offshore are often of sufficient note to publish about them, which is a scientific impact on a national to international scale. For example, the discoveries of the Cretaceous fossil woods, the Miocene petrified whale fossils and the Subantarctic, Algoa and West African molluscan taxa in the Last Transgression Sequence, are all published in the international scientific literature.

9.3.3 Duration

The impact of both the finding or the loss of fossils is permanent. Destroyed fossils are lost to posterity. The found fossils must be preserved for posterity.

9.3.4 Intensity

The intensity of the potential impact of mining on fossil resources is determined by the palaeontological sensitivity of the affected formations - the potential scientific value of the fossils which are included in it. Overall, the palaeontological sensitivity of marine deposits is HIGH (Almond & Pether, 2009) due to a few, crucial fossil bone finds of high scientific importance that provided the age constraints for the formations. However, there are complications as marine formations usually contain more than one type of fossil of differing importance, e.g. common shells and rare bones. Quaternary fossil shell assemblages consist mainly of well-known, usual taxa and it is the unexpected, out of range or unknown, new shell species which are important to distinguish from the expected, common species.

9.3.4.1 Petrified Fossil Wood

Although reworked petrified Cretaceous fossil wood is sparsely present in the inner-shelf LTS gravels it is in the form of transported, abraded cobbles and pebbles, while the valuable specimens are large well-preserved chunks more directly derived from the Cretaceous formations exposed on the middle shelf. Similarly, Miocene petrified wood is also expected to be much abraded clasts. This impact is therefore LOW.

CRITERIA	***WITHOUT MITIGATION***	***WITH MITIGATION***
Extent	*National 4*	*National 4*
Duration	*Permanent 5*	*Permanent 5*
Intensity	*Low 4*	*Low 4*
Probability	*Probable 3*	*Probable 3*
Confidence	*Medium*	*Medium*
Significance	***Medium negative 39***	***Medium positive 39***
Reversibility	*Irreversible*	
Mitigation potential	*Medium*	

9.3.4.2 Cenozoic Shelly Macrofauna

The 12B inner shelf is far removed from the offshore source area of these fossils which are expected to be very sparse and mostly in the form of worn shell casts, of which only some with distinctive shapes are identifiable. The impact of sampling and mining on the ex-situ Cenozoic shelly macrofauna is considered to be LOW.

CRITERIA	***WITHOUT MITIGATION***	***WITH MITIGATION***
Extent	*Regional 3*	*Regional 3*
Duration	*Permanent 5*	*Permanent 5*
Intensity	*Low 4*	*Low 4*
Probability	*Improbable 2*	*Improbable 2*
Confidence	*Medium*	*Medium*
Significance	***Low negative 24***	***Low positive 24***
Reversibility	*Irreversible*	
Mitigation potential	*Medium*	

9.3.4.3 Fossil Bones and Teeth

This category includes fossil bones and teeth of any origin as there is no purpose for distinctions when they must be captured before going overboard. Recent fresh bones such as those of fish and seals are common and are excluded. The fossil material is phosphatized (petrified) to various degrees and worn by transport *and/or pitted by boring organisms. This material is scarce, but the large volumes involved increase the probability that some will be encountered and could be of HIGH scientific value.*

CRITERIA	***WITHOUT MITIGATION***	***WITH MITIGATION***
Extent	*National 4*	*National 4*
Duration	*Permanent 5*	*Permanent 5*
Intensity	*High 8*	*High 8*
Probability	*Probable 3*	*Probable 3*
Confidence	*High*	*High*
Significance	***Medium-high - negative 51***	***Medium-high - positive 51***
Reversibility	*Irreversible*	
Mitigation potential	*Medium*	

9.3.4.4 Shells from the Last Transgression Sequence

Quaternary fossil shell assemblages consist mainly of well-known, usual taxa and it is the unexpected, out of range or unknown shell species which are important. The concern here are shell species which are not typical of the normal faunal assemblages of the Namaqua shelf and are generally sparse, although several may occur in the same area. It is important to obtain a comprehensive sample of the Algoa species extralimital occurrences for future study. In addition to radiocarbon dating the incursions on Agulhas influence, the individual shells are snapshot archives of the palaeoceanographic conditions at the time, as revealed by incremental analyses of the shell stable isotopes and trace elements. Sampling in Concession 12B has a strong potential to yield fossil shells of extralimital Algoa species and is accorded MODERATE palaeontological sensitivity.

CRITERIA	***WITHOUT MITIGATION***	***WITH MITIGATION***
Extent	*National 4*	*National 4*
Duration	*Permanent 5*	*Permanent 5*
Intensity	*Medium 6*	*Medium 6*
Probability	*Probable 3*	*Probable 3*
Confidence	*High*	*High*
Significance	***Medium - negative 45***	***Medium - positive 45***
Reversibility	*Irreversible*	
Mitigation potential	*Medium*	

See Appendices 1 and 2 for Impact Rating Criteria.

9.3.5 Cumulative Impact

As per **Part C, Appendix E: Paleontological Impact Assessment, page 374:**

The cumulative impact of coastal and offshore sampling and mining is the inevitable and permanent loss of fossils and the associated scientific implications. As mentioned, the impact of both the finding and the loss of fossils is permanent. Diligent and successful mitigation contributes to a positive cumulative impact as some fossils are rescued and preserved and accumulated for scientific study.

9.4 Socio economic impacts

There has been a recent increase in applications for prospecting and exploration rights along the west coast. An increase in prospecting/survey activity in the short term and marine mining in the long-term is therefore anticipated.

The assessment considered the impacts of prospecting in Concession Area 12B on eight socio-economic sectors . Available information from previous EIA's were used as guidance. These included:

1. Tuna Pole and Linefish sector;
2. Traditional Linefish Sector;

3. Small Pelagic Purse Seine Fisheries sector;
4. Aquaculture;
5. Local tourism and small businesses;
6. Sense of place, health and wellbeing;
7. Local Households; and
8. Local crime rates.

However, some of these were "SCOPED OUT" of the assessment due to being unlikely to occur. The remaining impacts were assessed to either be INSIGNIFICANT or could be reduced to INSIGNIFICANT after mitigation (where required). Positive impacts might include local and regional socio-economic benefits. The following impacts could potentially impact the livelihoods and household income of marine fisheries sectors. These impacts were informed by previous Environmental Authorisation Applications done for Sea Concessions.

9.4.1 Tuna pole and line

The commercial tuna pole fishing (TPL) grounds lie between Cape Agulhas and the Orange River, but the fleet operates predominantly out of Cape Town and Hout Bay harbours and most fishing effort takes place within 100 nautical miles of these ports (particularly in the Cape Canyon area). No TLP fishing effort occurs or grid block overlaps with Concession Area 12B. Snoek fishing activity within the area is not evident. Impacts on the TPL fleet due to the proposed prospecting activities within Concession Area 12B are expected to be negligible were SCOPED OUT of assessment.

9.4.2 Traditional Linefish Sector

Linefishers operate in shallow water (generally <100 m depth) and could potentially be negatively impacted by coastal and nearshore seismic exploration, prospecting and mining operations (particularly recreational, small scale and subsistence shore fishing). A spatial analysis of the reported commercial line fish catches data, however, shows an overlap with traditional line fishing activity on concession Area 12B.There might be an impact traditional linefishing as 2-3 tonnes per year annually is reported here. This is 0.025% of the annual reported catch. The proposed prospecting in Concession Area 12B is therefore expected to have a VERY LOW socio-economic impact on the direct and indirect dependants from the traditional linefishing sector.

9.4.3 Small Pelagic Purse Seine Fisheries

The small pelagic purse-seine fishery operates between the Orange River and East London mostly in nearshore waters (within 10 km of the coast). and in the late summer mainly during the months of February to July (SAPFIA pers. comm).

From Figure 84 it is clear that 12B overlaps with fishing grounds for anchovy, but not priority areas. The concession area doesn't overlap with sardine grounds.

Concession Area 12B also overlaps with west coast nursery ground, although not high as concession area 12B, but medium to low in anchovy abundance.

Prospecting and bulk sampling will take in Spring and Summer and will be planned to no coincide with the Anchovy and Sardine season. Therefore this impact will be VERY LOW to insignificant.

9.4.4 Impact on Aquaculture

Aquaculture is an emerging industry that is vital to socioeconomic growth in south Africa contributing 0.8% of fish production which amounts to R0.7 billion (0.2%) to South Africa's GDP (DAFF 2016). Most of the aquaculture enterprises are found in Western Cape (56%) followed by the Eastern Cape (17%). All other provinces, including the Northern Cape (3%) account for less than 10% of aquaculture farms in South Africa. On the West Coast, sea-based mariculture primarily occurs in Saldanha Bay, whilst land-based abalone farms are established at Jacobsbaai, Doringbaai and Kleinzee. Oyster farming is also conducted at Kleinzee and abalone ranching takes place in four Northern Cape concession areas and one recently established at Doringbaai in the Western Cape. Aquaculture is, however, not evident in the immediate vicinity of Sea Concession Area 12B and was therefore SCOPED OUT of the assessment

9.4.5 Impact on Local Tourism and Businesses

Matzikama Municipalities has the potential for local economic growth through the development of their tourism sectors. The Namaqualand is recognised internationally as a global centre for plant, reptile and insect diversity and endemism. It is situated in the northwest corner of Southern Africa forming part of the larger Succulent Karoo biome. The Namaqualand is major tourist attraction region. However, it is more popular during the flower season.

Within the Matzikama Municipality, strategic objectives (as per the LED) are currently underway in towns such as Doringbaai, Papendorp, Griqua Ratelgat, Strandfontein and surroundings and include developing the tourism routes, homestays, guesthouse- and resort establishments, tour guide training, trail developments, alien clearing initiatives (optimal use and manage local resources), and marketing of the Matzikama Municipality as an eco/adventure/heritage region (de Jager 2019).

Residential areas, guesthouses, restaurants, and other businesses are sparse along the coast adjacent to Concession Area 12B. There are, however, several farmers whose farmlands extend to the coastline and may be in proximity to the concession area. Although sediment plumes and water discolouration may occur during the operational phase, it is highly unlikely that these plumes would be visible from the shore. It is unlikely that the offshore prospecting activities will negatively impact any businesses, establishments, owners of the farms, tourists or surfers visiting the area or the Matzikama tourism sectors. Due to the local and temporary nature of the proposed prospecting activities, the significance of the potential impact on the tourism industry and small businesses were assessed to be VERY LOW and can be reduced to INSIGNIFICANT with the implementation of mitigation measures.

9.4.6 Impact of proposed prospecting on the Sense of Place, Health and Wellbeing

Sense of place is defined as the emotional relationship that you feel or experience in a particular location or environment which can have either positive connotation (e.g., safety and well-being) or negative connotations (e.g., fear) (Foote & Azaryahu 2009). It can also refer to a distinct character of an environment (Foote & Azaryahu 2009). The sense of belonging is deeply embedded in the history of the Khoisan people who were historically concentrated in the Matzikama municipal areas from where they migrated to other parts of the Namaqualand and other places in south Africa. The Khoisan people’s history contributed immensely to the rich cultural heritage in these municipalities. In addition, the residents and community have a spiritual connection to the land and ocean and have used this region for fishing for generations.

The prospecting vessel may disturb the unique character of the coastline and area. However, due to the area being remote and far from settlements, 5 km offshore and the prospecting activity temporary in nature, the significance of the potential impact was assessed to be VERY LOW with no mitigation measures required.

9.4.7 Local Households

Many coastal communities regard marine resources as valuable for both their household income and livelihoods. However, there are no major coastal towns in the vicinity of the concession Area 12B and the nearest inland settlements or towns are Papendorp, Standfontein and Ebenhaeser and Kotzesrus located 5 km, 7 and 16 km of Concession Area 12B, respectively. Other inland town and settlements which are present are connected with gravel roads. There are several farmlands and households on the coastline adjacent Concession Area 12B. Although little is known about their main source of income and livelihood, it is expected that farming, rather than fishing would be the most important contributor. The impact of prospecting 5-95 km offshore on local households is considered INSIGNIFICANT and improbable to occur.

9.4.8 <u>Local Crime</u>

The most small Municipalities have serious social crimes such as alcohol and drug abuse, illegal mining and selling of endangered species, violence and property crimes. The proposed prospecting will occur offshore at sea, crew members will not be able to come ashore and therefore the risk of an increase in the level of crime is, negligible and this impact was therefore SCOPED OUT of the assessment.

9.4.9 <u>Potential positive impacts</u>

Mining is economically important as it can create broad scale employment opportunities and boost the national and local economy. Little is known about the local development plans of existing mines in terms of provision of employment opportunities to the locals in the surrounding towns. Should prospecting reveal an economically viable resource and the project proceed to production phase, employment opportunities and further positive impacts will be investigated as part of the Mining Right Application.

Many of employment positions will likely be filled directly from within the surrounding communities. If not readily found, training could be provided. Training opportunities will be available for people with several types and levels of skills. The potential impact of prospecting on the socio-economic performance is, however, likely to be insignificant on a local scale.

Conversely, investment from investors in South Africa will have a greater positive impact on the regional economy.

However, within the broader context, the significance of this impact is considered to be INSIGNIFICANT.

9.5 Potential Impacts and Risks associated with the No-Go Alternative

There would be no change to the biophysical environment with the No-Go Alternative. The No-Go Alternative implies that the Applicant would forgo an opportunity to provide employment opportunities in an area and sector identified for opportunities for job provision and economic growth, and for the sourcing of diamonds. This potential would not be reached with the “no-go” option.

9.6 Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision).

The criteria for the description and assessment of environmental impacts were drawn from the National Environmental Management Act, 1998 (Act No. 107 of 1998).

The level of detail was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed it is necessary to establish a rating system, which is consistent throughout all criteria. For such purposes, each aspect was assigned a value, ranging from 1-5, depending on its definition.

Potential Impact

This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. Its description should include what is being affected and how it is being affected.

Extent

The physical and spatial scale of the impact is classified as:

- Local

The impacted area extends only as far as the activity, e.g., a footprint.

- Site

The impact could affect the whole or a measurable portion of the site.

- Regional

The impact could affect the area including the neighbouring erven, the transport routes, and the adjoining towns.

- National

Significantly beyond Saldanha Bay and adjacent land areas

Duration

The lifetime of the impact, which is measured in relation to the lifetime of the proposed base:

- Short term

The impact either will disappear with mitigation or will be mitigated through a natural process in a period shorter than any of the phases.

- Medium term

The impact will last up to the end of the phases, whereafter it will be entirely negated.

- Long term

The impact will continue or last for the entire operational lifetime of the Development but will be mitigated by direct human action or by natural processes thereafter.

- Permanent

This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Intensity

The intensity of the impact is considered here by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. These are rated as:

- Low

The impact alters the affected environment in such a way that the natural processes or functions are not affected.

- Medium

The affected environment is altered, but functions and processes continue, albeit in a modified way.

- High

Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project.

Probability

This describes the likelihood of the impacts occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:

- Improbable

The possibility of the impact occurring is none, due either to the circumstances, design or experience.

- Possible/Probable

The possibility of the impact occurring is very low, due either to the circumstances, design or experience.

- Likely

There is a possibility that the impact will occur to the extent that provisions must, therefore, be made.

- Highly Likely

It is most likely that the impacts will occur at some stage of the Development. Plans must be drawn up before conducting the activity.

- Definite

The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on.

Determination of Significance – Without Mitigation

The significance is determined through a synthesis of impact characteristics and is an indication of the importance of the impact in terms of both physical extent and time scale. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, the significance is noted as "positive." The significance is rated on the following scale:

- No significance

The impact is not substantial and does not require any mitigation action.

- Low

The impact is of little importance but may require limited mitigation.

- Medium

The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.

- High

The impact is of significant importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

Determination of Significance – With Mitigation

The significance is determined through a synthesis of impact characteristics. It is an indication of the importance of the impact in terms of both physical extent and time scale and therefore indicates the level of mitigation required. In this case, the prediction refers to the foreseeable significance of the impact after the successful implementation of the suggested mitigation measures. Significance with mitigation is rated on the following scale:

- No significance

The impact will be mitigated to the point where it is regarded to be insubstantial.

- Low

The impact will be mitigated to the point where it is of limited importance.

- Low to medium

The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.

- Medium

Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.

- Medium to high

The impact is of significant importance. Through implementing the correct mitigation measures, the negative impacts will be reduced to acceptable levels.

- High

The impact is of significant importance. Mitigation of the impact is not possible on a cost-effective basis. The impact continues to be of significant importance, and taken within the overall context of the project, is a fatal flaw in the project proposal. This could render the entire development option or the entire project proposal unacceptable.

9.7 The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected.

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties)

Refer to section 7.1 above for a comprehensive discussion relating to the positive and negative impacts of prospecting in Concession area 12B.

9.8 The possible mitigation measures that could be applied and the level of risk.

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ discussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered).

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 299:**

9.8.1 <u>Impacts on Marine Fauna</u>

9.8.1.1 Acoustic Impacts of Geophysical Prospecting and Sampling

No mitigation measures are possible, or considered necessary for the generation of noise by the sampling tools and vessels.

Despite the low significance of impacts for geophysical surveys, the Joint Nature Conservation Committee (JNCC) provides a list of guidelines to be followed by anyone planning marine sonar operations that could cause acoustic or physical disturbance to marine mammals (JNCC 2017). These have been revised to be more applicable to the southern African situation.

No.	***Mitigation measure***	***Classification***
1	*Onboard Marine Mammal Observers (MMOs) should conduct visual scans for the presence of cetaceans and penguins around the survey vessel prior to the initiation of any acoustic impulses.*	*Avoid / Abate on site*
2	*Pre-survey scans should be limited to 15 minutes prior to the start of survey equipment.*	*Avoid / Abate on site*
3	*"Soft starts" should be carried out for any equipment of source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes to give adequate time for marine mammals and diving seabirds to leave the vicinity.*	*Avoid / Abate on site*
4	*Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the marine mammal and/or penguin has vacated the area.*	*Avoid*
5	*Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November), and ensure that migration paths are not blocked by sonar operations. As no seasonal patterns of abundance are known for*	*Avoid*

No.	Mitigation measure	Classification
	odontocetes occupying the proposed concession area, a precautionary approach to avoiding impacts throughout the year is recommended.	
6	*If feasible schedule the survey to take place between February and May thereby avoiding the main seabird breeding seasons (March to October) and penguin summer moult periods (October to January).*	*Avoid*
7	*Ensure that PAM (passive acoustic monitoring) is incorporated into any surveying taking place between June and November.*	*Abate on site*
8	*A MMO should be appointed to ensure compliance with mitigation measures during seismic geophysical surveying.*	*Avoid / Abate on site*

9.8.1.2 Disturbance and loss of benthic fauna during sampling

No mitigation measures are possible, or considered necessary for the direct loss of macrobenthos due to drill and bulk sampling. However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area. In particular, bulk sampling by seabed crawler must avoid outcropping and sub-cropping reef areas.

No.	Mitigation measure	Classification
1	*Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area*	*Avoid*

9.8.1.3 Disturbance to and loss of rock lobsters during sampling operations

The following mitigation measures are recommended:

No.	Mitigation measure	Classification
1	*Monitor sorting screens during drill sampling and terminate operations should large numbers of lobsters appear on the screens over a short period of time*	*Abate on site*
2	*Avoid sampling in the immediate vicinity of rocky outcrop areas or other identified sensitive habitats in the licence area*	*Avoid*

9.8.1.4 Crushing of benthic fauna during sampling

No direct mitigation measures are possible, or considered necessary for the indirect loss of benthic macrofauna in unconsolidated sediments due to crushing by the drill-frame structure and the seabed crawler tracks. However, the following mitigation measures are recommended:

No.	Mitigation measure	Classification
1	*Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area*	*Avoid*
2	*Implement dynamically positioned sampling vessels in preference to vessels requiring anchorage*	*Avoid*

9.8.1.5 Increased turbidity due to generation of suspended sediment plumes

No mitigation measures are possible, or considered necessary for the discharge of fine tailings from the sampling vessel and the generation of suspended sediments plumes near the seabed by the sampling tools.

9.8.1.6 Remobilisation of contaminants and nutrients

No mitigation measures are possible, or considered necessary for the possible remobilisation of contaminants and nutrients in the sediments.

9.8.1.7 Smothering of benthos in redepositing tailings

No mitigation measures are possible, or considered necessary for the loss of macrobenthos due to smothering by redepositing sediments. However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area.

No.	Mitigation measure	Classification
1	Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area	Avoid
2	Make of geophysical data to conduct a pre-sampling geohazard analysis of the seabed, and near-surface substratum to map potentially vulnerable habitats and prevent potential conflict with the sampling targets.	Avoid

9.8.1.8 Loss of Ferrosilicon

The following mitigation measures are recommended:

No.	Mitigation measure	Classification
1	Reduce FeSi loss through the implementation of shell crushers or ball mills	Abate on site
2	Maintain accurate records of all FeSi used and discarded overboard with tailings	Repair / restore

9.8.1.9 Pollution of the marine environment through Operational Discharges from the Sampling Vessel(s)

In addition to compliance with MARPOL 73/78 regulations regarding waste discharges mentioned above, the following measures will be implemented to reduce wastes at the source:

No.	Mitigation measure	Classification
1	Prohibit operational discharges when transiting through a marine protected area during transit to and from the concession	Avoid/reduce at source
2	Use drip trays to collect run-off from equipment that is not contained within a bunded area and route contents to the closed drainage system	Avoid / Reduce at Source
3	Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc.	Avoid/Reduce at Source
4	Use a low-toxicity biodegradable detergent for the cleaning of the deck and any spillages	Reduce at Source

9.8.1.10 Lighting from Survey and Sampling Vessels

The use of lighting on the project vessels cannot be eliminated due to safety, navigational and operational requirements. Recommendations for mitigation include:

No.	Mitigation measure	Classification
1	The lighting on the vessel(s) should be reduced to a minimum compatible with safe operations whenever and wherever possible.	Avoid/Reduce at Source
2	Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised	Avoid/Reduce at Source
3	Keep disorientated, but otherwise unharmed, seabirds in dark containers (e.g. cardboard boxes) for subsequent release during daylight hours.	Repair or Restore
4	Report ringed/banded birds to the appropriate ringing/banding scheme (details are provided on the ring).	Repair or restore

9.8.2 Potential Impacts related to Unplanned Events

The following was taken from **Appendix E: Marine Fauna Impact Assessment, page 299:**

9.8.2.1 Collision of Vessels with Marine Fauna and Entanglement in Gear

Recommendations for mitigation include:

No.	Mitigation measure	Classification
1	All vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel.	Abate on site
2	Ensure vessel transit speed between the concession area and port is a maximum of 12 kts (22 km/hr), except within 25 km of the coast where it is reduced further to 10 kts (18 km/hr) as well as when sensitive marine fauna are present in the vicinity.	Avoid/reduce at source
3	Should a cetacean become entangled in mooring buoys or towed gear, contact the South African Whale Disentanglement Network (SAWDN) formed under the auspices of DEA to provide specialist assistance in releasing entangled animals	Repair / restore
4	Report any collisions with large whales to the International Whaling Commission (IWC) database, which has been shown to be a valuable tool for identifying the species most affected, vessels involved in collisions, and correlations between vessel speed and collision risk (Jensen & Silber 2003).	Repair or restore

9.8.2.2 Accidental Loss of Equipment

The following measures should be implemented to manage accidental loss of equipment:

No.	Mitigation measure	Classification
1	Ensure containers are sealed / covered during transport and loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system.	Avoid
2	Minimise the lifting path between vessels.	Avoid
3	Maintain an inventory of all equipment and undertake frequent checks to ensure these items are stored and secured safely on board each vessel.	Avoid
4	Notify SAN Hydrographer of any hazards left on the seabed or floating in the water column, and request that they send out a Notice to Mariners with this information.	Repair / restore

9.8.2.3 Loss of Fuel and/or Hydraulic Oils to Sea

In addition to the best industry practices and project standards, the following measures must be implemented to manage the impacts associated with small accidental spills:

No.	Mitigation measure	Classification
1	Ensure that vessels operate in accordance with South African Maritime safety regulations to minimise risks of accidents	Avoid / reduce at source
2	Refuelling of vessels is to occur under controlled conditions in a harbour only, i.e. bunkering at sea is not permitted	Avoid / reduce at source
3	Ensure personnel are adequately trained in both accident prevention and immediate response, and resources are available on each vessel.	Avoid / reduce at source
4	Ensure that the vessel operator has prepared and implemented a Shipboard Oil Pollution Emergency Plan and an Oil Spill Contingency Plan. In doing so, take cognisance of the South African Marine Pollution (Control and Civil Liability) Act, 1981 (No. 6 of 1981), Marine Pollution (Prevention of Pollution from Ships) Act, 1986 (No. 2 of 1986) and Marine Pollution (Intervention) Act, 1987 (No. 65 of 1987), which sets out national policies, principles and arrangements for the management of emergencies including oil pollution in the marine environment.	Abate on and off site
5	Use low toxicity dispersants cautiously and only with the permission of DFFE.	Abate on and off site

No.	Mitigation measure	Classification
6	*As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill*	*Abate on site*
7	*Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.*	*Restore*

9.8.3 Underwater Heritage

Taken from **Heritage Impact Assessment, Appendix E**:

As mitigation measures overlap it is summarised as:

- *Induction for site managers on archaeological site and artefact recognition.*
- *Geophysical surveys would pinpoint the wrecks to avoid damaging equipment.*
- *Reporting of sites to the heritage practitioner for assessment and evaluation.*
- *Avoiding the wrecks would preserve these MUCH resources for future generations.*

9.8.4 Palaeontology Impacts

From the **Paleontological Impact Assessment, Appendix E**:

The exploration and mining for diamonds in the marine environment is a once-off, never to be repeated opportunity to obtain fossils from various areas of the continental shelf, from deposits of various ages. It is cutting-edge, commercially-driven exploration at a scale and detail unaffordable by the state. In order to not overlook such opportunity to advance science co-operatively, the ambit of contemporary environmental management includes such concerns. The additional input from fossil information will be of benefit for the geological interpretation of the deposits. A find of an important fossil can generate favourable publicity. In the longer term, the offshore fossil heritage should also be made available in more permanent exhibitions at an appropriate facility.

The EMPs for the prospecting and mining rights areas must therefore include provisions for the collection of representative examples of the fossils that occur therein. As part of Environmental Awareness Training, geological staff involved in logging must be informed of the need to watch for fossil material and rescue such from the vibracores, grab samples and the drillship gravel oversize screen.

The prospecting/mining company must apply to SAHRA for a general permit to destroy, damage, excavate, disturb and collect fossils identified during sampling and mining, as per the NHRA.

9.8.5 Fisheries, socio-economic and other shipping

9.8.5.1 Essential mitigation measures

- Undertake surveys when fishing effort is lowest (preferably out of fishing seasons).
- Appoint a fisheries liaison officer (FLO) to facilitate communication with the Small Pelagic Fishing Industry Association. The FLO should report daily on vessel activity and respond and advise on action to be taken in the event of encountering purse seine fishing vessels in the survey area.
- Monitor water-quality surrounding the sediment plumes.
- Should any negative visual impacts be detectable, restrict prospecting activities during important tourism events and seasons.
- Should any negative visual impacts be detectable, restrict operational activities to the section of the concession area out of sight from the shore.
- The survey and sampling vessels must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. Lloyds Register, Det Norske Veritas). The certification, as well as existing safety standards, requires that safety precautions should be taken to minimise the possibility of an offshore accident. Collision prevention equipment should include radar, multi-frequency radio, foghorns, etc. Safety equipment and training of personnel to

ensure the safety and survival of the crew in the event of an accident is a further legal requirement; and

- The maximum sea days per year is 30 days for sampling but only a couple of hours will be spend on one specific site and the impact on other industries will be minimal. An open line of communication will be established with other existing industries operating in the area where sampling is planned to align activities.

9.8.5.2 Best Practice Mitigation

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

- Fishing industry / associations:
  - ➢ SA Marine Linefish Management Association (SAMLMA);
  - ➢ South African Pelagic Fishing Industry Association (SAPFIA); and,
  - ➢ Local fishing communities.
- Other associations and organs of state ➢ DFFE;
  - ➢ SAMSA;
  - ➢ South African Navy Hydrographic office; and
  - ➢ Overlapping and neighbouring right holders.

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

9.9 Motivation where no alternative sites were considered.

The concession holder does not have the right to prospect in any other areas. No alternatives sites were therefore considered in this Basic Assessment Process. In addition, the concession area is targeted as it is known to contain kimberlite pipes which is a source of diamonds and other mineral deposits.

9.10 Statement motivating the alternative development location within the overall site.

(Provide a statement motivating the final site layout that is proposed)

Refer to Section 4 above.

The project site has been selected based on the history and the identification of the sea concession areas.

In summary, therefore:

- The **Preferred Alternative** is the <u>prospecting of diamonds with bulk sampling</u>, as per the layout shown in Figure 2 **(page 4)**.
- The preferred and only **location** alternative of the prospecting activity is as per **Figure 2 (page** Error! Bookmark not defined.**),** which indicates the concession area. No access roads, infrastructure or services are required. No electricity powerline connections are required.
- The preferred and only **activity** alternative is the prospecting of diamonds over Sea Concession 12B shown in 3.3 **(page 2)**.
- The preferred **technology and operational** alternatives are the use of geophysical surveys, drill sampling and pre-/feasibility studies.

The operational approach is practical and based on best practices to ensure a phased approach of prospecting followed by rehabilitation in sequential stages.

There are therefore no other reasonable or feasible sites, layouts, activities, technologies, or operational alternatives for further consideration in the impact assessment component, other than the mandatory "no-go" alternative that must be assessed for comparison purposes.

Areas of conservation concern will be avoided to preserve the integrity of these environments. Furthermore, reef areas will also be avoided as these are known to be hotspots for marine biodiversity. As no geophysical sampling have been conducted in this area to date, the exact position of reefs and other areas that need to be avoided have not yet been identified. These areas will be identified only after the seismic surveys have been completed. Consultation with stakeholder during the Public Participation Process will further elucidate areas that need to be avoided. The preferred alternative within the site is thus subject to change pending results from the geophysical survey and consultation with stakeholders.

10 Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity.

(Including (i) a description of all environmental issues and risks that erer identified during the environmental impact assessment process and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.)

The National Environmental Screening Tool was used to assess terrestrial habitat adjacent to Concession Area 12B. The purpose of a screening process is to identify any environmental site sensitivities within the area.

Specialists were appointed to assess these site sensitivities and any potential impacts associated with prospecting in this area. Information from these studies and the screening tool, together with the expertise from the EAP and consultation with stakeholders will be used to identify and assess the potential impacts of prospecting in this area.

Refer to the Impact Assessment Methodology detailed in Section 8 above and employed in the rating of impacts detailed in the Impact Tables attached at **Appendix E**.

Refer to Section 6.5 above and **8.5.1** below, which references the findings from **Appendix D & E** and the measures to avoid, reverse, mitigate or manage the identified impacts to determine the extent of the residual risks that need to be managed and monitored.

10.1 Assessment of each identified potentially significant impact and risk

(This section of the report must consider all the known typical impacts of each of the activities (including those that could or should have been identified by knowledgeable persons) and not only those that were raised by registered interested and affected parties).

Also refer to Appendix E

<table>
<tr><th>NAME OF ACTIVITY</th><th>POTENTIAL IMPACT</th><th>ASPECTS AFFECTED</th><th>PHASE</th><th>SIGNIFICANCE if not mitigated</th><th>MITIGATION TYPE
(modify, remedy, control, or stop)</th><th>SIGNIFICANCE if mitigated</th></tr>
<tr><td>Planning Phase</td><td>N/A</td><td>N/A</td><td>Planning Phase</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Stakeholder consultation</td><td>N/A</td><td>Consultation with communities & I&APs</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Geophysical seismic survey and seafloor mapping</td><td>Impacts of multi-beam and sub-bottom profiling sonar on marine fauna</td><td>Marine Fauna</td><td>Planning/Survey Phase</td><td>Low -</td><td>No mitigation measures are possible, or considered necessary for the generation of noise by the sampling tools and vessels. Despite the low significance of impacts for geophysical surveys, the Joint Nature Conservation Committee (JNCC) provides a list of guidelines to be followed by anyone planning marine sonar operations that could cause acoustic or physical disturbance to marine mammals (JNCC 2017). These have been revised to be more applicable to the southern African situation.
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>Onboard Marine Mammal Observers (MMOs) should conduct visual scans for the presence of cetaceans and penguins around the survey vessel prior to the initiation of any acoustic impulses.</td><td>Avoid / Abate on site</td></tr>
<tr><td>2</td><td>Pre-survey scans should be limited to 15 minutes prior to the start of survey equipment.</td><td>Avoid / Abate on site</td></tr>
<tr><td>3</td><td>“Soft starts” should be carried out for any equipment of source levels greater than 210 dB re 1 μPa at 1 m over a period of 20 minutes to give adequate time for marine mammals and diving seabirds to leave the vicinity.</td><td>Avoid / Abate on site</td></tr>
<tr><td>4</td><td>Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the marine mammal and/or penguin has vacated the area.</td><td>Avoid</td></tr>
<tr><td>5</td><td>Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November), and ensure that migration paths are not blocked by sonar operations. As no seasonal patterns of abundance are known for odontocetes occupying the proposed concession area, a precautionary approach to avoiding impacts throughout the year is recommended.</td><td>Avoid</td></tr>
<tr><td>6</td><td>If feasible schedule the survey to take place between February and May thereby avoiding the main seabird breeding seasons (March to October) and penguin summer moult periods (October to January).</td><td>Avoid</td></tr>
<tr><td>7</td><td>Ensure that PAM (passive acoustic monitoring) is incorporated into any surveying taking place between June and November.</td><td>Abate on site</td></tr>
<tr><td>8</td><td>A MMO should be appointed to ensure compliance with mitigation measures during seismic geophysical surveying.</td><td>Avoid / Abate on site</td></tr>
</table></td><td>Very Low</td></tr>
<tr><td>Geophysical seismic survey and seafloor mapping</td><td>Impacts of noise from sampling operations on marine fauna</td><td>Marine Fauna</td><td>Planning/Survey & Prospecting Phase</td><td>Very Low</td><td>Plan sampling not to co-inside with migratory season of whales
Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November), and ensure that migration paths are not blocked by sonar operations. As no seasonal patterns of abundance are known for odontocetes occupying the proposed concession area, a precautionary approach to avoiding impacts throughout the year is recommended.</td><td>Very Low</td></tr>
<tr><td>Drill sampling or prospecting</td><td>Disturbance and loss of benthic fauna during sampling</td><td>Benthic fauna</td><td>Prospecting / Sampling</td><td>Very Low</td><td>No mitigation measures are possible, or considered necessary for the direct loss of macrobenthos due to drill sampling. However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area.
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area</td><td>Avoid</td></tr>
</table></td><td>Very Low</td></tr>
</table>

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop)	SIGNIFICANCE if mitigated
Drill sampling or prospecting	Disturbance to and loss of rock lobsters	Rock Lobsters	Prospecting / Sampling	Very Low	No. | Mitigation measure | Classification 1 | Monitor sorting screens during drill sampling and terminate operations should large numbers of lobsters appear on the screens over a short period of time | Abate on site 2 | Avoid sampling in the immediate vicinity of rocky outcrop areas or other identified sensitive habitats in the licence area | Avoid	Very Low
Drill sampling or prospecting	Crushing of benthic fauna during sampling	Benthic fauna	Prospecting / Sampling	Very Low	No. | Mitigation measure | Classification 1 | Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area | Avoid 2 | Implement dynamically positioned sampling vessels in preference to vessels requiring anchorage | Avoid	Very Low
Drill sampling or prospecting and Closure	Potential impacts on the water column associated with sediment plumes from sampling/mining vessels are primarily linked with increased turbidity and its effects on light penetration through the water column, remobilisation of dissolved constituents from seabed sediments (see section 4.4.6), and reduction in oxygen levels in the water column resulting from high levels of primary production.	Marine Fauna - light penetration through the water column, remobilisation of dissolved constituents from seabed sediments and reduction in oxygen levels in the water column resulting from high levels of primary production	Prospecting / Sampling	Very Low	No mitigation measures are possible, or considered necessary for the discharge of fine tailings from the sampling vessel and the generation of suspended sediments plumes near the seabed by the sampling tools.	Very Low
Drill sampling or prospecting and Closure	The re-suspension of sediments during sampling can release these trace metals and nutrients into the water column. Metal bio-availability and eco-toxicology is complex and depends on the partitioning of metals between dissolved and particulate phases and the speciation of the dissolved phase into bound or free forms (Rainbow 1995; Galvin 1996). Although dissolved forms are regarded as the most bio-available, many of these are not readily utilisable by aquatic organisms. Consequently those forms that are ultimately bio-available and potentially toxic to marine organisms usually constitute only a fraction of the total concentration. Trace metal uptake by organisms may occur through direct absorption from solution, by uptake of suspended matter and/or *via* their food source. Toxic effects on organisms may be exerted over	Marine Fauna	Prospecting / Sampling	Very Low	No mitigation measures are possible, or considered necessary for the possible remobilisation of contaminants and nutrients in the sediments.	Very Low

<table>
<tr><th>NAME OF ACTIVITY</th><th>POTENTIAL IMPACT</th><th>ASPECTS AFFECTED</th><th>PHASE</th><th>SIGNIFICANCE if not mitigated</th><th>MITIGATION TYPE
(modify, remedy, control, or stop)</th><th>SIGNIFICANCE if mitigated</th></tr>
<tr><td></td><td>the short term (acute toxicity), or through bioaccumulation.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Drill sampling , bulk sampling, prospecting and Closure</td><td>Smothering of benthos in redepositing tailings</td><td>benthos</td><td>Prospecting / Sampling</td><td>Very Low</td><td>No mitigation measures are possible, or considered necessary for the loss of macrobenthos due to smothering by redepositing sediments. However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area.
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area</td><td>Avoid</td></tr>
<tr><td>2</td><td>Make of geophysical data to conduct a pre-sampling geohazard analysis of the seabed, and near-surface substratum to map potentially vulnerable habitats and prevent potential conflict with the sampling targets.</td><td>Avoid</td></tr>
</table></td><td>Very Low</td></tr>
<tr><td>Drill sampling , bulk sampling, prospecting and Closure</td><td>Smothering effects on rocky outcrop communities</td><td>rocky outcrop communities</td><td>Prospecting / Sampling</td><td>Very Low</td><td>No mitigation measures are possible, or considered necessary for the loss of macrobenthos due to smothering by redepositing sediments. However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area.
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area</td><td>Avoid</td></tr>
<tr><td>2</td><td>Make of geophysical data to conduct a pre-sampling geohazard analysis of the seabed, and near-surface substratum to map potentially vulnerable habitats and prevent potential conflict with the sampling targets.</td><td>Avoid</td></tr>
</table></td><td>Very Low</td></tr>
<tr><td>Bulk sampling, prospecting and Closure</td><td>Loss of Ferrosilicon</td><td>Sea habitat communities</td><td>Prospecting / Sampling</td><td></td><td>The following mitigation measures are recommended:
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>Reduce FeSi loss through the implementation of shell crushers or ball mills</td><td>Abate on site</td></tr>
<tr><td>2</td><td>Maintain accurate records of all FeSi used and discarded overboard with tailings</td><td>Repair / restore</td></tr>
</table></td><td>Very Low</td></tr>
<tr><td>Drill sampling or prospecting and Closure</td><td>Redeposition of discarded sediments on soft-sediment macrofauna</td><td>soft-sediment macrofauna</td><td>Prospecting / Sampling</td><td>Very Low</td><td>The following mitigation measures are recommended:
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>Reduce FeSi loss through the implementation of shell crushers or ball mills</td><td>Abate on site</td></tr>
<tr><td>2</td><td>Maintain accurate records of all FeSi used and discarded overboard with tailings</td><td>Repair / restore</td></tr>
</table></td><td>Very Low</td></tr>
<tr><td>Prospecting and Closure</td><td>Pollution of the marine environment through Operational Discharges from the Sampling Vessel(s)</td><td>marine environment</td><td>Operational;</td><td>Very Low</td><td>In addition to compliance with MARPOL 73/78 regulations regarding waste discharges mentioned above, the following measures will be implemented to reduce wastes at the source:
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>Prohibit operational discharges when transiting through a marine protected area during transit to and from the concession</td><td>Avoid/reduce at source</td></tr>
<tr><td>2</td><td>Use drip trays to collect run-off from equipment that is not contained within a bunded area and route contents to the closed drainage system</td><td>Avoid / Reduce at Source</td></tr>
<tr><td>3</td><td>Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc.</td><td>Avoid/Reduce at Source</td></tr>
<tr><td>4</td><td>Use a low-toxicity biodegradable detergent for the cleaning of the deck and any spillages</td><td>Reduce at Source</td></tr>
</table></td><td>Very Low</td></tr>
<tr><td>Prospecting and Closure</td><td>Disturbance and behavioural changes in pelagic fauna due to vessel lighting</td><td>Pelagic Fauna</td><td>Operational;</td><td>Very Low</td><td>The use of lighting on the project vessels cannot be eliminated due to safety, navigational and operational requirements. Recommendations for mitigation include:
<table>
<tr><th>No.</th><th>Mitigation measure</th><th>Classification</th></tr>
<tr><td>1</td><td>The lighting on the vessel(s) should be reduced to a minimum compatible with safe operations whenever and wherever possible.</td><td>Avoid/Reduce at Source</td></tr>
<tr><td>2</td><td>Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised</td><td>Avoid/Reduce at Source</td></tr>
</table></td><td>Very Low</td></tr>
</table>

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop)	SIGNIFICANCE if mitigated
					3 | Keep disorientated, but otherwise unharmed, seabirds in dark containers (e.g. cardboard boxes) for subsequent release during daylight hours. | Repair or Restore 4 | Report ringed/banded birds to the appropriate ringing/banding scheme (details are provided on the ring). | Repair or restore	
Prospecting and Closure	Collision of Vessels with Marine Fauna and Entanglement in Gear	Marine Fauna	Operational;	Very Low	No. | Mitigation measure | Classification 1 | All vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel. | Abate on site 2 | Ensure vessel transit speed between the concession area and port is a maximum of 12 kts (22 km/hr), except within 25 km of the coast where it is reduced further to 10 kts (18 km/hr) as well as when sensitive marine fauna are present in the vicinity. | Avoid/reduce at source 3 | Should a cetacean become entangled in mooring buoys or towed gear, contact the South African Whale Disentanglement Network (SAWDN) formed under the auspices of DEA to provide specialist assistance in releasing entangled animals | Repair / restore 4 | Report any collisions with large whales to the International Whaling Commission (IWC) database, which has been shown to be a valuable tool for identifying the species most affected, vessels involved in collisions, and correlations between vessel speed and collision risk (Jensen & Silber 2003). | Repair or restore	Very Low
Prospecting and Closure	Equipment lost to the seabed	Equipment and seabed/marine environment and fauna	Operational	Very Low	No. | Mitigation measure | Classification 1 | Ensure containers are sealed / covered during transport and loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system. | Avoid 2 | Minimise the lifting path between vessels. | Avoid 3 | Maintain an inventory of all equipment and undertake frequent checks to ensure these items are stored and secured safely on board each vessel. | Avoid 4 | Notify SAN Hydrographer of any hazards left on the seabed or floating in the water column, and request that they send out a Notice to Mariners with this information. | Repair / restore	Very Low
Prospecting and Closure	Operational Spills and Vessel Accidents	seabed/marine environment and fauna	Operational	Very Low	In addition to the best industry practices and project standards, the following measures must be implemented to manage the impacts associated with small accidental spills: No. | Mitigation measure | Classification 1 | Ensure that vessels operate in accordance with South African Maritime safety regulations to minimise risks of accidents | Avoid / reduce at source 2 | Refuelling of vessels is to occur under controlled conditions in a harbour only, i.e. bunkering at sea is not permitted | Avoid / reduce at source 3 | Ensure personnel are adequately trained in both accident prevention and immediate response, and resources are available on each vessel. | Avoid / reduce at source 4 | Ensure that the vessel operator has prepared and implemented a Shipboard Oil Pollution Emergency Plan and an Oil Spill Contingency Plan. In doing so, take cognisance of the South African Marine Pollution (Control and Civil Liability) Act, 1981 (No. 6 of 1981), Marine Pollution (Prevention of Pollution from Ships) Act, 1986 (No. 2 of 1986) and Marine Pollution (Intervention) Act, 1987 (No. 65 of 1987), which sets out national policies, principles and arrangements for the management of emergencies including oil pollution in the marine environment. | Abate on and off site 5 | Use low toxicity dispersants cautiously and only with the permission of DFFE. | Abate on and off site 6 | As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill | Abate on site 7 | Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station. | Restore	Very Low
Operational	Impacts on Underwater Heritage Resources	Pre-Colonial Sites And Artefacts Shipwrecks Possibly In 12b	Operational	Low - Very Low – Very Low – Low – Medium—	Induction for site managers on archaeological site and artefact recognition. Geophysical surveys would possibly identify wrecks and wreck debris. Reporting of sites to the heritage practitioner for assessment and evaluation. Avoiding the wrecks would preserve these MUCH resources.	Low + Very Low + Low + Low + Medium +

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop)	SIGNIFICANCE if mitigated
		Shipwrecks With No Heritage Significance Shipwrecks Possibly In 12B Shipwrecks With A Low Heritage Significance Shipwrecks Possibly In 12B Shipwrecks With A Medium Heritage Significance Shipwrecks Possibly In 12B Shipwrecks With A High Heritage Significance Shipwrecks Improbably In 12B Shipwrecks With No Heritage Significance Shipwrecks Improbably In 12B Shipwrecks With Low Heritage Significance Shipwrecks Improbably In 12B Shipwrecks With Medium Heritage Significance Shipwrecks Improbably In 12B Shipwrecks With High Heritage Significance		Very Low – Very Low – Low – Medium -		Very Low + Low + Low + Medium +
	Impacts on Underwater Palaeontological Resources	Cretaceous Fossil Wood Cenozoic Shelly Macrofauna Fossil Bones and Teeth Shells from the Last Transgression Sequence	Operational	Medium – Medium to High - Medium to High - Medium -	The EMPs for the prospecting and mining rights areas must therefore include provisions for the collection of representative examples of the fossils that occur therein. As part of Environmental Awareness Training, geological staff involved in logging must be informed of the need to watch for fossil material and rescue such from the vibracores, grab samples and the drillship gravel oversize screen. The prospecting/mining company must apply to SAHRA for a general permit to destroy, damage, excavate, disturb and collect fossils identified during sampling and mining, as per the NHRA. Vibracores and Grab Samples Fossils may be found during the processing of the vibracores and grab samples. These may be obvious, such as petrified bone and teeth and shell casts, usually phosphatic. All material of potential interest must have the details of context recorded and be kept for identification by an appropriate specialist and if significant, to be deposited in a curatorial institution such as the IZIKO SA Museum. The identification of extralimital, Agulhas "sub-fossil" shell species in the loose shells of the Last Transgression Sequence requires a level of seashell knowledge. The best outcome for a set of cores from this poorly-known area is that they are the subject of a detailed study, such as for a B.Sc. Honours or M.Sc. project, with radiocarbon dates. It is possible that a core or two might intersect rarely preserved lagoonal deposits which are important for providing points on the sea-level curve applicable to the West Coast (Runds *et al*., 2018). Collection of Fossil Material during Prospecting and Mining As part of the normal sampling and mining process the material crossing the oversize screen (Figure 6) must be monitored for the occurrence of the various fossil types. Potential fossil material should be collected for later identification and evaluation. For overall monitoring purposes it is suggested that a few small bulk samples of shells (~5 litres) be collected on occasion. The idea is to sample the typical assemblage at a few points in the sampling/mining area. It is possible that an uncommon assemblage may be encountered, such as a shallow-water fauna or a lagoonal fauna, in which case it should also be sampled. Data to be recorded during fossil collection includes:	Medium + Medium to High + Medium to High + Medium +

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop)	SIGNIFICANCE if mitigated
					 • Date • Company name • Sample no. • Collector's name • Position (co-ordinates) • Water depth • Sample subsurface depth • Vessel • Brief description and photographs • A copy of the graphic log of the sample drill hole or mining face showing the vertical sequence of units and the estimated location of the fossil in the sequence. A map of the fossil finds in the particular sampling/mining area, such as a contoured multibeam bathymetric image showing the context of samples in relation to the bedrock topography and sediment bodies. Collected samples are to be temporarily stored by the company. Figure 6. The gravel oversize screen on a typical diamond mining vessel where the geological personnel monitor the material being dredged and where fossil collection takes place When a collection of fossil material has been accumulated, the appointed palaeontologist should undertake the identification and evaluation of the fossil material and compile the report for submission to SAHRA. A selection of material could be removed for further study. The Environmental Manager/Officer is to liaise with the appointed palaeontologist on the progress of the fossil collection and the scheduling of the evaluation. During all operations, personnel can send queries and images by email to an appointed palaeontologist for evaluation and prompt feedback.	
Vessel operation and physical presence	Disturbance	Vessels and shipping	Operational Phase – Phase 1, 2 and 3	Insignificant	N/A	Insignificant
Vessel and equipment operation during all activities including seismic surveys, core, grab and drill sampling	Reduction in fishing success and decline in socio-economic conditions	Local fishing communities dependent upon these resources and local economy	Operational Phase – Phase 1, 2 and 3	Very Low to insignificant	• Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities; • Remedy through design measures and noise control of survey equipment; • Control through management • Remedy through suspending activities. • An open line of communication will be established with other existing industries operating in the area where sampling is planned to align activities. • Undertake surveys when fishing effort is lower (preferably outside of fishing seasons). • Appoint a Fisheries Liaison Officer (FLO) to facilitate communication with the Small Pelagic Purse Seine Fishing Industry Association. The FLO should report daily on vessel activity and respond and advise on action to be taken in the event of encountering purse seine fishing vessels in the survey area.	Insignificant

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE if not mitigated	MITIGATION TYPE (modify, remedy, control, or stop)	SIGNIFICANCE if mitigated
Vessel operation and physical presence	Prospecting activity on the local tourism and businesses	The local tourism and businesses	Operational Phase	Very Low	•Monitor water-quality surrounding the sediment plumes. •Should any negative visual impacts be detectable, restrict prospecting activities during important tourism events and seasons. •Should any negative visual impacts be detectable, restrict operational activities to the section of the concession area out of sight from the shore	
Vessel operation and physical presence	Prospecting activity on the Sense of Place, Health and Wellbeing	Local communities	Operational Phase	Insignificant	N/A	
Vessel operation and physical presence	Prospecting activity on the local households	Local communities	Operational Phase	Insignificant	N/A	
Vessel operation	Increase in local crime	Local communities	Operational Phase	Insignificant	N/A	
Prospecting activities	Increase in regional economic opportunities and socio-economic values	WCDM and South African economy	Operational Phase – Phase 1, 2 and 3	Very low to insignificant positive	N/A	N/A

The supporting impact assessment conducted by the EAP must be attached as an appendix, marked **Appendix E**

11 SUMMARY OF SPECIALIST REPORTS

Table 35: Summary of Specialist Reports

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
Heritage Impact Assessment	A Heritage Impact Assessment Report was prepared by Vanessa Maitland (attached as **Appendix E, Heritage Impact Assessment, page 333**): *"A wide variety of sources were consulted to build this database. It may well be missing earlier, unrecorded wrecks. There is always the possibility of an early unknown wreck being found, as happened in Oranjemund when the Bom Jesus (1533) was discovered in 2008 during diamond mining operations (Alves 2011). There were no submerged objects or wrecks noted on SAN Chart 117 (SA Navy 1995) or in the Garmin electronic charts (Garmin Marine Charts 2022).* *In Sea Concession 12B there may be 48 shipwrecks, dating from the 1500s through to modern times.* *According to database, there are no DEFINITE wrecks, within the area. This would be able to be verified with geophysical data.* *There are five wrecks that may POSSIBLY be in Sea Concession 12B.* *The first is a modern wreck. It is reported as being lost 1 km off the coast, but the distance may be greater. This would be able to be verified with geophysical data. While the wreck has no heritage significance according to the NHRA, three local fishermen lost their lives and their family probably still live in the area. The contractors should be sensitive to this, and deal with it appropriately if they find the wreck.* *One is of LOW significance, although I am unsure about this prediction due to a dearth of information.* *There are two wrecks of MEDIUM significance. One is a whaler, that I could not track down more information on. However, given that the American whalers apparently anchored at Elizabeth Bay, entering the river with boats to row upstream for water and provisions (Green 1967) and that the whaling industry in the 19th century was underreported and not well documented, there may be other whaler wrecks in the area.* *There are two wrecks of HIGH significance. Although these vessels are probably on the beach, it is a high energy coast there is a considerable amount of sand movement which may have shifted the wrecks. There may also be artefacts of the wreck site that may have been washed offshore.*	**X** All of the recommendations included in the column to the left have been included in this report.	Section 8.1.2 **Appendix E, 4.1 Heritage Impact Assessment, page 333** PART B: **EMPr**, **page 240** **Table 38** Impact Tables (**Appendix F, page 581**) Final Rehabilitation, Decommissioning and Mine Closure Plan **(Appendix G, page 606**)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
	The other 42 shipwrecks may be found in this area during work, although it is IMPROBABLE. *These are vessels that either disappeared between two ports or were abandoned mid-ocean. One tries, through research, to narrow down the areas where these vessels were lost, if they are still in the list, it is because there is insufficient information to remove them.* *One of the* IMPROBABLE *shipwrecks is modern (younger than 60 years) and is not protected by the NHRA.* *Seven of the vessels are from the early 20th century (prior to 1962), with four that were sunk during World War II.* *Twenty vessels are from the 19th century, the heyday of sailing vessels. Eight vessels are from the 18th century, all VOC ships that went missing en route to the Netherlands, and two are from the 17th century. Four are from the 16th century, although it is highly unlikely that they are in this area.* *The significance of most of the wrecks is low or medium. There are, however, a few that may have a high significance factor. These include very old ships, war-time losses, and other vessels with a specific national or international significance. The significance of a shipwreck is hard to pinpoint without significant research and would have to be dealt with on an ad hoc basis if they are discovered.* *The potential for recovering pre-Colonial, Stone Age artefacts must be borne in mind.* *At the time of writing this report, no geophysical data for the area was available. When such surveys are undertaken, and any shipwrecks or shipwreck debris is noted, images and coordinates for these should be shared with the heritage practitioner and the MUCH Unit at SAHRA. This must be undertaken before bulk sampling has begun.* *This specialist study has found that there is a low possibility that impacts to underwater heritage could occur through the proposed development. The present report finds that the project is feasible, so long as the stipulated management (mitigation) measures are applied. With mitigation there is the possibility of a benefit to our heritage knowledge base through the discovery and recording of previously unknown underwater heritage.* 1. RECOMMENDED MANAGEMENT MEASURES *Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded (with an approved*		

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	Mitigation Permit from the MUCH Unit at SAHRA) and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future. ***Objectives*** • *Protection of heritage sites within the project boundary against vandalism, destruction, and theft.* • *The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during development activities.* ***The following shall apply:*** • *The proposed geophysical surveys should be inspected for wrecks and wreck debris. If any are noted or suspected, these images should be shared with the heritage practitioner for evaluation and assessment against the database and excluded* ***prior to undertaking sampling activities****.* • *The Environmental Control Officer should be given a short induction, by the heritage practitioners, on archaeological site and artefact recognition.* • *The contractors and workers should be notified that archaeological sites might be exposed during the prospecting activities.* • *Should any heritage artefacts be exposed during prospecting, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer and SAHRA shall be notified as soon as possible;* • *All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;* • *Where possible, if any heritage resources are accidently recovered photographs of them must be taken, noting the date, time, location and types of artefacts found. Under no circumstances may any artefacts be removed, destroyed or interfered on the site, unless under permit from SAHRA.* • *Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and* • *Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological, or palaeontological artefacts, as set out in the NHRA (Act No. 25 of 1999), Section 51. (1).*		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
	*(Referenced from Section 10 in **Appendix E, 4.1 Heritage Impact Assessment, page 333**).*		
A palaeontological impact assessment was commissioned by the HIA specialist and provided by John Pether, a Geological and Palaeontological Consultant.	A **palaeontological impact assessment** of the area was undertaken by John Pether, Geological and Palaeontological Consultant to determine the palaeontological sensitivities of the affected areas (see **Appendix E, Paleontological Impact Assessment, page 374**): ***The following recommendations are made*** *"The exploration and mining for diamonds in the marine environment is a once-off, never to be repeated opportunity to obtain fossils from various areas of the continental shelf, from deposits of various ages. It is cutting-edge, commercially-driven exploration at a scale and detail unaffordable by the state. In order to not overlook such opportunity to advance science co-operatively, the ambit of contemporary environmental management includes such concerns. The additional input from fossil information will be of benefit for the geological interpretation of the deposits. A find of an important fossil can generate favourable publicity. In the longer term, the offshore fossil heritage should also be made available in more permanent exhibitions at an appropriate facility.* *The EMPs for the prospecting and mining rights areas must therefore include provisions for the collection of representative examples of the fossils that occur therein. As part of Environmental Awareness Training, geological staff involved in logging must be informed of the need to watch for fossil material and rescue such from the vibracores, grab samples and the gravel oversize screens of the drillship, dredge-ship and crawler vessels.* *The prospecting/mining company must apply to SAHRA for a general permit to destroy, damage, excavate, disturb and collect fossils identified during sampling and mining, as per the NHRA.* ***11.1 Vibracores and Grab Samples*** *Fossils may be found during the processing of the vibracores and grab samples. These may be obvious, such as petrified bone and teeth and shell casts, usually phosphatic. All material of potential interest must have the details of context recorded and be kept for identification by an appropriate specialist and if significant, to be deposited in a curatorial institution such as the IZIKO SA Museum.* *The identification of extralimital, Agulhas "sub-fossil" shell species in the loose shells of the Last Transgression Sequence requires a level of seashell knowledge. The best outcome for a set of cores from this poorly-known area is that they are the subject of a detailed study, such as for a B.Sc. Honours or*	**X** All of the recommendations included in the column to the left have been included in this report.	Section 8.1.2 **Appendix E, 4.2 Paleontological Impact Assessment, page 374** PART B: **EMPr**, **page 240** **Table 38** Impact Tables (**Appendix F, 581**) Final Rehabilitation, Decommissioning and Mine Closure Plan **(Appendix G, page 606**)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
	M.Sc. project, with radiocarbon dates. It is possible that a core or two might intersect rarely preserved lagoonal deposits which are important for providing points on the sea-level curve applicable to the West Coast (Runds et al., 2019). ***11.2 Collection of Fossil Material during Prospecting and Mining*** *As part of the normal drillship sampling and bulk sampling processes the material crossing the oversize screen (Figure 6) must be monitored for the occurrence of the various fossil types. Potential fossil material should be collected for later identification and evaluation.* *For overall monitoring purposes it is suggested that a few small bulk samples of shells (~5 litres) be collected on occasion. The idea is to sample the typical assemblage at a few points in the sampling/mining area. It is possible that an uncommon assemblage may be encountered, such as a shallow-water fauna or a lagoonal fauna, in which case it should also be sampled.* *Data to be recorded during fossil collection includes:* • *Date* • *Company name* • *Sample no.* • *Collector's name* • *Position (co-ordinates)* • *Water depth* • *Sample subsurface depth* • *Vessel* • *Brief description and photographs* • *A copy of the graphic log of the sample drill hole or mining face showing the vertical sequence of units and the estimated location of the fossil in the sequence.* • *A map of the fossil finds in the particular sampling/mining area, such as a contoured multibeam bathymetric image showing the context of samples in relation to the bedrock topography and sediment bodies.*		

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	 ***Figure 6. The gravel oversize screen on a typical diamond sampling vessel where the geological personnel monitor the material being dredged and where fossil collection takes place.*** *Collected samples are to be temporarily stored by the company.* *When a collection of fossil material has been accumulated, the appointed palaeontologist should undertake the identification and evaluation of the fossil material and compile the report for submission to SAHRA. A selection of material could be removed for further study. The Environmental Manager/Officer is to liaise with the appointed palaeontologist on the progress of the fossil collection and the scheduling of the evaluation.* *During all operations, personnel can send queries and images by email to an appointed palaeontologist for evaluation and prompt feedback.* *(Referenced from Section 10 in **Appendix E2, 4.2 Paleontological Impact Assessment, page 374**).*		
Pisces Environmental Services (Pty) Ltd	A Marine Fauna Impact Assessment Report was prepared by Pisces Environmental Services (Pty) Ltd (attached as **Appendix E, Marine Fauna Impact Assessment, page 396**):	**X** All of the recommendations included in the column	Section 8.1.2 **Appendix E, Paleontological Impact Assessment, page 396**

Recommendations and Conclusions

Environmental Acceptability and Impact Statement

The main marine impacts associated with the proposed exploration activities are related to acoustic impacts on marine mammals and disturbance and loss of benthic macrofauna in the sampling footprint. No fatal flaws have been identified. Environmental impacts associated with the survey and sampling operations are summarised below:

Impact	***Significance (before mitigation)***	***Significance (after mitigation)***
General Operations		
Noise from geophysical surveying on marine fauna	*Low*	*Very Low*
Noise from sampling operations on marine fauna	*Very Low*	*Very Low**
Disturbance and loss of benthic macrofauna	*Very Low*	*Very Low**
Disturbance and loss of rock lobster	*Very Low*	*Very Low*
Crushing of benthic fauna during sampling	*Very Low*	*Very Low*
Generation of suspended sediment plumes	*Very Low*	*Very Low**
Remobilisation of contaminants and nutrients	*Very Low*	*Very Low**
Smothering of benthos in unconsolidated sediments by redepositing tailings	*Very Low*	*Very Low**
Smothering of reef communities by redepositing tailings	*Low to Medium*	*Low*
Impacts due to loss of ferrosilicon	*Very Low*	*Very Low*
Pollution of the marine environment through operational discharges to the sea from mining vessel	*Low*	*Low*
Lighting from survey and sampling vessels	*Very Low*	*Very Low*
Unplanned Events		
Vessel strikes and entanglement in gear	*Very Low*	*Very Low*
Potential loss of equipment to the seabed	*Very Low*	*Very Low*
Operational Spills and vessel accidents	*Medium*	*Low to Medium*

Most of the potential impacts associated with the prospecting activities would occur in the immediate vicinity of the vessel, would be of short term duration and of low to high intensity, and can thus mostly be considered to be of VERY LOW or LOW significance. Exceptions are smothering of reef communities by redepositing tailings when impacts can be considered of LOW to MEDIUM significance. For unplanned activities, most of the potential impacts are likewise of VERY LOW significance, with the exception of operational spills and vessel accidents, which are considered of MEDIUM significance but

to the left have been included in this report.

PART B: **EMPr**, **page 240**

Table 38

Impact Tables (**Appendix F, 581**)

Final Rehabilitation, Decommissioning and Mine Closure Plan **(Appendix G, page 606**)

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
	with a very low likelihood of occurrence. The impacts identified above, along with other areas of concern raised by stakeholders during the scoping process, are addressed in more detail in the Social and Environmental Management Plan. The process followed meets the requirements of the National Environmental Management Act (1998) to ensure that the regulatory authorities receive sufficient information to enable informed decision-making. *With the exception of the noise from sampling operations, disturbance and loss of benthic fauna, generation of suspended sediment plumes during tailings discharge and smothering of benthos in unconsolidated sediments (which are unavoidable and cannot be mitigated), recommended management actions and mitigation measures would reduce the negative impacts to low or very low.* *In the case of the "no-development" alternative, the primary impacts, namely acoustic disturbance of marine fauna (surveying) and disturbance and elimination of invertebrate macrofauna in unconsolidated sediments (drill and bulk sampling) will not occur. From a marine perspective this is undeniably the preferred alternative, as all impacts associated with prospecting operations will no longer be an issue. This must, however, be seen in the context of the low significance of most of the impacts assessed and the comparatively small impact footprint. Furthermore, it needs to be weighed up against the potential positive socio-economic impacts undoubtedly associated with the project itself.* *Should prospecting operations proceed, however, the marine biota in the prospecting target areas will be affected (albeit spatially and temporally constrained) regardless of the implementation of mitigation measures. All residual impacts, however, are of low or very low significance.* ***Recommendations*** ***<u>Compliance with EMP and Marpol 73/78 standards</u>*** *All phases of the survey and prospecting activities must comply with the Environmental Management Programme compiled for the project. Furthermore, the survey and sampling vessels must ensure compliance with MARPOL 73/78 standards.* ***<u>Notification and communication with key Stakeholders</u>*** • *Notify all key stakeholders prior to the commencement of geophysical surveys and sampling activities;*		

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	• *Liaise with the rock lobster industry to ensure that there is no overlap of activities in the same area over the same time period;* • *Prior to the commencement of activities, notify relevant bodies including: DME, the South African Navy (SAN) Hydrographic Office, relevant Port Captains and DFFE. These bodies must be notified of the navigational coordinates of any location prior to commencement of such activities;* • *Appropriate notices should be distributed timeously to mariners providing:* ➢ *The co-ordinates of the survey and sampling activities;* ➢ *An indication of the survey timeframes; and* ➢ *Reports on the location of survey/sampling vessels.* ***<u>Discharges and Emissions</u>*** • *Provide training and awareness to crew members of the need for thorough cleaning up of any spillages immediately after they occur in order to minimise the volume of contaminants washing off decks;* • *Use low toxicity, biodegradable detergents and reusable absorbent cloths during deck cleaning to further minimise the potential impact on the marine environment;* • *Machinery spaces must drain into bilge tanks in compliance with MARPOL Annex I;* • *'Save-alls' must be utilised around specific equipment, bunkering points and vents on open deck areas to prevent release of contaminated water overboard;* • *Undertake adequate maintenance of all hydraulic systems;* • *No solid waste may be disposed to the marine environment;* • *Ensure that stringent waste management practices are in place at all times; and* • *The vessel operator would be required to comply with the MARPOL 73/78 Annex IV requirements, wherever possible.* ***<u>Vessel Seaworthiness and Safety</u>*** • *The survey and sampling vessels must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. Lloyds Register, Det Norske Veritas);* • *The survey and sampling vessels should be equipped with collision prevention equipment including radar, multi-frequency radio, foghorns, etc. Safety equipment and training of personnel*		

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	to ensure the safety and survival of the crew in the event of an accident is a further legal requirement; • *Seek to reduce the probabilities of accidental and/or operational spills through enforcement of stringent oil spill management systems. These should incorporate plans for emergencies; and* • *Refueling will occur under controlled conditions in a harbour only.* ***Geophysical Surveying*** *The following mitigation measures are proposed during geophysical surveying:* • *Onboard Marine Mammal Observers (MMOs) should conduct visual scans for the presence of cetaceans around the survey vessel prior to the initiation of any acoustic impulses.* • *Pre-survey scans should be limited to 15 minutes prior to the start of survey equipment.* • *"Soft starts" should be carried out for any equipment of source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes to give adequate time for marine mammals to leave the vicinity.* • *Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the mammal has vacated the area.* • *The geophysical surveying should largely be undertaken between December and May, thereby avoiding the main migration period of baleen whales from their southern feeding grounds into low latitude waters. However, during the transition periods in June and November, surveying would be possible with stricter mitigation measures. As no seasonal patterns of abundance are known for odontocetes occupying the concession area, a precautionary approach to avoiding impacts throughout the year is recommended.* • *If feasible schedule the survey to take place between February and May thereby avoiding the main seabird breeding seasons (March to October) and penguin summer moult periods (October to January).* • *Ensure that PAM (passive acoustic monitoring) is incorporated into any surveying taking place between June and November.* • *A MMO should be appointed to ensure compliance with mitigation measures during geophysical surveying.* • *All vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel.*		

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	• *Ensure vessel transit speed between the survey area and port is a maximum of 12 kts (22 km/hr), except within 25 km of the coast where it is reduced further to 10 kts (18 km/hr) as well as when sensitive marine fauna are present in the vicinity.* • *A non-dedicated marine mammal observer (MMO) must keep watch for marine mammals behind the vessel when tension is lost on any towed equipment. Either retrieve or regain tension on towed gear as rapidly as possible.* • *Should a cetacean become entangled in mooring buoys or towed gear, contact the South African Whale Disentanglement Network (SAWDN) formed under the auspices of DEA to provide specialist assistance in releasing entangled animals.* • *Report any collisions with large whales to the International Whaling Commission (IWC) database, which has been shown to be a valuable tool for identifying the species most affected, vessels involved in collisions, and correlations between vessel speed and collision risk (Jensen & Silber 2003).* ***<u>Drill and Trench Sampling</u>*** *The following mitigation measures are proposed during sampling operations:* • *Prospecting sampling targets gravel bodies and would thus avoid known sensitive habitats and high-profile, predominantly rocky-outcrop areas without a sediment veneer. Prior to bulk sampling, a visual sampling programme must be undertaken in rocky-outcrop areas (should these have been identified during the geophysical surveying) to identify sensitive communities.* • *Implement dynamically positioned sampling vessels in preference to vessels requiring anchorage.* • *Use geophysical data to conduct a pre-sampling geohazard analysis of the seabed, and near-surface substratum to map potentially vulnerable habitats and prevent potential conflict with the sampling targets.* • *The positions of all lost equipment must be accurately recorded in a hazards database, and reported to maritime authorities. Every effort should be made to remove lost equipment.* • *Adhere strictly to best management practices recommended in the relevant EIA and EMPr and that of MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships, 1973) for all necessary disposals at sea.* • *Develop a waste management plan using waste hierarchy.*		

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	Recommended Environmental Management Actions *Most potential environmental impacts resulting from the proposed prospecting activities would be integrally managed in such a way as to prevent or minimise them. This is particularly the case for waste management, pollution control, equipment recovery and disaster prevention. Other potential but unlikely impacts (e.g. occurrence / behaviour of marine mammals around survey and sampling vessels) should be closely monitored to ensure that adequate responses can be implemented, should a significant impact be detected.* *The only impact which cannot be prevented or minimised through these integrated environmental management measures is the primary impact resulting from the removal of seabed sediments as part of the sampling itself. As there is no practical way of actively 'rehabilitating' these excavations other than discarding tailings back into the sampled area, recovery of the impacted habitats must rely on the gradual but continuous natural movement and deposition of fine sediments onto the seabed. Considering the comparatively small area of seabed impacted by sampling activities, the development of a monitoring plan to demonstrate natural recovery processes is not deemed necessary during the prospecting phase.* *Should prospecting activities indicate economic viability of the resource, allowances for a well-designed benthic monitoring programme should be made during the feasibility phase of the project.* ***Conclusions*** *If all environmental guidelines, and appropriate mitigation measures and management actions advanced in this report, and the EIA and EMPr for the proposed prospecting operations as a whole, are implemented, there is no reason why the proposed prospecting activities should not proceed.*		

12 ENVIRONMENTAL IMPACT STATEMENT

12.1 Summary of the key findings of the environmental impact assessment

12.1.1 Summary of the key findings of the environmental impact assessment;

Potential direct, indirect and cumulative impacts of the proposed prospecting and sampling activities on the environment have been identified, described and assessed in this report. Risks and impacts associated with the proposed activities range from medium to insignificant but with effective mitigation these can all be reduced to low, very low or insignificant. Potential impacts of most concern include noise disturbance to marine mammals, crushing of marine fauna, and disruption of fishing activities.

Both positive and negative impacts associated with not continuing with the prospecting activities, were identified. The negative impacts include lost opportunities in terms of collecting baseline environmental data, determining the presence of offshore mining resources and socio-economic benefits. This impact is, however, considered to be of low significance. The positive implications of the no-go option, on the other hand, is that there would be no effects on the biophysical environment in the proposed area. This was also assessed to be of low significance considering the lost opportunity in terms of scientific data and economic opportunities.

The significance ratings of impacts after mitigation on the key aspects of the “preferred alternative” and the “no go” alternative are shown per phase in the following tables.

Table 36: Summary of the key findings of the environmental impact assessment

<table>
<tr><th>IMPACTS AND ASPECTS</th><th>PREFERRED AND ONLY ALTERNATIVE - RISKS</th><th>NO-GO ALTERNATIVE</th></tr>
<tr><td colspan="3">Impact Assessment during Operational Phase</td></tr>
<tr><td>1. Impacts of multi-beam and sub-bottom profiling sonar on marine fauna</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>2. Impacts of noise from sampling operations on marine fauna</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>3. Disturbance and loss of benthic fauna during sampling</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>4. Disturbance to and loss of rock lobsters.</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>5. Crushing of benthic fauna during sampling</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>6. Increased turbidity in suspended sediment plumes and at the seabed</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>7. Remobilisation of contaminants and nutrients.</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>8. Smothering of benthos in redepositing tailings</td><td>Very Low -</td><td></td></tr>
<tr><td>9. Redeposition of discarded sediments on soft-sediment macrofauna</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>10. Redeposition of discarded sediments: smothering effects on rocky outcrop communities</td><td>Low -</td><td>NO IMPACT</td></tr>
<tr><td>11. Loss of Ferrosilicon</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>12. Pollution of the marine environment through Operational Discharges from the Sampling Vessel(s)</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>13. Disturbance and behavioural changes in pelagic fauna due to vessel lighting</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>14. Collision of Vessels with Marine Fauna and Entanglement in Gear</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>15. Equipment lost to the seabed</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td>16. Operational Spills and Vessel Accidents</td><td>Medium to Low -</td><td>NO IMPACT</td></tr>
<tr><td>17. Impacts on Underwater Heritage Resources: Pre-Colonial Sites And Artefacts</td><td>Low +</td><td>NO IMPACT</td></tr>
<tr><td colspan="2">18. Impacts on Underwater Heritage Resources:Shipwrecks possibly in 12B<table><tr><td>Shipwrecks possibly in 12B</td><td>Shipwrecks possibly in 12B</td><td>Shipwrecks possibly in 12B SHIPWRECKS WITH A MEDIUM</td><td>Shipwrecks possibly in 12B SHIPWRECKS WITH A HIGH HERITAGE SIGNIFICANCE</td></tr></table></td><td>NO IMPACT</td></tr>
</table>

<table>
<tr><th colspan="4">IMPACTS AND ASPECTS</th><th>PREFERRED AND ONLY ALTERNATIVE - RISKS</th><th>NO-GO ALTERNATIVE</th></tr>
<tr><td colspan="6">Impact Assessment during Operational Phase</td></tr>
<tr><td>SHIPWRECKS WITH NO HERITAGE SIGNIFICANCE</td><td>SHIPWRECKS WITH A LOW HERITAGE SIGNIFICANCE</td><td>HERITAGE SIGNIFICANCE</td><td colspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Very Low +</td><td>Low +</td><td>Low +</td><td colspan="2">Medium +</td></tr>
<tr><td colspan="5">19. Impacts on Underwater Heritage Resources SHIPWRECKS IMPROBABLY IN 12B</td><td rowspan="3"></td></tr>
<tr><td>SHIPWRECKS IMPROBABLY IN 12B
SHIPWRECKS WITH NO HERITAGE SIGNIFICANCE</td><td>SHIPWRECKS IMPROBABLY IN 12B
SHIPWRECKS WITH LOW HERITAGE SIGNIFICANCE</td><td>SHIPWRECKS IMPROBABLY IN 12B
SHIPWRECKS WITH MEDIUM HERITAGE SIGNIFICANCE</td><td colspan="2">SHIPWRECKS IMPROBABLY IN 12B
SHIPWRECKS WITH HIGH HERITAGE SIGNIFICANCE</td></tr>
<tr><td>Very Low +</td><td>Low +</td><td>Low +</td><td colspan="2">Medium +</td></tr>
<tr><td colspan="5">20. Impact on Underwater Palaeontological Resources</td><td rowspan="3">NO IMPACT</td></tr>
<tr><td>Cretaceous Fossil Wood</td><td>Cenozoic Shelly Macrofauna</td><td>Fossil Bones and Teeth</td><td colspan="2">Shells from the Last Transgression Sequence</td></tr>
<tr><td>Medium +</td><td>Medium – High +</td><td>Medium – High +</td><td colspan="2">Medium +</td></tr>
<tr><td colspan="4">21. Tuna pole and line fishing</td><td>Neglible</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">22. Traditional Linefish Sector</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">23. Small Pelagic Purse Seine Fisheries</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">24. Prospecting activity on the local tourism and businesses</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">25. Prospecting activity on the Sense of Place, Health and Wellbeing</td><td>Insignificant</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">26. Prospecting activity on the local households</td><td>Insignificant</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">27. Prospecting activity on the local crime performance</td><td>Insignificant</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">28. Prospecting activity on the regional socio-economic performance</td><td>Insignificant</td><td>NO IMPACT</td></tr>
<tr><td colspan="6">Impact Assessment during Decommissioning and Closure Phase</td></tr>
<tr><td colspan="4">1. Survey/Sampling Vessel To Leave Area</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">2. Communication And Information To Relevant Parties Of Mining Completion</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">3. Rehabilitation And Closure</td><td>Very Low -</td><td>NO IMPACT</td></tr>
<tr><td colspan="4">4. Final Waste Disposal</td><td>Very Low</td><td>NO IMPACT</td></tr>
</table>

All of the negative identified impacts will occur for a limited period and the extent of the negative impacts will be localised. All of the identified impacts can be suitably mitigated. There is a correlation between cumulative impacts post-mitigation, and the significance rating of impacts after mitigation as indicated in **Appendix E.**

12.2 Final Site Map

Refer to Figure 2**(page 4**) above for the location of the prospecting area over Sea Concession 12B that comprise this Prospecting Right Application.

12.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

Refer to Section 11.1 above.

12.4 Proposed Impact Management Objectives and the impact management outcomes for inclusion in the EMPr

12.4.1 Management Objectives

The proposed impact management objectives are listed below:

- Objective 1 - To create a safe and healthy post-mining environment
  - Develop a landscape that reduces the requirement for long term monitoring and management
  - Prevent degradation of coastal areas through littering, dumping of scrap mining equipment and scarring of the landscape by the proliferation of beach access roads and tracks, tailings dump etc.
  - Prevent waste discharges leading to pollution of freshwater on land and seawater.
- Objective 2 - To create a stable, post mining landform, which is compatible with the surrounding landscape
  - Economically viable and sustainable offshore area without physical and associated ecological modification as close as possible to its natural state.
  - Prevent disturbance to important biological communities such as seals, birds, whales and dolphins, damage to coastal vegetation and the loss of or damage to cultural and heritage sites.
  - Minimise the compromised water quality and sediment inundation of areas adjacent to those being mined due to mine tailings (oversize and undersize sediments) discharge and disposal.
- Objective 3 – To provide optimal post-mining social opportunities
  - Optimised benefits for the social environment
  - Minimise the operation of exclusion zones around mining operations, both on the coast and at sea, that may preclude or limit access to the areas by other users, e.g. commercial fishermen
  - Prevent over-subscription of the sparse services and infrastructure that exists on the West Coast.

12.4.2 Outcomes

- By providing sufficient information to strategically plan the prospecting activities, unnecessary social and environmental impacts be avoided.
- Ensure an approach that will provide the necessary confidence in terms of environmental compliance.
- Provide a management plan that is effective and practical for implementation.
- Through the implementation of the proposed mitigation measures, it is anticipated that the identified social and environmental impacts can be managed and mitigated effectively.
- Noise and light generation can be managed through consultation and applying mitigation measures and by maintaining equipment and applying noise abatement equipment if necessary.
- Marine faunal disturbance will be limited to the absolute minimum required.
- Contamination by hydrocarbons can be managed by conducting proper vehicle maintenance, refuelling with care to minimise the chance of spillages and by having a spill kit available on each site.
- Impacts to the marine environment can be managed by limiting prospecting areas to the minimal required area.

12.5 Final Proposed Alternatives

Refer to Section 6.

12.6 Aspects for inclusion as conditions of the authorisation

Any aspects which must be made conditions of the Environmental Authorisation

It is the opinion of the EAP that the following conditions should form part of the authorisation:

- All environmental legislation must be complied with. Specific aspects to be adhered to from environmental legislation include National Environmental Management Act, Act 107 of 1998 (NEMA), Minerals and Petroleum Resources Development Act, Act 28 of 2002 (MPRDA).

12.7 Descriptions of any Assumptions, Uncertainties & Gaps in Knowledge

- It is assumed that all relevant project description information has been provided by the applicant and that all information provided is correct.
- Information pertaining to the geology, bathymetry and topography of the area is based on a desktop approach and available bathymetry data. This information might therefore change pending the results of seismic surveys to be undertaken as part of the prospecting activities.
- This information might therefore change pending the results of the seismic surveys. After completion of the survey, information should be reviewed to determine if the EMPr is still valid.
- Due to the paucity of data for this concession area, the exact location of the grab, core and drill samples are yet to be determined, pending the results of the seismic surveys.
- It is assumed that the project description and activities will not change after the completion of this report.
- It is assumed that the proposed mitigation measures as listed in this report and included in the **EMPr (page 240)** will be implemented and adhered to. Mitigation measures are proposed which are considered reasonable and must be implemented for the outcome of the assessment to be accurate.
- It is assumed that the **Rehabilitation, Decommissioning and Closure Plan (Appendix G, page 606**) and any annual Rehabilitation Plans as part of the production, will be implemented and adhered to.

12.8 Reasoned opinion as to whether the proposed activity should or should not be authorised

12.8.1 <u>Reasons why the activity should be authorized or not</u>

It is the opinion of the EAP that the proposed prospecting right activity should be authorised. In reaching this conclusion the EAP has considered that:

- The "preferred alternative" takes into account location alternatives, activity alternatives, layout alternatives, technology alternatives and operational alternatives.
- The approach taken is that it is preferable to avoid significant negative environmental impacts, wherever possible. There are no significant environmental impacts associated with the proposed activity and most are rated as Low to Insignificant.
- The site, and the offshore west coast, is located on areas classified as Critical Biodiversity Area or Ecological Support Area, the site has been disturbed by previous prospecting, bulk sampling and mining activities. It is the opinion of the EAP that the underlying biodiversity objectives and ecological functioning will not be compromised beyond returning of functionality , subject to the strict adherence to the **EMPr** (**page 240**) and **Rehabilitation, Decommissioning and Closure Plan** (**page 606**).
- The activity has been assessed to have a positive socio-economic impact, especially in terms of the creation of employment and the provision of diamonds for the local and international markets.
- Provided the recommended mitigation measures are implemented in an environmentally sound manner and mining activities are managed in accordance with the stipulations of the **EMPr**, and **Rehabilitation, Decommissioning and Closure Plan** (**page 606**), the potential negative impacts associated with the implementation of the preferred alternative can be reduced to acceptable levels.

12.9 Conditions that must be included in the authorization

12.9.1 <u>Specific conditions to be included in the compilation and approval of EMPr</u>

As per section 12.6 above:

13 PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

The prospecting right has been applied for a period of five (5) years. The Environmental Authorisation should therefore allow for 5 years of prospecting.

14 Undertaking

It is confirmed that the undertaking required to meet the requirements of this section is provided at the end of this report.

15 FINANCIAL PROVISION

15.1 Explain how the aforesaid amount was derived.

This amount was derived based on market research, quotations and information from other similar surveys. The following was taken from the **Final Closure, Decommissioning and Rehab Plan in page 606.**

15.1.1.1 Quantified Closure elements

15.1.2 Onshore logistical Area

The following risk-based criteria and assumptions were used to calculate the final rehabilitation, decommissioning and closure cost for on shore processing and provision of logistical facilities:

- No mining will take place on shore only provision of logistical facilities.
- Any item that has no salvage value to the mine, but could be of value to individuals, will be sold (zero salvage assumed in cost estimation) and the remaining treated as waste and removed from site
- Removal of all structures and infrastructure except for the infrastructure leased from the landowner.
- Remove all assets
- All vehicles, plant and workshop equipment will be removed for salvage or resale
- All fixed assets that can be profitably removed will be removed for salvage or resale
- A hazardous disposal site will not be constructed and all hazardous waste will be removed from site and transported to the nearest licensed facility
- Remove waste from temporary storage and scrap from salvage yard
- Clean out Wash/Service Bay, Bunded Fuel Storage and Temporary Waste storage
- Final clean-up 2.0Ha

15.1.3 Offshore Exploration

The following risk-based criteria and assumptions were used to calculate the final rehabilitation, decommissioning and closure cost for on offshore exploration operations:

- All prospecting activities including primary processing will take place on the vessel off shore.
- Formal rehabilitation of the sea bed below the low water mark is presently not possible, and in any event at present scales and rates of marine diamond mining not deemed necessary, as sediment and organisms are redistributed effectively by natural water movements particularly in <40 meters depth.
- Return tailings to the sea in the vicinity of their origin,
- No waste or other materials will be dumped on the sea bed or into the water column.
- Facilitate calculation of benthic "rehabilitation" rates through:
  - supply DMR with a map of surface areas, calculations of volumes, records of surficial sediment types disturbed for each year of prospecting, and
  - calculate areas and locations disturbed historically and supply to DMR.
- Restrict the rate of mining to <15% (water depths <40m) or <3% (water depths >40m) per year of the total concession area, until either adequate MPA's are set aside by Government or confidence in estimates of benthic recovery rates (at various depths and sediment types) have been improved by the appropriate scientific research.

15.2 Confirm that this amount can be provided for from operating expenditure

Refer to the Prospecting Works Programme.

16 DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

16.1 Deviations from the methodology used in determining the significance of potential environmental impacts and risks

No deviations from the methodology.

16.2 Motivation for the deviation

Not applicable.

17 Other Information required by the competent Authority

17.1 Compliance with the provisions of sections 24(4) (a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998)

The EIA report must include the: -

(1) Impact on the socio-economic conditions of any directly affected person

Potential socio-economic impacts have been addressed in Sections **8** & **12**. High-level socio-economic impacts and mitigation measures are included in 9.4.

A full consultation process is being implemented during the environmental authorisation process. The purpose of the consultation is to provide affected and interested persons with the opportunity to raise any potential concerns. Comments received or concerns raised in the scoping process was addressed as part of the Final SR and the comments received as part of the dEIAR are included in Section **5** and **Appendix B**, page 273.

2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

A Specialist Heritage Impact Assessment and Palaeontological Impact Assessment (attached at **Appendix E, page 333**) have been prepared. Both reports will be submitted to the South African Heritage Resources Agency (SAHRA) during the 30-day public participation comment period. Recommendations and conclusions from **Appendix E** are included in Section 10, page 220 above, and any additional measures stipulated by SAHRA will be included in the Final EIA Report, **EMPr** (Part B) on page 240, Impact Table (**Appendix F, page 581**) and Final Rehabilitation, Decommissioning and Mine Closure Plan (**Appendix G, page 606**).

The Heritage Impact Assessment Report and Palaeontological Assessment have been attached as Appendix E. The applicable mitigation measures have been included in the relevant sections.

Prospecting activities could potentially have an impact on submerged Prehistoric Heritage, Marine Palaeontological Resources present within Concession area 12B. The significance of prospecting-related impacts on such material was assessed to be very low for Prehistoric Heritage and Palaeontological Resources. There is potential for the status of the potential impacts to be changed from negative to positive if core samples are retained for assessment of paleoenvironmental and prehistoric lithic material.

18 Other matters required in terms of sections 24(4) (a) and (b) of the Act

Section 2 of NEMA sets out a number of principles (see section 5.7 above) that are relevant to the:

- EIA process, such as:
  - Adopt a risk-averse and cautious approach;
  - Anticipate and prevent or minimise negative impacts;
  - Pursue integrated environmental management;
  - Involve stakeholders in the process; and
  - Consider the social, economic and environmental impacts of activities; and regarding the
- Project such as:

- Place people and their needs at the forefront of concern and serve their needs equitably;
- Ensure development is sustainable, minimises disturbance of ecosystems and landscapes, pollution and waste, achieves responsible use of non-renewable resources and sustainable exploitation of renewable resources;
- Assume responsibility for project impacts throughout its life cycle; and the
- Polluter pays for remediation costs.

This EIA process complies with the principles set out in section 2 of NEMA through its adherence to the EIA Regulations 2014 (as amended), and associated guidelines, which set out clear requirements for, inter alia, impact assessment and stakeholder involvement, and through the assessment of impacts and identification of mitigation measures during the Impact Assessment Phase.

- The Preferred and Only Alternative is considered in the Impact Assessment Phase (see Section 6) and the Impact Tables attached at **Appendix F, page 581**.
- The potential social and environmental impacts of the project are identified, assessed and evaluated using the impact assessment methodology (Section 9.4) to understand the significance of each positive and negative impact. The Impact Tables are attached at **Appendix F, page 581**.
- An **EMPr** has been compiled (**page 240**) to ensure that potential environmental impacts are prevented or minimised.
- Mitigation measures are recommended in the Impact Assessment Phase to allow for unavoidable impacts on the environment and people's environmental rights to be minimized and remedied.
- Opportunities for public participation are allowed in the EIA process.
- The needs and interests of I&APs will be taken into account.
- All relevant information is being made available for public comment before submission to DMR, as part of the public participation process.
- Comments were received on the Draft Scoping Report are considered for the EIA phase and should comments be received from the relevant government departments and I&APs in the EIA phase; these comments will inform the decisions taken by DMR regarding the Environmental Authorisation of the project.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

1 DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

1.1 Details of the EAP

Refer to Section 1.1 In Part A above.

1.2 Description of the Aspects of the Activity

Refer to Section 9.10 and **Table 36** above.

1.3 Composite Map

This is addressed in Section 8 in each environmental baseline map, in conjunction with the Prospecting Layout in Figure 2.

1.4 Description of Impact Management objectives including Management Statements

This is addressed in Section 11.4.1 in Part A above.

1.5 Determination of Impact management objectives including management statements

1.5.1 Determination of Closure Objectives

Objective 1 - To create a safe and healthy post-mining environment

- Develop a landscape that reduces the requirement for long term monitoring and management
- Prevent degradation of coastal areas through littering, dumping of scrap mining equipment and scarring of the landscape by the proliferation of beach access roads and tracks, tailings dump etc.
- Prevent waste discharges leading to pollution of freshwater on land and seawater.

Objective 2 - To create a stable, post mining landform, which is compatible with the surrounding landscape

- Economically viable and sustainable offshore area without physical and associated ecological modification as close as possible to its natural state.
- Prevent disturbance to important biological communities such as seals, birds, whales and dolphins, damage to coastal vegetation and the loss of or damage to cultural and heritage sites.
- Minimise the compromised water quality and sediment inundation of areas adjacent to those being mined due to mine tailings (oversize and undersize sediments) discharge and disposal. .

Objective 3 – To provide optimal post-mining social opportunities

- Optimised benefits for the social environment
- Minimise the operation of exclusion zones around mining operations, both on the coast and at sea, that may preclude or limit access to the areas by other users, e.g. commercial fishermen
- Prevent over-subscription of the sparse services and infrastructure that exists on the West Coast.

The closure process involves a series of actions, with continual monitoring, review and remedial actions (if required). Identified and assessed risks feed into mitigation actions (or primary tasks) of which successful implementation result in achievement of the mine closure objectives and aims. Risk's mitigation actions and believed impact rating at closure associated with each closure objectives are discussed below. In addition, the closure standard for each key aim is listed and quantified. Financial provision is made in section 6 to deal with these mitigating measures in case of temporary closure or sudden closure during the normal operation of the project or at final planned closure.

1.5.2 <u>The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity</u>

The mitigation measures contained in **Table 37** and **Appendix F, page 581** provide the measures for managing any environmental damage, pollution, water or ecological degradation.

In addition, an Environmental Control Officer is required to audit the mine on an annual basis, to ensure that mitigation measures are employed correctly and continuously.

1.5.3 <u>The potential risk of Acid Mine Drainage</u>

No acid mine drainage is associated with diamond mining and tailings.

1.5.4 <u>Steps taken to investigate, assess, and evaluate the impact of acid mine drainage</u>

Not applicable.

1.5.5 <u>Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage</u>

Not applicable.

1.5.6 <u>Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage</u>

Not applicable.

1.5.7 <u>Volumes and rate of water use required for the mining operation</u>

Potable water will be obtained from a municipal source before launching. Process water taken from the ocean if required. If processing is done onshore, water will be used from the existing facility.

1.5.8 <u>Has a water use license been applied for?</u>

No Water Use Licence is required for the proposed prospecting.

1.6 Impacts to be mitigated in their respective phases

Table 37: Measures to rehabilitate the environment affected by the undertaking of any listed activity

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
Site Access & Site Establishment			No site access and establishment will take place		
Prospecting in progress The operation directly relates to prospecting of an offshore mineral resource (diamonds) and requires a prospecting right in terms of section 16 of the MPRDA. Prospecting is planned within Sea Concession area 12B using both non-invasive and invasive sampling activities, none of which require infrastructure. Sampling will be conducted in	OPERATIONAL	Total Area 11166.9Ha Core samples footprint ±1.57m², & volume ±4.71m³. Grab samples footprint ±5m² & volume ±1.5m³ LDD footprint ± 2.4ha	**IMPACT 1: Impacts of multi-beam and sub-bottom profiling sonar on marine fauna** • Despite the low significance of impacts for geophysical surveys, the Joint Nature Conservation Committee (JNCC) provides a list of guidelines to be followed by anyone planning marine sonar operations that could cause acoustic or physical disturbance to marine mammals (JNCC 2017). These have been revised to be more applicable to the southern African situation • Onboard Marine Mammal Observers (MMOs) should conduct visual scans for the presence of cetaceans and penguins around the survey vessel prior to the initiation of any acoustic impulses. • Pre-survey scans should be limited to 15 minutes prior to the start of survey equipment. • “Soft starts” should be carried out for any equipment of source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes to give adequate time for marine mammals and diving seabirds to leave the vicinity. • Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the marine mammal and/or penguin has vacated the area. • Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November), and ensure that migration paths are not blocked by sonar operations. As no seasonal patterns of abundance are known for odontocetes occupying the proposed concession area, a precautionary approach to avoiding impacts throughout the year is recommended. • If feasible schedule the survey to take place between February and May thereby avoiding the main seabird breeding seasons (March to October) and	NEMA Section 2 Principles Environmental Authorisation	Throughout prospecting

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
three phases to detect the presence of paleo-beach deposits, which are known from other concessions to contain diamondiferous gravels. Prospecting operations are expected to occur sporadically within the concession area. Geophysical Surveys (Phase 1 Non-Invasive) including Swath bathymetry and sub-bottom profiling Corel Sampling (Phase 2a Invasive) Grab Sampling (Phase 2a Invasive)			penguin summer moult periods (October to January).		
			IMPACT 2: Impacts of noise from sampling operations on marine fauna • Plan sampling not to co-inside with migratory season of whales • Avoid planning geophysical surveys during the movement of migratory cetaceans (particularly baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November), and ensure that migration paths are not blocked by sonar operations. As no seasonal patterns of abundance are known for odontocetes occupying the proposed concession area, a precautionary approach to avoiding impacts throughout the year is recommended.	NEMA Section 2 Principles Environmental Authorisation	During the estimated 10-year lifespan of the activity. Start of activity and continuous as mining progresses over the site during the operational period. Upon cessation of each activity where applicable. Immediately in the event of spills.
			IMPACT 3: Disturbance and loss of benthic fauna during sampling • No mitigation measures are possible, or considered necessary for the direct loss of macrobenthos due to drill sampling. • However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area.		
			IMPACT 4: Disturbance to and loss of rock lobsters • Monitor sorting screens during drill sampling and terminate operations should large numbers of lobsters appear on the screens over a short period of time • Avoid sampling in the immediate vicinity of rocky outcrop areas or other identified sensitive habitats in the licence area		
			IMPACT 5: Crushing of benthic fauna during sampling • Sampling activities of any kind must avoid rocky outcrop areas or other identified sensitive habitats in the concession area • Implement dynamically positioned sampling vessels in preference to vessels requiring anchorage		
			IMPACT 6: Increased turbidity in suspended sediment plumes and at the seabed • No mitigation measures are possible, or considered necessary for the discharge of fine tailings from the sampling vessel and the generation of suspended sediments plumes near the seabed by the sampling tools.		
			IMPACT 7: Remobilisation of contaminants and nutrients • No mitigation measures are possible, or considered necessary for the possible remobilisation of contaminants and nutrients in the sediments		
			IMPACT 8: Smothering of benthos in redepositing tailings		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
Large Diameter Drilling (Phase 2b Invasive)			**The following recommendations are made:** • No mitigation measures are possible, or considered necessary for the loss of macrobenthos due to smothering by redepositing sediments. • However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area • Make of geophysical data to conduct a pre-sampling geohazard analysis of the seabed, and near-surface substratum to map potentially vulnerable habitats and prevent potential conflict with the sampling targets.		
			IMPACT 9: Redeposition of discarded sediments on soft-sediment macrofauna • No mitigation measures are possible, or considered necessary for the discharge of fine tailings from the sampling vessel and the generation of suspended sediments plumes near the seabed by the sampling tools..		
			IMPACT 10: Redeposition of discarded sediments: smothering effects on rocky outcrop communities • No mitigation measures are possible, or considered necessary for the loss of macrobenthos due to smothering by redepositing sediments. • However, sampling activities of any kind should avoid rocky outcrop areas or other identified sensitive habitats in the concession area • Make of geophysical data to conduct a pre-sampling geohazard analysis of the seabed, and near-surface substratum to map potentially vulnerable habitats and prevent potential conflict with the sampling targets		
			IMPACT 11: Loss of Ferrosilicon • Reduce FeSi loss through the implementation of shell crushers or ball mills • Maintain accurate records of all FeSi used and discarded overboard with tailings		
	OPERATIONAL		**IMPACT 12: Pollution of the marine environment through Operational Discharges from the Sampling Vessel(s)** • In addition to compliance with MARPOL 73/78 regulations regarding waste discharges mentioned above, the following measures will be implemented to reduce wastes at the source: • Prohibit operational discharges when transiting through a marine protected area during transit to and from the concession		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATIO N
			• Use drip trays to collect run-off from equipment that is not contained within a bunded area and route contents to the closed drainage system • Implement leak detection and repair programmes for valves, flanges, fittings, seals, etc. • Use a low-toxicity biodegradable detergent for the cleaning of the deck and any spillages		
	OPERATIONAL		**IMPACT 13: Disturbance and behavioural changes in pelagic fauna due to vessel lighting** The use of lighting on the project vessels cannot be eliminated due to safety, navigational and operational requirements. Recommendations for mitigation include: • The lighting on the vessel(s) should be reduced to a minimum compatible with safe operations whenever and wherever possible. • Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimised • Keep disorientated, but otherwise unharmed, seabirds in dark containers (e.g. cardboard boxes) for subsequent release during daylight hours. • Report ringed/banded birds to the appropriate ringing/banding scheme (details are provided on the ring).		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
	OPERATIONAL		**IMPACT 14: Collision of Vessels with Marine Fauna and Entanglement in Gear** • All vessel operators should keep a constant watch for marine mammals and turtles in the path of the vessel. • Ensure vessel transit speed between the concession area and port is a maximum of 12 kts (22 km/hr), except within 25 km of the coast where it is reduced further to 10 kts (18 km/hr) as well as when sensitive marine fauna are present in the vicinity. • Should a cetacean become entangled in mooring buoys or towed gear, contact the South African Whale Disentanglement Network (SAWDN) formed under the auspices of DEA to provide specialist assistance in releasing entangled animals • Report any collisions with large whales to the International Whaling Commission (IWC) database, which has been shown to be a valuable tool for identifying the species most affected, vessels involved in collisions, and correlations between vessel speed and collision risk (Jensen & Silber 2003).		
			IMPACT 15: Equipment lost to the seabed • Ensure containers are sealed / covered during transport and loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system. • Minimise the lifting path between vessels. • Maintain an inventory of all equipment and undertake frequent checks to ensure these items are stored and secured safely on board each vessel. • Notify SAN Hydrographer of any hazards left on the seabed or floating in the water column, and request that they send out a Notice to Mariners with this information.		
	OPERATIONAL		**IMPACT 16: Operational Spills and Vessel Accidents** • In addition to the best industry practices and project standards, the following measures must be implemented to manage the impacts associated with small accidental spills • Ensure that vessels operate in accordance with South African Maritime safety regulations to minimise risks of accidents • Refuelling of vessels is to occur under controlled conditions in a harbour only, i.e. bunkering at sea is not permitted		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			• Ensure personnel are adequately trained in both accident prevention and immediate response, and resources are available on each vessel. • Ensure that the vessel operator has prepared and implemented a Shipboard Oil Pollution Emergency Plan and an Oil Spill Contingency Plan. In doing so, take cognisance of the South African Marine Pollution (Control and Civil Liability) Act, 1981 (No. 6 of 1981), Marine Pollution (Prevention of Pollution from Ships) Act, 1986 (No. 2 of 1986) and Marine Pollution (Intervention) Act, 1987 (No. 65 of 1987), which sets out national policies, principles and arrangements for the management of emergencies including oil pollution in the marine environment. • Use low toxicity dispersants cautiously and only with the permission of DFFE. • As far as possible, and whenever the sea state permits, attempt to control and contain the spill at sea with suitable recovery techniques to reduce the spatial and temporal impact of the spill • Ensure adequate resources are provided to collect and transport oiled birds to a cleaning station.		
	OPERATIONAL		**IMPACT 17-19: Impacts on Underwater Heritage Resources** • Induction for site managers on archaeological site and artefact recognition. • Geophysical surveys would possibly identify wrecks and wreck debris. • Reporting of sites to the heritage practitioner for assessment and evaluation. • Avoiding the wrecks would preserve these MUCH resources. • Induction for site managers on archaeological site and artefact recognition. • Geophysical surveys would possibly identify wrecks and wreck debris. • Reporting of sites to the heritage practitioner for assessment and evaluation. • Avoiding the wrecks would preserve these MUCH resources.		
	OPERATIONAL		**IMPACT 20: Impacts on Palaeontological Resources** The EMPs for the prospecting and mining rights areas must therefore include provisions for the collection of representative examples of the fossils that occur therein. As part of Environmental Awareness Training, geological staff involved in logging must be informed of the need to watch for fossil material and rescue such from the vibracores, grab samples and the drillship gravel oversize screen.		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			The prospecting/mining company must apply to SAHRA for a general permit to destroy, damage, excavate, disturb and collect fossils identified during sampling and mining, as per the NHRA. **1.7 Vibracores and Grab Samples** Fossils may be found during the processing of the vibracores and grab samples. These may be obvious, such as petrified bone and teeth and shell casts, usually phosphatic. All material of potential interest must have the details of context recorded and be kept for identification by an appropriate specialist and if significant, to be deposited in a curatorial institution such as the IZIKO SA Museum. The identification of extralimital, Agulhas "sub-fossil" shell species in the loose shells of the Last Transgression Sequence requires a level of seashell knowledge. The best outcome for a set of cores from this poorly-known area is that they are the subject of a detailed study, such as for a B.Sc. Honours or M.Sc. project, with radiocarbon dates. It is possible that a core or two might intersect rarely preserved lagoonal deposits which are important for providing points on the sea-level curve applicable to the West Coast (Runds *et al*., 2018). **1.8 Collection of Fossil Material during Prospecting and Mining** As part of the normal sampling and mining process the material crossing the oversize screen (Figure 6) must be monitored for the occurrence of the various fossil types. Potential fossil material should be collected for later identification and evaluation. For overall monitoring purposes it is suggested that a few small bulk samples of shells (~5 litres) be collected on occasion. The idea is to sample the typical assemblage at a few points in the sampling/mining area. It is possible that an uncommon assemblage may be encountered, such as a shallow-water fauna or a lagoonal fauna, in which case it should also be sampled. Data to be recorded during fossil collection includes: • Date • Company name		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATIO N
			• Sample no. • Collector's name • Position (co-ordinates) • Water depth • Sample subsurface depth • Vessel • Brief description and photographs • A copy of the graphic log of the sample drill hole or mining face showing the vertical sequence of units and the estimated location of the fossil in the sequence. • A map of the fossil finds in the particular sampling/mining area, such as a contoured multibeam bathymetric image showing the context of samples in relation to the bedrock topography and sediment bodies. Collected samples are to be temporarily stored by the company.		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			 **Figure 6. The gravel oversize screen on a typical diamond mining vessel where the geological personnel monitor the material being dredged and where fossil collection takes place** When a collection of fossil material has been accumulated, the appointed palaeontologist should undertake the identification and evaluation of the fossil material and compile the report for submission to SAHRA. A selection of material could be removed for further study. The Environmental Manager/Officer is to liaise with the appointed palaeontologist on the progress of the fossil collection and the scheduling of the evaluation. During all operations, personnel can send queries and images by email to an appointed palaeontologist for evaluation and prompt feedback.		
	OPERATIONAL		**IMPACT 21: Tuna pole and line fishing**		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			An open line of communication will be established with other existing industries operating in the area where sampling is planned to align activities.		
	OPERATIONAL		**IMPACT 22: Traditional Linefish Sector** • An open line of communication will be established with other existing industries operating in the area where sampling is planned to align activities.. • Prior to survey commencement, key stakeholders (see below) should be consulted and informed of the proposed survey activity and the likely implications thereof: o Fishing industry / associations (contactable via liaison@fishsa.org): o South African Pelagic Fishing Industry Association (SAPFIA); o Local fishing communities. • Other associations and organs of state: o DFFE; o SAMSA; o South African Navy Hydrographic office; and o Overlapping and neighbouring right holders. • Appoint a fisheries liaison officer (FLO) to facilitate communication with potentially affected fishing sectors. The FLO should report daily on vessel activity and respond and advise on action to be taken in the event of encountering fishing gear in the survey area. Undertake surveys when fishing effort is lowest i.e., August to December. It is recommended that small pelagic peak fishing seasons (January-July) and snoek line fishing peak seasons (April-May) be avoided as far as possible, feasible and reasonable.		
	OPERATIONAL		**IMPACT 23: Small Pelagic Purse Seine Fisheries** • Undertake surveys when fishing effort is lower (preferably out of fishing seasons). • Appoint a fisheries liaison officer (FLO) to facilitate communication with the Small Pelagic Fishing Industry Association. The FLO should report daily on vessel activity and respond and advise on action to be taken in the event of encountering purse seine fishing vessels in the survey area • An open line of communication will be established with other existing industries operating in the area where sampling is planned to align		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			activities.		
	OPERATIONAL		**IMPACT 24: Prospecting activity on the local tourism and businesses** • Monitor water-quality surrounding the sediment plumes. • Should any negative visual impacts be detectable, restrict prospecting activities during important tourism events and seasons. • Should any negative visual impacts be detectable, restrict operational activities to the section of the concession area out of sight from the shore		
	OPERATIONAL		**IMPACT 25: Prospecting activity on the Sense of Place, Health and Wellbeing** **IMPACT 26: Prospecting activity on the local households** **IMPACT 27: Prospecting activity on the local crime performance** **IMPACT 28: Prospecting activity on the regional socio-economic performance** No mitigation		
Final Rehabilitation And Decommissioning And Closure Phase	**DECOMMISSIONING**	Total Area 11166.9Ha Core samples footprint ±1.57m², & volume ±4.71m³. Grab samples footprint ±5m² & volume ±1.5m³ LDD footprint ± 2.4ha	**IMPACT 1: SURVEY/SAMPLING VESSEL TO LEAVE AREA** • Ensure that no debris or dropped equipment that may be detrimental to environment or other users of the sea is left on the seafloor. The benefits of retrieval of debris or equipment must first be weighed up against the potential health and safety risks.	NEMA Section 2 Principles Environmental Authorisation	On completion of prospecting
			IMPACT 2: COMMUNICATION AND INFORMATION TO RELEVANT PARTIES OF MINING COMPLETION • Inform all key stakeholders (see Section 7.2.1.2) that the mining vessel is off location. • Notify the SAN Hydrographic office when the programme is complete so that the Navigational Warning can be cancelled. • Take steps to share data collected during the sampling programme (e.g. ROV video footage of the benthic environment), if requested, to resource managers (including DEA, South African National Biodiversity Institute and appropriate research institutes).		

			IMPACT 3: REHABILITATION AND CLOSURE
			• Apply for closure, submit the following documentation to the DMR:
			  ○ A final layout plan;
			  ○ A Closure Plan;
			  ○ An Environmental Risk Report;
			  ○ A Final Audit Report; and		

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			○ A completed application form to transfer environmental responsibilities and liabilities, if such transfer has been applied for.		
			IMPACT 3: FINAL WASTE DISPOSAL • Dispose all waste retained onboard at a licensed waste site using a licensed waste disposal contractor.		

1.9 Impact Management Outcomes

Table 38: Impact Management Outcomes

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	MITIGATION TYPE..	STANDARD TO BE ACHIEVED
Planning and design Phase	N/A	N/A	Planning Phase – Phase 1	N/A	Avoiding impacts
Desktop study and literature review	N/A	Planning Phase – Phase 1	N/A	Avoiding impacts	Desktop study and literature review
Stakeholder consultation	N/A	Local communities	Planning, Operational and Closure Phase	Management	Avoiding and mitigating impacts. NEMA; EIA Regulations
Geophysical seismic survey	Noise disturbance impacting marine fauna	Fish, Marine mammals, Marine mammals, Turtles	Operational Phase	• Control through noise control; • Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities; • Remedy through design measures and noise • control of survey equipment; • Remedy through suspending activities.	Limit noise levels Limit impacts, injury or death to animals; SANS 10103
Geological modelling	N/A	N/A	Operational Phase	N/A	To limit impacts by means of selecting specific sites for drilling and avoiding sensitive sites
Vessel operation	Injury or death of Megafauna such as whales due to collision with survey vessels	Megafauna such as whales	Operational Phase	Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities; • Control through modifying activities such as vessel speed	Avoiding impacts such as injury or death to animals and damage to vessels
Grab sampling	Disturbance of marine fauna due to physical	Benthic macrofauna	Operational Phase	•Control and modify activities through avoidance in terms of time and space;	Limit impacts and disturbance;

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	MITIGATION TYPE..	STANDARD TO BE ACHIEVED
	activities and sediment plumes			•Stop impacts through avoidance and terminating activities; • Remedy through suspending activities.	
Core sampling	Disturbance of marine fauna due to physical activities and sediment plumes	Benthic macrofauna	Operational Phase	See above	Limit impacts and disturbance
Drill sampling	Disturbance of marine fauna due to physical activities and sediment plumes	Benthic macrofauna	Operational Phase	See above	Limit impacts and disturbance; Listing Notice 1
Grab, core and drill , bulk sampling	Destruction and loss of Prehistoric Heritage, palaeontological and Maritime archaeological resources, particularly historical shipwrecks	Prehistoric Heritage, palaeontological (fossils) and Maritime archaeological resources, particularly historical shipwrecks	Operational Phase	• Avoidance of certain sites • Remedy through collection and preservation of samples	Limit impacts and destruction of Prehistoric Heritage, palaeontological and Maritime archaeological resources; Heritage Act
Tailings disposal	Disturbance of benthic macrofauna and due to physical activity and sediment plumes	Phytoplankton and consumers such as fish and invertebrates	Operational Phase	No essential or potential mitigation measures identified Best Practice: Planning and management of potential discharges to ensure that tailings are not discarded onto potentially sensitive habitats	To limit impacts by means of selecting specific sites for drilling and avoiding sensitive sites
Waste discharges	Waste discharges and pollution, deteriorating	The marine environment and ecosystem functions	Operational Phase	• Management through informing staff;	Limit impacts; limit waste through management; NEM:WA. Adherence to South

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	MITIGATION TYPE..	STANDARD TO BE ACHIEVED
	water quality and disturbance			• Management through compliance with relevant waste standards and protocols; • Control and modify activities; • Stop impacts through avoidance and terminating activities; • Remedy through design measures;.	African Water Quality Guidelines and MARPOL
Vessel operation and physical presence	Disturbance to vessels, shipping activities and fishing activities	Vessels and shipping	Operational Phase	• Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities; • Remedy through design measures and noise control of survey equipment; • Control through management • Remedy through suspending activities.	Limit disturbance
Vessel and equipment operation during all activities	Reduction in fishing success and decline in socio-economic conditions of Local fishing communities dependent upon these resources and local economy	Species targeted during fishing, fishing operations and local fishing communities dependent upon these resources	Operational Phase	See above	NEMA; EIA Regulations; Limit disturbance and impact on local communities
Grab, core and drill sampling	Prehistoric Heritage, palaeontological (fossils) and Maritime Heritage	Prehistoric Heritage, palaeontological (fossils) and Maritime Heritage	Operational Phase	• Avoidance of certain sites • Remedy through collection and preservation of samples	Limit destruction of resources. Preservation of resources

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE In which impact is anticipated	MITIGATION TYPE..	STANDARD TO BE ACHIEVED
	resources, particularly historical shipwrecks	resources, particularly historical shipwrecks			
Data acquisition and synthesis	N/A	N/A	Operational Phase	N/A	N/A
Feasibility study and resource estimation	N/A	N/A	Operational Phase	N/A	N/A
Decommissioning and Closure	N/A	N/A	Decommissioning Phase	N/A	Closure certificate; NEMA
Rehabilitation	N/A	N/A	Decommissioning Phase	N/A.	N/A

1.10 Impact Management Actions

Table 39: Impact Management Actions

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE	TIME PERIOD FOR IMPLEMENTATION	COMPLIANCE WITH STANDARDS
Planning and design Phase Desktop study and literature review	N/A	N/A	Prior to commencement	Avoiding impacts
Stakeholder consultation	N/A	Management	Prior to commencement of operation and throughout the entire process	Avoiding and mitigating impacts. NEMA; EIA Regulations
Geophysical seismic survey	Noise disturbance impacting marine fauna	• Control through noise control; • Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities; • Remedy through design measures and noise control of survey equipment; • Control through management such as through use of an independent Marine Mammal Observer;. • Remedy through suspending activities.	Throughout the seismic survey operation	Limit noise levels Limit impacts, injury or death to animals; SANS 10103
Geological modelling	N/A	N/A	After the modelling, sites for drilling and sites for avoidance should be selected	To limit impacts by means of selecting specific sites for drilling and avoiding sensitive sites
Vessel operation	Injury or death of Megafauna such as whales due to collision with survey vessels	• Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities;	Throughout the entire prospecting survey during which the vessel is being operated	Avoiding impacts such as injury or death to animals and damage to vessels

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE	TIME PERIOD FOR IMPLEMENTATION	COMPLIANCE WITH STANDARDS
		• Control through management such as through use of an independent Marine Mammal Observer;. • Control through modifying activities such as vessel speed		
Grab sampling	Disturbance of marine fauna due to physical activities and sediment plumes	• Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities; • Remedy through suspending activities.	During grab sampling	Limit impacts and disturbance;
Core sampling	Disturbance of marine fauna due to physical activities and sediment plumes	See above	During core sampling	Limit impacts and disturbance
Drill and bulk sampling	Disturbance of marine fauna due to physical activities and sediment plumes	See above	During drill sampling	Limit impacts and disturbance; Listing Notice 1
Grab, core, bulk and drill sampling	Destruction and loss of Prehistoric Heritage, palaeontological and Maritime heritage resources, particularly historical shipwrecks	• Avoidance of certain sites • Remedy through collection and preservation of samples	Before sampling commences and during	Limit impacts and destruction of Prehistoric Heritage, palaeontological and Maritime heritage resources; Preservation of resources Heritage Act
Tailings disposal	Disturbance of benthic macrofauna and due to physical activity and sediment plumes	No essential or potential mitigation measures identified Best Practice: Planning and management of potential discharges to ensure that tailings are not discarded onto potentially sensitive habitats	During the planning phase	To limit impacts by means of selecting specific sites for drilling and avoiding sensitive sites
Waste discharges	Waste discharges and pollution, deteriorating	• Management through informing staff;	Throughout the entire prospecting operation	Limit impacts; limit waste through management; NEM:WA

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE	TIME PERIOD FOR IMPLEMENTATION	COMPLIANCE WITH STANDARDS
	water quality and disturbance	• Management through compliance with relevant waste standards and protocols; • Control and modify activities; • Stop impacts through avoidance and terminating activities; • Remedy through design measures;.		
Vessel operation and physical presence	Disturbance to vessels, shipping activities and fishing activities	• Control and modify activities through avoidance in terms of time and space; • Stop impacts through avoidance and terminating activities; • Remedy through design measures and noise control of survey equipment; • Control through management • Remedy through suspending activities.	Throughout the entire prospecting survey during which the vessel is being operated	Limit disturbance
Vessel and equipment operation during all activities	Reduction in fishing success and decline in socio-economic conditions of Local fishing communities dependent upon these resources and local economy	See above	Planning phase and operational phase	NEMA; EIA Regulations; Limit disturbance and impact on local communities
Data acquisition and synthesis	N/A	N/A	N/A	N/A
Feasibility study and resource estimation	N/A	N/A	N/A	N/A
Decommissioning and Closure	N/A	N/A	Upon the cessation of prospecting	Closure certificate; NEMA
Rehabilitation	N/A	N/A.	N/A	N/A

2 FINANCIAL PROVISION

2.1 Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under the Regulation

As detailed in Section 15.5.1 above:

Objective 1 - To create a safe and healthy post-mining environment

- Develop a landscape that reduces the requirement for long term monitoring and management
- Prevent degradation of coastal areas through littering, dumping of scrap mining equipment and scarring of the landscape by the proliferation of beach access roads and tracks, tailings dump etc.
- Prevent waste discharges leading to pollution of freshwater on land and seawater.

Objective 2 - To create a stable, post mining landform, which is compatible with the surrounding landscape

- Economically viable and sustainable offshore area without physical and associated ecological modification as close as possible to its natural state.
- Prevent disturbance to important biological communities such as seals, birds, whales and dolphins, damage to coastal vegetation and the loss of or damage to cultural and heritage sites.
- Minimise the compromised water quality and sediment inundation of areas adjacent to those being mined due to mine tailings (oversize and undersize sediments) discharge and disposal.

Objective 3 – To provide optimal post-mining social opportunities

- Optimised benefits for the social environment
- Minimise the operation of exclusion zones around mining operations, both on the coast and at sea, that may preclude or limit access to the areas by other users, e.g. commercial fishermen
- Prevent over-subscription of the sparse services and infrastructure that exists on the West Coast.

2.2 Confirm specifically that the environmental objectives in relation to closure have been consulted with the landowner and interested and affected parties

The closure objectives are included in this Draft EIR and in the Rehabilitation, Decommissioning and Mine Closure Plan (**Appendix G, page 606**) which is being made available to all registered Interested and Affected Parties.

2.3 Provide a Rehabilitation Plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

Refer to the Rehabilitation, Decommissioning and Mine Closure Plan, which includes the Environmental Risk Assessment in **Appendix G, page 606**.

2.4 Explain why it can be confirmed that the Rehabilitation Plan is compatible with the closure objectives

The closure objectives are to return the land disturbed by prospecting activities back to its original condition. The Rehabilitation Plan provides the detail on how this will be achieved as detailed in **Appendix G, page 606**.

2.5 Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

Refer to Part A, Section 12, and **APPENDIX G: REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN, page 606** of this report.

2.6 Confirm that the financial provision will be provided as determined

Refer to Part A, Section 12.3 of this report.

2.7 Indicate the frequency of the submission of the performance assessment/ environmental audit report.

An external environmental performance audit and the EIA & **EMPr** performance assessment shall be conducted annually interchangeably by an independent environmental assessment practitioner.

2.8 Mechanisms for monitoring compliance with and performance assessment against the Environmental Management Programme and reporting

Table 40: Mechanisms for Monitoring Compliance

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
All prospecting activities	All commitments are contained in the EIA Report and accompanying **EMPr**.	Ensure commitments made within the approved EIR and **EMPr** are being adhered to.	Site Manager and EAP.	Undertake and submit an environmental performance audit to DMR, as per EA conditions.. Undertake and submit an environmental performance audit every two years to DMRE
Geophysical seismic survey	Noise	Ensure that the Prospecting Work Programme, mitigation measures and conditions as set out in the EMPr, are being adhered to.	Geologist. Environmental Control Officer, appointed crew member	Impact management actions should be implemented at all times during the activities or as per the EMPr. Reporting should be as per EA conditions either by the ECO or the appointed crew member to ensure that management actions are being implemented.
Vessel operation	Collision causing injury or death of marine fauna	Ensure that the Prospecting Work Programme, mitigation measures and conditions as set out in the EMPr, are being adhered to.	Captain, appointed crew member	Impact management actions should be implemented at all times during the activities or as per the EMPr. Reporting should be done as per EA conditions either by the ECO or the appointed crew member to ensure that management actions are being implemented.
Grab sampling, core, bulk and drill sampling	Disturbance of marine fauna and Sediment plumes	Ensure that the Prospecting Work Programme, mitigation measures and conditions as set out in the EMPr, are being adhered to.	Geologist;	Impact management actions should be implemented at all times during the activities or as per the EMPr. Reporting should be as per EA conditions either by the ECO or the appointed crew member to ensure that management actions are being implemented.
Grab, core, bulk and drill sampling	Destruction and loss of Prehistoric Heritage, palaeontological and Maritime heritage resources, particularly historical shipwrecks	Ensure that the Prospecting Work Programme, mitigation measures and conditions as set out in the EMPr, are being adhered to.	Geologist and trained heritage representative	Impact management actions should be implemented at all times during the activities or as per the EMPr. Reporting should be done as per EA conditions either by the ECO or the appointed crew member to ensure that management actions are being implemented.
Tailings disposal	Visual inspection of Disturbance and destruction, erosion and gulleys, if possible	Ensure that the Prospecting Work Programme, mitigation measures and conditions as set out in the EMPr, are being adhered to.	Geologist	Impact management actions should be implemented at all times during the activities or as per the EMPr. Reporting should be done as

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY and TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
				per EA conditions either by the ECO or the appointed crew member to ensure that management actions are being implemented.
Waste discharges	Waste discharges and pollution, deteriorating water quality	Ensure that the Prospecting Work Programme, mitigation measures and conditions as set out in the EMPr, are being adhered to. Implementation of effective waste management	ECO	Impact management actions should be implemented at all times during the activities or as per the EMPr. Reporting should be done as per EA conditions either by the ECO or the appointed crew member to ensure that management actions are being implemented.
Vessel operation and physical presence	Disturbance to vessels	See above	Captain	See above
Vessel and equipment operation during all activities	Reduction in fishing success and decline in socio-economic conditions	See above & Ensure stakeholders and regularly consulted and implement stakeholder complaints register.	Fishing Liaison Officer	See above
Closure & Rehabilitation	Rehabilitation, lost equipment, return to original land form	Inspection of all rehabilitated areas to assess whether gulleys and erosion is occurring and to implement corrective action where required.	Geologist	A final audit report for site closure must be submitted to the DMR for approval, or as per the EA conditions.

3 ENVIRONMENTAL AWARENESS PLAN

3.1 Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

Environmental awareness and training include:

- Awareness training for contractors and employees.
- Job-specific training – training for personnel performing tasks that could cause potentially significant environmental impacts.
- Comprehensive training – on emergency response, spill management, etc.
- Specialised skills.
- Training verification and record-keeping.

Before commencement of the mining activities all new employees and contractors who are involved with such activities should attend relevant induction and training. It is standard practice for employees and the employees of contractors that will be working on a new project or at a new site to attend an induction course where the nature and characteristics of the project and the site are explained.

The training course should include key information abstracted from the **EMPr** pertaining to the potential environmental impacts, the mitigation measures that will be applied, the monitoring activities that will be undertaken and the roles and responsibilities of contractors and personnel.

The **EMPr** document will also be made available to attendees.

3.2 Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

Environmental risks and how to manage them are dealt with in the induction course referred to in Section 17.1 above. Should an incident of environmental pollution or damage occur it will be analysed and appropriate prevention and/or mitigation measures developed. These measures will be added to the **EMPr** and conveyed to the relevant personnel.

All unplanned incidents with the potential to cause pollution or environmental degradation or conflict with local residents will be reported to the Mineral Resources Manager within 24 hours.

Hydrocarbon Spills: Hydrocarbon spills that are considered to be emergency incidents are large-scale spills (cover a surface area >1m^2), resulting from situations such as: a leaking diesel bowser; an oil drum that is knocked over; and large spillages from equipment.
Activities that are involved in the clean-up of such instances include:

- The containment of the spill;
- The removal of all contaminated material; and,
- The disposal (at a licensed hazardous disposal facility) or bioremediation (at a licensed facility) of this material.

Fire: There is the potential for fire to occur onboard of the sea vessel and equipment.

Vehicles and Equipment: Fire extinguishers will be available on site where prospecting activities will take place and on the vessels. All staff members will be trained in the use of fire-fighting equipment.

First aid and life-guarding: At least one person on board should be trained in first aid and in life saving as prospecting will take place offshore and a distance from medical aid and services.

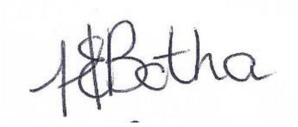
3.3 The specific information required by the Competent Authority

Not applicable at this stage.

4 UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

The EAP herewith confirms

1. the correctness of the information provided in the reports ☒
2. the inclusion of comments and inputs from stakeholders and I&APs; ☒
3. the inclusion of inputs and recommendations from the specialist reports where relevant; ☒and
4. that the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected. parties are correctly reflected herein. ☒



Signature of the environmental assessment practitioner:

GroenbergEnviro (Pty) Ltd

Name of company:

23/02/2023

Date: