ENVIRONMENTAL IMPACT REPORT FOR AN EIA FOR BULK SAMPLING ACTIVITIES FOR OFFSHORE MARINE DIAMONDS, WEST COAST

Sea Concession 6C

Prepared for: De Beers Consolidated Mines (Pty) Ltd

Authority References:

NCS 30/5/1/13/2/1 (12189) PR

DE BEERS GROUP

SLR

SLR Project No.: 720.04062.00002

Report No.: 2

Revision No.: 0

September 2020

DOCUMENT INFORMATION

Title	Environmental Impact Report for an EIA for Bulk Sampling Activities for Offshore Marine Diamonds, West Coast
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Keywords	West Coast, De Beers, diamonds, prospecting, bulk sampling, EIA, offshore
Status	Draft
DEA Reference	Not Applicable
DMRE Reference	NCS 30/5/1/13/2/1 (12189) PR
DWS Reference	Not Applicable
Report No.	2
SLR Company	SLR Consulting (South Africa) (Pty) Ltd

DOCUMENT REVISION RECORD

Rev No.	Issue Date	Description	Issued By
A	June 2020	Draft for client comment	N. Arnott

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EXECUTIVE SUMMARY

1. INTRODUCTION

On 14 June 2018 De Beers Consolidated Mines (Pty) Ltd (De Beers) lodged an application for a Prospecting Right with the Department of Mineral Resources and Energy (DMRE) to undertake offshore diamond prospecting activities in Sea Concession 6C (see Figure 1-1). The application was lodged in terms of Section 22 of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA), as amended.

In response to the application, DMRE requested that a Basic Assessment Report (BAR) be submitted for the geophysical and sampling activities to be undertaken as part of the proposed prospecting operations. It was also indicated that the planned bulk sampling activities would constitute a listed activity in terms of Listing Notice 2 published in Government Notice (GN) No. 984 of 8 December 2014 (as amended by GN No. 375 of 7 April 2017). Thus, as a Listing Notice 2 activity the proposed bulk sampling activities would require an application for Environmental Authorisation (EA) by means of a Scoping and Environmental Impact Assessment (EIA) process. It is pointed out that a BAR (and associated specialist studies) was completed for the proposed geophysical and sampling activities in Sea Concession 6C and that an EA was granted for these operations on 4 February 2019.

De Beers has appointed SLR Consulting (South Africa) (Pty) Ltd (SLR) as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and EIA process for the proposed bulk sampling activities in Sea Concession 6C in accordance with the requirements of the MPRDA, National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) and Regulations thereto.

2. OPPORTUNITY TO COMMENT

This draft Environmental Impact Report (EIR) has been distributed for a 30-day comment period from **7 September to 8 October 2020** in order to provide interested and affected parties (I&APs) with an opportunity to comment on any aspect of the proposed project and the findings of the EIA project to date. Copies of the full report have been made available on the SLR website (at https://slrconsulting.com/public-documents/de-beers-consolidated-mines).

Any comments should be forwarded to SLR at the address, telephone / fax numbers or e-mail addresses shown below. For comments to be included in the in the updated EIR, comments should reach SLR by no later than **8 October 2020**.

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3. SCOPING AND EIA PROCESS

3.1. SCOPING PHASE

3.1.1. Application for Environmental Authorisation

An "Application Form for Environmental Authorisation" form was submitted to DMRE at the same time as making this draft version of the Scoping Report available for review and comment. The application was accepted by DMRE on 21 August 2019.

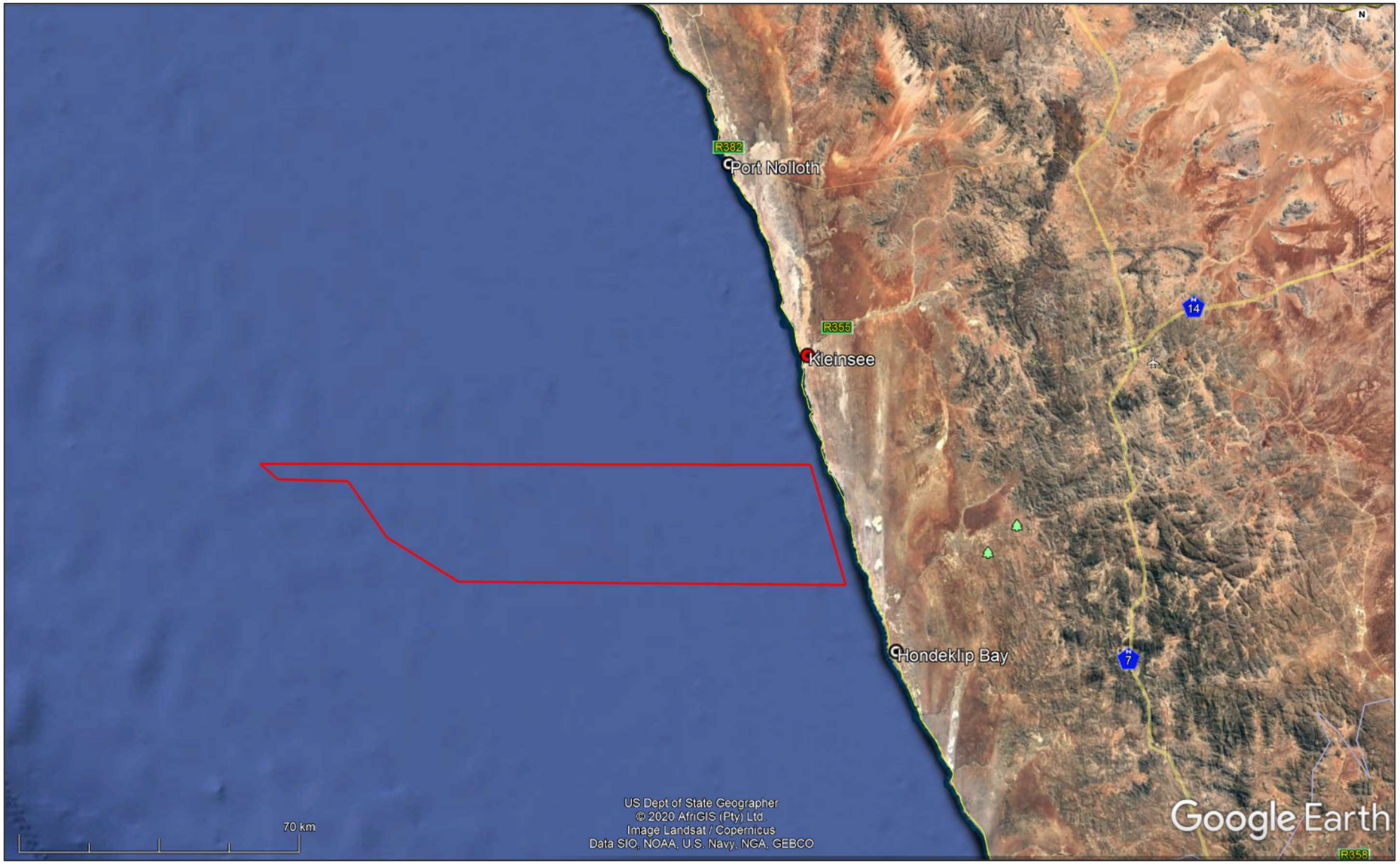

FIGURE 1-1: LOCATION OF THE 6C PROSPECTING RIGHT AREA, OFF THE WEST COAST OF SOUTH AFRICA.

3.1.2. Compilation and review of the Scoping Report

The Scoping Report was prepared in compliance with Appendix 2 of the EIA Regulations 2014 (as amended). The final Scoping Report was submitted to DMRE for acceptance on 25 September 2019. DMRE accepted the report on 4 December 2019 and indicated that the EIR should be submitted before 26 May 2020. However, following the implementation of the nation-wide lockdown on 26 March 2020, the Minister of Forestry, Fisheries and the Environment issued Directions ("*Measures to Address, Prevent and Combat the Spread of Covid-19*" published in GN No. R 439 of 31 March 2020) which extended the above-mentioned time frame "*by the number of days of the duration of the lockdown period of the national state of disaster declared for the COVID-19 pandemic … with effect from 27 March 2020 until the termination of the lockdown period*".

Subsequently, on 5 June 2020 updated Directions were published (GN No. 650 of 5 June 2020) which repealed the above-mentioned Directions of 31 March 2020. In terms of these new Directions, the timeframes set out in the EIA Regulations 2014 (as amended) were resumed and "*remain extended … by the number of days calculated from 27 March 2020 until further notice*". In light of the above, the final EIR must be submitted to DMRE by 14 October 2020.

3.2. EIA PHASE

3.2.1. Specialist Studies

Three specialist studies were undertaken as part of the previous Basic Assessment application and also addressed the key issues and detailed assessment of the planned bulk sampling activities. These studies were: (1) an Underwater Heritage Impact Assessment, (2) a Marine Faunal Assessment, and (3) a Fisheries Impact Assessment. The studies also recommended appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively.

3.2.2. Integration and Assessment

Information from the specialists, desktop analysis, and the generic EMP prepared for marine diamond mining off the West Coast, are integrated into this EIR, which will include an Environmental Management Programme (EMPr). The EIR has been released for a 30-day comment period. After closure of the comment period, all comments received on the draft report will be incorporated and responded to in a Comments and Responses Report. The draft report will then be updated to a final report, to which the Comments and Responses Report will be appended, and will be submitted to DMRE for consideration and decision-making.

The decision taken by DMRE will be advertised and distributed to all I&APs on the project database as part of the statutory appeal period.

4. PROJECT DESCRIPTION

4.1 GENERAL INFORMATION

The proposed bulk sampling activities would be undertaken within Sea Concession 6C, off the West Coast of South Africa. The mineral targeted by the proposed operations would be diamonds. Sea Concession 6C is situated approximately 400 km north of Cape Town; with the inshore boundary located 5 km seaward of the coast between Hondeklip Bay in the south and Kleinzee in the north. The offshore boundary is located between approximately 70 to 100 km offshore (refer to Figure 1-1). Sea Concession 6C has a total extent of 345 746 hectares (ha).

4.2 NEED AND DESIRABILITY

In the recently published DMR Strategic Plan 2014-2019, the foreword by the Minister of Mineral Resources notes that the Department "*will continue to promote mineral value addition to strengthen the interface between extractive industries and national socio-economic developmental objectives*".

This project aims to identify economically viable diamond deposits on the continental shelf off the coast of the Northern Cape with the intention of deriving value from the identified offshore mineral resources and contributing to the existing diamond mining sector in the Northern Cape.

4.3 PROJECT OVERVIEW

The proposed exploration sampling programme would entail sampling (for which EA has already been granted) and bulk sampling activities. The sampling / bulk sampling activities may be divided into stages subject to reviews and follow-up sampling. A decision on the planned sampling / bulk sampling technology appropriate to each target area would be made based on the available data at the time.

The proposed bulk sampling activities would be undertaken using a vessel of opportunity which may include the De Beers Marine (Pty) Ltd (the appointed operator for Beers Consolidated Mines (Pty) Ltd) owned vessel, the *mv Coral Sea* or one of the marine diamond vessels operated by Debmarine Namibia (Pty) Ltd or a similar vessel. In this regard, there are two possible basic configurations of vessel available for bulk sampling: (i) the vertical method, utilising a tool mounted on a drill string; and (ii) the horizontal method, using a seabed crawler. The planned bulk sampling operations would have a total footprint of approximately 480 000 m^2 and would be undertaken in up to 60 days over the 5-year licence period. A summary of the proposed operation is provided in the table below.

TABLE 1: SUMMARY OF PROPOSED BULK SAMPLING OPERATIONS

Activity		Detail
Number of pits/trenches planned		Up to 60
Dimensions of pits/trenches	**Length**	Up to 400 m
	Breadth	Typically 20 m
	Depth	Typically up to 1.5 m
Total Volume Overburden (Waste)		Maximum 480 000 m^3
Total Volume Ore		Maximum 240 000 m^3
Density Overburden		1.5 t/m^3
Density Ore		1.9 t/m^3

4.4 NO-GO ALTERNATIVE

The No-Go alternative is the non-occurrence of the proposed bulk sampling project. The negative implications of not going ahead with the proposed project are as follows:

- Loss of opportunity to establish whether further viable offshore diamond resources exist;
- Prevention of any socio-economic benefits associated with the continuation of prospecting activities; and
- Lost economic opportunities.

The positive implications of the no-go option are that there would be no effects on the biophysical environment in the area proposed for the bulk sampling activities.

5. AFFECTED ENVIRONMENT

5.1 PHYSICAL ENVIRONMENT

Sea Concession 6C lies within the southern zone of the Benguela Current region and is characterised by the cool Benguela upwelling system. The dominant southerly and south-easterly winds in summer drive the massive offshore movement of surface water, resulting in strong upwelling of nutrient-rich bottom waters. Nutrient-rich upwelled water enhances primary production, and the West Coast region consequently supports substantial pelagic fisheries. Two geological features of note within the vicinity of Sea Concession 6C include Childs Bank, situated approximately 80 km south and Tripp Seamount, approximately 150 km west.

5.2 BIOLOGICAL OCEANOGRAPHY

Sea Concession 6C falls into one of the nine bioregions, namely the cold temperate Namaqua Bioregion. 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).

The fish species likely to be encountered comprise primarily the large pelagic species (e.g. tunas, billfish and pelagic sharks), which migrate throughout the southern oceans, between surface and deep waters (>300 m).

Most seabirds in the region reach highest densities offshore of the shelf break (200 to 500 m depth) and are likely to be encountered. Marine mammals likely to be encountered include sperm whales, migrating humpback whales and various baleen and toothed whales known to frequent offshore waters.

5.3 HUMAN UTILISATION

The only commercial fisheries sectors that could be affected by the proposed prospecting operations are the demersal long-line, traditional line-fish and tuna pole fisheries. Sea Concession 6C falls outside of all other sectors. The majority of shipping traffic is located on the outer edge of the continental shelf with traffic inshore of the continental shelf along the South-West Coast largely comprising fishing vessels, especially between Kleinzee and Oranjemund. The majority of the shipping traffic would be limited to the western portions of the concession area. Exploration for oil and gas is currently undertaken in a number of licence blocks off the West Coast. There is no current development or production from the South African West Coast offshore. A number of proposed prospecting areas for glauconite and phosphorite / phosphate are located off the South-West Coast, all of which are located south of Sea Concession 6C. A number of marine diamond mining right and prospecting concession areas are also located in proximity to Sea Concession 6C.

5. ENVIRONMENTAL IMPACT ASSESSMENT

Table 1 provides a summary of the significance ratings assigned to each potential impact of the proposed prospecting activities.

Table 1: Summary of the significance of the potential impacts associated with the proposed prospecting activities and No-Go Alternative.

Potential impact	Significance	
	Without mitigation	With mitigation
Impact on marine fauna:		
Noise associated with sampling operations	VL	**VL**
Crushing of benthic fauna and sediment removal	L	**L**

Potential impact		Significance	
		Without mitigation	With mitigation
Generation of sediment plumes		VL	**VL**
Smothering of benthos by redepositing tailings		VL – M	**VL – L**
Impact on other users of the sea:			
Fishing industry	Exclusion of the demersal long-line, traditional line-fish, tuna pole and fisheries research	L	**L**
	Sediment plume impact on fish stock recruitment	Insig	**INSIG**
Fishery Research		VL	**VL**
Marine mining and prospecting		Insig	**INSIG**
Petroleum exploration		VL-L	**VL**
Marine transport routes		Insig	**INSIG**
Impact on cultural heritage material:			
Impact on historical shipwrecks		M	**INSIG**
Socio-Economic Impacts:			
Job creation and business opportunities		VL	**VL**
No-Go Alternative:			
Lost opportunity to establish whether or not a viable offshore diamond resources exists off the West Coast and the lost economic opportunities.		L	-
Cumulative Impact:			
Benthic environment		L	**L**

VH=Very High	H=High	M=Medium	L=Low	VL=Very low	Insig = insignificant	N/A= Not applicable

6. CONCLUSIONS

The majority of the impacts associated with the vessel operations would be of short-term duration and limited to the immediate sampling areas. As a result, the majority of the impacts associated with the sampling vessels are considered to be of **INSIGNIFICANT** to **LOW** significance after mitigation.

Potential impacts on marine fauna as a result of the proposed bulk sediment sampling activities would be of medium- to short-term duration and limited to the immediate sampling areas. As a result, the impacts on marine fauna associated with the sampling activities are considered to be of **VERY LOW** to **LOW** significance after mitigation.

The likelihood of disturbing a shipwreck is expected to be very low considering the vast size of the South African offshore area. In the event that any cultural heritage material is disturbed during bulk sampling operations, the impact would be at the national level, and of high intensity. Without mitigation this is of **Medium** significance. However, with the implementation of mitigation, cultural heritage sites can largely be avoided and if sampling is terminated in the unlikely event of encountering a shipwreck, the impact is regarded as **INSIGNIFICANT**.

The implications of not going ahead with the proposed prospecting operations relate to the lost opportunity to establish whether or not a viable offshore diamond resource exists off the West Coast and the lost economic opportunities. This potential impact of the No-Go Alternative is considered to be of **LOW** significance. The positive implications on the no-go option are that there would be no effects on the biophysical environment in the area proposed for the prospecting activities.

7. RECOMMENDATIONS

7.1 Compliance with Environmental Management Programme and MARPOL 73/78 standards

- All phases of the proposed project must comply with the Environmental Management Programme presented in Chapter 7; and
- The prospecting and support vessels must ensure compliance with MARPOL 73/78 standards.

7.2 Notification and communication with key stakeholders

- Prior to the commencement of the proposed activities, De Beers should consult with the managers of the DEFF fishery research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in order to minimise or avoid disruptions to both parties, where required.
- Notify Cairn, PetroSA, Sungu Sungu, Sunbird, Africa Energy Corp and Simbo and their contractors, as well as any other neighbouring petroleum exploration rights holders, as well as any companies undertaking marine prospecting or mining activities in the study area, prior to the commencement of activities.
- Liaise with all petroleum exploration operators and any overlapping mineral prospecting rights holders to ensure that there is no overlapping of activities in the same area over the same time period.
- Prior to the commencement of the proposed survey and/or sampling activities the following key stakeholders should be consulted and informed of the proposed activities (including navigational co-ordinates of the sampling areas, timing and duration of proposed activities) and the likely implications thereof:
  - > Fishing industry / associations (these include South African Tuna Association, South African Tuna Longline Association, Fresh Tuna Exporters Association, South African Commercial Linefish Association, Hake Longline Association, National SMME Fishing Forum); and
  - > Other: DEFF, South African Maritime Safety Authority (SAMSA), South African Navy (SAN) Hydrographic office, overlapping and neighbouring exploration right holders and applicants, and Transnet National Ports Authority (ports of Cape Town and Saldanha Bay).
- The required safety zones around the sampling vessels should be communicated via the issuing of Daily Navigational Warnings for the duration of the sampling operations through the South African Naval Hydrographic Office.
- The SAN Hydrographic office should be notified when the programme is complete so that the Navigational Warning can be cancelled.

7.3 Discharges

- All process areas should be bunded to ensure drainage water flows into the closed drainage system.
- Undertake training and awareness of crew in spill management to minimise contamination.
- Low-toxicity biodegradable detergents and reusable absorbent cloths should be used in cleaning of all deck spillage.
- All hydraulic systems should be adequately maintained.
- Minimise the discharge of galley waste material should obvious attraction of marine fauna be observed.

7.4 Vessel seaworthiness and safety

- Vessels used during prospecting must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. Lloyds Register, Det Norske Veritas).

- 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.
- A Notice to Mariners should provide the co-ordinates of the sampling areas.

7.5 Bulk Sampling Activities

- Exploration sampling targets gravel bodies in unconsolidated sediments and does not target high-profile rocky-outcrops.
- Prior to bulk sampling in areas adjacent to high-profile rocky-outcrop an assessment must be undertaken to identify if these outcrops host sensitive communities which must not be targeted. If this assessment cannot be conducted timeously then the high-profile rocky-outcrop will be mapped and avoided.
- An appropriate buffer zone must be established around identified sensitive communities on the high-profile rocky-outcrop based on independent ecological assessment. If this assessment cannot be conducted timeously then a 150 m buffer must be applied around high-profile rocky-outcrop without a sediment veneer.

7.6 Cultural Heritage Material

- Areas where shipwreck sites are identified during the geophysical surveys must be excluded prior to undertaking sampling activities.
- The onboard De Beers representative must undergo a short induction on archaeological site and artefact recognition, as well as the procedure to follow should archaeological material be encountered during sampling.
- The contractor must be notified that archaeological sites could be exposed during sampling activities, as well as the procedure to follow should archaeological material be encountered during sampling.
- If shipwreck material is encountered during the course of sampling in the concession area, the following mitigation measure should be applied:
  - > Cease work in the directly affected area to avoid damage to the wreck until SAHRA has been notified and the contractor/De Beers has complied with any additional mitigation as specified by SAHRA; and
  - > Where possible, take photographs of artefacts found, noting the date, time, location and types. Under no circumstances may any artefacts be removed, destroyed or interfered on the site, unless under permit from SAHRA.

8. ENVIRONMENTAL MANAGEMENT PROGRAMME

The EMPr has been compiled for the proposed prospecting activities, which consolidates management activities required to address the issues and mitigation measures identified in this EIR.

CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
CITES	Convention on International Trade in Endangered Species
DEFF	Department of Environment, Forestry and Fisheries
DMRE	Department of Mineral Resources and Energy
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ha	Hectares
I&AP	Interested and Affected Party
IUCN	International Union for Conservation of Nature
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973/1978
MMO	Marine Mammal Observer
MPA	Marine Protected Area
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002)
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
nm	Nautical mile
ROV	Remote Operated Vehicle
SAHRA	South African Heritage Resources Agency
SAMSA	South African Maritime Safety Authority
SAN	South African Navy
SANBI	South African National Biodiversity Institute
TAC	Total Allowable Catch
TAE	Total Applied Effort
VME	Vulnerable Marine Ecosystem

1 INTRODUCTION

This chapter describes the purpose of this report, provides a brief description of the project background, summarises the legislative authorisation requirements and terms of reference, describes the structure of the report and outlines the opportunity for comment on the report.

1.1 PURPOSE OF THIS REPORT

This Environmental Impact Report (EIR) has been compiled and distributed for review and comment as part of the Scoping and Environmental Impact Assessment (EIA) process that is being undertaken for the proposal by De Beers Consolidated Mines (Pty) Ltd (De Beers) to undertake offshore bulk sampling activities in Sea Concession 6C off the West Coast of South Africa, as part of a Prospecting Right application.

This report summarises the process followed to date and provides an overview of the proposed project and affected environment. It also presents the findings of the specialist studies and provides an assessment of the impacts of the proposed project.

De Beers Marine (Pty) Ltd (DBM), the appointed operator for De Beers Consolidated Mines (Pty) Ltd, has appointed SLR Consulting (South Africa) (Pty) Ltd (SLR) as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and EIA process for the proposed bulk sampling activities in accordance with the requirements of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) (as amended), Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA) (as amended) and Regulations thereto.

1.2 PROJECT BACKGROUND

On 14 June 2018, De Beers lodged an application for a Prospecting Right with the DMRE to undertake diamond prospecting activities in Sea Concession 6C off the West Coast of South Africa. The planned activities included regional geophysical surveys, sampling activities and bulk sampling activities. The application was lodged in terms of Section 16 of the MPRDA. In terms of the MPRDA, a Prospecting Right must be issued prior to the commencement of any prospecting activities. A requirement for obtaining a Prospecting Right is that the applicant must comply with Chapter 5 of the NEMA with regards to consultation and reporting.

In terms of the EIA Regulations (2014) (as amended), promulgated in terms of Chapter 5 of NEMA, an application for a Prospecting Right requires Environmental Authorisation (EA) from the competent authority, the Minister of Mineral Resources or delegated authority, to carry out the proposed prospecting activities.

In support of the Prospecting Right application, an application for EA by means of a Basic Assessment process was submitted to the DMRE. In response to the Basic Assessment application, DMRE indicated that the application for EA would be processed without the inclusion of the proposed bulk sampling activities, as bulk sampling would trigger a listed activity in Listing Notice 2 (Government Notice (GN) No. 984 of 4 December 2014, amended by GN No. 325 of 7 April 2017) of the EIA Regulations, 2014 (as amended). Thus, as a Listing Notice 2 activity, a Scoping and EIA (in terms of NEMA, as amended) would have to be undertaken for the planned bulk sampling activities to be undertaken as part of the overall prospecting operations.

On 4 February 2019 the DMRE granted EA for the planned geophysical surveys and sampling operations (to be undertaken as part of the overall prospecting operations within Sea Concession 6C). This Scoping and EIA process covers the proposed bulk sampling activities associated with the overall prospecting operations to be undertaken in Sea Concession 6C.

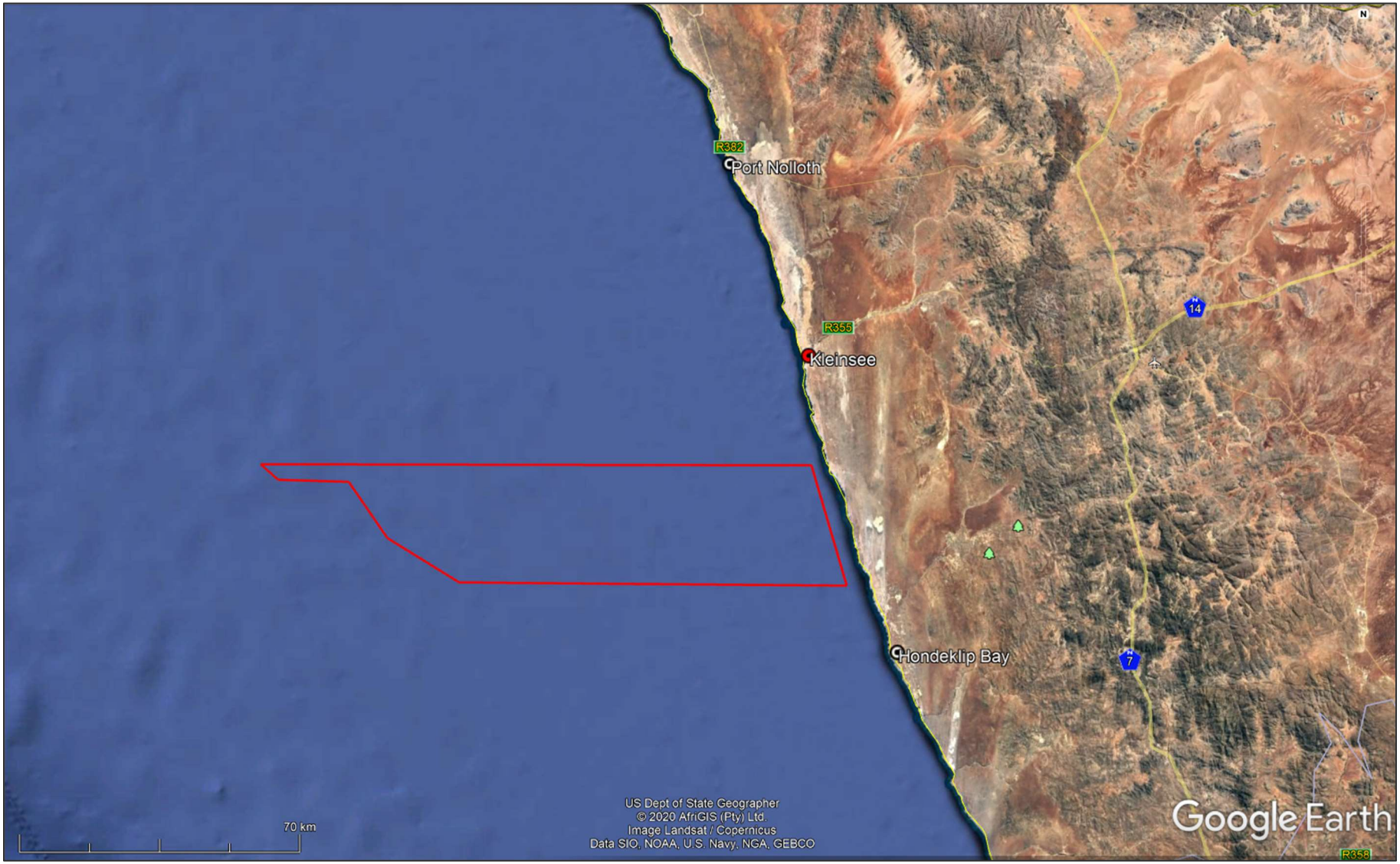

FIGURE 1-1: LOCATION OF THE 6C PROSPECTING RIGHT AREA, OFF THE WEST COAST OF SOUTH AFRICA.

1.3 TERMS OF REFERENCE

The terms of reference for the Scoping and EIA are as follows:

1. Ensure the Scoping and EIA is undertaken in accordance with the requirements of NEMA and the EIA Regulations, 2014 (as amended);
2. Ensure the Scoping and EIA is undertaken in an open, participatory manner to ensure that all potential impacts are identified;
3. Undertake a formal public participation process, which specifically addresses the distribution of information to Interested & Affected Parties (I&APs) and provides the opportunity for I&APs to raise any concerns/issues, as well as an opportunity to comment on all Scoping and EIA documentation;
4. Commission specialists to undertake studies, identified during the scoping process, to assess key issues and concerns; and
5. Integrate all the information, including the finding of the specialist studies, into an Environmental Impact Report (EIR) to allow an informed decision to be taken concerning the proposed project.

1.4 STRUCTURE OF THIS REPORT

This report consists of eight chapters and five appendices, the contents of which are outlined below.

Section	Contents
Executive Summary	Provides a summary of the EIR.
Chapter 1	**Introduction** Describes the purpose of this report, provides a brief description of the project background, summarises the legislative authorisation requirements, presents the terms of reference of the EIA, and describes the structure of the report and the opportunity for comment.
Chapter 2	**Legislative requirements and study process** Outlines the key legislative requirements applicable to the proposed prospecting activities and outlines the methodology and consultation process followed in the EIA process.
Chapter 3	**Project overview** Describes the need and desirability for the proposed project, provides general project information, an overview of the proposed prospecting activities and a description of the project alternatives.
Chapter 4	**Description of the affected environment** Describes the existing biophysical and social environment that could potentially be affected by the proposed project.
Chapter 5	**Impact description and assessment** Describes and assesses the potential impacts of the proposed project on the affected environment. It also presents mitigation or optimisation measures that could be used to reduce the significance of any negative impacts or enhance any benefits, respectively.

Section	Contents
Chapter 6	**Conclusion and recommendations** Provides conclusions to the EIA and summarises the recommendations for the proposed project.
Chapter 7	**Environmental Management Programme** Provides an Environmental Management Programme for the proposed prospecting activities.
Chapter 8	**References** Provides a list of the references used in compiling this report.
Appendices	Appendix 1: DMRE EIR and EMPr Template Appendix 2: DMRE acceptance of the Scoping Report Appendix 3: Public Participation Appendix 3.1: I&AP database Appendix 3.2: Comments and Responses Report Appendix 4: Specialist studies Appendix 4.1: Convention for assigning significance ratings to impacts Appendix 4.2: Fisheries Assessment Appendix 4.3: Marine Faunal Assessment Appendix 4.4: Maritime Heritage Assessment Appendix 5: EAP declaration

1.5 OPPORTUNITY TO COMMENT

This EIR has been distributed for a 30-day comment period from **7 September 2020 to 8 October 2020** in order to provide I&APs with an opportunity to comment on any aspect of the proposed project and the findings of the EIA project to date. Copies of the full report have been made available on the SLR website (at https://slrconsulting.com/public-documents/de-beers-consolidated-mines) and at the Cape Town offices of SLR.

Any comments should be forwarded to SLR at the address, telephone/fax numbers or e-mail addresses shown below. For comments to be included in the updated EIR, comments should reach SLR by **no later than 8 October 2020.**

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2 LEGISLATIVE REQUIREMENTS AND EIA PROCESS

This chapter outlines the key legislative requirements applicable to the proposed bulk sampling activities and outlines the methodology and I&AP consultation process followed in the Scoping and EIA process.

2.1 LEGISLATIVE REQUIREMENTS

2.1.1 Mineral and Petroleum Resources Development Act, 2002

In terms of the MPRDA, a Prospecting Right must be obtained prior to the commencement of any prospecting activities. A requirement for obtaining a Prospecting Right is that an applicant must submit an application in terms to Section 16(1) of the MPRDA to the Regional Manager, who must accept the application within 14 days if, *inter alia*, no other person holds a Prospecting Right, Mining Right, Mining Permit or Retention Permit for the same mineral and land. If the application for a Prospecting Right is accepted, the Regional Manager must request that the applicant comply with Chapter 5 of NEMA with regards to consultation and reporting (see Section 2.1.2 below).

As mentioned in Section 1.2, in June 2018, De Beers lodged an application with DMRE for a Prospecting Right in terms of the MPRDA and an Application for EA in terms of NEMA. In response to the EA application, DMRE indicated that the planned bulk sampling activities would, in accordance with Section 20(2) of the MPRDA, require written permission from the Minister of Mineral Resources for the removal and/or disposal of diamonds found in the course of prospecting operations.

In light of the above, the removal and disposal of minerals contemplated in terms of Section 20 of the MPRDA triggers listed activity 19 of Listing Notice 2 (GN R984, as amended by GN No. 325 of 7 April 2017). This is discussed in more detail below.

2.1.2 National Environmental Management Act, 1998

Chapter 2 of NEMA sets out a range of environmental principles that are to be applied by all organs of state when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. NEMA also provides for the participation of I&APs and stipulates that decisions must take into account the interests, needs and values of all I&APs.

Chapter 5 of NEMA outlines the general objectives and implementation of Integrated Environmental Management (IEM), which provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 provides a framework for granting of EAs. In order to give effect to the general objectives of IEM, the potential impacts on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment and communication of the potential impact of activities.

The EIA Regulations 2014 (as amended) promulgated in terms of Chapter 5 of NEMA, and published in GN No. R982 (as amended), provides for the control of certain listed activities. These activities are listed in GN No. R983 (Listing Notice 1), R984 (Listing Notice 2) and R985 (Listing Notice 3) of 4 December 2014 (as amended), and are prohibited until EA has been obtained from the competent authority. The Minister of Mineral

Resources remains responsible for the granting of an EA for the proposed bulk sampling activities in terms of NEMA. Such EA, which may be granted subject to conditions, will only be considered once there has been compliance with GN No. R982.

GN No. R982 sets out the procedures and documentation that need to be complied with when applying for EA. A Basic Assessment process must be applied to an application if the authorisation applied for is in respect of an activity(ies) listed in Listing Notice 1 and / or 3 and an Scoping and EIA process must be applied to an application if the authorisation applied for is in respect of an activity(ies) listed in Listing Notice 2.

As noted in Section 2.1.1 above, the proposed project triggers, amongst others, Activity 19 contained in Listing Notice 2, thus a full Scoping and EIA process must be undertaken in order for DMRE to consider the application in terms of NEMA and make a decision as to whether to grant EA or not. All the listed activities triggered by the proposed project are indicated in Table 2-1 below.

TABLE 2-1: LIST OF APPLICABLE ACTIVITIES IN TERMS OF LISTING NOTICE 1 AND 2.

Activity No.	Activity Description	Description of activity in relation to the proposed project
GN No. R983: Listing Notice 1		
22	*"The decommissioning of any activity requiring-* *(i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or* *(ii) a …prospecting right… where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure."*	On completion of the proposed prospecting operation, De Beers would be required to apply to the DMRE for a closure certificate. The process of applying for a Closure Certificate would trigger this listed activity.
GN No. R984: Listing Notice 2		
19	*"The removal and disposal of minerals contemplated in terms of section 20 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to prospecting of a mineral resource; the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies."*	The proposed bulk sampling would involve the removal and disposal of marine diamonds and would include extraction, screening and washing during the bulk sampling operations.

2.1.3 National Environmental Management: Air Quality Act, 2004

The National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004) (NEM:AQA) regulates all aspects of air quality, including prevention of pollution, providing for national norms and standards and including a requirement for an Atmospheric Emissions Licence (AEL) for listed activities, which result in atmospheric emissions and have or may have a significant detrimental effect on the environment.

Activities that require an AEL are listed in GN No. 893 (22 November 2013), published in terms of Section 21(1)((b) of the NEM:AQA. In terms of Section 22 of NEM:AQA no person may conduct a listed activity without an AEL. The incineration of waste is a listed activity (Category 8.1 – Thermal treatment of Hazardous and General Waste) and requires an AEL for all installations treating 10 kg or more of waste per day.

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)[1] does 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.

2.1.4 National Environmental Management: Waste Act, 2008

The National Environmental Management: Waste Act, 2008 (No. 59 of 2008) (NEM: WA) regulates all aspects of waste management and has an emphasis on waste avoidance and minimisation. NEM: WA creates a system for listing and licensing waste management activities. Listed waste management activities above certain thresholds are subject to a process of impact assessment and licensing. Activities listed in Category A require a Basic Assessment, while activities listed in Category B require a Scoping and EIA process.

The Department of Environment, Forestry and Fisheries (DEFF) has indicated that NEM: WA is not applicable to offshore activities. Thus, a Waste Management Licence would not be required for offshore waste management activities, such as those related to sewage. These aspects would be managed in terms of and comply with the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).

2.1.5 Other Relevant Legislation

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

- 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);

[1] The Exclusive Economic Zone is the zone extending from the coastline out to a distance of 200 nautical miles within which South Africa holds exclusive economic rights.

- 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).

Other South African legislation

- Carriage of Goods by Sea Act, 1986 (No. 1 of 1986);
- 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 Birds and Seals Protection Act, 1973 (No. 46 of 1973);
- Ship Registration Act, 1998 (No. 58 of 1998); and
- Wreck and Salvage Act, 1995 (No. 94 of 1995).

2.2 LEGISLATION CONSIDERED IN THE PREPARATION OF THE EIR

In accordance with the EIA Regulations 2014 (as amended), all legislation and guidelines that have been considered in the EIA process must be documented.

Table 2-2 below provides a summary of the applicable legislative context and policy.

TABLE 2-2: LEGAL FRAMEWORK

Applicable legislation and guidelines	Relevance or reference
Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002)	Refer to Section 2.1.1.
National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA)	Refer to Section 2.1.2
EIA Regulations 2014, as amended (GN No. R982), Listing Notice 1 (GN No. R983), Listing Notice 2 (GN No. R984).	Refer to Section 2.1.2 and Table 2-1. The proposed project triggers activities listed in Listing Notice 1 and Listing Notice 2 and, therefore, requires a Scoping and EIA process to inform the application for EA. This EIR has been compiled in accordance with Appendix 3 of the EIA Regulations 2014 (as amended).

2.3 GUIDELINES AND POLICIES

The guidelines and policies listed in Table 2-3 have been taken into account during the Scoping and EIA process.

TABLE 2-3: GUIDELINES AND POLICIES RELEVANT TO THE PROPOSED PROJECT.

Guideline	Governing body	Applicability
Specialist Studies, Integrated Environmental Management, Information Series 4 (2002)	DEFF	This guideline was consulted to ensure adequate development of terms of reference for specialist studies.
Impact significance, Integrated Environmental Management, Information Series 5 (2002)	DEFF	This guideline was consulted to inform the assessment of significance of impacts of the proposed project.
Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7 (2004)	DEFF	This guideline will be consulted to inform the consideration of potential cumulative effects of the proposed project.
Criteria for determining Alternatives in EIA, Integrated Environmental Management, Information Series 11 (2004)	DEFF	This guideline was consulted to inform the consideration of alternatives.
Environmental Management Plans, Integrated Environmental Management, Information Series 12 (2004)	DEFF	This guideline will be consulted to ensure that the Environmental Management Programme (EMP) has been adequately compiled.
Environmental Impact Reporting, Integrated Environmental Management, Information Series 15 (2004)	DEFF	This guideline was consulted to inform the approach to impact reporting.

Guideline	Governing body	Applicability
Guideline on need and desirability (2017)	DEFF	This guideline informed the consideration of the need and desirability aspects of the proposed project.
Public Participation guideline in terms of NEMA (2017)	DEFF	The purpose of these guidelines is to ensure that an adequate public participation process was undertaken during the EIA process.

2.4 SCOPING AND EIA PROCESS

2.4.1 Details of the EIA project team

As noted in Section 1, SLR has been appointed as the independent EAP to undertake the EIA for the proposed bulk sampling activities. The details of the EIA project team that were involved in the preparation of this EIR are provided in Table 2-4.

SLR has no vested interest in the proposed project other than fair payment for consulting services rendered as part of the EIA process and has declared its independence as required by the EIA Regulations 2014 (as amended).

TABLE 2-4: DETAILS OF THE EIA PROJECT TEAM

General				
Organisation	SLR Consulting (South Africa) (Pty) Ltd			
Postal address	PO Box 10145, CALEDON SQUARE, 7905			
Tel No.	+27 (0)21 461 1118 / 9			
Fax No.	+27 (0)21 461 1120			
Name	**Qualifications**	**Professional registrations**	**Experience (Years)**	**Tasks and roles**
Jonathan Crowther	M.Sc. (Env. Sci.). University of Cape Town (UCT)	Pr.Sci.Nat., Member IAIAsa	30	Project Director
Stuart Heather-Clark	M.Phil. (Env. Sci.) UCT	Registered EAP Member IAIAsa	23	Report review
Nicholas Arnott	Hons. (Earth & Geog. Sci.), UCT	Pr.Sci.Nat., Member IAIAsa	12	Management of the EIA process, including process review, specialist study review and report compilation
Rizqah Baker	Hons. (Envir. & Geog. Sci.), UCT	Member IAIAsa	2	Project assistant

2.4.2 Qualifications and Experience of the EAPs

Jonathan Crowther has been involved in environmental consulting since 1988 and is currently a Lead Environmental Consultant at SLR Consulting (South Africa) (Pty) Ltd. He has expertise in a wide range of environmental disciplines, including Environmental Impact Assessments (EIA), Environmental Management

Plans / Programmes, Environmental Planning & Review, Environmental Control Officer services, and Public Consultation & Facilitation. He has project managed a number of offshore oil and gas EIAs for various exploration and production activities in South Africa and Namibia. He also has extensive experience in projects related to roads, property developments and landfill sites.

Stuart Heather-Clark is a Technical Director in SLR's Environmental Management Planning and Approvals team in Africa. He holds a BSc in Civil Engineering and a Masters degree in Environmental Science and has 23 years of relevant experience. He has expertise in a wide range of environmental disciplines, including EIAs, EMPs, environmental planning and review and public consultation and a registered EAP.

Nicholas Arnott has worked as an environmental assessment practitioner since 2006 and has been involved in a number of projects covering a range of environmental disciplines, including Basic Assessments, Environmental Impact Assessments and Environmental Management Programmes. He has gained experience in a wide range of projects relating to mining, infrastructure projects (e.g. roads), housing and industrial developments.

Rizqah Baker has been working in the environmental field for two years. She has worked in both the public and private sector, having worked for the City of Cape Town and an environmental landscape contractor respectively. She brings with her strong report writing skills and practical experience in the review and implementation of Environmental Management Programmes.

2.4.3 Assumptions and Limitations

The Scoping and EIA assumptions and limitations are listed below:

- The Scoping and EIA assumes that SLR has been provided with all relevant project information and that it was correct and valid at the time it was provided;
- Specialists will be provided with all the relevant project information in order to produce accurate and unbiased assessments;
- There will be no significant changes to the project description or surrounding environment between the completion of the EIR and implementation of the proposed project that could substantially influence findings, recommendations with respect to mitigation and management, etc.; and
- The assessment will be based, to a large extent, on a generic description of the proposed bulk sampling activities, as the specific details were not available at the time of writing this report (e.g. exact timing and duration, sound levels, etc.).

These assumptions and limitations, however, are not considered to have any negative implications in terms of the credibility of the results of the Scoping and EIA process.

2.5 SCOPING PHASE

2.5.1 Objectives

In accordance with Appendix 2 of GN No. R982 (as amended), the objectives of the Scoping process were:

- To identify the relevant policies and legislation relevant to the activity;
- To present the need and desirability of the proposed activity and its preferred location;
- To identify feasible alternatives related to the project proposal;
- To ensure that all potential key environmental issues and impacts that would result from the proposed project are identified;

- To provide a reasonable opportunity for I&APs to be involved in the Scoping and EIA process;
- To assess potential impacts of the proposed project alternatives during the different phases of project development;
- To present appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively; and
- Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.

The Scoping process consists of a series of steps to ensure compliance with these objectives and the EIA Regulations 2014 as set out in GN No. R982 (as amended). The process involves an open, participatory approach to ensure to ensure that all impacts are identified and that decision-making takes place in an informed, transparent and accountable manner. A flowchart indicating the Scoping and EIA process is presented in Figure 2-1. Box 2-1 describes the public participation tasks undertaken during the Scoping Phase.

BOX 2-1: TASKS UNDERTAKEN DURING THE SCOPING PUBLIC PARTICIPATION PROCESS

- **I&AP identification**

  A preliminary I&AP database of authorities (including State Departments with jurisdiction in the area, municipal offices and ward councillors), Organs of State, Non-Governmental Organisations, Community-based Organisations, adjacent landowners and other key stakeholders with a potential interest in the proposed project was compiled. To date 69 I&APs have been registered on the project database (see Appendix B).

- **I&AP Notification Letters**

  All identified I&APs were notified of the proposed project, Application for EA and EIA process by means of a notification letter. The purpose of the notification letter was to convey information on the proposed project, EA process, as well as to invite I&APs to register on the project database and notify them of the availability of the draft Scoping Report for review and comment. The draft Scoping Report review and comment period was from 14 August to 13 September 2019.

- **Press advertisement**

  A press advertisement providing notification of the proposed project, EA process and availability of the Scoping Report for review and comment was placed in the “Die Burger” newspaper on 14 August 2019.

- **Scoping Report availability**

  The draft Scoping Report was made available on the SLR website (www.slrconsulting.com\za) and the Cape Town offices of SLR for the duration of the review and comment period.

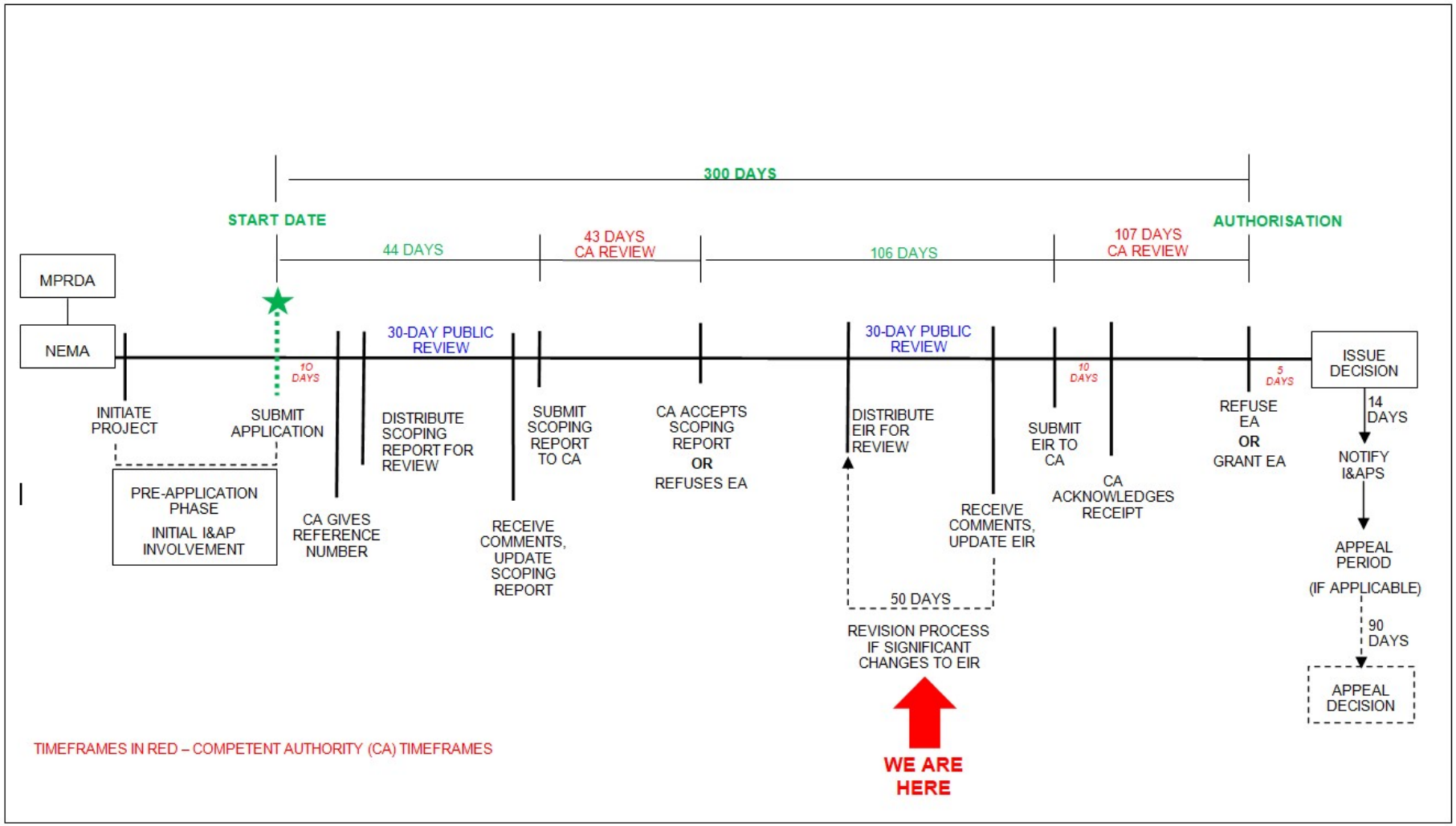

FIGURE 2-1: FLOW DIAGRAM SHOWING THE SCOPING AND EIA PROCESS. *

* The above-mentioned timeframes do not include any extensions to timeframes allowed for in the "*Directions Regarding Measures to Address, Prevent and Combat the Spread of Covid -19 Relating to National Environmental Management Permits and Licences*" published in GN No. 650 of 5 June 2020.

2.5.2 Application for Environmental Authorisation

An "Application Form for Environmental Authorisation" form was submitted to DMRE at the same time as making this draft version of the Scoping Report available for review and comment. The application was accepted by DMRE on 21 August 2019.

2.5.3 Compilation and Acceptance of Scoping Report

The final Scoping Report was prepared in compliance with Appendix 2 of the EIA Regulations 2014 (as amended) and took into consideration comments received on the draft Scoping Report. Steps undertaken during the Scoping Phase are summarised in Box 2-1 and all supporting information was appended to the final Scoping Report. All written comments received were collated, and responded to, in a Comments and Responses Report, which was appended to the final Scoping Report.

The final Scoping Report was submitted to DMRE for acceptance on 25 September 2019. DMRE accepted the report on 4 December 2019 and indicated that the EIR should be submitted before 26 May 2020 (see Appendix 3). However, following the implementation of the nation-wide lockdown on 26 March 2020, the Minister of Forestry, Fisheries and the Environment issued Directions ("*Measures to Address, Prevent and Combat the Spread of Covid-19*" published in GN No. R 439 of 31 March 2020) which extended the above-mentioned time frame "*by the number of days of the duration of the lockdown period of the national state of disaster declared for the COVID-19 pandemic, including any extensions to such duration, with effect from 27 March 2020 until the termination of the lockdown period*".

Subsequently, on 5 June 2020 updated Directions were published (GN No. 650 of 5 June 2020) which repealed the above-mentioned Directions of 31 March 2020. In terms of these new Directions, the timeframes set out in the EIA Regulations 2014 (as amended) were resumed and "*remain extended … by the number of days calculated from 27 March 2020 until further notice*". In light of the above, the final EIR must be submitted to DMRE by 14 October 2020.

2.5.4 Summary of the Issues Raised by I&APs

A summary of the key issues and concerns raised I&APs during the Scoping Phase are summarised in Table 2.5 below.

TABLE 2-5: KEY PROJECT ISSUES IDENTIFIED DURING THE SCOPING STUDY

Name	Date Received	Issues Raised	Response Provided
South African Heritage **Resource Agency** – Briege Williams	21 August 2019	SAHRA previously commented on the Basic Assessment Report (BAR) produced as part of the prospecting right application. SAHRA supports the recommendation that the Maritime Heritage Impact Assessment produced for the BAR be included as a specialist study in the Environmental Impact Assessment.	Support for the proposal to use the HIA undertaken as part of the Basic Assessment Process for the prospecting right application is acknowledged. The related mitigation measures relevant to the proposed bulk sampling operations will be included in the Environmental Management

Name	Date Received	Issues Raised	Response Provided
			Programme (EMPr) to be compiled in the EIA phase.
Ms. Abegail Makgato - Trans Hex	16 August 2019	Requested to be registered on the project database.	Ms. Makgato was included on the project database in addition to the contact persons for the Trans Hex operations which had been included previously.

2.6 EIA PHASE

2.6.1 Objectives

In accordance with Appendix 3 of GN R982 (as amended) the key activities of the EIA are to:

- determine the policies and legislation relevant to the activity and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity in the context of the development footprint on the approved site as contemplated in the accepted Scoping Report;
- identify feasible alternatives related to the project proposal;
- ensure that all potential key environmental issues and impacts that would result from the proposed project are identified;
- assess potential impacts of the proposed project alternatives during the different phases of project development;
- identify the most ideal location of the activity within the development footprint of the approved site based on the lowest level of environmental sensitivity identified during the assessment;
- present appropriate mitigation or optimisation measures to avoid, manage or mitigate potential impacts or enhance potential benefits, respectively;
- identify residual risks that need to be managed and monitored; and
- provide a reasonable opportunity for I&APs to be involved in the EIA process.

Through the above, ensure informed, transparent and accountable decision-making by the relevant authorities.

2.6.2 Specialist Studies

Three specialist studies were undertaken as part of the previous Basic Assessment application and also addressed the key issues and detailed assessment of the planned bulk sampling activities. These studies were: (1) the impact on marine fauna, (2) the impact on fishing, and (3) the impact on underwater cultural heritage materials. A list of the specialists and their details are provided in Table 2-6.

The specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the proposed geophysical and sampling activities (considered in the above-mentioned Basic Assessment application), as well as the proposed bulk sampling activities. These impacts were assessed according to pre-defined rating scales (see Appendix 4.1). Specialists also recommended appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively.

TABLE 2-6: LIST OF SPECIALIST STUDIES AND SPECIALISTS

No.	Specialist study	Specialist/s	Qualifications	Company
1	Marine Fauna	Dr Andrea Pulfrich	PhD, (Fisheries Biology), Christian-Albrechs University, Kiel, Germany	Pisces Environmental Services (Pty) Ltd
2	Fisheries	Mr Dave Japp	MSc (Ichthyology and Fisheries Science), Rhodes University	Capricorn Marine Environmental (Pty) Ltd
		Ms Sarah Wilkinson	BSc (Hons), (Botany), University of Cape Town	
3	Underwater Cultural Heritage Material	Ms Vanessa Maitland	MSc (Maritime Archaeology), University of South Africa	-

2.6.3 Compilation and Review of the draft EIR

This draft EIR has been prepared in compliance with Appendix 3 of the EIA Regulations, 2014 (as amended) (see Table 2-7). The specialist studies and other relevant information have been integrated into this report.

The specialist information and other relevant information has been integrated into the EIR and includes an Environmental Managements Programme (EMPr) (see Section 7). The EIR has been released for a 30-day comment period and all I&APs on the project database have been notified.

TABLE 2-7: REQUIREMENTS OF AN EIR IN TERMS OF APPENDIX 3 OF THE EIA REGULATIONS, 2014 (AS AMENDED)

Appendix 3	Content of an EIR	Completed (Y/N or N/A)	Location in report
2(a)	*(i & ii) Details and expertise of the Environmental Assessment Practitioner (EAP) who prepared the report, including a CV.*	Y	Section 2.4.1 and Appendix 1.
(b)	*The location of the activity, including:*	N/A	N/A
	(i) the 21 digit Surveyor General code of each cadastral land parcel; or		
	(ii) where available, the physical address and farm name		
	(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Y	Section 3.1.2.
(c)	*A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is:*	Y	Figure 1-1.
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	N/A	N/A
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	N/A	N/A
(d)	*A description of the scope of the proposed activity, including:*	Y	Section 2.1.2 and Table 2-1.
	(i) all listed and specified activities triggered;		
	(ii) a description of the activities to be undertaken, including associated structures and infrastructure.	Y	Section 3.

Appendix 3	Content of an EIR	Completed (Y/N or N/A)	Location in report
(e)	*A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.*	Y	Section 2.
(f)	*A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location.*	Y	Section 3.2.
(h)	*A full description of the process followed to reach the proposed preferred activity, site and location within the site, including:*		
	(i) details of all the alternatives considered;	Y	Section 3.3.
	(ii) details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Y	Sections 2.5 and 0.
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Y	Section 2.5.2.
	(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Y	Section 4.
	(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts *(aa) can be reversed;* *(bb) may cause irreplaceable loss of resources; and* *(cc) can be avoided, managed or mitigated.*	Y	Section 5.
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Y	Section 5 and Appendix 4.
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Y	Section 5.
	(viii) the possible mitigation measures that could be applied and level of residual risk;	Y	Section 5 and Section 7.
	(ix) the outcome of the site selection matrix;	N/A	N/A
	(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	Y	Section 3.3
	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity.	Y	Section 3.3.
(i)	*A full description of the process undertaken to identify, assess and rank the impacts the activity and associated infrastructure will impose on the preferred location through the life of the activity, including:*	Y	Section 5 and Appendix 4.
	(i) a description of all environmental issues and risks that were identified during the EIA process; and		

Appendix 3	Content of an EIR	Completed (Y/N or N/A)	Location in report
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which each issue and risk could be avoided or addressed by the adoption of mitigation measures.		
(i)	*An assessment of each identified significant impact and risk, including:* *(i) Cumulative impacts;* (ii) *The nature, significance and consequence of the impact and risk;* (iii) *The extent and duration of the impact and risk*; (iv) *The probability of the impact occurring*; (v) *The degree to which the impact and risk can be reversed*; (vi) *The degree to which the impact and risk may cause irreplaceable loss of resources*; and (vii) *The degree to which the impact and risk can be mitigated*.	Y	Section 5 and Appendix 4.
(k)	*Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.*	Y	Section 4 and 7.
(l)	*An environmental impact statement which contains:*		
	i) A summary of the key findings of the EIA;	Y	Section 6.1
	ii) A map at an appropriate scale which superimposes the activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	N/A	N/A
	iii) A summary of the positive and negative impacts of the proposed activity and identified alternatives.	Y	Section 6.1
(m)	*Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.*	Y	Section 6.2
(n)	*The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.*	Y	Section 3.4.
(o)	*Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.*	N/A	N/A
(p)	*A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.*	Y	Section 2.4.3
(q)	*A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.*	Y	Section 6.1.3
(r)	*Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.*	N/A	N/A
(s)	*An undertaking under oath or affirmation by the EAP in relation:* *(i) The correctness of the information provided in the report;* *(ii) The inclusion of comments and inputs from stakeholders and I&APs;*	Y	**Error! Reference source not found.**

Appendix 3	Content of an EIR	Completed (Y/N or N/A)	Location in report
	(iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and *(iv) Any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs.*		
(t)	*Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.*	Y	Section 3.1.3
(u)	*An indication of any deviation from the approved Scoping Report, including the plan of study, including:* *(i) Any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and* *(ii) A motivation for the deviation.*	N/A	N/A
(v)	*Any specific information that may be required by the competent authority.*	N/A	N/A
(w)	*Any other matter required in terms of section 24(4)(a) and (b) of the Act.*	N/A	N/A

2.6.4 Completion of the EIA Phase

The following steps are envisaged for the remainder of the EIA process (see Figure 2-1):

- After closure of the comment period, the draft EIR will be updated and finalised. All comments received on the draft EIR will be assimilated and, where relevant, responded to in a Comments and Responses Report that will be appended to the final report.
- The final EIR will be submitted to DMRE for consideration and decision-making.
- After DMRE has reached a decision, all I&APs on the project database will be notified of the outcome of the application and the reasons for the decision.

A statutory appeal period in terms of the National Appeal Regulations (GN No. R993), will follow the issuing of the decision. In terms of Regulation 4(1)(a), an appellant must submit an appeal to the appeal administrator, and a copy of the appeal to the applicant, any registered I&AP and any organ of state with interest in the matter within 20 days from the date that the notification of the decision on the issuing of a EA was sent to the registered I&APs by the applicant.

3 PROJECT DESCRIPTION

This section provides general project information, describes the need and desirability for the proposed project, considers alternatives, and provides information on the proposed bulk sampling activities.

3.1 GENERAL PROJECT INFORMATION

3.1.1 Applicant

De Beers Consolidated Mines (Pty) Ltd is the applicant.

Address:	**De Beers Consolidated Mines (Pty) Ltd** Corner Crownwood Road and Diamond Drive Theta Ext 4 Johannesburg 2013	
Responsible Persons:	**Nompumelelo Dessederia Zikalala**	**Michelle Bossenger**
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3.1.2 Details of the Sea Concession Area

The proposed bulk sampling activities would be undertaken within Sea Concession 6C, located off the West Coast of South Africa (see Figure 1-1). The co-ordinates of the boundary points of Sea Concession 6C are provided in Table 3-1 below.

TABLE 3-1: CO-ORDINATES OF THE BOUNDARY POINTS OF SEA CONCESSION 6C

Point	Latitude	Longitude	Total Area (km^2)
1	29° 54’ 18’’ S	17° 04’ 56’’ E	3 457.46 km^2
2	30° 10’ 55’’ S	17° 10’ 19’’ E	
3	30° 10’ 55’’ S	16° 10’ 10’’ E	
4	30° 04’ 26’’ S	15° 58’ 47’’ E	
5	29° 56’ 28’’ S	15° 53’ 13’’ E	
6	29° 56’ 28’’ S	15° 41’ 46’’ E	
7	29° 54’ 18’’ S	15° 39’ 43’’ E	

3.1.3 Financial Provision

In terms of Section 24 of NEMA, an application for EA for a Prospecting Right must comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.

De Beers has financial provisioning in place for this rights area and would review the quantum of the financial provision as required by DMRE.

3.1.4 Proposed Work Programme

The target mineral for the bulk sampling activities is marine diamonds. In addition to the proposed bulk sampling activities, the proposed prospecting operations would also entail regional scale and high-resolution geophysical surveys and sampling. As noted previously, EA for the planned geophysical surveys and sampling activities has already been granted.

Due to the dynamic nature of prospecting, the work programme may have to be modified, extended or curtailed as data and analyses become available. The overall prospecting programme would run over a five-year period.

3.2 NEED AND DESIRABILITY

The Integrated Environmental Management Guideline on Need and Desirability (2017) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. Thus, the over-arching framework for considering the need and desirability of development in general is taken at the policy level through the identification and promotion of activities / industries / developments required by civil society as a whole. The DEA guideline further notes that at a project level (as part of an EIA process), the need and desirability of the project should take into consideration the content of regional and local plans, frameworks and strategies.

In light of the above, and in alignment with the above-mentioned guideline (DEA, 2017), this section aims to provide an overview of the need and desirability for the proposed project by highlighting how it is aligned with the strategic context of national development policy and planning, broader societal needs and regional and local planning, as appropriate.

3.2.1 National Policy and Planning Framework

3.2.1.1 National Development Plan 2030 (2012)

The National Development Plan (NDP) 2030 (2012) provides the context for all growth in South Africa, with the overarching aim of eradicating poverty and inequality between people in South Africa through the promotion of development. The NDP provides a broad strategic framework, setting out an overarching approach to confronting poverty and inequality based on the six focused and interlinked priorities. One of the key priorities is “faster and more inclusive economic growth”.

In order to transform the economy and create sustainable expansion for job creation, an average economic growth exceeding 5% per annum is required. One of the approaches to achieve this includes increasing exports by focusing on areas where South Africa already has natural endowments and comparative advantage, such as mining.

Notwithstanding the above, it is also acknowledged that environmental challenges are in conflict with some of these development initiatives. As such, it is emphasised that there is also a need to:

- Protect the natural environment;
- Enhance the resilience of people and the economy to climate change;
- Reduce carbon emissions in line with international commitments;

- Make significant strides toward becoming a zero-waste economy; and
- Reduce greenhouse gas emissions and improve energy efficiency.

The NDP identifies the "minerals and metals cluster" (which encompasses all mining and quarrying activities, supplier industries to the mining sector, and downstream beneficiation of mined minerals) as a sector with substantial potential for growth stimulation and/or employment. It is pointed out that South Africa must exploit its mineral resources to create employment and generate foreign exchange and tax revenue. Thus, 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.

3.2.1.2 Operation Phakisa (2014)

Operation Phakisa was established in 2014 with the aim to accelerate execution of the NDP. The ultimate goal is to boost economic growth and create jobs in order to address poverty, unemployment and inequality. It also aims operate as a cross-sectoral programme for implementation of the NDP through improved cooperation between government, organised business and organised labour. Two programme areas identified under Operation Phakisa which are of relevance for the proposed project include the Oceans Economy programme and the Mining Phakisa programme. It is noted that offshore mining is not specifically addressed under the Oceans Economy Lab of Operation Phakisa, however, it was included under the Mining Lab of Operation Phakisa (also referred to as the Mining Phakisa). These are discussed in more detail below.

3.2.1.2.1 Oceans Economy programme

Operation Phakisa has identified the oceans economy as a key programme area, on the premise that it has the potential to contribute up to R 177 billion to Gross Domestic Product (GDP) by 2033 (compared to R 54 billion in 2010) and to create up to one million jobs (compared to 316 000 in 2010). The following six growth areas were identified as key priorities for growing the ocean economy:

- Marine Protection Services and Ocean Governance;
- Marine Transport and Manufacturing;
- Offshore Oil and Gas;
- Aquaculture;
- Small Harbours Development; and
- Coastal and Marine Tourism.

Under the Marine Protection Services and Ocean Governance work stream, Government developed an overarching governance plan with the aim to protect the ocean environment from illegal activities and promote its socio-economic benefits. A key output of this workstream is the proclamation of 22 new Marine Protected Areas (MPAs) covering an area of 68 578 km^2 of the EEZ. These areas have been set aside for the long-term protection of marine ecosystems (see Section 4.2).

As a result of the Marine Transport and Manufacturing workstream, the port of Port Nolloth has been upgraded as part of a rehabilitation project undertaken by the Transnet National Ports Authority. The infrastructure upgrade included the refurbishment of the jetty structure, concrete and quay infrastructure, as well as replacement of revetment works to address erosion of the shoreline. The aim of these improvements was to enable Port Nolloth to better support offshore activities. The port is now used as an offshore supply base of De Beers Group Services, who has held a five-year lease agreement to use the port as an offshore supply base for conducting diamond prospecting activity in Namibia, with Smit Amandla (now

operating as African Marine Solutions Group) supply vessels stationed at the port used to transfer supplies to De Beers' offshore prospecting vessels. The refurbished port is intended to continue to serve as a support facility to the fishing and offshore mining industries in the future (Frankson, 2017).

3.2.1.2.2 Mining Phakisa

The goal of Mining Phakisa is to ensure that (1) the mining industry of South Africa remains economic sustainable during commodity price slumps, and (2) initiatives are put in place to position the mining cluster on a firm foundation to grow, transform, and optimize the contribution of the industry to the economic and social development of mining related communities and the country as a whole.

Five work streams were established as part of Mining Phakisa to address the challenges faced by the mining industry:

- Cluster Employment;
- Win-win Beneficiation;
- Sustainable Communities;
- Reviving Investment and Access to Affordable and Reliable Infrastructure; and
- Advancing the Cluster.

After the Phakisa Lab workshops, the Chamber of Mines South Africa (CoM) adopted an internal strategic framework for modernization - a process of transition and transformation of the mining industry. This process would, amongst others, involve using South Africa's mineral resources in the safest, most efficient, cost-effective, and sustainable manner possible, as well as promoting the conservation of natural resources, preservation and restoration of the environment.

3.2.2 Regional and Local Policy and Planning Framework

This section aims to provide an overview of the regional and local policy and planning context relating to the proposed project. The Constitution assigns Provincial and regional planning as exclusive responsibilities of Provincial Government and each province is required to publish a spatial development framework which coordinates, integrates and aligns provincial plans and development strategies with policies of National Government, Provincial departments and municipalities. Sea Concession 6C is located offshore of the Nama Khoi and Kamiesberg Local Municipalities, both located within the Namakwa District Municipality of the Northern Cape Province.

As pointed out in Section 2.1.3 above, the offshore area of activity, as well as the EEZ as a whole, do not fall within the borders of any municipality or province of South Africa as set out in the Constitution. Thus, the related planning documentation, especially at the District and Local Municipality level, typically does not directly address offshore areas and activities in a significant level of detail. Notwithstanding the above, a discussion of the provincial, district and local municipality planning context, where available, for the proposed project is considered below.

3.2.2.1 Northern Cape Provincial Spatial Development Framework (PSDF)

The Northern Cape PSDF aims to act as an enabling mechanism that responds and complies with the National Spatial Development Framework (NSDF). The latter encourages lower sphere spatial development plans and frameworks (such as the PSDF) to create an environment that promotes a developmental state. The Northern Cape PSDF (2012) aims to serve as a mechanism towards enhancing the future of the Province and its people.

The Northern Cape PSDF recognises the importance of the mining sector in the province's economic growth. However, it also aims to manage any direct detrimental impacts of resource use and promote positive socio-economic conditions once the resource use has reached the end of its productive life cycle.

The Northern Cape PSDF also notes that "*the greatest value from marine and coastal resources is generated through the mining and fishing sectors*" and that the "*Northern Cape has an abundance of diamond deposits both onshore and in marine deposits. This has led to the development of a large diamond mining sector, which has become the dominant activity of the coastal zone*". Thus, the proposed bulk sampling activities fall within the ambit of a well-established sector within the Province.

3.2.2.2 Namakwa District Municipality Integrated Development Plan (IDP) Revision 2017 - 2022

The IDP prepared for the Namakwa District Municipality identifies mining as one of the major economic sectors within the District Municipality. It is noted that the municipality's economy is undiversified with heavy reliance on the primary sectors of mining, for sectoral contribution, and both mining and agriculture for employment.

In order to combat poverty, the need to promote productive employment opportunities is considered essential to achieve poverty reduction and sustainable economic and social development. The IDP identifies that those people living in underdeveloped rural areas are the most at risk and that unless programmes are implemented timeously to deal directly with the problems of rural poverty, these challenges would continue.

The IDP also sets out the various sectoral plans for the District to ensure alignment between the different organs of state and provide input in the overall strategic objectives of the Municipality. Of relevance to the proposed project are the following:

- The District Municipalities Climate Change Response Plan which identifies various impacts on the District's marine and aquatic systems as a result of climate change were identified, including impacts on coastal fishing communities. Various priority responses to climate change in the Coastal and Marine Environment Sector were identified and included, amongst others, delineation/refinement of the coastal protection zone and enforcing environmental legislation and Environmental Management Programmes (EMPr) in mining areas. While the proposed project would not have a direct impact on the coastal zone of the District Municipality, the management actions included in the EMPr would need to be adhered to.
- The Tourism Sector Plan includes the Northern Cape Coastal and Marine Tourism Development Strategy, which has an impact on the coastal towns of Port Nolloth, Hondeklipbay and Kleinzee. The strategy identifies development opportunities that would unlock the tourism economic potential of the Province's coastal towns in the region. As such, the plan aims to ensure the optimal use of environmental resources that constitute a key element in coastal tourism development, maintaining essential ecological processes and helping to conserve natural heritage and biodiversity. Due to the fact that the proposed prospecting activities would be undertaken a large distance far offshore, it is not foreseen that the proposed project would be in conflict with the Tourism Sector plan.

3.2.2.3 Nama Khoi Local Municipality Spatial Development Framework (2014)

The Nama Khoi Local Municipality Spatial Development Framework (SDF) provide the framework and strategy for future spatial (and economic) development within the municipality. The SDF identifies goals that are intended to inform the spatial objectives and SDF proposals for the municipality. Of relevance to the proposed project are the following:

- "Explore new economic and development opportunities and ventures, and to encourage and support local economic development and job creation strategies" (Goal 3). Under this goal low economic growth, a lack of economic diversification, high unemployment (especially amongst the youth) and escalating poverty are identified as issues of concern. Thus, the need to exploit new economic and development opportunities, and to create support for local economic development and job creation is identified. Possible job opportunities related to the coastal, marine and fishing industry are identified as means of addressing this issue.

Arising from the spatial analysis undertaken in developing the SDF, various broad development frameworks for various settlement areas within the local municipality were created. These broad development frameworks provide an overview of the general growth direction and vision for each area. With respect to the framework prepared for Kleinzee, support for the possible extraction of offshore resources (up to 9 km from the coastline) was deemed to be an activity that could boost the economy of Kleinzee. Notwithstanding this, it was also acknowledged that a strategy for rehabilitating the coastal line and degraded areas that have been severely transformed as a result of alluvial diamond mining activities was also required.

3.2.2.4 Nama Khoi Local Municipality Integrated Development Plan (2019 – 2020)

The Integrated Development Plan (IDP) (2019 – 2020) of Nama Khoi Municipality creates the framework within which the municipality aims to deliver and create jobs and improve infrastructure and housing. The IDP identifies various spatial objectives for the municipality. Those of relevance to the proposed project include:

- Improving the sea connection between Saldanha, Kleinzee and Port Nolloth, in order to link the Coastal Development Corridor to the north and south and investigating the feasibility of direct boat access to the ocean at Kleinzee by means of a small harbour or port.
- Developing sustainable and diverse local economies by the utilisation of opportunities in the different spatial categories: investment is required to upgrade under-developed coastal infrastructure within the municipality. In addition, insufficient fish quotas must be addressed and accessibility to markets and to the coast should be improved.
- Investigating and exploiting known concentration of minerals around the Springbok area, as well as in a broad band along the south of the Orange River. It is acknowledged that while many of these sources have been depleted, there are still resources that can be exploited.

3.2.2.5 Kamiesberg Local Municipality Integrated Development Plan (2017 – 2022)

The Kamiesberg Local Municipality Integrated Development Plan (IDP) is considered to be aligned with national strategies. The document sets out the key strategic objectives for the municipality, which include (but are not limited to):

- Creating an enabling environment for economic growth that attracts investors, encourages innovation and facilitate pro-poor intervention
- Developing socially integrated, safe and healthy communities
- Ensuring ecological integrity and climate response through sustainable practices; and
- Developing progressive strategies to optimize the use of available human resources.

The IDP provides an overview of the current status-quo within the Municipality and highlights some of the anticipated key future challenges for various aspects. Under the theme of "Biodiversity and Environment", climate change is highlighted as one of these key challenges for the coastal and marine environment. It states that rising sea levels pose a risk to coastal communities and warming seas may impact fishing communities as water temperatures may not be suitable for the current catch.

To address the above, various measures for the management of marine and benthic ecosystems:

- Identify and conserve coastal areas that are rich in biodiversity;
- Develop a research project in collaboration with SANBI, aimed at providing environmental feedback to coastal communities; and
- Conduct research which seeks to understand the impacts of mining and how climate change exacerbates the industries impact.

3.2.3 Consistency with Policy and Planning Context

The previous sections have considered the policy and planning context at national and regional level which are relevant to the proposed project. There is a drive from national and provincial Government to stimulate development and grow the economy of South Africa with a strong focus on job creation in all sectors, whilst protecting the environment. Mining has been a long-term driver of economic growth and job creation for the country and still considered to be an important for the national economy.

The proposed prospecting activities would allow for the determination of the extent and economic viability of the mineral reserves in Sea Concession 6C. By gaining a better understanding of the extent, nature and economic feasibility of extracting these potential resources, the viability of undertaking future mining operations within the concession area would be better understood.

However, the promotion of the mining sector could also be considered a contradiction with some other plans and policies, which identify the need to reduce the reliance on the extraction of non-renewable resources as they contribute to Green-House Gas emissions. Nevertheless, due to the limited overall economic growth within the country there is still a need to undertake mineral exploration and mining activities within the country.

3.2.4 DEFF Guideline on Need and Desirability

When considering an application for EA, the competent authority must comply with Section 24O of NEMA and must have regard for any guideline published in terms of Section 24J of the Act and any minimum requirements for the application. This includes the DEFF's Guideline on Need and Desirability (March 2017). Additionally, the EIA Regulations, 2014, (as amended) require EAPs who undertake environmental assessments, to have knowledge and take into account relevant guidelines. A person applying for an EA must abide by the Regulations, which are binding on the applicant.

The DEFF's Guideline on Need and Desirability (March 2017) sets out a list of questions which should be addressed when considering need and desirability of a proposed development. These are divided into questions that relate to the aspects of ecological sustainability and justifiable economic and social development of the proposed project. Table 3-2 below sets out the list of questions as per the Guideline.

TABLE 3-2: QUESTIONS TO BE ENGAGED WITH WHEN CONSIDERING NEED AND DESIRABILITY, AS PER THE INTEGRATED ENVIRONMENTAL MANAGEMENT GUIDELINE ON NEED AND DESIRABILITY (MARCH 2017).

QUESTION	LOCATION IN REPORT
1. How will this development (and its separate elements / aspects) impact on the ecological integrity of the area?	
1.1 How were the ecological integrity considerations taken into account? 1.1.1. Threatened Ecosystems, 1.1.2. Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure, 1.1.3. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs"), 1.1.4. Conservation targets, 1.1.5 Ecological drivers of the ecosystem, 1.1.6. Environmental Management Framework, 1.1.7. Spatial Development Framework, and 1.1.8. Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.)	See Sections 3.2.1, 3.2.2, 4 and 5.
1.2 How will this development disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	See Sections 5 and 7.
1.3 How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	See Sections 5 and 7.
1.4 What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	A description of the anticipated types of waste, associated volumes are provided in Section 3.6. The proposed management measures are included in Section 7.
1.5 How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Refer to Sections 4.1.4.6.3 and 5.4.1.

QUESTION	LOCATION IN REPORT
1.6 How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	The purpose of the proposed prospecting operations are to determine the extent and economic viability of the mineral reserves in the sea concession area for future exploitation. Thus, the proposed project could facilitate the future extraction of non-renewable mineral resources. Notwithstanding the above, due to the high-costs of undertaking prospecting (and possible future mining) operations in the offshore environment, the location and extent of disturbed areas would be limited to only those areas targeted by the planned activities.
1.7 How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts? 1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life) 1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?) 1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?	
1.8 How were a risk-averse and cautious approach applied in terms of ecological impacts? 1.8.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)? 1.8.2. What is the level of risk associated with the limits of current knowledge? 1.8.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	See Section 2.4.3.
1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following: 1.9.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts? 1.9.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	See Section 5.

QUESTION	LOCATION IN REPORT
1.10. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socioeconomic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	See Sections 4 and 5.
1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	See Section 5.
1.12. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	See Section 3.3.
1.13. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	See Section 5.
2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?: 2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area, 2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.), 2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and 2.1.4. Municipal Economic Development Strategy ("LED Strategy").	See Sections 3.2.2.
2.2. Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area? 2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	See Sections 3.2.2.
2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	See Sections 3.2.1, 3.2.2, 4 and 5.
2.4. Will the development result in equitable (intra- and inter-generational) impact distribution, in the short and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	See Section 5.
2.5. In terms of location, describe how the placement of the proposed development will: 2.5.1. Result in the creation of residential and employment opportunities in close proximity to or integrated with each other, 2.5.2. Reduce the need for transport of people and goods,	Due to the offshore nature of the proposed project, these are not applicable.

QUESTION	LOCATION IN REPORT
2.5.3. Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport), 2.5.4. Compliment other uses in the area, 2.5.5. Be in line with the planning for the area, 2.5.6. For urban related development, make use of underutilised land available with the urban edge, 2.5.7. Optimise the use of existing resources and infrastructure, 2.5.8. Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement), 2.5.9. Discourage "urban sprawl" and contribute to compaction/densification, 2.5.10. Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs, 2.5.11. Encourage environmentally sustainable land development practices and processes, 2.5.12. Take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.), 2.5.13. The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential), 2.5.14. Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and 2.5.15. In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	
2.6. How were a risk-averse and cautious approach applied in terms of socio-economic impacts?: 2.6.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)? 2.6.2. What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge? 2.6.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	See Section 2.4.3.
2.7. How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following: 2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts? 2.7.2. Positive impacts. What measures were taken to enhance positive impacts?	See Sections 5 and 7.

QUESTION	LOCATION IN REPORT
2.8. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	See Sections 5 and 7.
2.9. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	See Sections 5 and 7.
2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Due to the offshore nature of the proposed project, these are not applicable.
2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	Due to the offshore nature of the proposed project no such issues are deemed to be likely to arise as a result of the proposed bulk sampling operations.
2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	See Sections 5 and 7.
2.13. What measures were taken to: 2.13.1. Ensure the participation of all interested and affected parties, 2.13.2. Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, 2.13.3. Ensure participation by vulnerable and disadvantaged persons, 2.13.4. Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means, 2.13.5. Ensure openness and transparency, and access to information in terms of the process, 2.13.6. Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge, and 2.13.7. Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted?	See Sections 2.5 and 2.6.

QUESTION	LOCATION IN REPORT
2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	Due to the offshore nature of the proposed project no such issues are deemed to be likely as a result of the proposed project.
2.15. What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Project activities would comply with the De Beers internal occupational health and safety policies and/or standards as well as national legislation.
2.16. Describe how the development will impact on job creation in terms of, amongst other aspects: 2.16.1. The number of temporary versus permanent jobs that will be created, 2.16.2. Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area), 2.16.3. The distance from where labourers will have to travel, 2.16.4. The location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and 2.16.5. The opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	See Section 5.4.2.
2.17. What measures were taken to ensure: 2.17.1. That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and 2.17.2. That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	See Section 3.2.3.
2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	See Section 7.
2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	See Section 7.
2.20. What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	See Section 7.
2.21. Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	See Section 3.3.

QUESTION	LOCATION IN REPORT
2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	See impact assessment included in Section 5.

3.3 CONSIDERATION OF ALTERNATIVES

This section presents the various alternatives considered in this EIR.

3.3.1 Location and Technology Alternatives

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.

As the intention of the proposed prospecting operations is to determine the presence of economically viable diamond deposits that occur within Sea Concession 6C, no further location alternatives are considered in the Scoping and EIA process.

The different bulk sampling methodologies (i.e. technologies) being considered in the Scoping and EIA process are described in detail in Section 3.4 below.

3.3.2 The No-Go Alternative

The No-Go alternative is the non-occurrence of the proposed bulk sampling project. The negative implications of not going ahead with the proposed project are as follows:

- Loss of opportunity to establish whether further viable offshore diamond resources exist;
- Prevention of any socio-economic benefits associated with the continuation of bulk sampling activities; and
- Lost economic opportunities.

The positive implications of the no-go option are that there would be no effects on the biophysical environment in the area proposed for the bulk sampling activities.

3.4 EXPLORATION SAMPLING OVERVIEW

The proposed exploration sampling programme would entail geophysical surveys and sampling (for which EA has already been granted) and bulk sampling activities. The sampling / bulk sampling activities may be divided into stages subject to reviews and follow-up sampling. A decision on the planned sampling / bulk sampling technology appropriate to each target area would be made based on the available data at the time.

The proposed bulk sampling activities would be undertaken using a vessel of opportunity, which may include the De Beers Marine (Pty) Ltd (the appointed operator for Beers Consolidated Mines (Pty) Ltd) *MV Coral Sea* or one of the marine diamond vessels operated by Debmarine Namibia (Pty) Ltd or a similar vessel (see Figure 3-1). In this regard, there are two possible basic configurations of vessel available for sampling: (i) the vertical method, utilising a vertically mounted tool / tool mounted on a drill string; and (ii) the horizontal method, using a seabed crawler.

A description of these bulk sampling methodologies as well as information pertaining to the number of samples and total project footprint are provided below.


FIGURE 3-1: EXAMPLES OF POSSIBLE VESSELS OF OPPORTUNITY THAT COULD BE UTILISED DURING SAMPLING – *MV CORAL SEA* (LEFT) AND *MV MAFUTA* (RIGHT).

3.4.1 Vertical Method

The vertical method utilises an ADS (Alternative Drill System) deployed at the end of a drill string which is suspended from a derrick mounted mid-ships and deployed through a moon pool. The drill stem is suspended in a state of constant tension by means of a compensation system that absorbs the motion of the ship, enabling the ADS to remain in contact with the seabed. The tool agitates the unconsolidated sediments and airlifts all sediment particles of typically up to 250 mm in diameter to the vessel for processing. The material from the seabed is pumped onto multi-decked screens to separate the boulders and sandy silt from the size fraction of interest - the 'plantfeed' (typically approx. 1.5 mm – 19 mm in diameter). All material except the plantfeed is returned overboard immediately after having passed over the screens. The plant feed is then separated using a dense medium separation system and the diamonds are extracted using an X-ray sorter.

Sediments are recovered to a depth of typically between 0.5 m and 4 m.

3.4.2 Horizontal Method

The horizontal method makes use of a seabed crawler. The seabed crawler is lowered to the seabed by a hoist winch and heave compensator via a large, fixed A-frame over the stern of the vessel (see Figure 3-2). The seabed crawler is fitted with acoustic seabed navigation and imaging systems that allow for the remote operation of the crawler from the surface support vessel through power and signal umbilical cables. The seabed crawler is track-driven and is equipped with a dredge pump system, hydraulic power pack and may have a jet-water system to facilitate the agitation and suction of unconsolidated surficial sediments (typically up to 250 mm in diameter) to the vessel (see Figure 3-3). Onboard processing of the sediments takes place in the same way as described in section 3.4.1. The seabed crawler would remove the seabed sediments to a depth of typically between 0.5 m to 4 m in a set path within the target area identified for bulk-sampling activities.

FIGURE 3-2: DEPLOYMENT OF THE SEABED CRAWLER.

FIGURE 3-3: SCHEMATIC DIAGRAM SHOWING OPERATION OF A SEABED CRAWLER AND PHOTOGRAPH OF SEABED CRAWLER.

3.4.3 Summary of operations

The planned bulk sampling operations would have a total footprint of approximately 480 000 m^2 and would be undertaken in a total of 60 days over the duration of the 5-year licence period. The bulk prospecting operation could consist of up to 60 pits and / or trenches. These would typically each be up to approximately 8 000 m^2 in extent and typically up to 1.5 m in depth. Specific details are provided in Table 3-3 below.

TABLE 3-3: SUMMARY OF PROPOSED BULK SAMPLING OPERATIONS

Activity		Detail
Number of pits/trenches planned		Up to 60
Dimensions of pits/trenches	**Length**	Up to 400 m
	Breadth	Typically 20 m
	Depth	Typically up to 1.5 m
Total Volume Overburden (Waste)		Maximum 480 000 m^3
Total Volume Ore		Maximum 240 000 m^3
Density Overburden		1.5 t/m^3
Density Ore		1.9 t/m^3

3.5 REHABILITATION

The immediate impact on the seabed entails the localised removal of the seabed habitat, with the fine sediment surface layers replaced with coarse sediments (boulders and gravels). The majority of the material that is pumped to the surface is returned directly to the sea after the primary screening process. Operations are designed such that the coarse tailings, and to some extent the finer sediments, discharged from the vessel land back into disturbed areas as far as possible. This avoids reprocessing the same sediments, minimises the disturbance footprint and provides material for re-establishment of habitat.

Sediments typically settle rapidly, with most of the silt sinking within minutes. Mixing with descending seawater then results in dilution of the finer sediment, with the remaining particulate matter settling over a period of hours. Seabed research programs have demonstrated the re-establishment of the ecological functioning of the seabed after removal of the diamonds. Seabed recovery rates are linked to fine sediment infill, the rate of which is influenced by a range of factors including resuspension and settlement of sediments from adjacent areas by near-seabed currents, Orange River flooding etc. Recolonisation takes place by passive translocation of animals during storms or sediment slumping from nearby unaffected areas, active immigration of mobile species, and immigration and settlement of pelagic larvae and juveniles.

3.6 VESSEL EMISSIONS AND DISCHARGES

This section provides a brief description of the types of emissions and discharges that are expected from the bulk sampling and related activities. 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.

3.6.1 Discharges to sea

3.6.1.1 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 15 ppm 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.

3.6.1.2 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.

3.6.1.3 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 5.5 km) from land. Such comminuted or ground food wastes shall be capable of passing through a screen with openings no greater than 25 mm. Disposal overboard without macerating can occur greater than 12 nautical miles (approximately 22 km) from the coast. Although De Beers vessels macerate food regardless of the distance, this may not be the case for all contracted vessels, although best practice is encouraged. The daily discharge from a vessel is typically about 0.15 m^3.

3.6.1.4 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 3.6.1.1 above).

3.6.1.5 Other

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

3.6.2 Waste disposal to land

A number of other types of wastes 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 licenced 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 a typical bulk sampling operation is given below.

3.6.2.1 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.

3.6.2.2 Scrap Metal

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

3.6.2.3 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 licenced landfill site in accordance with legal requirements.

3.6.2.4 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 licenced landfill site acceptable to the relevant authorities.

3.6.2.5 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.

3.6.2.6 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.

3.6.2.7 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.

3.6.2.8 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 garbage incinerators.

4 THE AFFECTED ENVIRONMENT

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 previous information compiled for the area.

4.1 MARINE ENVIRONMENT

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

The study area lies within the southern zone of the Benguela Current region and is characterised by the cool Benguela upwelling system (Shillington 1998; Shannon 1985). A conceptual model of the Benguela system is shown in Figure 4-1.

4.1.1 Meteorology

The meteorological processes of the South African West Coast have been described by numerous authors, including Andrews and Hutchings (1980), Heydorn and Tinley (1980), Nelson and Hutchings (1983), Shannon (1985), Shannon and Nelson (1996), and Shillington (1998).

Wind and weather patterns along the West Coast are primarily due to the South Atlantic high-pressure cell and the eastward movement of mid-latitude cyclones (which originate within the westerly wind belt between 35° to 45°S), south of the subcontinent.

The South Atlantic high-pressure cell is perennial, but strongest during austral summer when it attains its southernmost extension to the south and south-west (approximately 30°S, 05°E) of the subcontinent. Linked to this high-pressure in summer is a low-pressure cell that forms over the subcontinent due to strong heating over land. The pressure differential of these two systems induces moderate to strong south-easterly (SE) winds near the shore during summer. Furthermore, the southern location of the South Atlantic high-pressure cell limits the impact that mid-latitude cyclones have on summer weather patterns so that, at best, the mid-latitude cyclones cause a slackening of the SE winds. During the austral winter both the weakening and north-ward migration of the South Atlantic high-pressure cell (to approximately 26°S, 10°E) and the increase in atmospheric pressure over the subcontinent result in the eastward moving mid-latitude cyclones advancing closer to the coast.

Strong north-westerly (NW) to south-westerly (SW) winds result from mid-latitude cyclones passing the southern Cape at a frequency of 3 to 6 days. Associated with the approach of mid-latitude cyclones is the appearance of low-pressure cells, which originate from near Lüderitz on the Namibian coast and quickly travel around the subcontinent (Reason and Jury 1990; Jury, Macarthur and Reason 1990).

A second important wind type that occurs along the West Coast are katabatic ‘berg’ winds during the formation of a high-pressure system (lasting a few days) over, or just south of, the south-eastern part of the subcontinent. This results in the movement of dry adiabatically heated air offshore (typically at 15 m/s). At times, such winds may blow along a large proportion of the West Coast north of Cape Point and can be intensified by local topography. Aeolian transport of fine sand and dust may occur up to 150 km offshore.

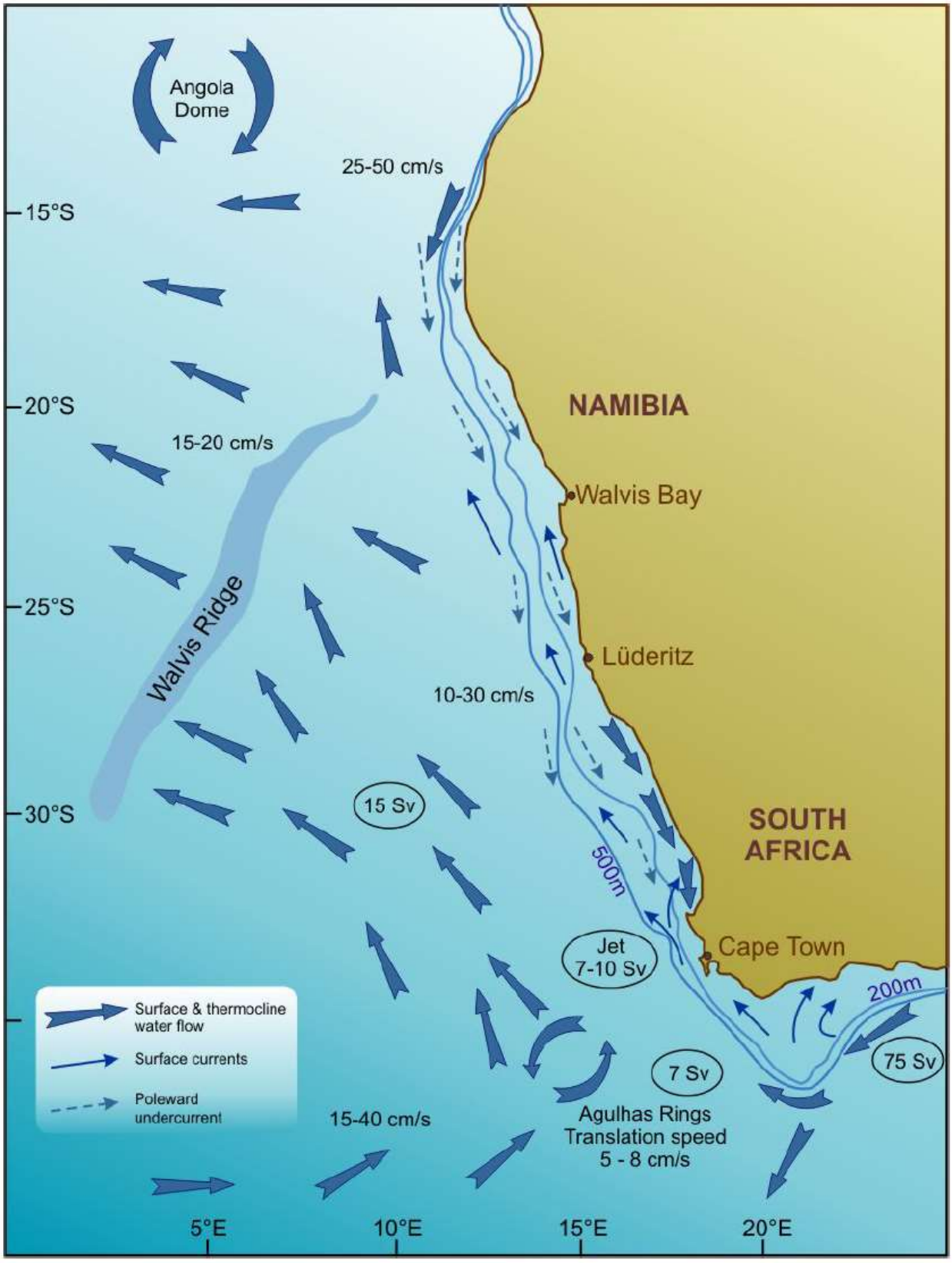

FIGURE 4-1: CIRCULATION AND VOLUME FLOWS OF THE BENGUELA CURRENT (AFTER SHANNON & NELSON, 1996).

4.1.2 Physical Oceanography

4.1.2.1 Waves

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 southerly winds. 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 south-west - south direction. Winter swells are strongly dominated by those from the south-west – south-south-west 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.

4.1.2.2 Tides

Tides along the West Coast are subject to a simple semi-diurnal tidal regime with a mean tidal range along the Namaqualand coast of about 1.57 m (at least 50% of the time in the nearshore area), with spring tides as much as 2.24 m and neap tides in the order of 1 m. Tides arrive almost simultaneously (within 5 to 10 minutes) along the whole of the West Coast. Other than in the presence of constrictive topography, e.g. an entrance to enclosed bay or estuary, tidal currents are weak.

4.1.2.3 Topography

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 north-north-west trend, widening north of Cape Columbine and reaching its widest off the Orange River (180 km). 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 middle shelf. The immediate nearshore area consists mainly of a narrow (about 8 km wide) rugged rocky zone, sloping steeply seawards to a depth of around 80 m. The middle and outer shelf typically lacks relief, sloping gently seawards before reaching the shelf break at a depth of approximately 300 m.

Banks on the continental shelf include the Orange River pro-delta, a shallow (160 - 190 m) zone that reaches maximal widths (180 km) offshore of the Orange River, and Child's Bank, situated approximately 150 km offshore at about 31°S. Tripp Seamount is a geological feature located to the west-northwest of the western extent of Sea Concession 6C (see Figure 4-2) which rises from approximately 1 000 m to a depth of 150 m.

4.1.2.4 Coastal and Continental Shelf Geology and Seabed Geomorphology

The inner shelf is underlain by Precambrian bedrock (also referred to as Pre-Mesozoic basement), whilst the middle and outer shelf areas are composed of Cretaceous and Tertiary sediments (Dingle 1973; Birch *et al.* 1976; Rogers 1977; Rogers & Bremner 1991). As a result of erosion on the continental shelf, the unconsolidated surface sediment cover is generally thin, often less than 1 m. Sediments are finer seawards, changing from sand on the inner and middle 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 (see Figure 4-3).

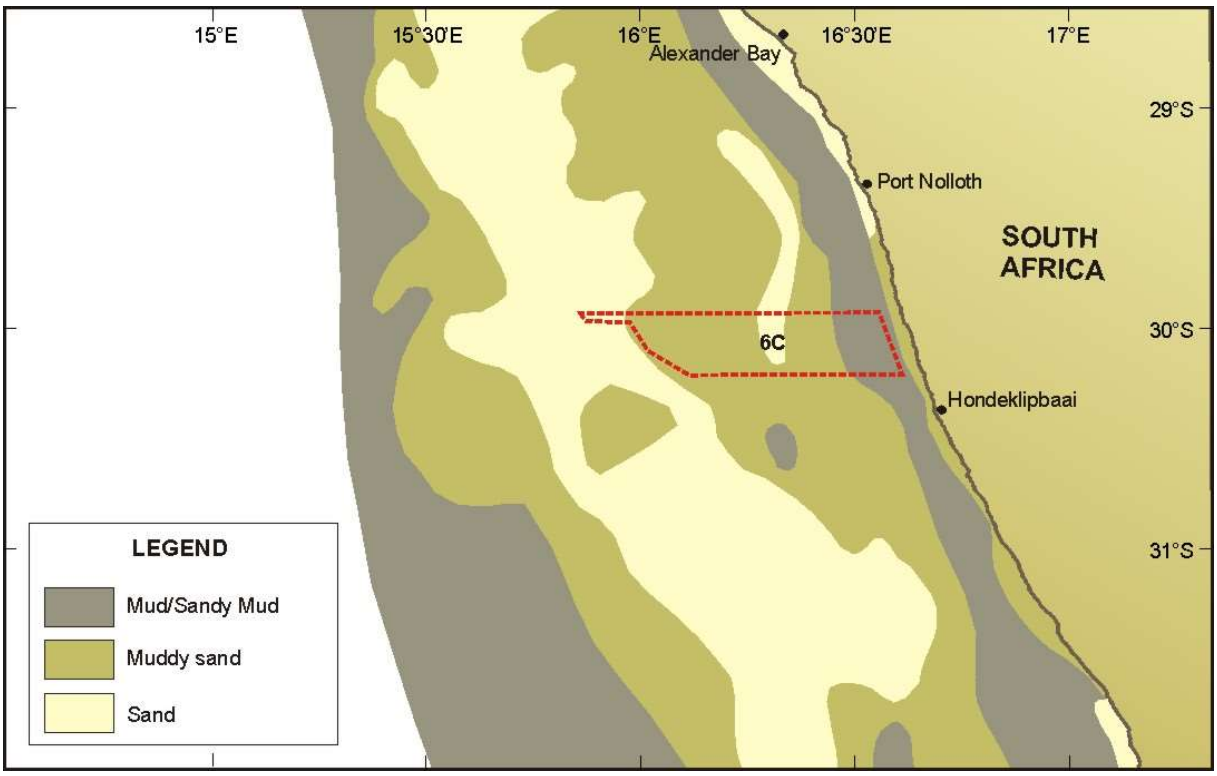

FIGURE 4-2: SEA CONCESSION 6C IN RELATION TO SEDIMENT DISTRIBUTION ON THE CONTINENTAL SHELF (ADAPTED FROM ROGERS 1977).

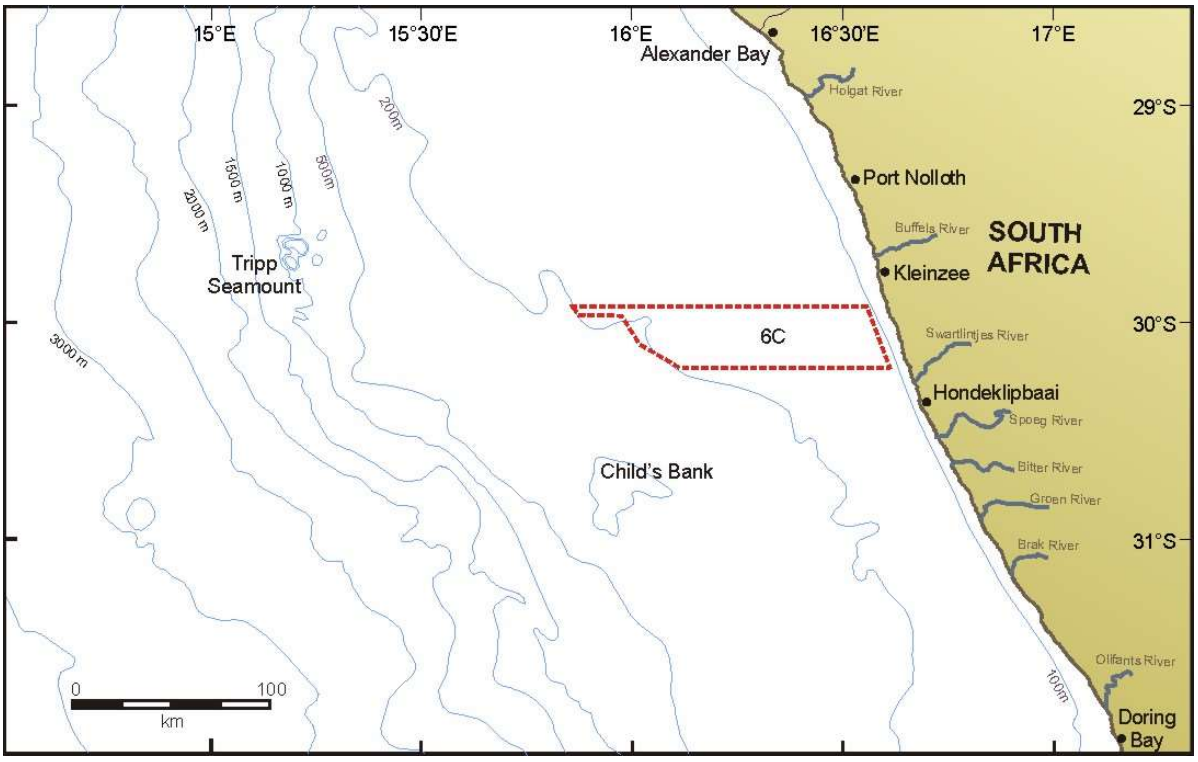

FIGURE 4-3: SEA CONCESSION 6C IN RELATION TO THE REGIONAL BATHYMETRY AND SHOWING PROXIMITY OF PROMINENT SEABED FEATURES.

An approximately 500 km long mud belt (up to 40 km wide, and of 15 m average thickness) is situated at water depths of between -30 m and -100 m over the innershelf slope between the Orange River and St Helena Bay (Birch *et al.* 1976). Further offshore, sediment is dominated by muddy sands, sandy muds, mud and some sand. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous ooze.

Present day sedimentation is limited to input mainly from the Orange River and minor contributions from other rivers like the Buffels and the Olifants Rivers. As the coarser sand and gravel sediment fractions are generally transported northward, most of the sediment containing the diamond mineralisation in the project area is considered to be relict deposits of ephemeral rivers active during wetter climates in the geological past. The Orange River, when in flood, still contributes largely to the mudbelt 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 and hinterland.

4.1.2.5 Upwelling and Plankton Production

The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman & Shannon 1985). During upwelling the comparatively nutrient-poor surface waters are displaced by enriched deep water, supporting substantial seasonal primary phytoplankton production. This, in turn, serves as the basis for a rich food chain up through zooplankton, pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (hake and snoek), mammals (primarily seals and dolphins) and seabirds (African penguins, cormorants, pelicans, terns and others). 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.

4.1.2.6 Organic Inputs

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 (African 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 the Benguela region supported biomasses of 76.9 tons/km2 of phytoplankton and 31.5 tons/km2 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 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. 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.

4.1.2.7 Low Oxygen Events

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations with less than 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 (see Figure 4 3) 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). The development of anoxic conditions as a result of the decomposition of huge amounts of organic matter generated by algal blooms is the main cause for these mortalities and walkouts. The blooms develop over a period of unusually calm wind conditions when sea surface temperatures were 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.

4.1.2.8 Turbidity

Turbidity is a measure of the degree to which 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 River or from 'berg' wind events. 'Berg' wind events can potentially contribute the same order of magnitude of sediment input as the annual estimated input of total sediment by the Orange River (Shannon & Anderson 1982; Zoutendyk 1992, 1995; Shannon & O'Toole 1998; Lane & Carter 1999).

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 re-suspending 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; De Decker 1986). 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 approximately 10 m depth, whilst 6 m waves achieve this at approximately 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, discharges from terrestrial, coastal and marine mining operations (Airoldi 2003), and sediment plumes as a result of bottom trawling fishery activities. Such increase of sediment loads has been recognised as a major threat to marine biodiversity at a global scale (UNEP 1995).

4.1.3 Biological Oceanography

Biogeographically, Sea Concession 6C falls into the cold temperate Namaqua Bioregion, which extends from Sylvia Hill, north of Lüderitz in Namibia to Cape Columbine (Emanuel *et al.* 1992; Lombard *et al.* 2004) (see Figure

4-4). 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).

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). The majority of the proposed bulk sampling area is located beyond the 80 m depth contour. 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 bulk sampling activities.

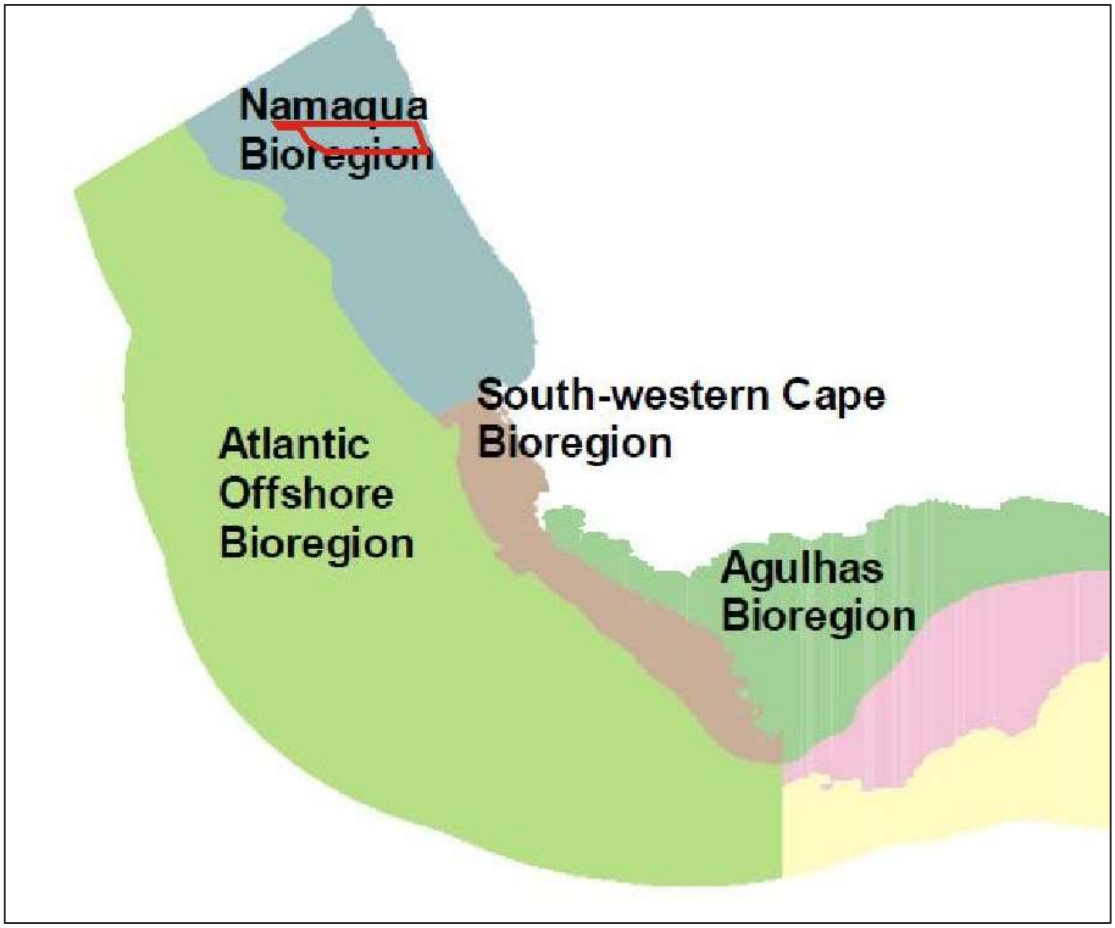

FIGURE 4-4: SEA CONCESSION 6C (RED POLYGON) IN RELATION TO THE SOUTH AFRICAN INSHORE AND OFFSHORE BIOREGIONS (ADAPTED FROM LOMBARD *ET AL.* 2004).

4.1.3.1 Demersal Communities

4.1.3.1.1 Nearshore and Offshore Unconsolidated Habits

The benthic biota of unconsolidated marine sediments constitute invertebrates that live on (epifauna) or burrow within (infauna) the sediments, and are generally divided into macrofauna (animals >1 mm) and meiofauna (< 1 mm).

Sea Concession 6C includes three macro-infauna communities on the inner- (i.e. 0-30 m depth) and midshelf (i.e. 30-150 m depth, Karenyi unpublished data). 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. 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). 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. Ms N. Karenyi, SANBI and NMMU). However, the marine component of the 2011 National Biodiversity Assessment (Sink *et al.* 2012), rated portions of the outer continental shelf on the West Coast as 'vulnerable' and 'critically endangered'. Sea Concession 6C does not fall within these areas.

Generally, species richness increases from the inner shelf across the mid shelf and is influenced by sediment type (Karenyi unpublished data). The highest total abundance and species diversity was measured in sandy sediments of the mid-shelf. Biomass is highest in the inshore (± 50 g/m2 wet weight) and decreases across the mid-shelf averaging around 30 g/m2 wet weight. This is contrary to Christie (1974) who found that biomass was greatest in the mudbelt at 80 m depth off Lamberts Bay, south of Sea Concession 6C, where the sediment characteristics and the impact of environmental stressors (such as low oxygen events) are likely to differ from those in the concession area.

Surveys conducted between 180 m and 480 m depth in the vicinity of Sea Concession 6C revealed high proportions of hard ground rather than unconsolidated sediment on the outer shelf, although this requires further verification (Karenyi unpublished data). The benthic fauna of the outer shelf and continental slope (beyond approximately 450 m depth) are very poorly known largely due to limited opportunities for sampling as well as the lack of access to Remote Operated Vehicles (ROVs) for visual sampling of hard substrata. To date very few areas of the continental slope off the West Coast have been biologically surveyed.

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). 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 override 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) a single epifaunal community exists between the depths of 100 m and 250 m 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.

4.1.3.1.2 Deep-water coral communities

There has been increasing interest in deep-water corals in recent years because of their likely sensitivity to disturbance and their long generation times. These benthic filter-feeders generally occur deeper than 150 m with some 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 to form. Nutrient seepage from the substratum might also promote a location for settlement (Hovland *et al.* 2002). In the productive Benguela region, substantial areas on the shelf should thus potentially be capable of supporting rich, cold water, benthic, filter-feeding communities.

In the vicinity of Sea Concession 6C there are two geological features of note, namely Child's Bank, situated 150 km offshore at 31°S and approximately 60 km due south of the Sea Concession 6C, and Tripp Seamount situated 250 km offshore at approximately 29°40'S and 150 km to the west-northwest of the concession area. Child's Bank was described by Dingle *et al.* (1987) to be a carbonate mound (bioherm). Composed of sediments and the calcareous deposits from an accumulation of carbonate skeletons of sessile organisms (e.g. cold-water coral, foraminifera or marl), such features typically have topographic relief, forming isolated seabed knolls in otherwise lowprofile homogenous seabed habitats (Kopaska-Merkel & Haywick 2001; Kenyon *et al.* 2003, Wheeler *et al.* 2005, Colman *et al.* 2005). Features such as banks, knolls and seamounts (referred to collectively here as "seamounts"), which protrude into the water column, are subject to, and interact with, the water currents surrounding them. The effects of such seabed features on the surrounding water masses can include the up-welling of relatively cool, nutrient-rich water into nutrient-poor surface water thereby resulting in higher productivity (Clark *et al.* 1999), which can in turn strongly influences the distribution of organisms on and around

seamounts. Evidence of enrichment of bottom-associated communities and high abundances of demersal fishes has been regularly reported over such seabed features.

The enhanced fluxes of detritus and plankton that develop in response to the complex current regimes lead to the development of detritivore-based food-webs, which in turn lead to the presence of seamount scavengers and predators. Seamounts provide an important habitat for commercial deepwater fish stocks such as orange roughy, oreos, alfonsino and Patagonian toothfish, which aggregate around these features for either spawning or feeding (Koslow 1996).

Such complex benthic ecosystems in turn enhance foraging opportunities for many other predators, serving as mid-ocean focal points for a variety of pelagic species with large ranges (turtles, tunas and billfish, pelagic sharks, cetaceans and pelagic seabirds) that may migrate large distances in search of food or may only congregate on seamounts at certain times (Hui 1985; Haney *et al.* 1995). Seamounts thus serve as feeding grounds, spawning and nursery grounds and possibly navigational markers for a large number of species (SPRFMA 2007).

Enhanced currents, steep slopes and volcanic rocky substrata, in combination with locally generated detritus, favour the development of suspension feeders in the benthic communities characterising seamounts (Rogers 1994). Deep- and cold-water corals (including stony corals, black corals and soft corals) are a prominent component of the suspension-feeding fauna of many seamounts, accompanied by barnacles, bryozoans, polychaetes, molluscs, sponges, sea squirts, basket stars, brittle stars and crinoids (reviewed in Rogers 2004). There is also associated mobile benthic fauna that includes echinoderms (sea urchins and sea cucumbers) and crustaceans (crabs and lobsters) (reviewed by Rogers 1994; Kenyon *et al.* 2003). Some of the smaller cnidarians species remain solitary while others form reefs thereby adding structural complexity to otherwise uniform seabed habitats. The coral frameworks offer refugia for a great variety of invertebrates and fish (including commercially important species) within, or in association with, the living and dead coral framework thereby creating spatially fragmented areas of high biological diversity.

Compared to the surrounding deep-sea environment, seamounts typically form biological hotspots with a distinct, abundant and diverse fauna, many species of which remain unidentified. Consequently, the fauna of seamounts is usually highly unique and may have a limited distribution restricted to a single geographic region, a seamount chain or even a single seamount location (Rogers *et al.* 2008). Levels of endemism on seamounts are also relatively high compared to the deep sea. As a result of conservative life histories (i.e. very slow growing, slow to mature, high longevity, low levels of recruitment) and sensitivity to changes in environmental conditions, such biological communities have been identified as Vulnerable Marine Ecosystems (VMEs). They are recognised as being particularly sensitive to anthropogenic disturbance (primarily deep-water trawl fisheries and mining), and once damaged are very slow to recover, or may never recover (FAO 2008).

It is not always the case that seamount habitats are VMEs, as some seamounts may not host communities of fragile animals or be associated with high levels of endemism. South Africa's seamounts and their associated benthic communities have not been extensively sampled by either geologists or biologists (Sink & Samaai 2009). Deep water corals are known from Child's Bank as well as the iBhubezi Reef to the south-east of Child's Bank. Furthermore, evidence from video footage taken on hard-substrate habitats in 100 - 120 m depth off the West Coast of South Africa (De Beers Marine (Pty) Ltd, unpublished data) suggest that sensitive communities including gorgonians, octocorals and reef-building sponges do occur on the continental shelf, and similar communities may thus be expected in Sea Concession 6C.

4.1.3.1.3 Demersal Fish Species

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 on the West Coast is discussed by Compagno *et al.* (1991). The species likely to occur in the licence area, and their approximate depth range, are listed in Table 4-1.

TABLE 4-1: 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).

Common Name	Scientific name	Depth Range
Frilled shark	*Chlamydoselachus anguineus*	200 - 1 000
Six gill cowshark	*Hexanchus griseus*	150 - 600
Gulper shark	*Centrophorus granulosus*	480
Leafscale gulper shark	*Centrophorus squamosus*	370 - 800
Bramble shark	*Echinorhinus brucus*	55 - 285
Black dogfish	*Centroscyllium fabricii*	> 700
Portuguese shark	*Centroscymnus coelolepis*	> 700
Longnose velvet dogfish	*Centroscymnus crepidater*	400 - 700
Birdbeak dogfish	*Deania calcea*	400 - 800
Arrowhead dogfish	*Deania profundorum*	200 - 500
Longsnout dogfish	*Deania quadrispinosum*	200 - 650
Sculpted lanternshark	*Etmopterus brachyurus*	450 - 900
Brown lanternshark	*Etmopterus compagnoi*	450 - 925
Giant lanternshark	*Etmopterus granulosus*	> 700
Smooth lanternshark	*Etmopterus pusillus*	400 - 500

Common Name	Scientific name	Depth Range
Spotted spiny dogfish	*Squalus acanthias*	100 - 400
Shortnose spiny dogfish	*Squalus megalops*	75 - 460
Shortspine spiny dogfish	*Squalus mitsukurii*	150 - 600
Sixgill sawshark	*Pliotrema warreni*	60 - 500
Goblin shark	*Mitsukurina owstoni*	270 - 960
Smalleye catshark	*Apristurus microps*	700 - 1 000
Saldanha catshark	*Apristurus saldanha*	450 - 765
“grey/black wonder” catsharks	*Apristurus spp.*	670 - 1 005
Tigar catshark	*Halaelurus natalensis*	50 - 100
Izak catshark	*Holohalaelurus regani*	100 - 500
Yellowspotted catshark	*Scyliorhinus capensis*	150 - 500
Soupfin shark/Vaalhaai	*Galeorhinus galeus*	< 10 - 300
Houndshark	*Mustelus mustelus*	< 100
Whitespotted houndshark	*Mustelus palumbes*	> 350
Little guitarfish	*Rhinobatos annulatus*	> 100
Atlantic electric ray	*Torpedo nobiliana*	120 - 450
African softnose skate	*Bathyraja smithii*	400 - 1 020
Smoothnose legskate	*Cruriraja durbanensis*	> 1 000
Roughnose legskate	*Crurirajaparcomaculata*	150 - 620
African dwarf skate	*Neoraja stehmanni*	290 - 1 025
Thorny skate	*Raja radiata*	50 - 600
Bigmouth skate	*Raja robertsi*	> 1 000
Slime skate	*Raja pullopunctatus*	15 - 460
Rough-belly skate	*Raja springeri*	85 - 500
Yellowspot skate	*Raja wallacei*	70 - 500
Roughskin skate	*Raja spinacidermis*	1 000 - 1 350
Biscuit skate	*Raja clavata*	25 - 500
Munchkin skate	*Raja caudaspinosa*	300 - 520
Bigthorn skate	*Raja confundens*	100 - 800
Ghost skate	*Raja dissimilis*	420 - 1 005
Leopard skate	*Raja leopardus*	300 - 1 000
Smoothback skate	*Raja ravidula*	500 - 1 000
Spearnose skate	*Raja alba*	75 - 260
St Joseph	*Callorhinchus capensis*	30 - 380
Cape chimaera	*Chimaera sp.*	680 - 1 000
Brown chimaera	*Hydrolagus sp.*	420 - 850
Spearnose chimaera	*Rhinochimaera atlantica*	650 - 960

4.1.3.2 Pelagic Communities

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

4.1.3.2.1 Plankton

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 bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton

Phytoplankton are the principle primary producers with mean productivity ranging from 2.5 - 3.5 g C/m2/day for the midshelf region and decreasing to 1 g C/m2/day inshore of 130 m (Shannon & Field 1985; Mitchell-Innes & Walker 1991; Walker & Peterson 1991). 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.

Red-tides are ubiquitous features of the Benguela system (see Shannon & Pillar, 1986). 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. They are unlikely to occur in the offshore regions of Sea Concession 6C.

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/m2, with maximum values recorded during upwelling periods. Macrozooplankton biomass ranges from 0.1 - 1.0 g C/m2, 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 zooplanktors (euphausiids) known to occur at oceanographic fronts. Beyond the continental slope biomass decreases markedly.

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.

Sea Concession 6C lies within the influence of the Namaqua upwelling cell, and seasonally high phytoplankton abundance can be expected, providing favourable feeding conditions for micro-, meso- and macrozooplankton, and for ichthyoplankton. Immediately to the north of the upwelling cell, high turbulence and deep mixing in the

water column result in diminished phytoplankton biomass and consequently the area is considered to be an environmental barrier to the transport of ichthyoplankton from the southern to the northern Benguela upwelling ecosystems. Important pelagic fish species, including anchovy, redeye round herring, horse mackerel and shallow-water hake, are reported as spawning on either side of the Orange River Banks area, but not within it (see Table 4-5). Phytoplankton, zooplankton and ichthyoplankton abundances in the Sea Concession area are thus expected to be comparatively high relative to the Orange River Banks area. In the offshore portions of the Sea Concession 6C area plankton abundance is also expected to be low, with the major fish spawning and migration routes occurring further inshore on the shelf.

4.1.3.2.2 Cephalopods

The major cephalopod resource in the southern Benguela 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.

4.1.3.2.3 Pelagic Fish

Small pelagic species occurring beyond the surfzone and generally within the 200 m contour include the sardine/pilchard (*Sadinops ocellatus*), anchovy (*Engraulis capensis*), chub mackerel (*Scomber japonicus*), horse mackerel (*Trachurus capensis*) 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 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, 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 east of Cape Point. 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.

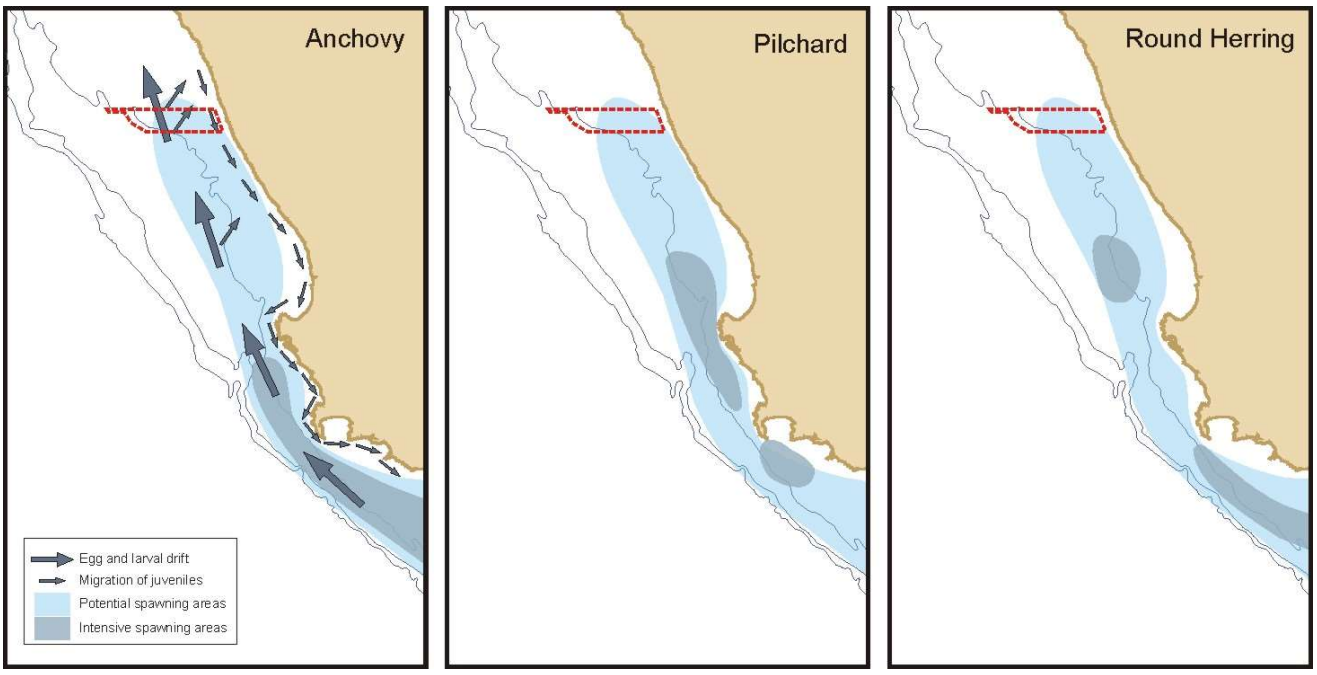

FIGURE 4-5: SEA CONCESSION 6C (RED POLYGON) IN RELATION TO MAJOR SPAWNING AREAS IN THE SOUTHERN BENGUELA REGION (ADAPTED FROM CRUIKSHANK 1990).

Two species that migrate along the West Coast following the shoals of anchovy and pilchards are snoek Thyrsites atun and chub mackerel Scomber japonicas. Their appearance along the West and South-West coasts are highly seasonal. Snoek migrating along the southern African West Coast reach the area between St Helena Bay and the Cape Peninsula between May and August. They spawn in these waters between July and October before moving offshore and commencing their return northward migration (Payne & Crawford 1989). 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).

Large pelagic species include tunas, billfish and pelagic sharks, which 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 distribution of these species is dependent on food availability in the mixed boundary layer between the Benguela and warm central Atlantic waters. Concentrations of large pelagic species are also known to occur associated with underwater feature such as canyons and seamounts as well as meteorologically induced oceanic fronts (Penney *et al.* 1992).

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 whites (*Carcharodon carcharias*) may also be encountered in coastal and offshore areas. This species is a significant apex predator along the southern African coast, particularly in the vicinity of the seal colonies.

Although not necessarily threatened with extinction, great whites 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 is described as "vulnerable" in the International Union for Conservation of Nature (IUCN) Red listing. In response to global declines in abundance, white sharks were legislatively protected in South Africa in 1991.

Many of the large migratory pelagic species are considered threatened by the IUCN, primarily due to overfishing (see Table 4-2). 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.

TABLE 4-2: SOME OF THE MORE IMPORTANT LARGE MIGRATORY PELAGIC FISH LIKELY TO OCCUR IN THE OFFSHORE REGIONS OF THE SOUTH COAST.

Common Name	Species	IUCN Conservation Status
Tunas		
Southern Bluefin Tuna	*Thunnus maccoyii*	Critically Endangered
Bigeye Tuna	*Thunnus obesus*	Vulnerable
Longfin Tuna/Albacore	*Thunnus alalunga*	Near Threatened
Yellowfin Tuna	*Thunnus albacares*	Near Threatened
Frigate Tuna	*Auxis thazard*	Least concern
Skipjack Tuna	*Katsuwonus pelamis*	Least concern
Billfish		
Blue Marlin	*Makaira nigricans*	Vulnerable
Sailfish	*Istiophorus platypterus*	Least concern
Swordfish	*Xiphias gladius*	Least concern
Black Marlin	*Istiompax indica*	Data deficient
Pelagic Sharks		
Pelagic Thresher Shark	*Alopias pelagicus*	Vulnerable
Common Thresher Shark	*Alopias vulpinus*	Vulnerable
Great White Shark	*Carcharodon carcharias*	Vulnerable
Shortfin Mako	*Isurus oxyrinchus*	Vulnerable
Longfin Mako	*Isurus paucus*	Vulnerable
Blue Shark	*Prionace glauca*	Near Threatened
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Vulnerable

4.1.3.2.4 Turtles

Three species of turtle occur along the West Coast, namely the Leatherback (*Dermochelys coriacea*), and occasionally the Loggerhead (*Caretta caretta*) and the Green (*Chelonia mydas*) turtle. Loggerhead and Green turtles are expected to occur only as occasional visitors along the West Coast. 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 jellyfish 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). 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)

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 Convention on Migratory Species. Loggerhead and green turtles are listed as "Endangered". As a signatory of the Convention on Migratory Species, South Africa has endorsed and signed an International Memorandum of Understanding specific to the conservation of marine turtles. South Africa is thus committed to conserve these species at an international level.

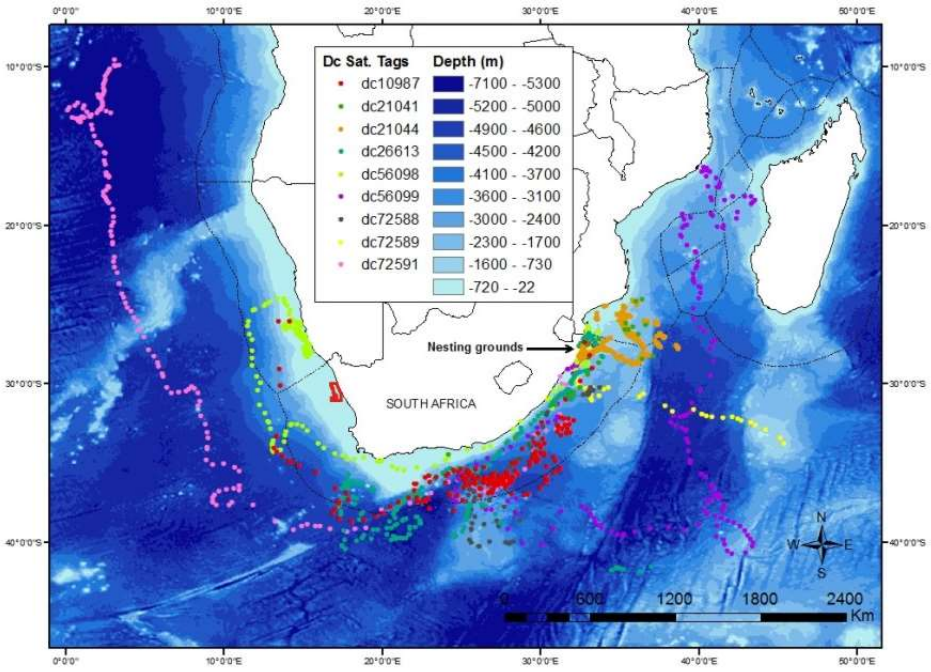

FIGURE 4-6: THE POST-NESTING DISTRIBUTION OF NINE SATELLITE TAGGED LEATHERBACK FEMALES (1996 – 2006; OCEANS AND COAST, UNPUBLISHED DATA). THE APPROXIMATE LOCATION OF CONCESSION 6C IS INDICATED (RED POLYGON).

4.1.3.2.5 Seabirds

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, 14 are defined as resident, 10 are visitors from the northern hemisphere and 25 are migrants from the southern Ocean. The 18 species classified as being common in the southern Benguela are listed in Table 4-3. 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 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.

Fourteen species of seabirds breed in southern Africa; Cape Gannet, African Penguin, four species of Cormorant, White Pelican, three Gull and four Tern species (see Table 4-4). The breeding areas are distributed around the coast with islands being especially important. 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, however, are known to forage up to 140 km offshore (Dundee 2006; Ludynia 2007), and African Penguins have also been recorded as far as 60 km offshore.

TABLE 4-3: PELAGIC SEABIRDS COMMON IN THE SOUTHERN BENGUELA REGION (CRAWFORD *ET AL.* 1991).

Common Name	Species name	Global IUCN
Shy albatross	*Thalassarche cauta*	Near Threatened
Black browed albatross	*Thalassarche melanophrys*	Endangered[1]
Yellow nosed albatross	*Thalassarche chlororhynchos*	Endangered
Giant petrel sp.	*Macronectes halli/giganteus*	Near Threatened
Pintado petrel	*Daption capense*	Least concern
Greatwinged petrel	*Pterodroma macroptera*	Least concern
Soft plumaged petrel	*Pterodroma mollis*	Least concern
Prion spp	*Pachyptila spp.*	Least concern
White chinned petrel	*Procellaria aequinoctialis*	Vulnerable
Cory's shearwater	*Calonectris diomedea*	Least concern
Great shearwater	*Puffinus gravis*	Least concern
Sooty shearwater	*Puffinus griseus*	Near Threatened
European Storm petrel	*Hydrobates pelagicus*	Least concern
Leach's storm petrel	*Oceanodroma leucorhoa*	Least concern
Wilson's storm petrel	*Oceanites oceanicus*	Least concern
Blackbellied storm petrel	*Fregetta tropica*	Least concern
Skua spp.	*Catharacta/Stercorarius spp.*	Least concern
Sabine's gull	*Larus sabini*	Least concern

1. May move to Critically Endangered if mortality from long-lining does not decrease.

TABLE 4-4: BREEDING RESIDENT SEABIRDS PRESENT ALONG THE WEST COAST (CCA & CMS 2001).

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

Common name	Species name	Global IUCN Status
Swift Tern	*Sterna bergii*	Least Concern
Roseate Tern	*Sterna dougallii*	Least Concern
Damara Tern	*Sterna balaenarum*	Near Threatened

4.1.3.2.6 Marine mammals

The marine mammal fauna occurring off the southern African coast includes several species of whales and dolphins and one resident seal species. Thirty-four 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 these waters (see Table 4-5). The offshore areas have been particularly poorly studied with almost all available information from deeper waters (>200 m) arising from historic whaling records prior to 1970. Current information on the distribution, population sizes and trends of most cetacean species occurring on the west coast of southern Africa is lacking. Information on smaller cetaceans in deeper waters is particularly poor and the precautionary principal must be used when considering possible encounters with cetaceans in this area.

Records from stranded specimens show that the area between St Helena Bay (~32° S, 18° E) 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). The project area 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 approximately 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. Importantly, species from both environments may be found on the continental slope (200 – 2000 m) making this the most species rich area for cetaceans. Cetacean density on the continental shelf is usually higher than in pelagic waters as species associated with the pelagic environment tend to be wide ranging across thousands of kilometers. As the bulk sampling area is located on the continental shelf, cetacean diversity in the area can be expected to be high. In the offshore portions of Sea Concession 6C abundances will, however, be low compared to further inshore. 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 and humpback whale.

Cetaceans are comprised of 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 4-5: CETACEANS OCCURRENCE OFF THE WEST COAST OF SOUTH AFRICA, THEIR SEASONALITY, LIKELY ENCOUNTER FREQUENCY WITH PROPOSED EXPLORATION DRILLING OPERATIONS AND IUCN CONSERVATION STATUS.

Common Name	Species	Shelf	Offshore	Seasonality	Likely encounter frequency	IUCN Conservation Status
Delphinids						
Dusky dolphin	*Lagenorhynchus obscurus*	Yes (0- 800 m)	No	Year round	Daily	Data Deficient
Heaviside's dolphin	*Cephalorhynchus heavisidii*	Yes (0-200 m)	No	Year round	Daily	Least Concern
Common bottlenose dolphin	*Tursiops truncatus*	Yes	Yes	Year round	Monthly	Least Concern
Common (short beaked) dolphin	*Delphinus delphis*	Yes	Yes	Year round	Monthly	Least Concern
Southern right whale dolphin	*Lissodelphis peronii*	Yes	Yes	Year round	Occasional	Least Concern
Striped dolphin	*Stenella coeruleoalba*	No	?	?	Very rare	Least Concern
Pantropical spotted dolphin	*Stenella attenuata*	Edge	Yes	Year round	Very rare	Least Concern
Long-finned pilot whale	*Globicephala melas*	Edge	Yes	Year round	<Weekly	Least Concern
Short-finned pilot whale	*Globicephala macrorhynchus*	?	?	?	Very rare	Least Concern
Rough-toothed dolphin	*Steno bredanensis*	?	?	?	Very rare	Least Concern
Killer whale	*Orcinus orca*	Occasional	Yes	Year round	Occasional	Data Deficient
False killer whale	*Pseudorca crassidens*	Occasional	Yes	Year round	Monthly	Least Concern
Pygmy killer whale	*Feresa attenuata*	?	Yes	?	Occasional	Least Concern
Risso's dolphin	*Grampus griseus*	Yes (edge)	Yes	?	Occasional	Least Concern
Sperm whales						
Pygmy sperm whale	*Kogia breviceps*	Edge	Yes	Year round	Occasional	Data Deficient
Dwarf sperm whale	*Kogia sima*	Edge	?	?	Very rare	Data Deficient
Sperm whale	*Physeter macrocephalus*	Edge	Yes	Year round	Occasional	Vulnerable

Common Name	Species	Shelf	Offshore	Seasonality	Likely encounter frequency	IUCN Conservation Status
Beaked whales						
Cuvier's	*Ziphius cavirostris*	No	Yes	Year round	Occasional	Data Deficient
Arnoux's	*Beradius arnouxii*	No	Yes	Year round	Occasional	Data Deficient
Southern bottlenose	*Hyperoodon planifrons*	No	Yes	Year round	Occasional	Least Concern
Layard's	*Mesoplodon layardii*	No	Yes	Year round	Occasional	Data Deficient
True's	*M. mirus*	No	Yes	Year round	?	Data Deficient
Gray's	*M. grayi*	No	Yes	Year round	Occasional	Data Deficient
Blainville's	*M. densirostris*	No	Yes	Year round	?	Data Deficient
Baleen whales						
Antarctic Minke	*Balaenoptera bonaerensis*	Yes	Yes	>Winter	Monthly	Least Concern
Dwarf minke	*B. acutorostrata*	Yes	Yes	Year round	Occasional	Least Concern
Fin whale	*B. physalus*	Yes	Yes	MJJ & ON, rarely in summer	Occasional	Endangered
Blue whale	*B. musculus*	No	Yes	?	Occasional	Critically Endangered
Sei whale	*B. borealis*	Yes	Yes	MJ & ASO	Occasional	Endangered
Bryde's (offshore)	*B. brydei*	Yes	Yes	Summer (JF)	Occasional	Not assessed
Bryde's (inshore)	*B brydei (subspp)*	Yes	Yes	Year round	Occasional	Vulnerable
Pygmy right	*Caperea marginata*	Yes	?	Year round	Occasional	Least Concern
Humpback	*Megaptera novaeangliae*	Yes	Yes	Year round, higher in SONDJF	Daily*	Vulnerable
Southern right	*Eubalaena australis*	Yes	No	Year round, higher in JFASOND	Daily*	Least Concern

The cetaceans likely to be found within the project area, based on data sourced from: Findlay *et al.* (1992), Best (2007), Weir (2011), Dr J-P. Roux, (MFMR pers. comm.) and unpublished records held by the Namibian Dolphin Project are listed in Table Table 4-5. Of the 34 species listed, one is critically endangered, two are endangered and two are considered vulnerable (South African Red Data list Categories, 2016). Altogether 10 species are listed as "data deficient" underlining how little is known about cetaceans, their distributions and population trends. 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). Some data on species occurrence is available from newer datasets, mainly from marine mammal observers working on earlier seismic surveys, but these are almost all confined to the summer months.

A review of the distribution and seasonality of the key cetacean species likely to be found within the project area is provided below.

(a) Mysticete (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, 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.

Two genetically and morphologically distinct populations of Bryde's whales 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. It may move further north into the Benguela current areas of the west of coast of South Africa and Namibia, especially in the winter months (Best 2007).

Sei whales migrate through South African waters, where they were historically hunted in relatively high numbers, to unknown breeding grounds further north. Their migration pattern thus shows a bimodal peak with numbers west of Cape Columbine highest in May and June, and again in August, September and October. All whales were caught in waters deeper than 200 m with most deeper than 1000 m (Best & Lockyer 2002). Almost all information

is based on whaling records 1958-1963 and there is no current information on abundance or distribution patterns in the region.

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. Some juvenile animals may feed year round in deeper waters off the shelf (Best 2007). There are no recent data on abundance or distribution of fin whales off western South Africa.

Although blue whales were historically caught in high numbers off the South African West Coast, with a single peak in catch rates during June to July in Walvis Bay, Namibia and at Namibe, Angola suggesting that in the eastern South Atlantic these latitudes are close to the northern migration limit for the species (Best 2007). Several recent (2014-2015) sightings of blue whales have occurred during seismic surveys off the southern part of Namibia in water >1 000 m deep confirming their current existence in the area and occurrence in autumn months. The chance of encountering the species in the Sea Concession area is considered low.

Two forms of minke whale 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 approximately 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. 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. Both species are generally solitary and densities are likely to be low in the project area.

The most abundant baleen whales in the Benguela are Southern Right whales and Humpback whales. In the last decade, both species have been increasingly observed to remain on the west coast of South Africa well after the 'traditional' South African whale season (June – November) into spring and early summer (October – February) where they have been observed feeding in upwelling zones, especially off Saldanha and St Helena Bay (Barendse *et al.* 2011; Mate *et al.* 2011).

The majority of Humpback whales passing through the Benguela are migrating to breeding grounds off tropical west Africa, between Angola and the Gulf of Guinea (Rosenbaum *et al.* 2009; Barendse *et al.* 2010). In coastal waters, the northward migration stream is larger than the southward peak (Best & Allison 2010; Elwen *et al.* 2013), 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, but no clear migration 'corridor. 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.* 2013, Rosenbaum *et al.* in press). Recent abundance estimates put the number of animals in the west African breeding population to be in excess of 9 000 individuals in 2005 (IWC 2012) and it is likely to have increased since this time at about 5% per annum (IWC 2012). Humpback whales are thus likely to be the most frequently encountered baleen whale in the project area, ranging from the coast out beyond the shelf, with year round presence but

numbers peaking in July – February associated with the breeding migration and subsequent feeding in the Benguela.

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). The most recent abundance estimate for this population is available for 2017 which estimated the population at approximately 6 100 individuals including all age and sex classes, and still growing at 6.5% per annum (Brandaõ *et al.* 2017). When the population numbers crashed, 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., in review) and Mozambique (Banks *et al.* 2011). Southern right whales are seen regularly in the nearshore waters of the West Coast (<3 km from shore), extending north into southern Namibia (Roux *et al.* 2001, 2011). Southern Right whales have been recorded off the West Coast in all months of the year, but with numbers peaking in winter (June - September). Notably, all available records have been very close to shore with only a few out to 100 m depth, so they are unlikely to be encountered in the concession area.

In the last decade, deviations from the predictable and seasonal migration patterns of these two species have been reported from the Cape Columbine – Yzerfontein area (Best 2007; Barendse *et al.* 2010). High abundances of both Southern Right and Humpback whales in this area during spring and summer (September-February), indicates that the upwelling zones off Saldanha and St Helena Bay may serve as an important summer feeding area (Barendse *et al.* 2011, Mate *et al.* 2011). It was previously thought that whales feed only rarely while migrating (Best *et al.* 1995), but these localised summer concentrations suggest that these whales may in fact have more flexible foraging habits.

(b) Odontocetes (toothed) whales

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. Those in the region can range in size from 1.6 m long (Heaviside's dolphin) to 17 m (bull sperm whale).

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 1000 m depth, although they occasionally come onto the shelf in water 500 - 200 m deep (Best 2007). 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 thus likely to be encountered in relatively high numbers in deeper waters (> 500 m), predominantly in the winter months (April - October). 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 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 the southern African West Coast. Beaked whales are all considered to be true deep water species usually being seen in waters in excess of 1000 - 2000 m deep (see various species accounts in Best 2007). Presence in the project area may fluctuate seasonally, but insufficient data exist to define this clearly.

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, although their seasonality is unknown. The majority of what is known about Kogiidae whales in the southern African subregion results from studies of stranded specimens (e.g. Ross 1979; Findlay *et al.* 1992; Plön 2004; Elwen *et al.* 2013).

Killer whales 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 western South Africa (Best *et al.* 2010), Namibia (Elwen & Leeney 2011) and in the Eastern Tropical Atlantic (Weir *et al.* 2010). Killer whales are found in all depths from the coast to deep open ocean environments and may thus be encountered in the project area at low levels.

The false killer whale 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).

Long-finned pilot whales display a preference for temperate waters and are usually associated with the continental shelf or deep water adjacent to it (Mate *et al.* 2005; Findlay *et al.* 1992; Weir 2011). They are regularly seen associated with the shelf edge by marine mammal observers (MMOs) and 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 (Best 2007), it is likely that the vast majority of pilot whales encountered in the project area will be long-finned.

The common dolphin is known to occur offshore in West Coast waters (Findlay *et al.* 1992; Best 2007), although the extent to which they occur in the project area is unknown, but likely to be low. Group sizes of common dolphins can be large, averaging 267 (± SD 287) for the South Africa region (Findlay *et al.* 1992). They are more frequently seen in the warmer waters offshore and to the north of the country, seasonality is not known.

In water <500 m deep, dusky dolphins 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). Although no information is available on the size of the population, they are regularly encountered in near shore waters between Cape Town and Lamberts Bay (Elwen *et al.* 2010a; NDP 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 approximately 27°S and 30°S, associated with the Lüderitz upwelling cell (Findlay *et al.* 1992). Dusky dolphins are resident year round in the Benguela.

Heaviside’s dolphins are relatively abundant in the Benguela ecosystem region with 10 000 animals estimated to live in the 400 km of coast between Cape Town and Lamberts Bay (Elwen *et al.* 2009). This species 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), but this varies throughout the species range. Heaviside's dolphins are resident year round.

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.

Beaked whales were never targeted commercially and their pelagic distribution makes them the most poorly studied group of cetaceans. 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). They also appear to be particularly vulnerable to certain types of anthropogenic noise, although reasons are not yet fully understood. 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).

In summary, the Humpback and Southern Right whale are likely to be encountered year-round, with numbers in the Cape Columbine area highest between September and February, and not during winter as is common on the South Coast breeding grounds. Several other large whale species are also most abundant on the West Coast during winter: fin whales peak in May-July and October-November; sei whale numbers peak in May-June and again in August-October and offshore Bryde's whale numbers are likely to be highest in January-February. Whale numbers on the shelf and in offshore waters are thus likely to be highest between October and February.

Of the migratory cetaceans, the Blue is listed as 'critically endangered', Fin and Sei whales are listed as 'Endangered' and the Bryde's (inshore) and Humpback whale as 'Vulnerable' in the IUCN Red Data book. 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.

The Cape fur seal (*Arctocephalus pusillus pusillus*) 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 (see Figure 4-7). 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).

There are a number of Cape fur seal colonies within the study area: at Kleinzee (incorporating Robeiland), at Bucchu Twins near Alexander Bay, and Strandfontein Point (south of Hondeklipbaai). The colony at Kleinzee has the highest seal population and produces the highest seal pup numbers on the South African Coast (Wickens 1994). The colony at Buchu Twins, formerly a non-breeding colony, has also attained breeding status (M. Meyer, SFRI, pers. comm.). Non-breeding colonies occur south of Hondeklip Bay at Strandfontein Point and on Bird Island at Lamberts Bay, with the McDougall's Bay islands and Wedge Point being haul-out sites only and not permanently occupied by seals. 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. The timing of the annual breeding cycle is very regular, occurring between November and January. 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).

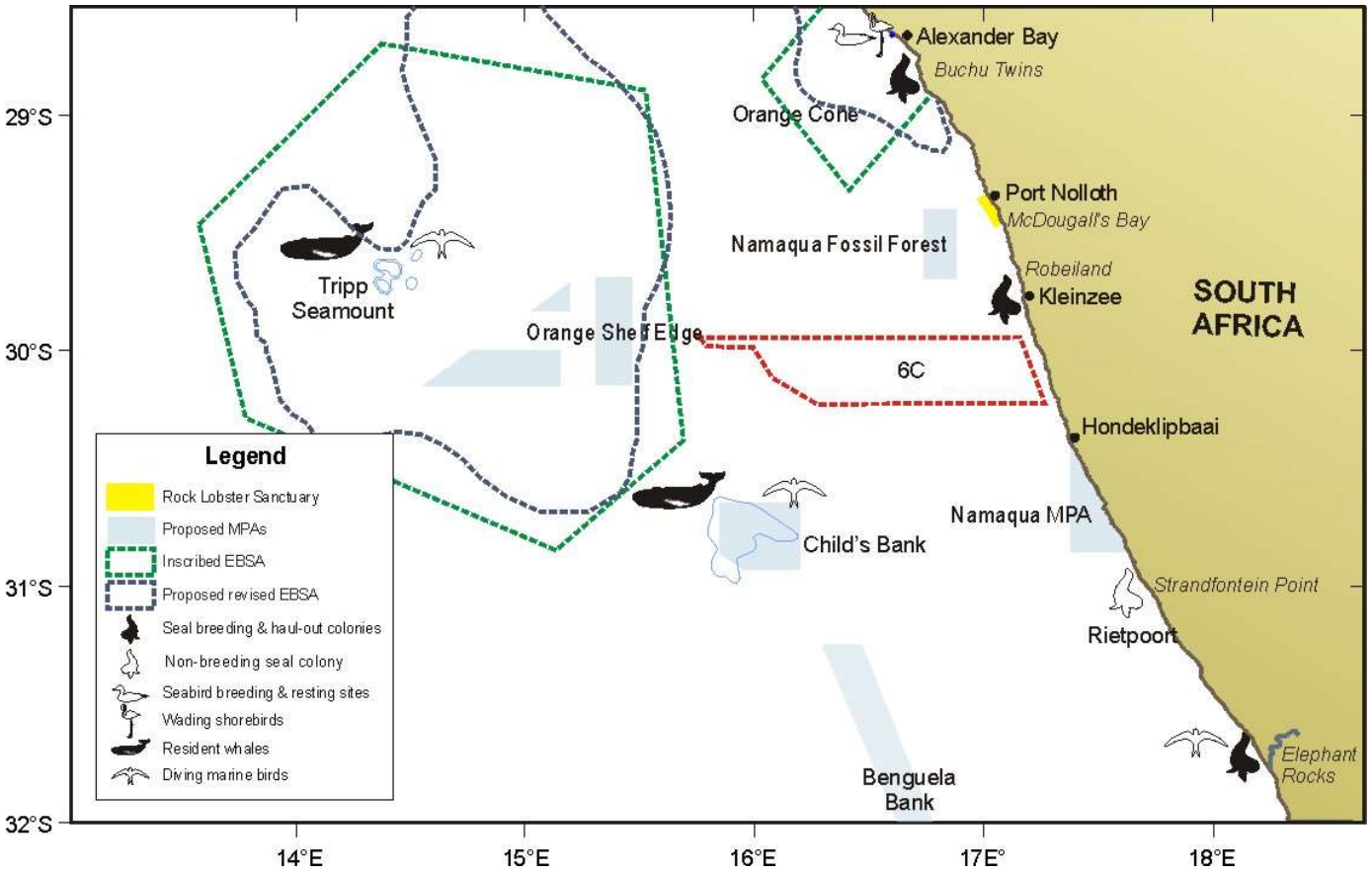

FIGURE 4-7: PROJECT - ENVIRONMENT INTERACTION POINTS ON THE WEST COAST, ILLUSTRATING THE LOCATION OF SEA CONCESSION 6C (RED POLYGON) IN RELATION TO SEABIRD AND SEAL COLONIES AND RESIDENT WHALE POPULATIONS.

4.1.4 Human Utilisation

4.1.4.1 Fisheries and Other Harvesting

4.1.4.1.1 Introduction

The South African fishing industry consists of approximately 14 commercial sectors operating within the 200 nautical mile EEZ. The western coastal shelf is a highly productive upwelling ecosystem (Benguela current) and supports a number of fisheries.

Primary fisheries in terms of economic value and overall tonnage of landings are the 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*). 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 line-fish sectors. West Coast rock lobster (*Jasus lalandi*) is an important trap fishery exploited close to the shoreline (waters shallower than 100 m) including the intertidal zone and kelp beds off the West Coast.

On the West Coast of South Africa, major fishing grounds tend to be centred along the shelf break which is located approximately along the 500 m isobath. Historically and currently the bulk of the main commercial fish stocks caught on the northern West Coast of South Africa have been landed and processed at the Western Cape ports of Cape Town and Saldanha (less than 1% of the South African commercial allowable catch is landed in the Northern Cape Province). The main reasons for this include lack of local infrastructure, distance to market and relatively low volumes of fish landings.

Sea Concession area 6C is situated near to the fishing harbour of Port Nolloth, a regional fishing node which operates at a low level of development. Historically, the harbour accommodated a West Coast rock lobster fishery, an experimental hake-long-line fishery and a small experimental trawl fishery during the 1980's (targeting gurnards and sole). Currently there is little fishing activity taking place from Port Nolloth (only inshore West Coast rock lobster and traditional line fishing). As the harbour is relatively shallow and does not have a breakwater, it becomes inaccessible to vessels during rough weather conditions and cannot accommodate larger vessels (length greater than 22 m). This has been a restrictive factor to the development of fisheries in the region. The main commercial sectors operating in the vicinity of the study area are discussed below:

4.1.4.1.2 Small Pelagic Purse-Seine

The South African small pelagic purse seine fishery is the largest fishery by volume and the second most important in terms of value. The pelagic purse-seine fishery targets small mid-water and surface-shoaling species such as sardine, anchovy, juvenile horse mackerel and round herring using purse-seine fishing techniques. Annual landings have fluctuated between 300 000 and 600 000 tons over the last decade, with landings of 391 000 tons recorded per annum between 2008 and 2012.

Once a shoal has been located the vessel steams around it and encircle it with a large net. The depth of the net is usually between 60 m and 90 m. Netting walls surround aggregated fish both from the sides and from underneath, thus preventing them from escaping by diving downwards. These are surface nets framed by lines: a float line on top and lead line at the bottom (see Figure 4-8). once the shoal has been encircled the net is pursed and hauled in and the fish are pumped on board into the hold of the vessel. After the net is deployed the vessel has no ability to manoeuvre until the net has been fully recovered on board, which may take up to 1.5 hours. Vessels usually operate overnight and return to offload their catch the following day.

The South African fishery, consisting of approximately 101 vessels, is active all year round with a short break from mid-December to mid-January (to reduce impact on juvenile sardine), with seasonal trends in the specific species targeted. The geographical distribution and intensity of the fishery is largely dependent on the seasonal fluctuation and geographical distribution of the targeted species. Fishing grounds occur primarily along the Western Cape and Eastern Cape coast up to a distance of 100 km offshore, but usually closer inshore. The sardine-directed fishery tends to concentrate effort in a broad area extending from St Helena Bay, southwards past Cape Town towards Cape Point and then eastwards along the coast to Mossel Bay and Port Elizabeth. The anchovy-directed fishery takes place predominantly on the South-West Coast from St Helena Bay to Cape Point and is most active in the period from March to September. Round herring (non-quota species) is targeted when available and specifically in the early part of the year (January to March) and is distributed South of Cape Point

to St Helena Bay. The spatial extent of the fishing grounds in relation to the Sea Concession area are shown in Figure 4-9. The map omits fishing grid blocks which have less than one hour of fishing effort per year (average values for the period 2000 to 2016), as sporadic fishing events have been recorded within the concession area but these are considered to be insignificant in the overall context of the distribution of fishing activity by the sector. The concession area is situated at least 120 km northward of grounds fished regularly by the purse-seine sector. The concession area does, however, overlap spawning and recruitment areas for small pelagic species.

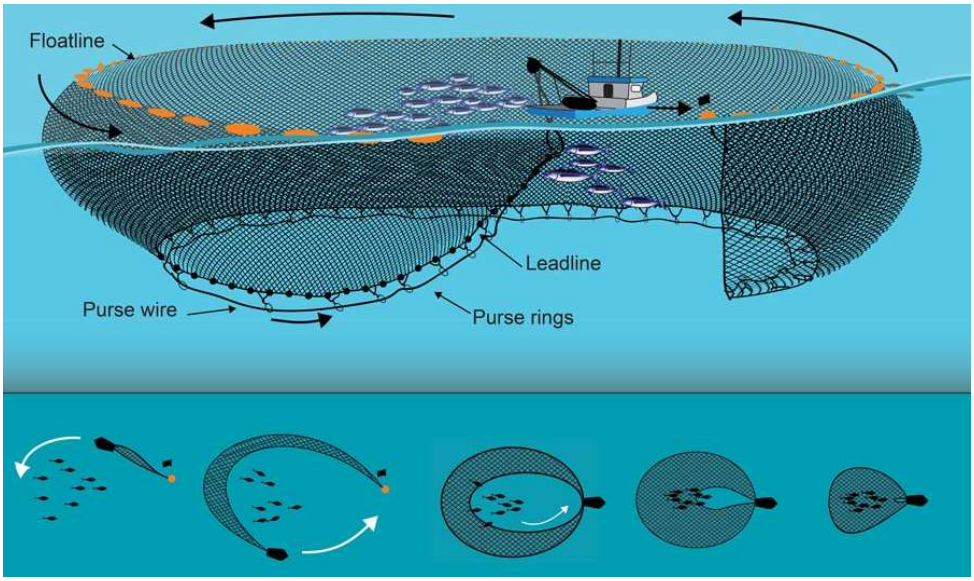

FIGURE 4-8: SCHEMATIC OF TYPICAL PURSE-SEINE GEAR DEPLOYED IN THE "SMALL" PELAGIC FISHERY. (SOURCE: HTTP://WWW.AFMA.GOV.AU/PORTFOLIO-ITEM/PURSE-SEINE).

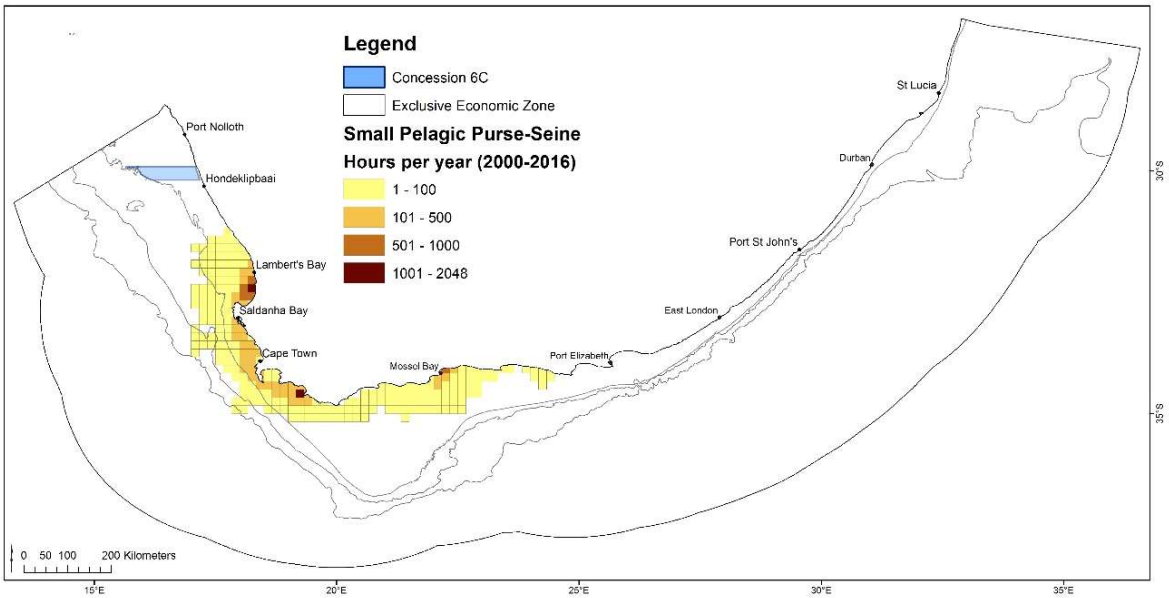

FIGURE 4-9: SEA CONCESSION 6C IN RELATION TO THE SPATIAL DISTRIBUTION OF EFFORT REPORTED BY THE SOUTH AFRICAN SMALL PELAGIC PURSE-SEINE FISHERY (2000 – 2016).

4.1.4.1.3 Demersal Trawl

The hake-directed trawl fishery is the most valuable sector of the South African fishing industry and is split into two sub-sectors: the offshore ("deep-sea") sector which is active off both the South and West Coasts, and the much smaller inshore trawl sector which is active off the South Coast. A fleet of 45 trawlers operate within the offshore sector targeting the Cape hakes (*Merluccius capensis* and *M. paradoxus*). Main by-catch species include monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*) and snoek (*Thyrsites atun*).

Trawls are usually conducted along specific trawling lanes on "trawl friendly" substrate (flat, soft ground). On the West Coast, these grounds extend in a continuous band along the shelf edge between the 300 m and 1 000 m bathymetric contours. Monk-directed trawlers tend to fish shallower waters than hake-directed vessels on mostly muddy substrates. Trawl nets are generally towed along depth contours (thereby maintaining a relatively constant depth) running parallel to the depth contours in a north-westerly or south-easterly direction. Trawlers also target fish aggregations around bathymetric features, in particular seamounts and canyons (i.e. Cape Columbine and Cape Canyon), where there is an increase in seafloor slope and in these cases the direction of trawls follow the depth contours. Trawlers are prohibited from operating within five nautical miles of the coastline.

The offshore fleet is segregated into wetfish and freezer vessels which differ in terms of the capacity for the processing of fish at sea and in terms of vessel size and capacity. While freezer vessels may work in an area for up to a month at a time, wetfish vessels may only remain in an area for about a week before returning to port. Wetfish vessels range between 24 m and 56 m in length while freezer vessels are usually larger, ranging up to 80 m in length. The gear configurations are similar for both freezer and wet fish vessels. Trawl gear is deployed astern of the vessel.

The towed gear typically consists of trawl warps, bridles and trawl doors, a footrope, headrope, net and codend (see Figure 4-10). The monk-directed trawlers use slightly heavier trawl gear, trawl at slower speeds and for longer periods (up to eight hours) compared to the hake-directed trawlers (60 minutes to four hours). Monk gear includes the use of "tickler" chains positioned ahead of the footrope to chase the monk off the substrate and into the net.

Figure 4-11 shows the demersal trawl effort and catch between 2008 and 2016 in relation to the area of interest. The South African Deepsea Trawling Industry Association (SADSTIA) has implemented a self-imposed restriction which confines fishing effort to a designated area ("the historical footprint of the fishery"). This spatial restriction is also written into the permit conditions for the fishery. In the vicinity of the concession area, demersal trawling is centred along the 500 m bathymetric contour but ranges to 300 m and to 200 m in places (e.g. around Child's Bank submarine canyon). There is no direct overlap between trawling grounds and Sea Concession area 6C, which is situated at least 30 km from the designated footprint of trawling ground. The concession area does, however, coincide with spawning and recruitment areas for hake and other demersal species.

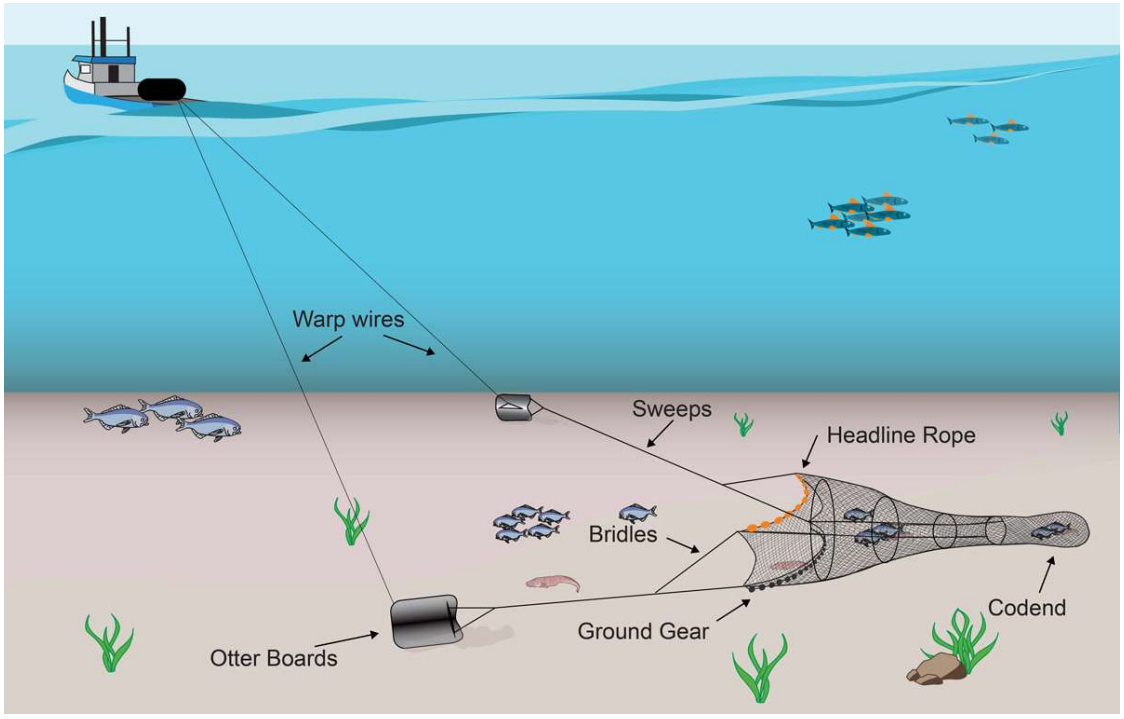

FIGURE 4-10: TYPICAL GEAR CONFIGURATION USED BY DEMERSAL TRAWLERS (OFFSHORE) TARGETING HAKE (SOURCE: HTTPS://WWW.AFMA.GOV.AU/FISHERIES-MANAGEMENT/METHODS-AND-GEAR/TRAWLING).

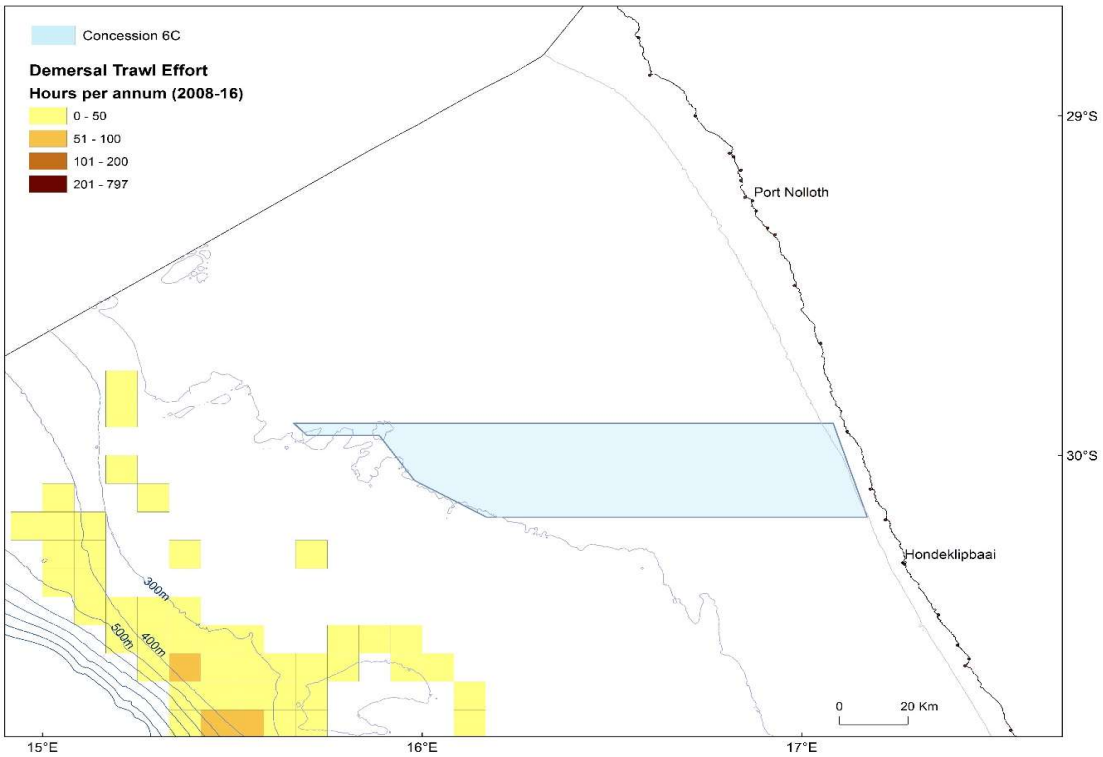

FIGURE 4-11: SEA CONCESSION 6C IN RELATION TO THE SPATIAL DISTRIBUTION OF TRAWLING EFFORT EXPENDED BY THE DEMERSAL TRAWL SECTOR (2008 TO 2016).

4.1.4.1.4 Demersal Long-Line

The demersal long-line fishing technique is used to target bottom-dwelling species of fish. Like the demersal trawl fishery, the target species of the longline fishery is the Cape hakes, with a small amount of non-targeted commercial by-catch.

A demersal long-line vessel may deploy either a double or single line which is weighted along its length to keep it close to the seafloor (see Figure 4-12). Steel anchors, of 40 kg to 60 kg, are placed at the ends of each line to anchor it, and are marked with an array of floats. If a double line system is used, top and bottom lines are connected by means of dropper lines. Lines are typically between 10 km and 20 km in length, carrying between 6 900 and 15 600 hooks each. Baited hooks are attached to the bottom line at regular intervals (1 to 1.5 m) by means of a snood. Gear is usually set at night at a speed of between five and nine knots. Once deployed the line is left to soak for up to eight hours before it is retrieved. A line hauler is used to retrieve gear (at a speed of approximately one knot) and can take six to ten hours to complete. During hauling operations a demersal long-line vessel would be severely restricted in manoeuvrability. Currently 64 hake-directed vessels are active within the fishery, most of which operate from the harbours of Cape Town and Hout Bay.

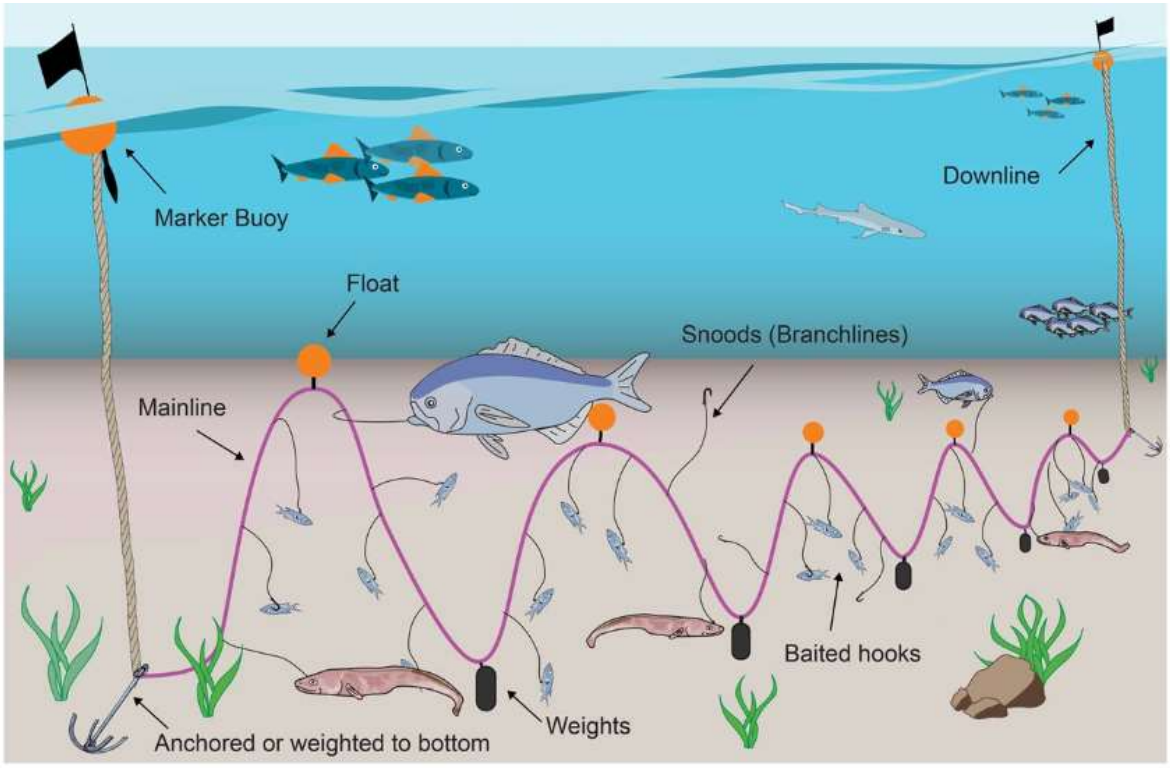

FIGURE 4-12: TYPICAL CONFIGURATION OF DEMERSAL (BOTTOM-SET) HAKE LONG-LINE GEAR USED IN SOUTH AFRICAN WATERS (SOURCE: HTTP://WWW.AFMA.GOV.AU/PORTFOLIO-ITEM/LONGLINING).

The target fishing grounds are similar to those targeted by the hake-directed trawl fleet. Off the West Coast, vessels target fish along the shelf break from Port Nolloth (15°E, 29°S) to the Agulhas Bank (21°E, 37°S). Off the West Coast (westward of 20°E) the fishery is prohibited from operating within five nautical miles of the coastline and effort is concentrated at about 300 m depth on areas of rough ground. Fishing activity records (from 2000 to 2017) shows frequented grounds at distances of 20 km and 40 km from the north-westerly and south-westerly

extents of the concession area, respectively (see Figure 4-13). However, there are records of sporadic activity within the concession area that amounts to an average of one line set per year and a catch of approximately 4 tons of hake. This is equivalent to approximately 0.05% of the total landing of hake by the sector per year during this period. As noted above, that the concession area overlaps spawning and recruitment areas for hake and other demersal species.

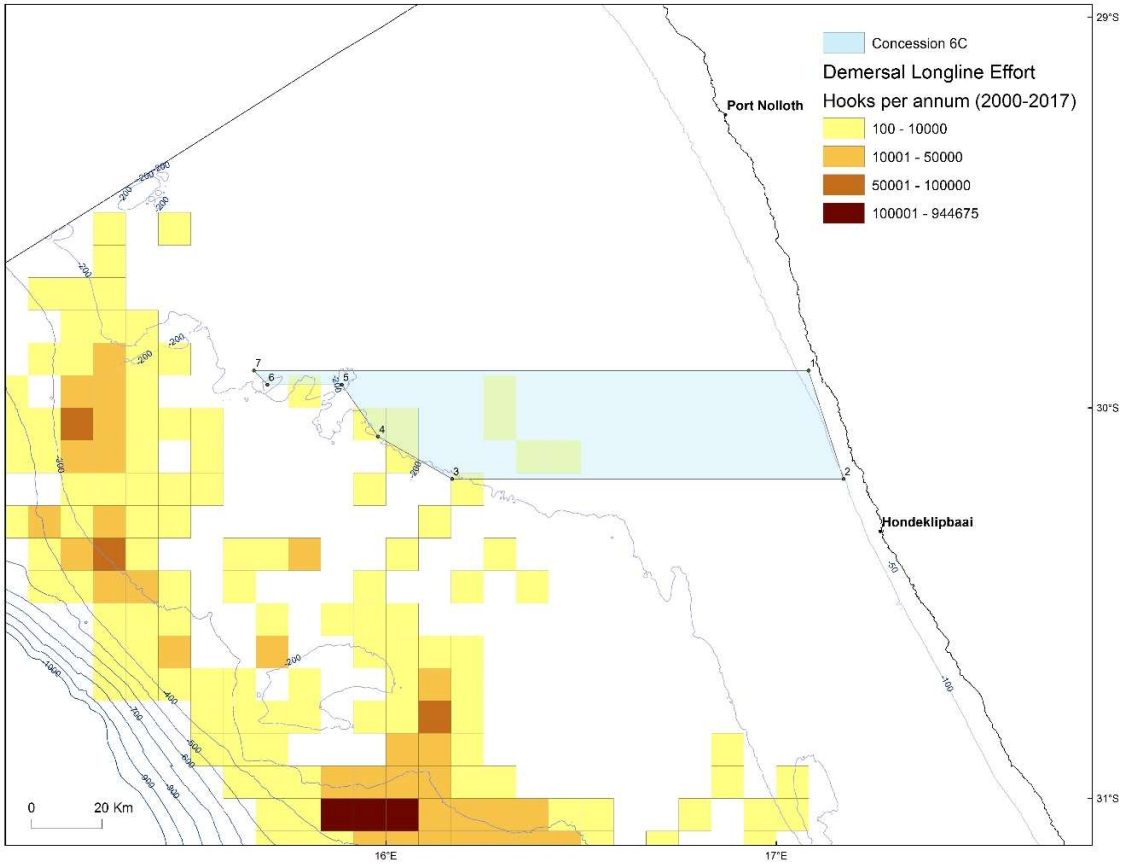

FIGURE 4-13: SEA CONCESSION 6C IN RELATION TO THE SPATIAL DISTRIBUTION OF EFFORT EXPENDED BY DEMERSAL LONG-LINE FISHERY (2000 – 2017).

4.1.4.1.5 Large Pelagic Long-Line

The large pelagic long-line fishery operates year-round, extensively within the South African EEZ targeting primarily tuna and swordfish. Due to the highly migratory nature of these species, stocks straddle the EEZ of a number of countries and international waters. As such they are managed as a "shared resource" amongst various countries. There are currently 30 commercial large pelagic fishing rights issued for South African waters and there are 21 vessels active in the fishery.

Pelagic long-line vessels set a drifting mainline, which can be up to 100 km in length. The mainline is kept near the surface or at a certain depth (20 m below) by means of buoys connected via "buoy-lines", which are spaced approximately 500 m apart along the length of the mainline (see Figure 4-14). Hooks are attached to the mainline via 20 m long trace lines, which are clipped to the mainline at intervals of approximately 50 m. There can be up to 3 500 hooks per line. A single main line consists of twisted rope (6 to 8 mm diameter) or a thick nylon monofilament (5 to 7.5 mm diameter). Various types of buoys are used in combinations to keep the mainline

near the surface and locate it should the line be cut or break for any reason. Each end of the line is marked by a Dahn Buoy and Radar reflector, which marks its position for later retrieval by the fishing vessel. A line may be left drifting for up to 18 hours before retrieval by means of a powered hauler at a speed of approximately 1 knot. During hauling a vessel's manoeuvrability is severely restricted and, in the event of an emergency, the line may be dropped to be hauled in at a later stage.

The fishery operates extensively from the continental shelf break into deeper waters, year-round. Pelagic long-line vessels are primarily concentrated seawards of the 500 m depth contour where the continental slope is steepest and can be expected within the area of interest.

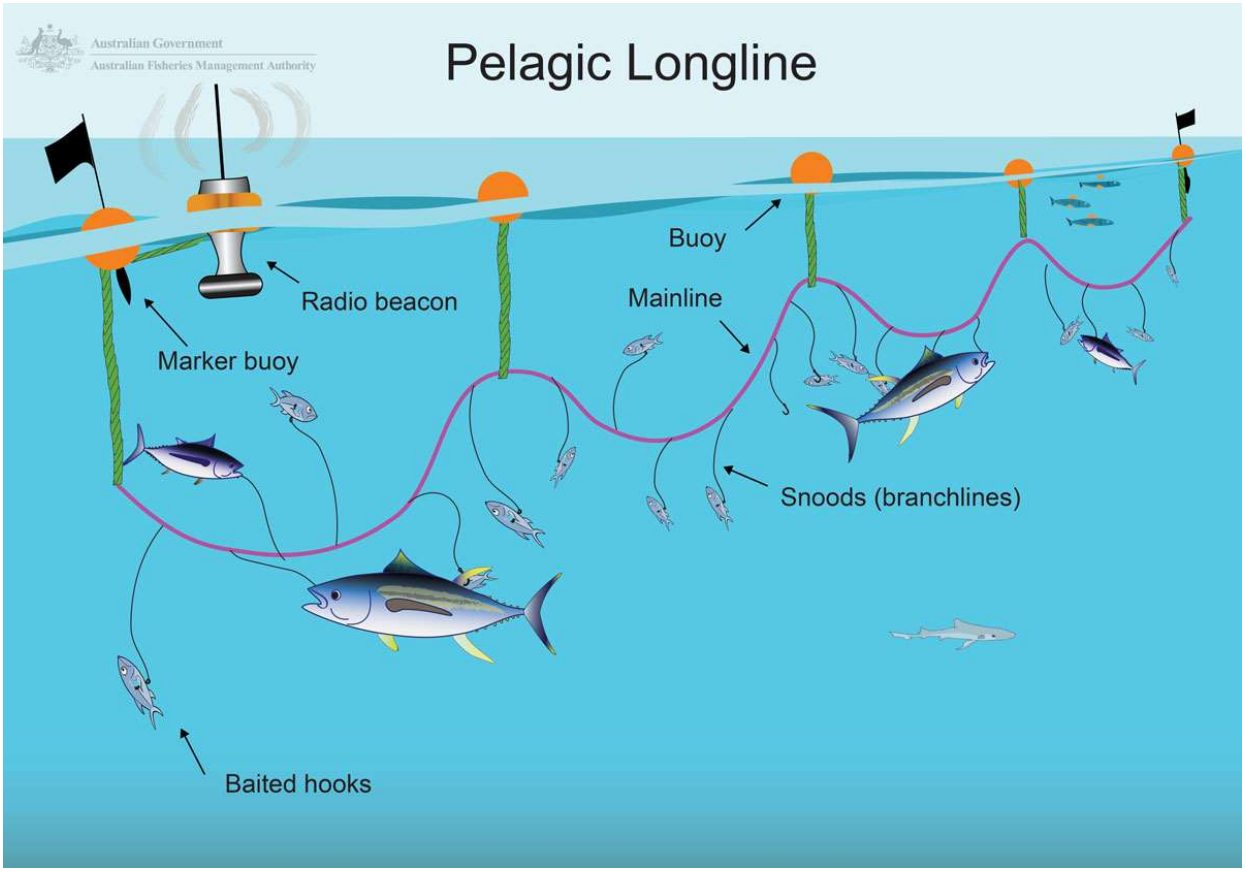

FIGURE 4-14: TYPICAL PELAGIC LONG-LINE CONFIGURATION TARGETING TUNA, SWORDFISH AND SHARK SPECIES (SOURCE: HTTPS://WWW.AFMA.GOV.AU/FISHERIES-MANAGEMENT/METHODS-AND-GEAR/LONGLINING).

Vessels operate predominantly from the shelf break and into deeper waters and are prohibited from operating within 12 nm of the coastline (or within 20 nm of the coastline off KwaZulu-Natal). In the vicinity of Concession Area 6C, vessels operate along and offshore of the 500 m depth contour, which is situated about 90 km offshore of the concession area (See Figure 4-15). There is no direct overlap of the concession area with either fishing ground or spawning and recruitment areas of large pelagic species.

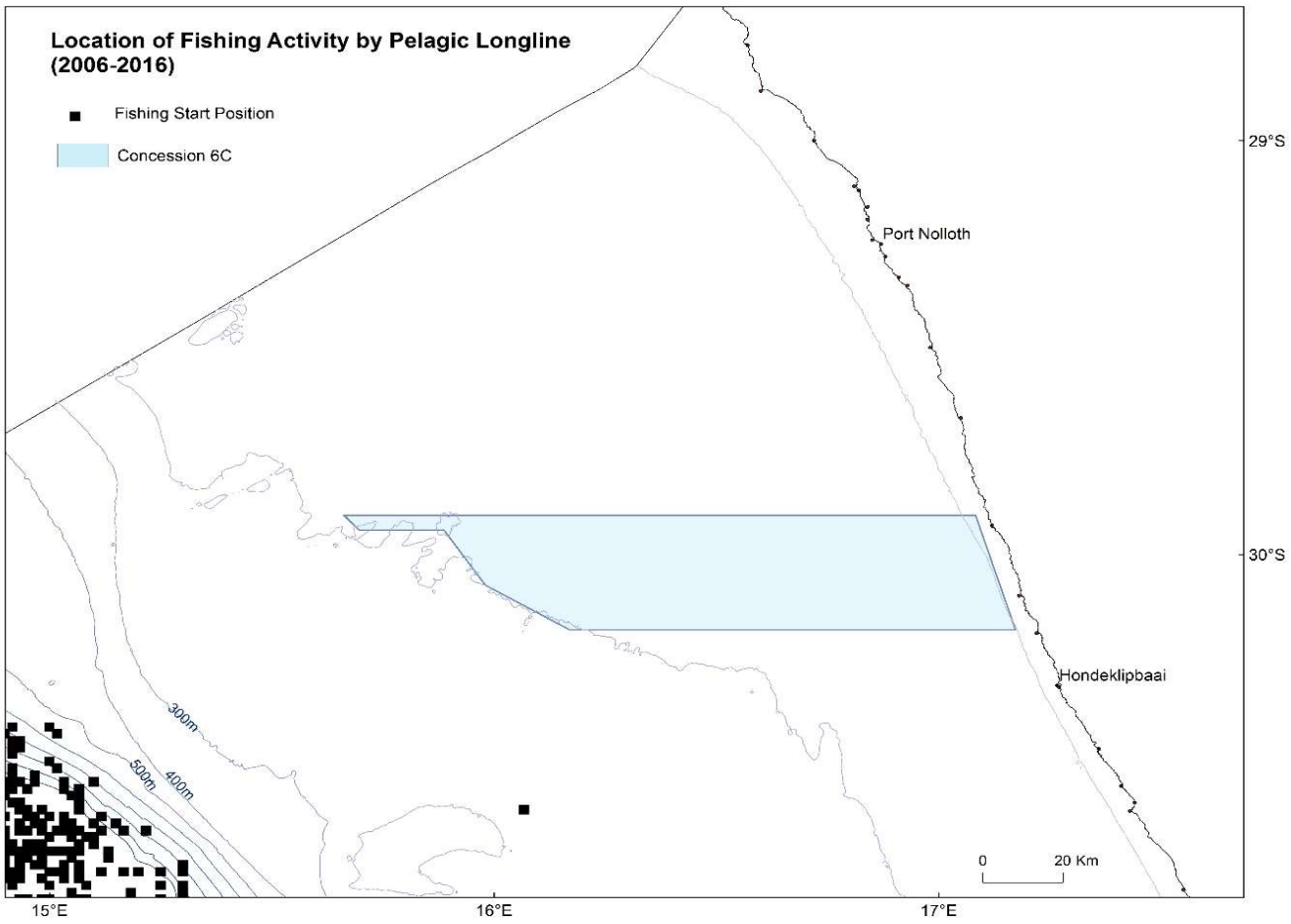

FIGURE 4-15: SEA CONCESSION 6C IN RELATION TO SPATIAL DISTRIBUTION OF FISHING POSITIONS RECORDED BETWEEN 2006 AND 2016 BY THE SOUTH AFRICAN LARGE PELAGIC LONGLINE SECTOR.

4.1.4.1.6 Tuna Pole

The tuna pole fishery is based on migratory species of tuna, predominantly Atlantic longfin tuna stock and a very small amount of skipjack tuna, yellowfin tuna and bigeye tuna. The South African fleet consists of approximately 128 pole-and-line vessels, which are based at the ports of Cape Town, Hout Bay and Saldanha Bay. The fishery is seasonal with vessel activity mostly between December and May and peak catches in February and March.

Vessels drift whilst attracting and catching shoals of pelagic tunas. Sonars and echo sounders are used to locate schools of tuna. Once a school is located, water is sprayed outwards from high-pressure nozzles to simulate small baitfish aggregating near the water surface. Live bait is then used to entice the tuna to the surface (chumming). Tuna swimming near the surface are caught with hand-held fishing poles. The ends of the 2 to 3 m poles are fitted with a short length of fishing line leading to a hook. In order to land heavier fish, lines may be strung from the ends of the poles to overhead blocks to increase lifting power (see Figure 4-16). Vessels are relatively small (less than 25 m in length) and store catch on ice, thus staying at sea for short periods (approximately five days).

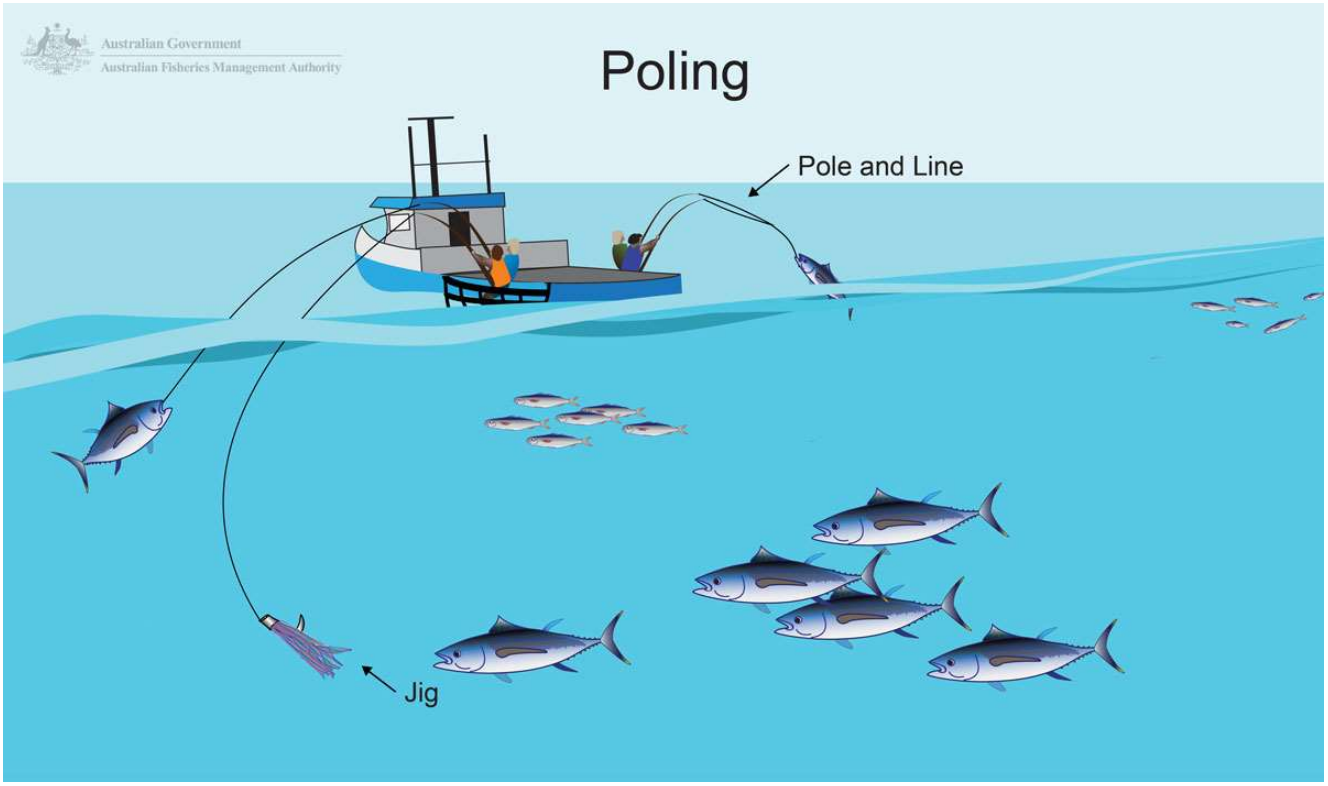

FIGURE 4-16: SCHEMATIC DIAGRAM OF POLE AND LINE OPERATION. (SOURCE: HTTP://WWW.AFMA.GOV.AU /PORTFOLIO-ITEM/MINOR-LINES/).

The nature of the fishery and communication between vessels often results in a large number of vessels operating in close proximity to each other at a time. The vessels fish predominantly during daylight hours and are highly manoeuvrable. However, at night in fair weather conditions the fleet of vessels may drift or deploy drogues to remain within an area and would be less responsive during these periods.

Fishing activity occurs along the entire West Coast beyond the 200 m bathymetric contour. Activity would be expected to occur along the shelf break with favoured fishing grounds including areas north of Cape Columbine and between 60 km and 120 km offshore from Saldanha Bay. The tuna pole effort and catch between 2007 and 2016 in relation to the area of interest is shown in Figure 4-17. Although the main targeted fishing grounds off the West Coast are situated south of the concession area, there are records of fishing activity which coincide with the north-western extent of the concession area which is most likely due to vessels fishing en route to favoured grounds off Tripp Seamount on the Namibian side of the maritime border. Over the period 2007 to 2016, 32 fishing events were reported within the concession area (this is comparable to 32 days of fishing effort) with a cumulative catch of 58.3 tons of albacore over this period. This amounts to 5.8 tons per year which is equivalent to 0.2% of the total albacore landed by the sector (nationally).

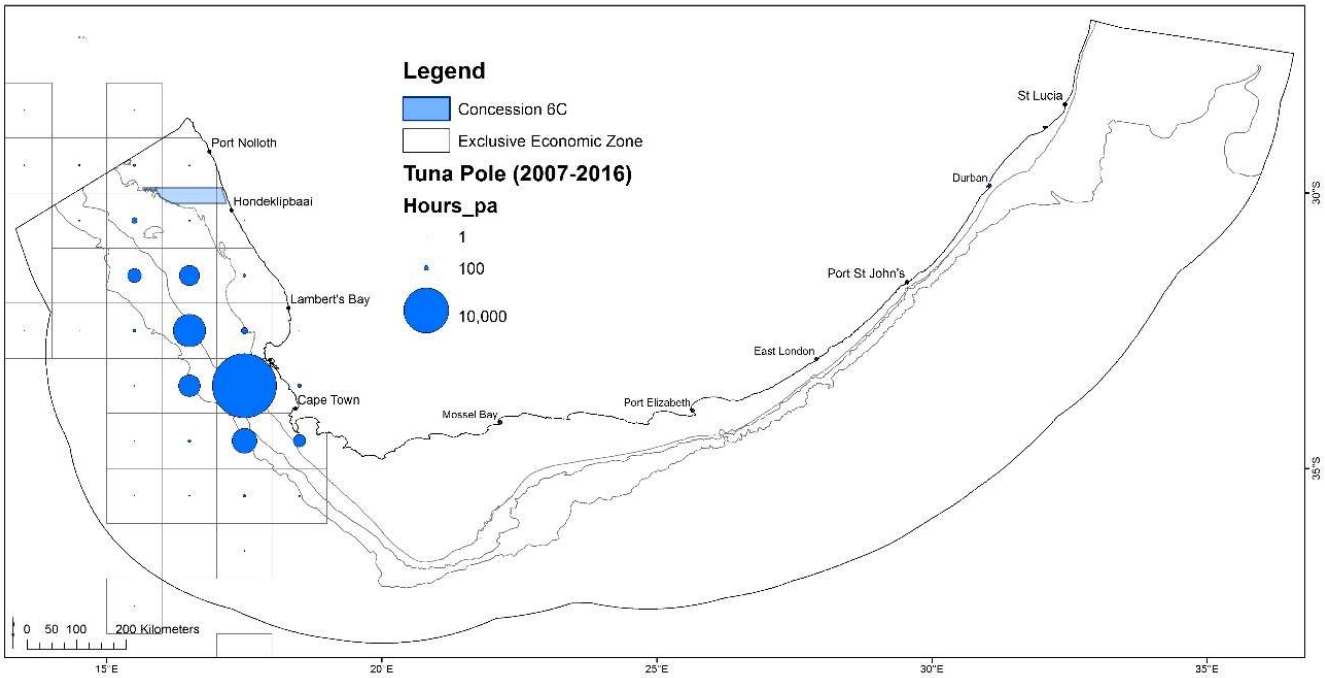

FIGURE 4-17: SEA CONCESSION 6C IN RELATION TO THE SPATIAL DISTRIBUTION OF TUNA POLE CATCH (2007 TO 2016).

4.1.4.1.7 Traditional Line-Fish

The line-fishery is divided into the commercial and recreational sectors, with the subsistence sector now falling under the classification of small-scale fishing. The commercial (or traditional) line fishery is the country's third most important fishery in terms of total tons landed and economic value. The bulk of the fishery catch is made up of about 35 different species of reef fish as well as pelagic and demersal species which are mostly marketed locally as "fresh fish". In South Africa effort is managed geographically with the spatial effort of the fishery divided into three zones. The majority of the catch (up to 95%) is landed by the Cape commercial fishery, which operates on the continental shelf mostly up to a depth of 200 m from the Namibian border on the West Coast to the Kei River in the Eastern Cape. Sea Concession 6C coincides with line-fish management Zone A which extends from the Namibian border to Cape Infanta. Fishing vessels generally range up to a maximum offshore distance of about 70 km, although fishing at this outer limit and beyond is sporadic (C. Wilke, pers. comm).

The traditional line fishery is defined by the use of a simple hook-and-line fishing system (excluding the use of longlines and drumlines), with a limit of 10 hooks per line (DAFF 2017). There are 450 vessels operating in the fishery, making it the largest fishing fleet in South Africa. Vessels are monitored by Vessel Monitoring System (VMS) and permit conditions require that catch be reported for each fishing trip; however, logbook data are unverified and may underestimate total landings (da Silva et al., 2015).

The recreational line fishery includes shore- and boat-based fishing with the predominant use of rod and line. An estimated 500 000 participants are active in the recreational sector (Griffiths and Lamberth, 2002). Community-based fishing of line-fish species for subsistence purposes is now managed under South Africa's small-scale fishery policy which was implemented in 2016 (DAFF 2016).

Fishing activity is reported by landing point. In the vicinity of Sea Concession 6C, Hondeklipbaai is the closest landing point. Over the period 2000 to 2016, an average landing of 182 kg per year was reported for the area. Over the same period 2.5 tons of catch was reported for fishing positions in the vicinity of Port Nolloth, situated

70 km northward of the concession area. The combined catch at Hondeklipbaai and Port Nolloth is equivalent to approximately 0.03% of the overall national landings of the sector. The reporting of fishing positions is not specific, but generally reported according to reference positions for different areas. It is assumed that fishing could take place across the extent of Sea Concession 6C.

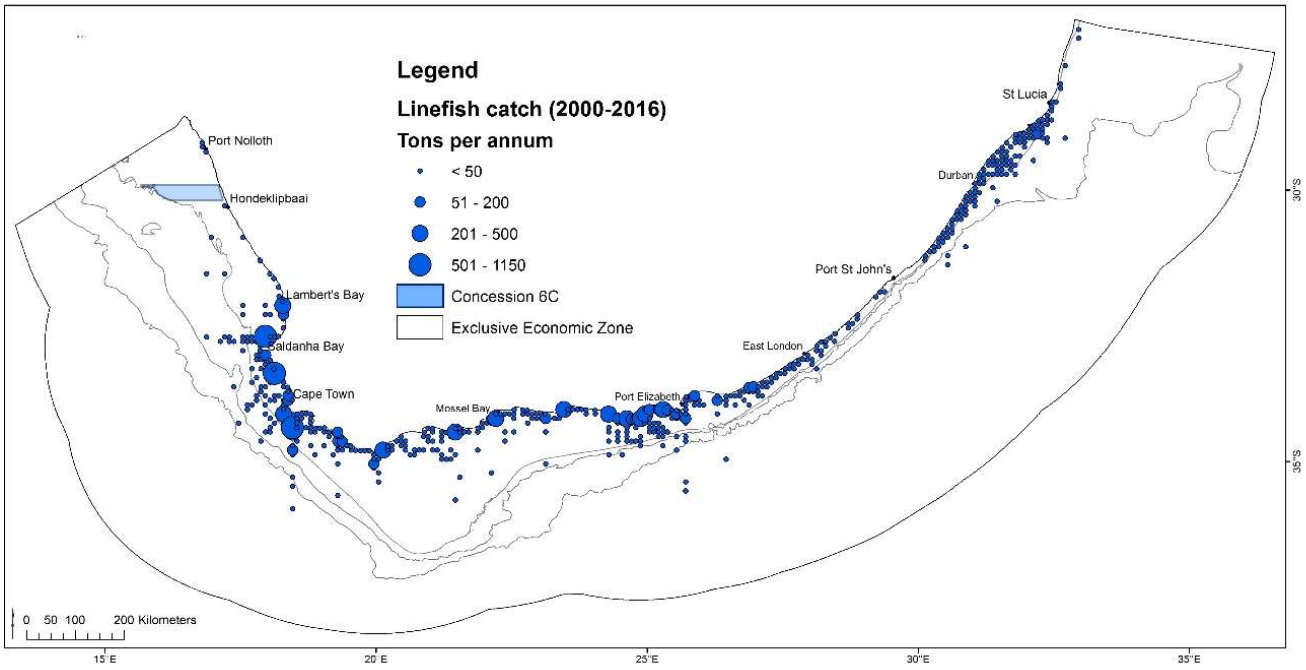

FIGURE 4-18: SEA CONCESSION 6C IN RELATION TO SPATIAL DISTRIBUTION OF CATCH LANDED BY THE SOUTH AFRICAN TRADITIONAL LINE-FISH SECTOR (2000 – 2016).

4.1.4.1.8 West Coast Rock Lobster

The West Coast rock lobster occurs inside the 200 m depth contour along the West Coast from Namibia to East London on the East Coast of South Africa. In South Africa the fishery is divided into the offshore fishery and the near-shore fishery, both directed inshore of the 100 m bathymetric contour. The offshore sector operates in a water depth range of 30 m to 100 m whilst the inshore fishery is restricted by the type of gear used to waters shallower than 30 m in depth.

Fishing grounds are divided into Zones stretching from the Orange River mouth to east of Cape Hangklip in the South-Eastern Cape. Effort is seasonal with boats operating from the shore and coastal harbours. Catch is managed using a TAC set annually for different management areas. The fishery operates seasonally, with closed seasons applicable to different management zones.

The Sea Concession area falls within Zone A, Management Area 2 (Hondeklipbaai) and Subarea 1 (Agtervoorklip to Swartduin), which extends along the coastline from 30°19´S to 29°40´S. Over the period 2006 to 2017 there has been no effort recorded by trap boats within the area, however there has been activity recorded by the near-shore sector amounting to 230 traps per year yielding 930 kg of rock lobster. Commercial catches of rock lobster in Management Area 2 are limited to shallow water (<30 m) with almost all the catch being taken shallower than 15 m depth. There is therefore no direct overlap with the proposed bulk sampling activities which would be

located offshore of the 70 m depth contour. The areas fished by bakkies (using hoopnets) in the vicinity of marine concession area 6C are shown in Figure 4-19.

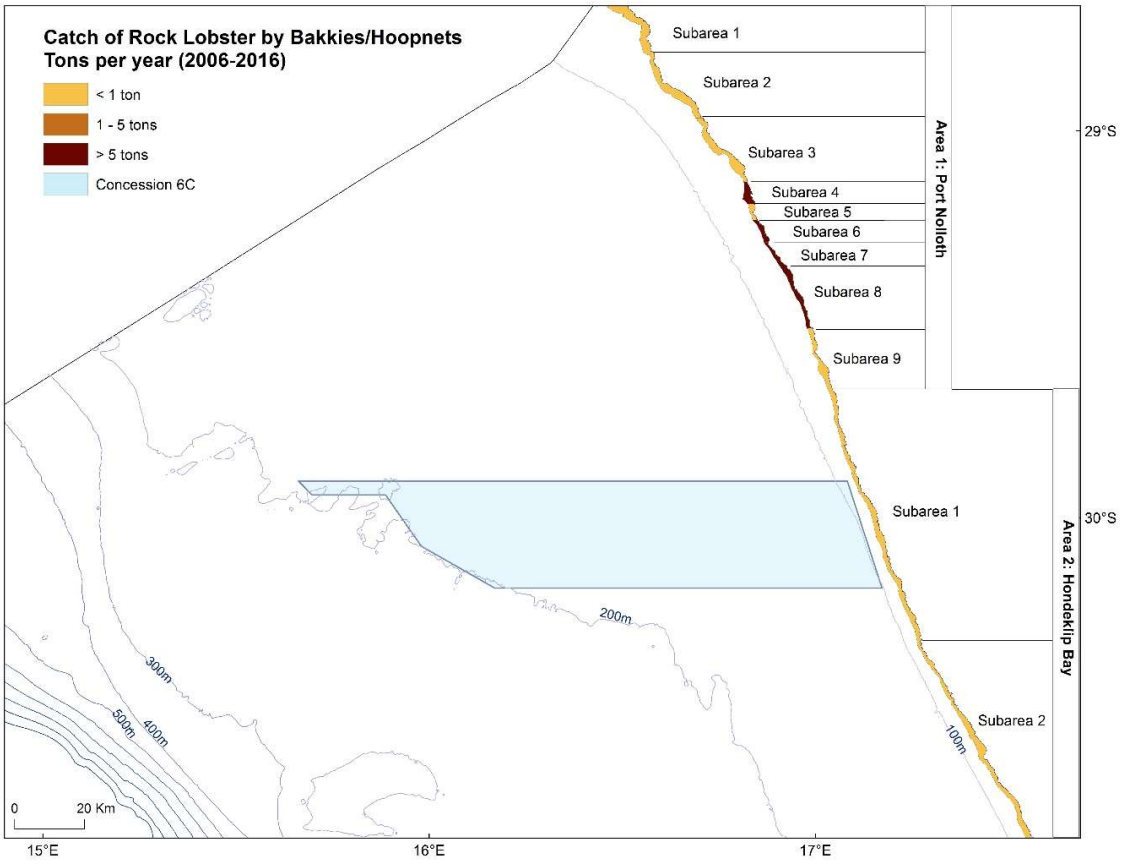

FIGURE 4-19: SEA CONCESSION 6C IN RELATION TO THE AVERAGE CATCH PER SEASON (TONS WHOLE WEIGHT) BY THE NEARSHORE (BAKKIE) SECTOR OF THE WEST COAST ROCK LOBSTER FISHERY (2006 TO 2016).

4.1.4.1.9 Abalone Ranching

The Abalone (Haliotus midae), is endemic to South Africa with the natural population extending east from St Helena Bay in the Western Cape to Port St Johns on the east coast (Branch *et al.* 2010; Troell et al 2006). Seeding of abalone in designated areas (ranching) has led to the establishment of abalone outside this natural range, including sites along approximately 50 km of the Namaqualand coast in the Northern Cape. The potential to increase this seeded area to 175 km has been made possible through the issuing of "Abalone Ranching Rights" (Government Gazette No. 729 of 20 August 2010) in four concession zones between Alexander Bay and Hondeklipbaai (Diamond Coast Abalone 2016).

Kelp forests are a key habitat for abalone, as they provide a key food source for abalone as well as an ideal ecosystem for abalone's life cycle (Branch et al., 2010). In the wild, abalone may take 30 years to reach full size of 200 mm, but farmed abalone attain 100 mm in only 5 years, which is the maximum harvest size (Sales & Britz, 2001).

Abalone ranching was pioneered by Port Nolloth Sea Farms who were experimentally seeding kelp beds in Port Nolloth by 2000. Abalone ranching expanded in the area in 2013 when the, then, Department of Agriculture, Forestry and Fisheries (DAFF) issued rights for each of four Concession Area Zones. Two hatcheries exist in Port Nolloth producing up to 250 000 spat. To date, there has been no seeding in Zones 1 or 2. However, seeding has taken place in Zones 3 and 4, both of which are situated on the inshore portion of Sea Concession 6C, thus there is a small degree of overlap (see Figure 4-18).

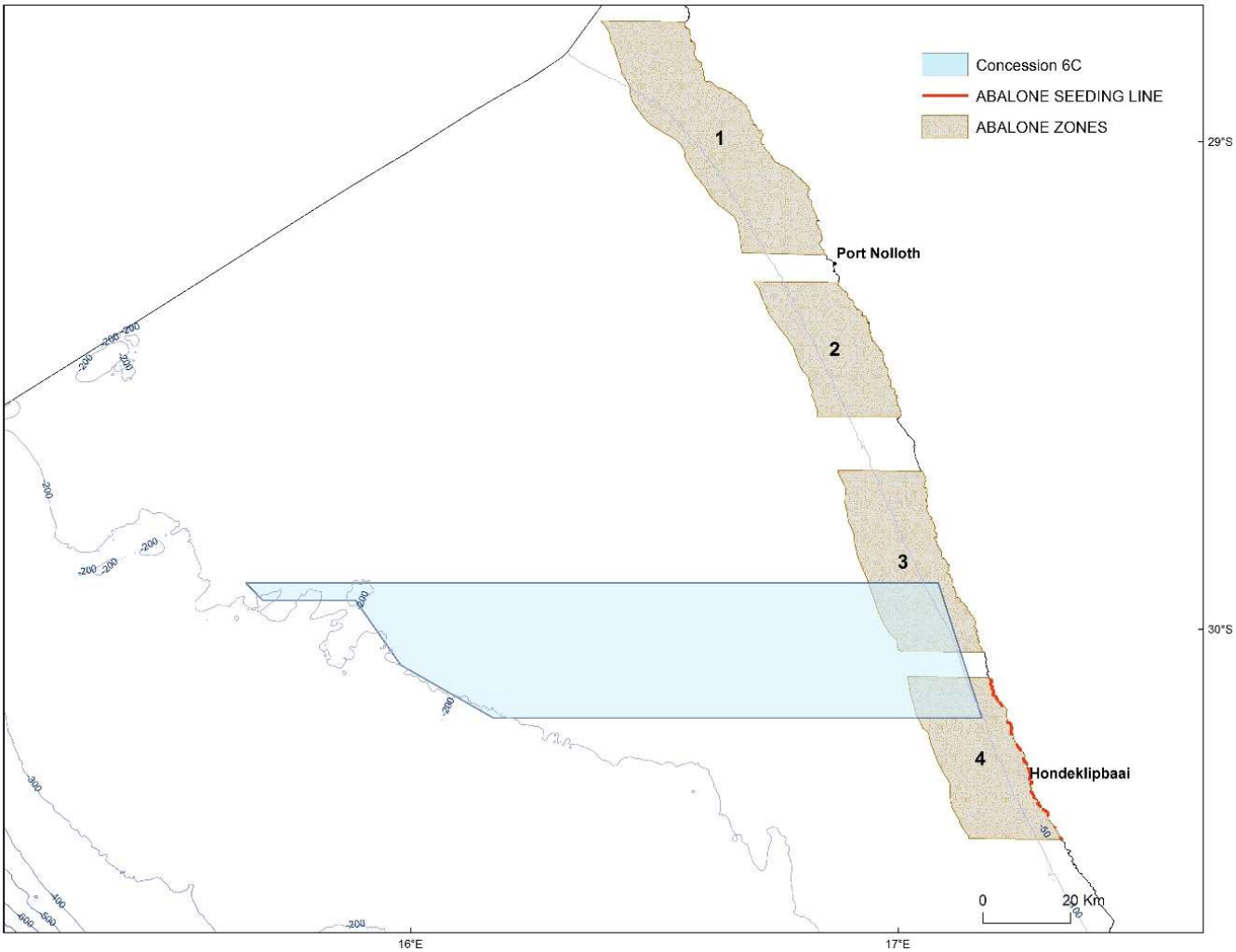

FIGURE 4-20: LOCATION OF SEA CONCESSION 6C IN RELATION TO OF ABALONE RANCHING ZONES.

4.1.4.1.10 Small-Scale Fisheries

Small-scale fishers using traditional fishing gear have historically harvested marine resources along the coastline of South Africa for consumptive use, livelihoods, and medicinal purpose. In compliance with an order from the Equality Court to redress the inequality suffered by the small scale fishers, the small-scale fishery policy implementation plan was initiated in 2016 (DAFF 2016).

Small-scale fishers fish to meet food and basic livelihood needs, and may be directly involved in harvesting, processing and distribution of fish for commercial purposes. These fishers traditionally operate on nearshore fishing grounds, using traditional low technology or passive fishing gear to harvest marine living resources on a

full-time, part-time or seasonal basis. Fishing trips are usually a single day in duration and fishing/harvesting techniques are labour intensive.

In the Eastern Cape, KwaZulu-Natal and the Northern Cape, small-scale fishers live predominantly in rural areas while those in the Western Cape live mainly in urban and peri-urban areas. Resources are managed in terms of a community-based co-management approach that aims to ensure that harvesting and utilisation of the resource occurs in a sustainable manner in line with the ecosystems approach.

The small-scale fisheries policy proposes that certain areas on the coast be prioritized and demarcated as small-scale fishing areas. In some areas access rights could be reserved exclusively for use by small-scale fishers. The community, once they are registered as a community-based legal entity, could apply for the demarcation of these areas and should conflict arise, it should be referred to conflict resolution under the Policy. The policy also requires a multi-species approach to allocating rights, which will entail allocation of rights for a basket of species that may be harvested or caught within particular designated areas.

DAFF recommended five basket areas: 1. Basket Area A – The Namibian border to Cape of Good Hope – 57 different resources 2. Basket Area B – Cape of Good Hope to Cape Infanta – 109 different resources 3. Basket Area C – Cape Infanta to Tsitsikamma – 107 different resources 4. Basket Area D – Tsitsikamma to the Pondoland MPA – 138 different resources 5. Basket Area E – Pondoland MPA to the Mozambican border – 127 different resources. Sea Concession Area 6C falls within the area demarcated as Basket Area 1, within which Hondeklipbaai is the access point for participants in the small-scale fishing sector.

4.1.4.1.11 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 fishermen active in fisheries using beach-seine and gillnets, mostly (86%) along the West and South coasts. These fishermen 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 (Fréon *et al.* 2010). Beach-seining is an active form of fishing in which woven nylon nets are rowed out into the surf zone to encircle a shoal of fish. They are then hauled shorewards by a crew of 6–30 persons, depending on the size of the net and length of the haul. Nets range in length from 120 m to 275 m. Fishing effort is coastal and net depth may not exceed 10 m (DAFF 2014b). There are currently no rights issued for Area B (Hondeklipbaai).

The gillnet fishery operates from Yzerfontein to Port Nolloth on the West Coast. Surface-set gillnets (targeting mullet) are restricted in size to 75 m x 5 m and bottom-set gillnets (targeting St Joseph shark) are restricted to 75 m x 2.5 m (da Silva *et al.* 2015) and are set in waters shallower than 50 m. The spatial distribution of effort is

represented as the annual number of nets per kilometre of coastline and ranges up to a maximum of 15 off St Helena Bay. Of a total of 162 right holders, two operate within Area B (Hondeklipbaai).

Sea Concession 6C is situated offshore of Management Area B (see Figure 4-21) and the range of gillnets (50 m) and that of beach-seine activity (20 m) is not likely to directly overlap with the concession area where bulk sampling would take place in waters deeper than 70 m.

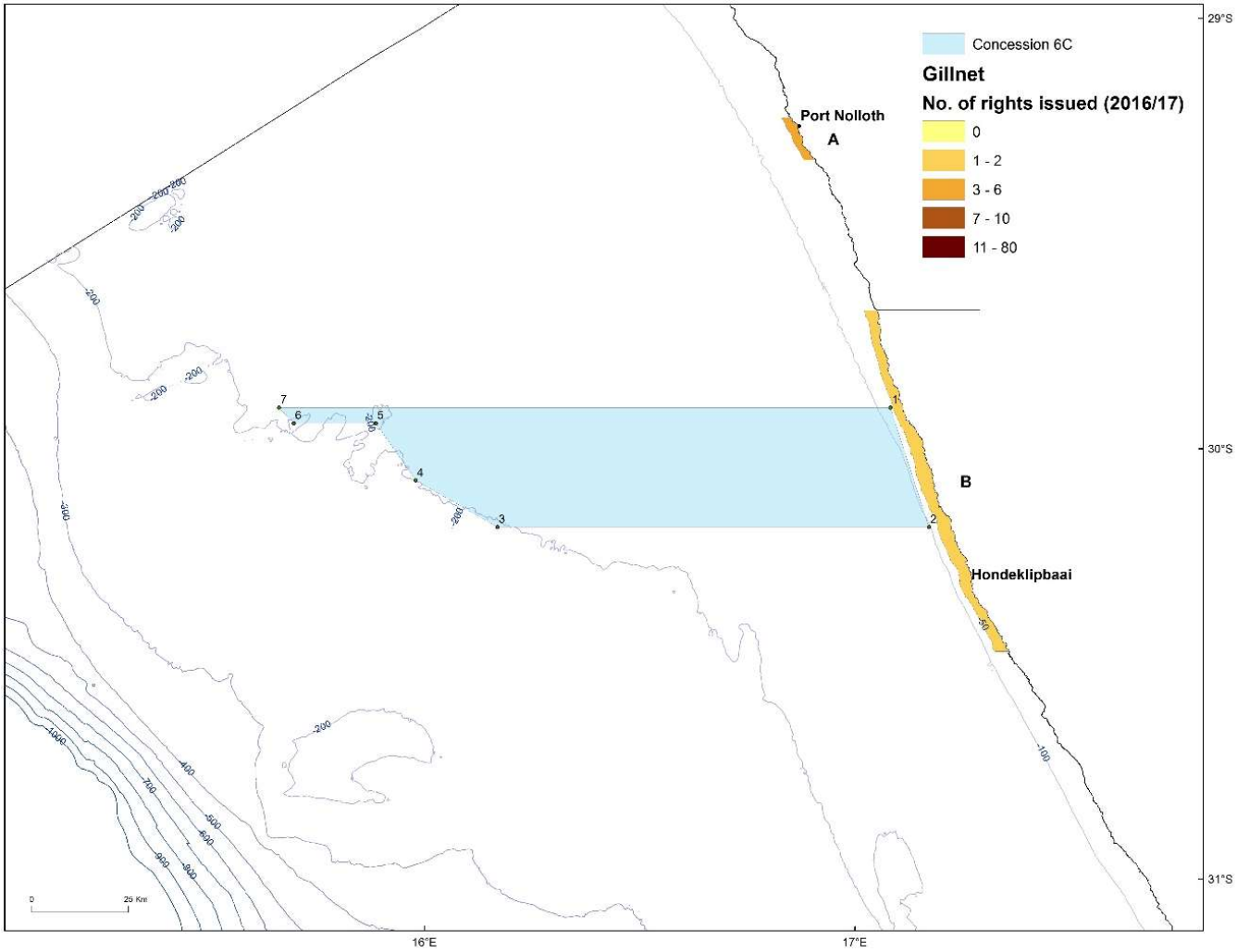

FIGURE 4-21 SEA CONCESSION 6C IN RELATION TO THE RIGHTS ISSUED FOR GILLNET FISHING AREAS A & B.

4.1.4.1.12 Fisheries Research

Swept-area trawl surveys of demersal fish resources are carried out in January (West Coast survey) and April/May (South Coast survey) each year by DEFF in order to set the annual TACs for demersal fisheries. Stratified, bottom trawls are conducted to assess the biomass, abundance and distribution of hake, horse mackerel, squid and other demersal trawl species on the shelf and upper slope of the South African coast. The gear configuration is similar to that of commercial demersal trawlers, however, nets are towed for a shorter duration of generally 30 minutes per tow. Trawl positions are randomly selected to cover specific depth strata that range from the coast to the 1 000 m bathymetric contour (see Figure 4-22). Approximately 120 trawls are conducted during each survey over a period of approximately one month.

The biomass of small pelagic species is assessed bi-annually by an acoustic survey. The first of these surveys is timed to commence in mid-May and runs until mid-June, while the second starts in mid-October and runs until mid-December. The timing of the demersal and acoustic surveys is not flexible, due to restrictions with availability of the research vessel as well as scientific requirements. During these surveys the survey vessels travel pre-determined transects (perpendicular to bathymetric contours) running offshore from the coastline to approximately the 200 m isobath (see Figure 4-23). The surveys are designed to cover an extensive area from the Orange River on the West Coast to Port Alfred on the East Coast and the DEFF survey vessel progresses systematically from the Northern border Southwards, around Cape Agulhas and on towards the east. Acoustic biomass surveys take place inshore of the 200 m isobath.

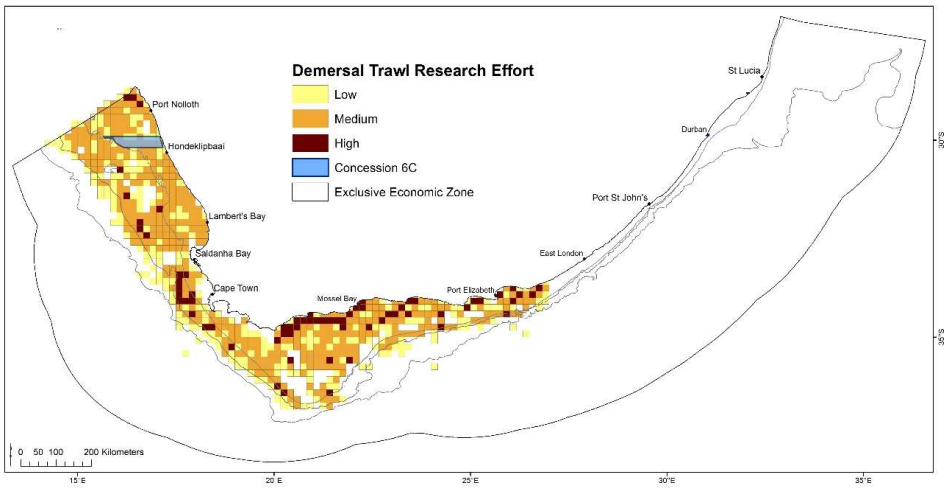

FIGURE 4-22: SEA CONCESSION 6C IN RELATION TO THE SPATIAL DISTRIBUTION OF TRAWLING EFFORT EXPENDED DURING RESEARCH SURVEYS UNDERTAKEN BY DEFF BETWEEN 1985 AND 2012.

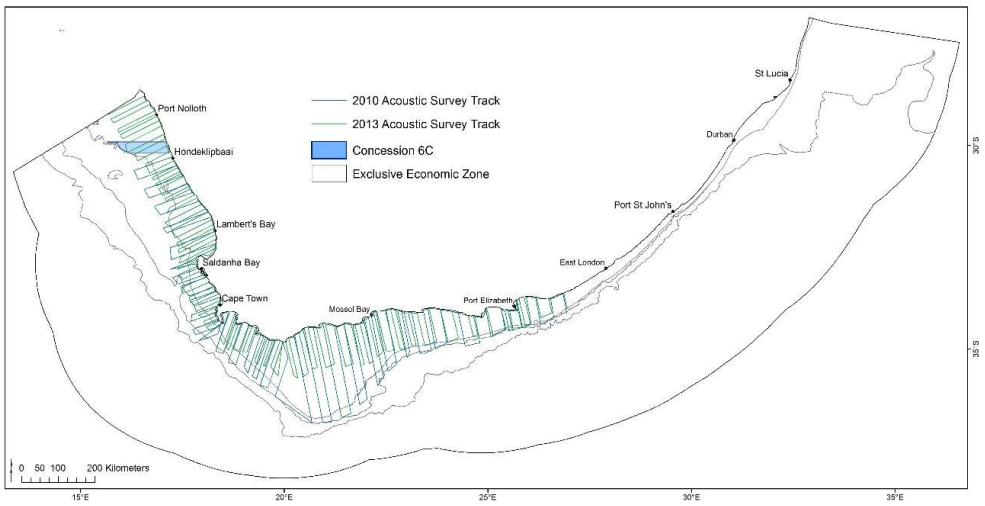

FIGURE 4-23: SEA CONCESSION 6C IN RELATION TO THE SPATIAL DISTRIBUTION OF TRACKS UNDERTAKEN DURING BIOMASS SURVEYS OF SMALL PELAGIC SPECIES UNDERTAKEN BY DEFF DURING 2010 AND 2013.

4.1.4.2 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 Kleinzee

and Oranjemund (see Figure 4-24). The main shipping lanes overlap with the western portion of the Sea Concession 6C area.

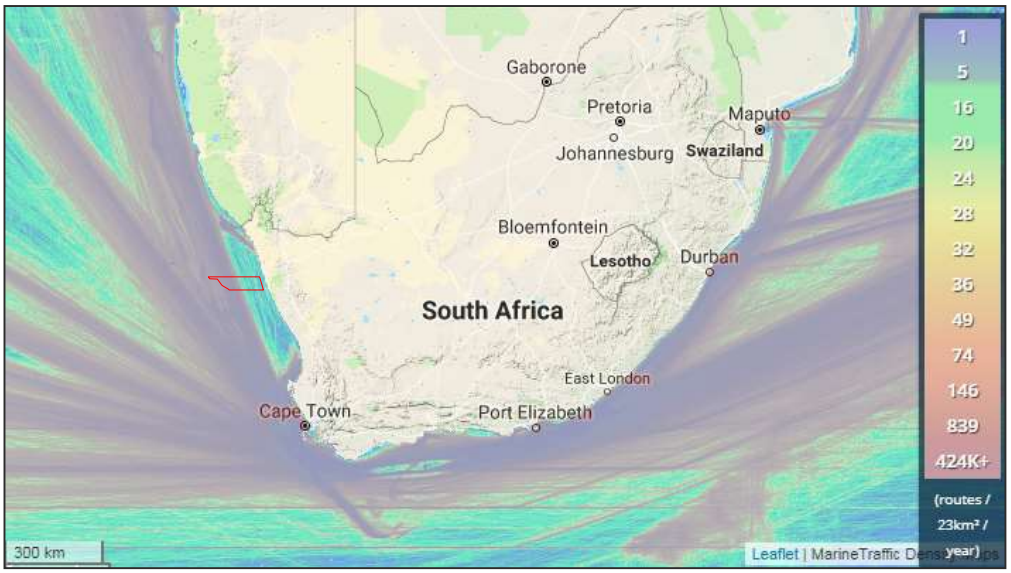

FIGURE 4-24: THE MAJOR SHIPPING ROUTES ALONG THE WEST COAST OF SOUTH AFRICA SHOWING PETROLEUM LICENSE BLOCKS (DATA FROM THE SOUTH AFRICAN CENTRE FOR OCEANOGRAPHY). APPROXIMATE LOCATION OF SEA CONCESSION AREA 6C IS ALSO SHOWN.

4.1.4.3 Oil and Gas Exploration and Production

4.1.4.3.1 Exploration

The South African continental shelf and economic exclusion zone (EEZ) have similarly been partitioned into Licence blocks for petroleum exploration and production activities. Oil and gas exploration in the South African offshore commenced with seismic surveys in 1967. Since then numerous 2D and 3D seismic surveys have been undertaken in the West Coast offshore.

Approximately 40 exploration wells have been drilled since the 1960's. Prior to 1983, reliable technology was not available for removing wellheads from the seafloor. Since then, however, on completion of drilling operations, the well casing has been severed 3 m below the sea floor and removed from the seafloor together with the permanent and temporary guide bases. Of the approximately 40 wells drilled, 35 wellheads remain on the seafloor (see Figure 4-25). Location and wellhead details are available from the Hydrographic office of the South African Navy (which issues the details to the public in a notice to mariners) or directly from PASA. Although no wells have recently been drilled in the area, further exploratory drilling is proposed for inshore and offshore portions of Block 1, with further target areas in Block 2B and the Orange Basin.

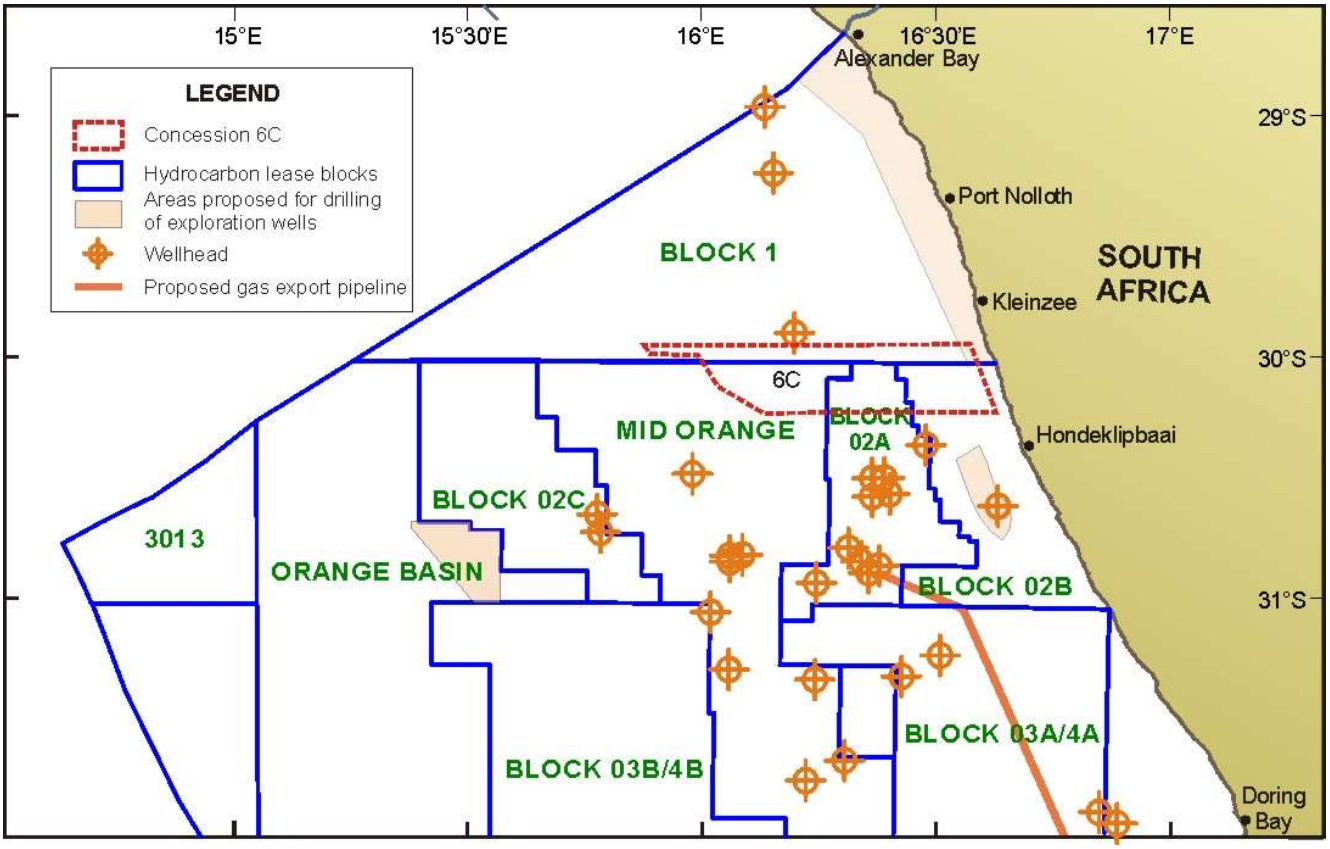

FIGURE 4-25: SEA CONCESSION AREA 6C IN RELATION TO THE LOCATION OF HYDROCARBON LEASE BLOCKS, EXISTING WELL HEADS, PROPOSED AREAS FOR EXPLORATORY WELLS AND THE ROUTING OF THE PROPOSED IBHUBESI GAS EXPORT PIPELINE.

4.1.4.3.2 Development and Production

There is no current development or production from the South African west coast offshore. The Ibhubesi Gas Field (Block 2A) and Kudu Gas Field (which lies several hundred kilometres to the north-west off the coast of southern Namibia) have been identified for development. In this regard, a subsea pipeline to export gas from the iBhubesi field to a location either on the Cape Columbine peninsula or to Ankerlig approximately 25 km north of Cape Town is currently being proposed by Sunbird SA.

4.1.4.4 Diamond Prospecting and Mining

The coastal area onshore of Sea Concession 6C falls within the West Coast Resources coastal diamond concession areas and as public access is restricted, recreational activities along the coastline between Hondeklipbaai and Alexander Bay is limited to the area around Port Nolloth.

The concession area lies adjacent to a number of marine diamond concession areas. The marine diamond concession areas 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 (see Figure 4-26).

On the Namaqualand coast marine diamond prospecting and mining activity is primarily restricted to the surf-zone and (a)-concessions. Nearshore shallow-water mining is typically conducted by divers using small-scale suction hoses operating either directly from the shore or from converted fishing vessels out to approximately 20 m depth. Diver-assisted mining is largely exploratory and highly opportunistic in nature, being dependent on

suitable, calm sea conditions. The typically exposed and wave-dominated nature of the Namaqualand coast effectively limits the periods in which mining can take place to a few days per month. As shore-based divers cannot excavate a gravel depth much more than 0.5 m, mining rates are low, approximately 35 m^2 worked by each contractor per year. Because of the tidal cycle and limitations imposed by sea conditions, such classifiers usually operate for less than 4 hours per day for an average of 5-6 days per month, although longer periods may be feasible in certain protected areas. However, with reference to the Alexkor 2013 Annual Report, it is noted that the number of days had declined from 79 in 2003 to eight in 2012 and 23 in 2013. Similarly, the Alexkor 2019 Annual Report noted that there was reduced diamond production during the financial year as a result of fewer suitable sea-days during which operations had to be curtailed due to safety reasons.

Vessel-based diver-appointed contractors usually work in the depth range immediately seaward of that exploited by shore-based divers, targeting gullies and potholes in the sub-tidal area just behind the surf-zone. A typical boat-based operation consists of a 10 - 15 m vessel, with the duration of their activities limited to daylight hours for 3 - 10 diving days per month. Estimated mining rates for vessel-based operations range from 300 m^2 – 1 000 m^2/year. 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, although some vessels do still operate out of Alexander Bay and Port Nolloth.

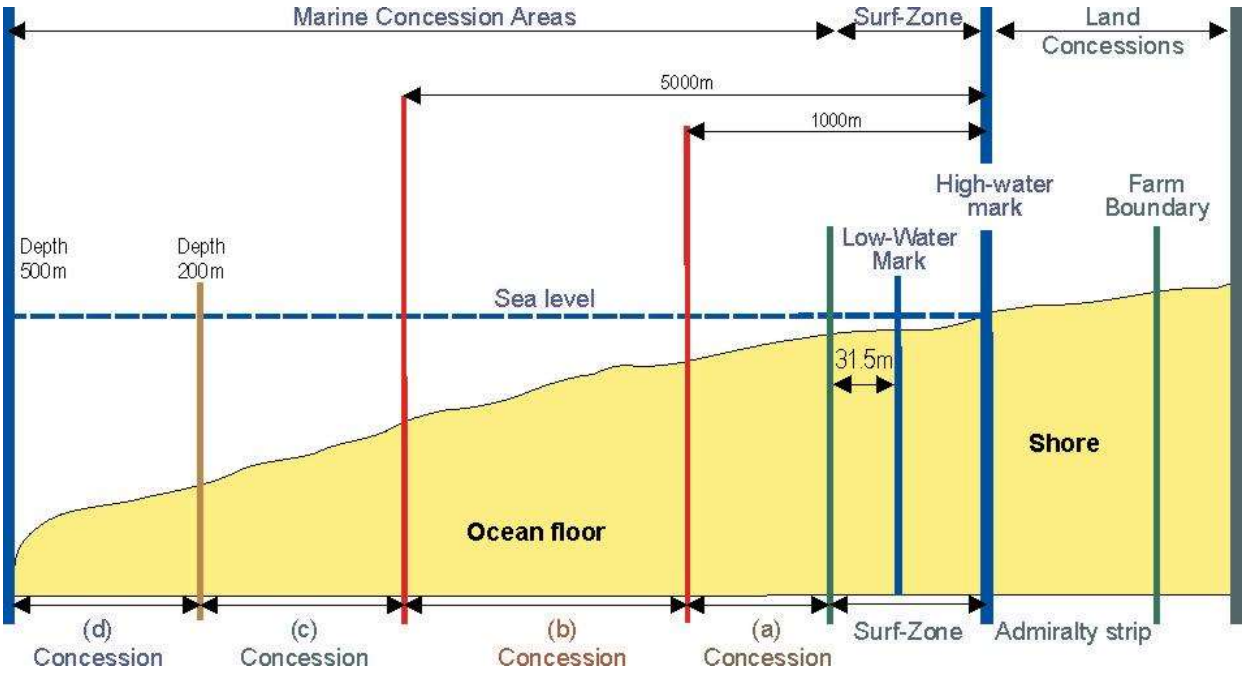

FIGURE 4-26: DIAGRAM OF THE ONSHORE AND OFFSHORE BOUNDARIES OF THE SOUTH AFRICAN (A) TO (D) MARINE DIAMOND CONCESSION AREAS.

Offshore diamond mining and prospecting in the "C" Concession areas is currently limited to operations by Belton Park Trading 127 (Pty) Ltd in concessions 2C and 3C for mining and De Beers Marine (Pty) Ltd for prospecting in concessions 4C and 5C. In Namibian waters, offshore diamond mining by Debmarine Namibia (Pty) Ltd is currently operational in the Atlantic 1 Mining Licence Area.

These prospecting and mining operations are typically conducted in water depths of 70 m to 160 m from fully self-contained vessels with onboard sediment processing facilities, using either vertically mounted tools or

seabed crawler technology. The vessels operate as semi-mobile platforms, anchored by a four anchor spread or held on station with a dynamic positioning system (DP). Computer-controlled positioning using DP or winches enable the vessels to locate themselves precisely over a prospecting or mining block of up to 400 m x 400 m. These vessels have limited manoeuvrability whilst in position and other vessels should remain at a safe distance.

4.1.4.5 Prospecting and Mining of Other Minerals

4.1.4.5.1 Heavy Minerals

Heavy mineral sands containing, amongst other minerals, zircon, ilmenite, garnet and rutile may be found offshore of the West Coast. Although a literature search has not identified any published studies that detail the distribution of heavy minerals offshore, concentrations are known to exist onshore. Tronox's Namakwa Sands is currently exploiting heavy minerals from onshore deposits near Brand-se-Baai (approximately 385 km north of Cape Town).

4.1.4.5.2 Glauconite and Phosphate

Glauconite pellets (an iron and magnesium rich clay mineral) and bedded and peletal phosphorite occur on the seafloor over large areas of the continental shelf on the West Coast. These represent potentially commercial resources that could be considered for mining as a source of agricultural phosphate and potassium (Birch 1979a & b; Dingle *et al.* 1987; Rogers and Bremner 1991).

A number of prospecting areas for glauconite and phosphorite / phosphate are located off the West Coast (see Table 4-6 and Figure 4-27), although none overlap with the proposed bulk sampling area. Green Flash Trading received their prospecting rights for Areas 251 and 257 in 2012/2013. The prospecting rights for Agrimin1, Agrimin2 and SOM1 have expired (Jan Briers, DMR pers. comm., December 2013).

TABLE 4-6: LIMITS OF PROSPECTING BLOCKS FOR GLAUCONITE AND PHOSPHORITE WITHIN THE WEST COAST REGION. IN EACH CASE THE BLOCK IS A POLYGON OF POINTS LABELLED A, B, C, D, ETC

Block Title	Corner points	Latitude (S):	Longitude (E):
Agrimin1	A	32º 49' 40.11''	17º 19' 57.12"
	B	32º 49' 39.93"	16º 44' 23.13"
	C	33º 17' 40.92"	17º 01' 11.70"
	D	33º 13' 59.88"	17º 07' 59.99"
Agrimin2	A	33º 56' 23.4654"	17º 27' 23.9975"
	B	34º 54' 31.9601"	18º 07' 40.2233"
	C	34º 53' 59.5830"	18º 27' 34.4074"
	D	33º 55' 43.0337"	17º 57' 58.6973"
SOM1	A	32º 49' 39.00"	16º 50' 9.66"
	B	33º 10' 24.74"	16º 53' 29.30"
	C	33º 40' 00.00''	17º 50' 00.00"
	D	33º 23' 30.00"	17º 50' 00.00"
	E	33º 19' 00.00"	17º 24' 00.00"

Block Title	Corner points	Latitude (S):	Longitude (E):
	F	33º 29’ 00.00”	17º 41’ 00.00”
	G	33º 16’ 00.00”	17º 41’ 00.00”
	H	32º 49’ 00.00”	17º 20’ 08.08”

4.1.4.5.3 Manganese Nodules in Ultra-Deep Water

Rogers (1995) and Rogers and Bremner (1991) report that manganese nodules enriched in valuable metals occur in deep water areas (>3 000 m) off the West Coast. The nickel, copper and cobalt contents of the nodules fall below the current mining economic cut-off grade of 2% over most of the area, but the possibility exists for mineral grade nodules in the areas north of 33°S in the Cape Basin and off northern Namaqualand.

4.1.4.6 Other

4.1.4.6.1 Anthropogenic marine hazards

Human use of the marine environment has resulted in the addition of numerous hazards on the seafloor. Readers are referred to the Annual Summary of South African Notices to Mariners No. 5 or charts from the South African Navy or Hydrographic Office for the location of different underwater hazards along the West Coast.

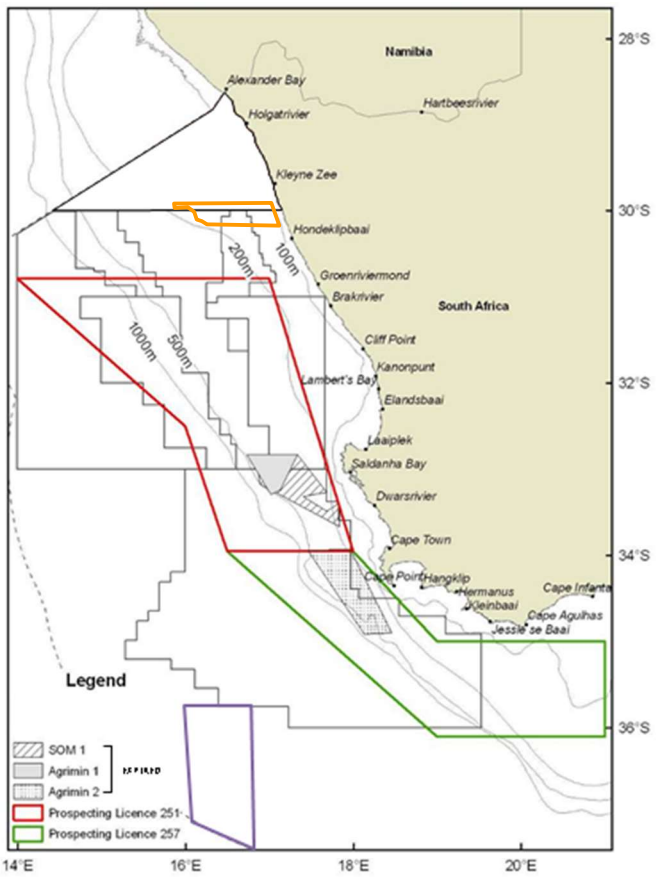

FIGURE 4-27: APPROXIMATE LOCATION OF SEA CONCESSION 6C (ORANGE) IN RELATIONS TO GLAUCONITE AND PHOSPHORITE PROSPECTING AREAS.

4.1.4.6.2 Undersea Cables

There are a number of submarine telecommunications cable systems across the Atlantic and the Indian Ocean (see Figure 4-28), including inter alia:

- South Atlantic Telecommunications cable No.3 / West African Submarine Cable / South Africa Far East (SAT3/WASC/SAFE): This cable system is divided into two sub-systems, SAT3/WASC in the Atlantic Ocean and SAFE in the Indian Ocean. The SAT3/WASC sub-system connects Portugal (Sesimbra) with South Africa (Melkbosstrand). From Melkbosstrand the SAT-3/WASC sub-system is extended via the SAFE sub-system to Malaysia (Penang) and has intermediate landing points at Mtunzini South Africa, Saint Paul Reunion, Bale Jacot Mauritius and Cochin India (www.safe-sat3.co.za).
- Eastern Africa Submarine Cable System (EASSy): This is a high bandwidth fibre optic cable system, which connects countries of eastern Africa to the rest of the world. EASSy runs from Mtunzini (off the East Coast) in South Africa to Port Sudan in Sudan, with landing points in nine countries, and connected to at least ten landlocked countries.
- West Africa Cable System (WACS): WACS is 14 530 km in length, linking South Africa (Yzerfontein) and the United Kingdom (London). It has 14 landing points, 12 along the western coast of Africa (including Cape Verde and Canary Islands) and 2 in Europe (Portugal and England) completed on land by a cable termination station in London.
- African Coast to Europe (ACE): The ACE submarine communications cable is a 17 000 km cable system along the West Coast of Africa between France and South Africa (Yzerfontein).

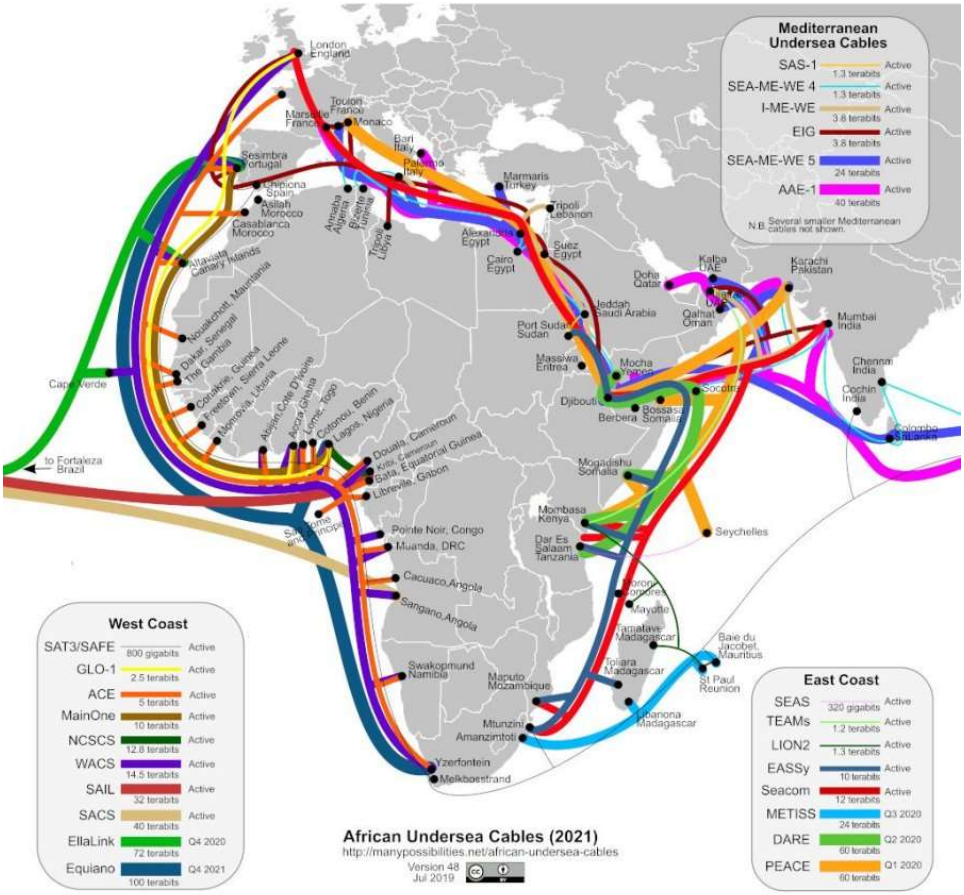

FIGURE 4-28: CONFIGURATION OF THE CURRENT AFRICAN UNDERSEA CABLE SYSTEMS, JULY 2019 (FROM HTTP://WWW.MANYPOSSIBILITIES.NET).

There is an exclusion zone applicable to the telecommunication cables 1 nm (approximately 1.9 km) each side of the cable in which no anchoring is permitted.

4.1.4.6.3 Maritime and Underwater Cultural Heritage

As the West Coast contains a wealth of shell middens, cave deposits, historical artefacts, palaeontological sites and shipwrecks close to the shore, the occurrence of such sites further offshore cannot be excluded.

a) Palaeontological sites

Stevenson & Bamford (2003) describe an abundance of fossilised yellowwood tree trunks in an approximate 2 km2 area of seabed outcrop in 136-140 m depth located within Sea Concession 4C. The fossilized wood and accompanying cold water coral colonies are considered vulnerable to any activities that could impact on the seabed (FAO 2006; Rogers *et al.* 2008; FAO 2009; Sink *et al.* 2012a,b). In addition, there are other sites where fossilised yellowwood has been observed within Sea Concession 5C. These sites are located approximately 25 km north of Sea Concession 6C.

Following the application of the Conservation on Biological Diversity's (CBD) Ecologically or Biologically Significant Marine Areas (EBSA) criteria, the area (referred to as the Namaqua Fossil Forest) was identified as unique, and presented at the CBD Southeast Atlantic Ocean regional workshop for consideration as an EBSA warranting formal conservation.

b) Shipwrecks

Over 2 000 shipwrecks are present along the South African coastline. The majority of known wrecks along the West Coast are located in relatively shallow water close inshore (within the 100 m isobath). Wrecks older than 60 years old have National Monument status.

Possible wrecks most likely to be encountered during the proposed marine sediment sampling are those most likely to fall outside of known shallow water wreck events. The majority of shipwreck locations are unknown as they have been documented only through survivor accounts, archival descriptions and eyewitness reports recorded in archives and databases. In the area under consideration, there are at least five vessels that could possibly have been wrecked in the vicinity of the concession area (see Table 4-7) as well as a further 28 vessels that may be somewhere in the area.

TABLE 4-7: SHIPWRECKS POTENTIALLY LOCATED WITHIN THE BROADER PROJECT AREA.

Vessel Name	Date	Comment
Eros	1918	This 174-ton steel steamer was wrecked either off Port Nolloth or off Lamberts Bay.
Haab	1897	This 861-ton wooden barque was abandoned near Concession 5C and therefore may be in or near 6C. Approximate co-ordinates: 29° 49.902'S 16° 40.070'E.
Jessie Smith	1853	This 226-ton British brig was wrecked somewhere off Alexander Bay, Orange River Mouth. The vessel was swept out to sea and it is possible that the wreck may be somewhere in the concession area 4C.
Ocean King	1881	This 419-ton barque apparently hit a reef about 3-4 miles (6.4 – 8 km) offshore and about 20 miles (32km) south of Port Nolloth. This vessel may be in the vicinity of Concession 4C. Approximate co-ordinates: 29.47567 S 16.89444 E.
Laporte / La Porte	1904	This 2448-ton steamer was on a voyage from Cardiff for Cape Town with coal when she foundered in a north-westerly gale approximately 160 km from

Vessel Name	Date	Comment
		shore and 80 km north of Port Nolloth. There are differing reports as to where the vessel sank. Approximate co-ordinates include: • Position 1: 28° 35.691'S 14° 48.532'E • Position 2: 28° 37.133'S 16° 24.555'E • Position 3: 29° 17.078'S 15° 55.764'E**

4.1.4.7 Ammunition Dump Sites

Details of ammunition dumped at the ammunition dumpsites on the West Coast are given on the respective SAN charts. No ammunition dumps are located within the extent of Sea Concession 6C. No ammunition dumps are located within the extent of Sea Concession 6C.

4.2 MARINE PROTECTED AREAS

4.2.1 Conservation Areas and Marine Protected Areas

Using biodiversity data mapped for the 2004 and 2011 National Biodiversity Assessments a systematic biodiversity plan has been developed for the West Coast with the objective of identifying coastal and offshore priority focus areas for MPA expansion (Sink *et al.* 2011; Majiedt *et al.* 2013). 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.

The biodiversity data were used to identify ten focus areas 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 MPAs. Those approved MPAs within the broad project area are shown in Figure 4-7. Sea Concession 6C does not overlap with any of these areas.

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 and South Coasts, with the intention of implementing improved conservation and protection measures within these sites. Sea Concession 6C does not overlap with any of these areas.

The 2018 National Biodiversity Assessment (Sink et al. 2019) provides a map illustrating MPAs, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), based on the first national Coastal and Marine Spatial Biodiversity Plan (Harris and Sink 2019). Protected Areas, CBAs and ESAs together form a network of natural and semi-natural areas that enable ecologically functional seascapes in the long term, designed to be spatially efficient and wherever possible to avoid conflict with non-compatible ocean uses. Whereas CBAs should be kept in a natural or near natural state to support ecological sustainability, ESAs do not need to be entirely natural, but should be kept at least semi-natural so that they retain their ecological processes. These natural and semi-natural areas can co-exist in a matrix of multiple uses, including fisheries, mining and others.

As work is still underway to advance the CBA map, the data required for higher resolution project-interaction mapping are not yet available. From the map provided in the 2018 NBA, it appears that there is no direct overlap between Sea Concession 6C and CBAs or ESAs, but such areas are present to the north and south.

The Orange River Mouth wetland located to the north of Concession 6C provides an important habitat for large numbers of a great diversity of wetland birds and is listed as a Global Important Bird Area (IBA) (ZA023/NA 019) (BirdLife International 2005). The area was designated a Ramsar site in June 1991, and processes are underway to declare a jointly-managed transboundary Ramsar reserve. Further IBAs south of the project area include the Olifants River Estuary (ZA078), Verlorenvlei (ZA082), the Lower Berg River wetlands (ZA083) and the West Coast National Park and Saldanha Bay Islands (ZA084). All of these are located well to the south and inshore of the Sea Concession area.

4.2.2 Ecologically or Biologically Significant Areas (EBSAs)

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 EBSAs 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 identified solely within its national jurisdiction with a further three having been proposed[2]. It also shares eight trans-boundary EBSAs with other countries (Namibia (3) and Mozambique (2)) and/or 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. There is no direct overlap between Sea Concession 6C and the ESBAs, but such areas are present between 22 – 30 km to the north, west and south (see Figure 4-29).

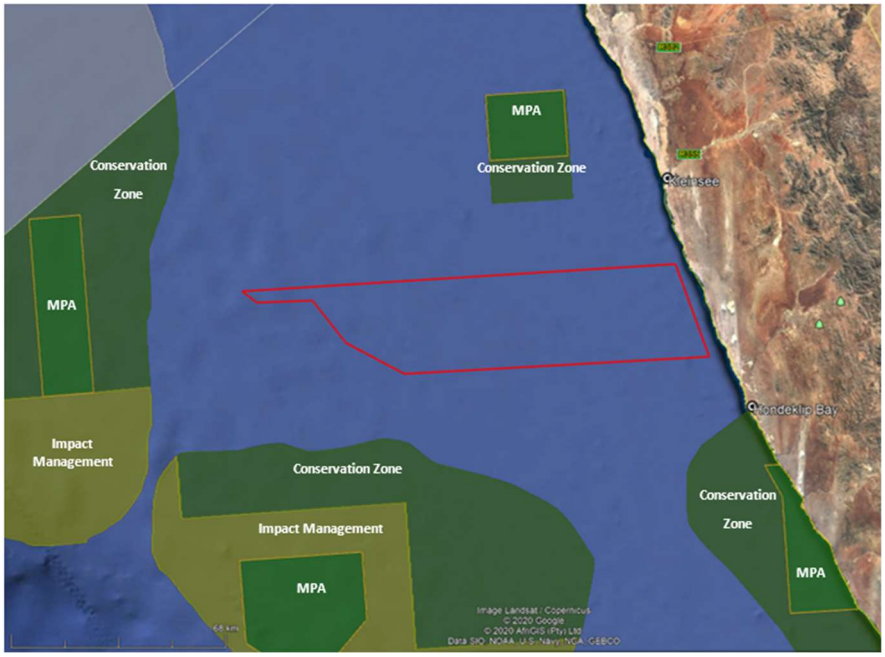

FIGURE 4-29: ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT AREAS ON THE WEST COAST IN RELATION TO SEA CONCESSION 6C (RED OUTLINE)[2].

[2] The delineation of the EBSA zones and associated management activities are still under discussion and these may be modified even further if compromises are made between sectors (Institute for Coastal and Marine Research, 2020). Once signed off there they will be submitted to the subsidiary body on scientific, technical and technological advice (SBSTTA) of the CBD. The original boundaries have already been internationally adopted (pers. comm. Harris & Holness, MARISMA).

4.2.3 Threat Status and Vulnerable Marine Ecosystems

Rocky shore and sandy beach habitats are generally not particularly sensitive to disturbance and natural recovery occurs within 2-5 years. However, much of the Namaqualand coastline has been subjected to decades of disturbance by shore-based diamond mining operations (Penney *et al.* 2007). With the establishment of a network of offshore MPAs in 2019, the ocean protection within the South African Exclusive Economic Zone (EEZ) was increased to 5% resulting in a re-assessment of the ecosystem threat status in the 2018 National Biodiversity Assessment (Sink et al. 2019).

The threat status of the benthic habitats within Sea Concession 6C, and those potentially affected by proposed bulk sampling activities, were identified as 'Least Concern' (see Table 4-8).

TABLE 4-8: ECOSYSTEM THREAT STATUS FOR MARINE AND COASTAL HABITAT TYPES IN SEA CONCESSION 6C (ADAPTED FROM SINK *ET AL.* 201).

Habitat Type	Threat Status
Namaqua Muddy Sands	Least Concern
Namaqua Muddy Mid Shelf Mosaic	Least Concern
Southern Benguela Outer Shelf Mosaic	Least Concern
Southern Benguela Sandy Outer Shelf	Least Concern

4.2.4 Development Potential of the Marine Environment in the Project Area

The economy of the Namaqualand region is dominated by mining. However, with the decline in the mining industry and the closure of many of the coastal mines, the economy of the region is declining and jobs are being lost with potential devastating socio-economic impacts on the region. The Northern Cape provincial government has recognized the need to investigate alternative economic activities to reduce the impact of minerals downscaling and has commissioned a series of baseline studies of the regional economy (Britz & Hecht 1997, Britz *et al.* 1999, 2000, Mather 1999). These assessments concluded that fishing and specifically mariculture offer a significant opportunity for long term (10+ years) sustainable economic development along the Namaqualand coast. The major opportunities cited in these studies include hake and lobster fishing (although the current trend in quota reduction is likely to limit development potentials), seaweed harvesting and aquaculture of abalone, seaweeds, oysters and finfish. The Northern Cape provincial government is facilitating the development of the fishing and mariculture sectors by means of a holistic sector planning approach and has in partnership with a representative community and industry based Fishing and Mariculture Development Association (FAMDA), developed the Northern Cape Province Fishing and Mariculture Sector Plan. This plan forms part of the 'Northern Cape - Fishing and Mariculture Sector Development Strategy' (www.northern-cape.gov.za, accessed December 2013) whereby implementation of the plan will be coordinated and driven by FAMDA.

As discussed in Section 4.1.4.1.9, the creation of abalone ranching enterprises around Hondeklip Bay and Port Nolloth have been identified as part of the sector plan's development targets (www.northern-cape.gov.za). In the past, experimental abalone ranching concessions have been granted to Port Nolloth Sea Farms (PNSF) in sea mining areas 5 and 6, a 60-km strip of coastline, and to Ritztrade in the Port Nolloth area (www.northern-cape.co.za).

These experimental operations have shown that although abalone survival is highly variable depending on the site characteristics and sea conditions, abalone ranching on the Namaqualand coast has the potential for a lucrative commercial business venture (Sweijd et al. 1998, de Waal 2004).

Besides abalone sea-ranching, several other potential projects were identified in the sector plan. Most of these are land-based aquaculture projects (e.g. abalone and oyster hatcheries in Port Nolloth and abalone grow-out facility in Hondeklip Bay), but included was a pilot project to harvest natural populations of mussels and limpets in the intertidal coastal zone along the entire Northern Cape coast. The objective of the project was to determine the stock levels and to ascertain what percentage of the biomass of each species can be sustainably harvested, as well as the economic viability of harvesting the resource.

5 IMPACT DESCRIPTION AND ASSESSMENT

This chapter describes and assesses the significance of potential impacts related to the proposed offshore prospecting activities in Sea Concession 6C. All impacts are systematically assessed and presented according to predefined rating scales (see Appendix 4.1). Mitigation or optimisation measures are proposed which could ameliorate the negative impacts or enhance potential benefits, respectively. The status of all impacts should be considered to be negative unless otherwise indicated. The significance of impacts with and without mitigation is also assessed.

Specialist input was provided in order to address the likely effect of the proposed prospecting activities on fisheries (Appendix 4.2), marine fauna (Appendix 4.3) and underwater cultural and heritage resources (Appendix 4.4). In addition, this assessment used as a basis the issues identified in the Generic EMP prepared for marine diamond mining off the West Coast of South Africa (Lane and Carter 1999) and similar studies.

Sections 5.1 to 5.3 assess impacts related to the proposed project and associated alternatives on the benthic environment, marine fauna and other users of the sea. The identified potential socio-economic impacts of the project are described in Section 5.4. The implications of not going ahead with the proposed project (i.e. the No-Go Alternative) are assessed in Section 5.5.

5.1 IMPACT OF THE SAMPLING / SUPPORT VESSELS AND HELICOPTER OPERATION

The normal operation of the sampling and/or support vessel(s) could result in potential impacts on the marine environment due to the following discharges from the vessel:

- Deck drainage;
- Machinery space drainage;
- Sewage effluent;
- Galley waste; and
- Solid waste.

As the assessment undertaken in the BAR for the geophysical surveys and sediment sampling operations deemed that these impacts were of **VERY LOW** significance (with mitigation) and are largely common to any normal vessel operations off the coast of South Africa, they have not been addressed again in this EIR. However, the applicable mitigation measures to address these impacts have been included in the EMPr (see Section 7).Reference should be made to the Basic Assessment Report (September 2018) where the detailed assessment of these issues can be found.

5.2 IMPACT ON MARINE FAUNA

5.2.1 Noise Associated with Bulk Sampling Activities

Description of impact

The sampling vessel, as well as the ADS (Alternative Drill System)/crawler used during bulk sampling would generate underwater noise, which may have an impact on macrobenthic communities, fishes and marine mammals in the area.

Assessment

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 would be audible for considerable ranges (in the order of tens of kilometres) before attenuating to below threshold levels. Underwater noise from sampling operations may induce localised behavioural changes in some marine mammals; it is unlikely that such behavioural changes would impact on the wider ecosystem.

Notwithstanding the above, noise from sampling operations and associated vessels is not considered to be of sufficient amplitude to cause direct harm to marine life. The impact of underwater noise generated during sampling operations is thus 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 to be of **VERY LOW** significance (see Table 5-1).

Mitigation

No mitigation measures are possible, or considered necessary for the generation of noise by the sampling tools and vessels.

TABLE 5-1: IMPACT OF NOISE FROM SAMPLING OPERATIONS ON MARINE FAUNA

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	No mitigation is proposed for this impact.
Duration	Short-term	
Intensity	Low	
Probability	Definite	
Confidence	High	
Consequence	Very Low	
Significance	**Very Low**	
Cumulative impact	None	
Nature of cumulative impact	Other vessels traversing the Sea Concession area would also generate noise. The cumulative impact is considered to be of VERY LOW significance.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A.	
Degree to which impact can be mitigated	No possible mitigation identified.	

5.2.2 Crushing of Benthic Fauna and Sediment Removal

Description of impact

The proposed bulk sampling operations are expected to result in the disturbance and loss of benthic fauna within the sampling footprint due to crushing (as a result of the drill frame structure or weight of the seabed crawler) and the removal of seafloor sediments.

Following the disturbance, the rate of ecological recovery would depend on the magnitude of the disturbance, the type of community that inhabits the sediments, the extent to which the community is naturally adapted to disturbance, the sediment character (grain size) that remains following the disturbance, and physical factors such as depth and exposure (waves, currents) of the habitat.

Assessment

The crushing and removal of sediment from the seafloor is anticipated to result in the mortality of a large proportion of the benthic infaunal and epifaunal biota within the sampling footprint. Natural rehabilitation of the seabed following mining operations has been demonstrated on the southern African continental shelf through a process involving influx of sediments and recruitment of invertebrates into previously disturbed areas. Recovery rates of impacted communities were observed to be variable and dependent on the approach, sediment influx rates and the influence of natural disturbances on succession communities. It is pointed out that the proposed sampling operations would takes place on a significantly smaller scale that the above-mentioned mining operations.

Results of on-going research (Parkins & Field 1998; Pulfrich & Penney 1999; Steffani 2012) on the southern African West Coast suggest that differences in biomass, biodiversity or community composition following mining below the wave base may endure beyond the medium term (6-15 years). However, other research suggests that the physical disturbance resulting from mining may be no more stressful than the regular naturally occurring anoxic events typical of the West Coast continental shelf area.

As the proposed sampling activities would be undertaken in depths beyond the wave base (>40 m), near-bottom sediment transport is expected to be less than in shallower waters affected by swell. Thus, the excavations may persist for extended periods (years) due to slow infill rates. Long-term or permanent changes in grain size characteristics of sediments in these areas may occur which could potentially result in a shift in benthic fauna community structure if the original community is unable to adapt to the new conditions. However, slumping of adjacent unconsolidated sediments into the excavations could occur 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 sampled areas. It is further noted that the sampling footprints would be much smaller than that of the mining operations for which natural rehabilitation of the seabed has been demonstrated (as mentioned above).

Furthermore, 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 reduction in benthic biodiversity can be considered negligible and impacts on higher order consumers are thus unlikely.

The impact on the offshore benthos as a result of the removal of sediments during the sampling activities is considered to be of medium intensity within the sampling target areas. Full recovery within the sampling footprints is expected to take place within the medium term, as the excavations would have slow infill rates and may persist for extended periods (years). Furthermore, biomass often remains reduced for several years as long-lived species like molluscs and echinoderms need longer to re-establish the natural age and size structure of the

population. While the impact on the associated communities is unavoidable within the sampling footprints, it would be extremely localised with a total footprint of 0.48 km^2 (which constitutes approximately 0.014% of the overall area of Sea Concession 6C). This impact is assessed to be of **LOW** significance with and without mitigation (see Table 5-2).

Mitigation

No direct mitigation measures are possible, or considered necessary for the indirect loss of benthic macrofauna due to crushing by the drill-frame structure and/or crawler. However, the following is recommended:

- Remote sensing data should be used to conduct a pre-sampling analysis of the seabed to identify high-profile, rocky-outcrop areas without a sediment veneer. Exploration sampling targets gravel bodies in unconsolidated sediments and does not target these high-profile rocky-outcrops.
- Prior to bulk sampling in areas adjacent to high-profile rocky-outcrop an assessment must be undertaken to identify if these rocky-outcrops host sensitive communities which must not be targeted. If this assessment cannot be conducted timeously then the high-profile rocky-outcrop without a sediment veneer must be mapped and avoided.

TABLE 5-2: IMPACT OF CRUSHING AND SEDIMENT REMOVAL ON OFFSHORE BENTHIC COMMUNITIES

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Medium-term	Medium-term
Intensity	Medium	Medium
Probability	Definite	Definite
Confidence	High	High
Consequence	Low	Low
Significance	**Low**	**LOW**
Cumulative impact	Yes	Yes
Nature of cumulative impact	Previous sampling and mining activities have been undertaken by DBM in sea concession areas to the north of Sea Concession 6C (with an estimated disturbance of 5 km^2). In relation to the total area of the Namaqua Bioregion (222 240 km^2), the cumulative impact of such sampling activities is considered to be an insignificant percentage, thus the cumulative impact is considered to be of VERY LOW significance.	
Degree to which impact can be reversed	Partially reversible – The recovery of excavations through sediment influx and recolonisation will occur over the medium term.	
Degree to which impact may cause irreplaceable loss of resources	Negligible considering the total surface area of seabed affected.	
Degree to which impact can be mitigated	No possible mitigation identified.	

5.2.3 Generation of Sediment Plumes

Description of impact

As part of the sampling operations, the seabed sediments are pumped to the surface and discharged onto sorting screens on the sampling vessel for screening. The unwanted material is discarded overboard from where the

heavy portion settles on the seafloor in the excavated areas and the finer portion forms a suspended sediment plume in the water column which dissipates with time. The 'plantfeed' is processed onboard the sampling vessel and the fine tailings are similarly deposited overboard. These 'plantfeed' sediments would also generate suspended sediment plumes in the water column.

The main effect of sediment plumes is an increase in water column turbidity, leading to a reduction in light penetration with potential adverse effects on the photosynthetic capability of phytoplankton. Other potential impacts include inhibiting pelagic visual predators due to poor visibility, egg and/or larval development impairment and reduction of benthic bivalve filter-feeding efficiencies. Negative impacts may also occur when heavy metals or contaminants associated with fine sediments are remobilised.

Assessment

As set out in Section 4.1.2.8, the total suspended Particulate Inorganic Matter (PIM) off Namaqualand (particularly in nearshore waters) is strongly related to natural inputs from the Orange River or from 'berg' wind events. These natural concentrations are naturally increased under stronger wave conditions associated with high tides and storms, or under flood conditions. 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. Thus, there is a natural variation in turbidity and sediment load within the waters off the West Coast.

From previous operations undertaken by De Beers Marine, suspended sediments in plumes settle fairly rapidly (within hours) and water sampling has confirmed that contaminant levels in the plumes are well below water quality guideline levels (Carter 2008).

Given that the marine environment within Sea Concession 6C is naturally exposed to large variations in turbidity and sediment load and that possible contaminant levels of the plumes are below water quality guideline levels, the impact of suspended sediment plumes in the water column are deemed to be of low intensity, persist only over the short-term, and would be extremely localised around the sampling vessel. This impact is assessed to be of **VERY LOW** significance (see Table 5-3).

Mitigation

No mitigation measures are possible, or considered necessary for the discharge of tailings from the sampling vessel.

TABLE 5-3: IMPACT OF THE GENERATION OF SUSPENDED SEDIMENT PLUMES

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	No mitigation is proposed for this impact.
Duration	Short-term	
Intensity	Low	
Probability	Definite	
Confidence	High	
Consequence	Very Low	
Significance	**Very Low**	
Cumulative impact	Yes	
Nature of cumulative impact	Other activities that may result in the generation of sediment plumes and contribute to the cumulative impact on the marine environment include other prospecting,	

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
	mining, production projects, and other fishing activities. As sediment plumes are very localised and persist for short durations for such activities, the cumulative impact over the large Namaqua bioregion is considered to be VERY LOW.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.2.4 Smothering of Benthos by Redepositing Sediments

Description of impact

As mentioned above, the processed sediments are discarded and settle back onto the seabed largely beneath the vessel within the previously excavated area. However, some of the processed sediments could impact on adjacent areas, where they could result in smothering of benthic communities on the seafloor.

Assessment

Smothering-related impacts on benthic communities involve physical crushing, a reduction in nutrients and oxygen, clogging of feeding apparatus, as well as affecting choice of settlement site, and post-settlement survival. Generally, rapid deposition of coarser material 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. In contrast, sedentary communities may be adversely affected by both rapid and gradual deposition of sediment.

Of greater concern is that sediments discarded during sampling operations may impact rocky-outcrop communities potentially located adjacent to sampling target areas and potentially hosting sensitive deep-water coral communities. Within the sampling target areas, such communities would be expected in the Namaqua Hard Inner Shelf habitats. As high proportions of hard ground have been identified between 180 m and 480 m depth to the north of Sea Concession 6C, and video footage from southern Namibia and to the south-east of Childs Bank has identified vulnerable communities including gorgonians, bryozoans and octocorals, the potential occurrence of such sensitive deep-water ecosystems within the sea concession area cannot be excluded. As deep-water corals tend to occur in areas with low sedimentation rates, these benthic suspension-feeders and their associated faunal communities are likely to show particular sensitivity to increased turbidity and sediment deposition associated with tailings discharges.

Discarding of excess sediment may result in limited smothering effects on the seabed. However, considering the available area of unconsolidated seabed habitat, the reduction in biodiversity of macrofauna can be considered negligible. The impacts would be of low intensity but highly localised and short-term, as recolonization would occur rapidly. The potential impact of smothering on communities in unconsolidated habitats is consequently deemed to be of **VERY LOW** significance (see Table 5-4).

In the case of rocky-outcrop communities, impacts would be of medium intensity and highly localised, but potentially enduring over the medium-term due to the slow recovery rates of these communities. The potential impact of smothering on rocky-outcrop communities is consequently deemed to be of **Medium** significance

without mitigation. If the rocky-outcrop areas are avoided during sampling, there would be no direct impact, however the tailings plume may still result in possible smothering impacts should any such communities be located in proximity to sampling areas. This is deemed to be of **LOW** significance (see Table 5-5).

Mitigation

- No mitigation measures are possible, or considered necessary for the loss of macrobenthos due to smothering of unconsolidated seabed habitats.
- Remote sensing data should be used to conduct a pre-sampling analysis of the seabed to identify high-profile, rocky-outcrop areas without a sediment veneer. Exploration sampling targets gravel bodies in unconsolidated sediments and does not target these high-profile rocky-outcrops.
- An appropriate buffer zone will be established around identified sensitive communities on the high-profile rocky-outcrops based on an independent ecological assessment. If this assessment cannot be conducted timeously then a 150 m buffer will be applied around high-profile rocky-outcrop without a sediment veneer.

TABLE 5-4: SMOTHERING OF SOFT-SEDIMENT MACROFAUNA

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Consequence	Very Low	Very Low
Significance	**Very Low**	**VERY LOW**
Cumulative impact	Yes	Yes
Nature of cumulative impact	Activities that may contribute to the cumulative impact of smothering soft-sediment macrofauna largely include prospecting, mining, exploration and/or production projects. As these activities would have a localised low intensity impact and as such effects are expected to be small in comparison to natural infill resulting from the deposition of sediment discharged by the Orange River, the cumulative impact is considered to be of LOW significance.	
Degree to which impact can be reversed	Fully Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

TABLE 5-5: SMOTHERING OF ROCKY-OUTCROP COMMUNITIES

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Medium-term	Medium-term
Intensity	High	Medium
Probability	Probable	Possible
Confidence	High	High
Consequence	Medium	Low
Significance	**Medium**	**LOW**
Cumulative impact	Yes	Yes
Nature of cumulative impact	As mentioned above, other activities may contribute to the cumulative impact of smothering. However, as the effects are anticipated to be small in comparison to the natural infill of sediment discharged by the Orange River, the cumulative impact is considered to be of LOW significance.	
Degree to which impact can be reversed	Partially Reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Medium	

5.3 IMPACT ON OTHER USERS OF THE SEA

5.3.1 Potential Impact on Fishing Industry

5.3.1.1 Exclusion of Fishing and Research Operations

Description of impact

While the sampling vessel is operational at a given location, a temporary 500 m operational safety zone around the unit would be in force, i.e. no other vessels (except the support vessels) may enter this area. A vessel conducting sampling operations would typically operate on a 3 or 4 anchor spread with unlit anchor mooring buoys. For the duration of sampling operations a coastal navigational warning would be issued by the South African Navy Hydrographic Office (SANHO) requesting a 2 nautical mile clearance from the sampling vessel.

The safety zones aim to ensure the safety both of navigation and of the sampling vessel, avoiding or reducing the probability of accidents caused by the interaction of fishing boats and gears and the vessel. The exclusion of vessels from entering the safety zone around the sampling vessel would pose a direct impact to fishing operations in the form of loss of access to fishing grounds where overlap occurs.

Assessment

The extent of commercial fishing in and around Sea Concession 6C is described in detail in Section 4.1.4.1. Although the sea concession area coincides, or is in proximity to designated management areas of the West

Coast rock lobster, abalone ranching and netfish sectors, the depths exploited by these fisheries are less than 100 m and therefore would not be expected to be affected. However, the sectors could be impacted upon:

- Demersal longline
- Tuna pole; and
- Traditional linefish.

The potential impacts on the remaining fisheries are described and assessed below.

Demersal longline
Based on the commercial catch and effort data submitted by the demersal longline fishery over the period 2000 and 2017, favoured fishing grounds are situated at least 20 km from the north-western and 40 km from the south-western extents of Sea Concession 6C (refer to Figure 4-11). Sporadic fishing has been reported within the sea concession area during this time, amounting to an average of one line set per year and approximately 4 tons of catch. This is equivalent to some 0.05% of the total landing of hake by the sector per year over this period. There is no overlap of the concession area with fishing grounds for demersal shark species targeted by demersal longline.

Tuna pole
Over the period 2007 to 2016, 32 fishing events were reported within the sea concession area (this is comparable to 32 days of fishing effort) with a cumulative catch of 58.3 tons of albacore over this period. This amounts to 5.8 tons per year which is equivalent to 0.2% of the total albacore landed by the sector (nationally) over this period.

Traditional linefish
Fishing activity is reported by landing point. In the vicinity of Sea Concession 6C, Hondeklipbaai is the closest landing point. Over the period 2000 to 2016, an average of 182 kg per year were reported for the area. Over the same period 2.5 tons of catch was reported for fishing positions in the vicinity of Port Nolloth, situated 70 km northward of the sea concession area. The combined catch at Hondeklipbaai and Port Nolloth is equivalent to approximately 0.03% of the overall national landings of the sector. The reporting of fishing positions is not specific, but generally reported according to reference positions for different areas. It is assumed that fishing could take place across the extent of Sea Concession 6C.

The potential impact of the proposed sampling activities on the above-mentioned fisheries would be of local extent, short-term and of low intensity. The significance of impact is thus considered to be **LOW** with and without mitigation (see Table 5-6).

Mitigation

The mitigation measures listed below are unlikely to reduce the significance of potential impacts, but they would minimise disruptions to prospecting and fishing / research operations.

- Prior to the commencement of the proposed prospecting activities the following key stakeholders should be consulted and informed of the proposed activities (including navigational co-ordinates of the sampling areas, timing and duration of proposed activities) and the likely implications thereof:
  - Fishing industry / associations (these include South African Tuna Association, South African Tuna Longline Association, Fresh Tuna Exporters Association, South African Commercial Linefish Association, Hake Longline Association, National SMME Fishing Forum); and

> Other: DEFF, South African Maritime Safety Authority (SAMSA), South African Navy (SAN) Hydrographic office, overlapping and neighbouring exploration right holders and applicants, and Transnet National Ports Authority (ports of Cape Town and Saldanha Bay).

- The required safety zones around the sampling vessels should be communicated via the issuing of Daily Navigational Warnings for the duration of the sampling operations through the South African Naval Hydrographic Office; and
- The SAN Hydrographic office should be notified when the programme is complete so that the Navigational Warning can be cancelled.

TABLE 5-6: ASSESSMENT OF THE POTENTIAL IMPACT RELATING TO INCREASED FISHING EFFORT AND DISRUPTION TO THE DEMERSAL LONGLINE, TUNA POLE, AND TRADITIONAL LINEFISH FISHERIES.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Consequence	Low	Low
Significance	**Low**	**LOW**
Cumulative impact	Yes	Yes
Nature of cumulative impact	As indicated above, there is limited fishing activity in the area and with no additional mining/production activities currently planned for the sea concession area, the cumulative impact would be of VERY LOW significance.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.3.1.2 Impact of Sediment Plume on Fish Stock Recruitment

Description of impact

Sediment plumes generated during bulk sampling could have an impact on fish stock recruitment.

Assessment

Typically fisheries stock recruitment is highly variable spatially and temporally. Spawning and recruitment of small pelagic species, as well as of many demersal species, occurs primarily well to the south of Sea Concession 6C.

The spawn from these fisheries typically drift northwards with the prevailing Benguela Current and larval development mainly occurs nearshore and in bays along the West Coast of South Africa. Sampling in Sea Concession 6C would occur offshore of the 70 m depth contour. Relative to the location of the nursery areas, the

sediment plumes generated during benthic sampling would be predominantly dispersed northwards and offshore of the nursery areas. The impact on fish recruitment is considered to be improbable, localised (due to the localised nature of the proposed sampling events in relation to fish nursery areas) and of medium intensity over the short-term. The impact is thus considered to be **INSIGNIFICANT** without mitigation (see Table 5-7).

TABLE 5-7: ASSESSMENT OF THE POTENTIAL IMPACT ON FISH STOCK RECRUITMENT DUE TO SEDIMENT PLUMES.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Medium	Medium
Probability	Improbable	Improbable
Confidence	Medium	Medium
Consequence	Very Low	Very Low
Significance	**Insignificant**	**INSIGNIFICANT**
Cumulative impact	No	No
Nature of cumulative impact	Other activities may contribute to the cumulative impact of smothering. However, as the effects are anticipated to be small in comparison to the natural infill of sediment discharged by the Orange River, the cumulative impact is considered to be of VERY LOW significance.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	Negligible	
Degree to which impact can be mitigated	None	

5.3.2 Potential Impact on Fisheries Research

Description of impact

Fisheries research on small pelagic and demersal fish resources are undertaken by DEFF (previously the Department of Agriculture, Forestry and Fisheries) off the South African coastline on a bi-annual basis in order to set the annual Total Allowable Catch. The presence of the sampling vessel, and associated 500 m safety zone, could interfere with research.

Assessment

The spatial distribution of the trawling effort undertaken during demersal surveys off the West Coast of South Africa is illustrated in Figure 4-22. Research trawls take place over the entire extent of the Sea Concession area from the 20 m to the 200 m isobath. Each year DEFF undertakes an average of three trawls within Sea Concession Area 6C.

It is possible that timing of the demersal research surveys and sampling activities would coincide. However, as the sampling activities are highly localised in extent in comparison to the research survey area, the prospecting

operations are not anticipated to influence fish distribution. The impact on the fishery research is considered to be local in extent and of low intensity (as the research surveys could continue in a modified way) in the short-term. The overall significance of this impact is expected to be **VERY LOW** with and without mitigation (see Table 5-8).

Mitigation

- The most effective means of mitigation would be to ensure that the proposed prospecting activities do not coincide with the research surveys between January and March. It is recommended that prior to the commencement of the proposed activities, De Beers consult with the managers of the DEFF research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in order to minimise or avoid disruptions to both parties, where required.

TABLE 5-8: ASSESSMENT OF THE POTENTIAL IMPACT ON FISHERIES RESEARCH.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Improbable
Confidence	High	High
Consequence	Very Low	Very Low
Significance	**Very Low**	**VERY LOW**
Cumulative impact	Yes	Yes
Nature of cumulative impact	Currently there is very little fishing activity in the area and with no other mining/production activities currently planned for the concession area, the cumulative impact would be of LOW significance.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.3.3 Potential Impact on Other Marine Prospecting / Mining Operations

Description of impact

The presence of the sampling vessel could interfere with other marine mining or prospecting operations in the neighbouring concession areas.

Assessment

Diver-assisted diamond mining is concentrated around Port Nolloth and Alexander Bay and typically confined to the inshore areas in the A-concession areas, in depths less than 20 m. Further offshore, diamond mining and prospecting is conducted by Belton Park Trading 127 in Sea Concessions 2C and 3C, respectively. No activities are currently taking place in the 'D' concession areas, located to the west of the study area.

As the 6C concession area does not overlap with any other marine mining operations, the impact of the planned prospecting operations on other mining activities would be localised, in the short term and of low intensity. The significance of impact is consequently **INSIGNIFICANT** with or without mitigation (see Table 5-9).

Mitigation

- Contact any companies undertaking marine prospecting or mining activities within the study area prior to prospecting in order to notify them of the planned activities.

TABLE 5-9 ASSESSMENT OF THE POTENTIAL IMPACT ON MARINE PROSPECTING / MINING.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Improbable	Improbable
Confidence	High	High
Consequence	Very Low	Very Low
Significance	**Insignificant**	**INSIGNIFICANT**
Cumulative impact	None	None
Nature of cumulative impact	No cumulative impacts are anticipated	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.3.4 Potential Impact on Petroleum Exploration and Production

Description of impact

The proposed prospecting activities could affect petroleum exploration and future production activities, that overlap with the concession area, and vice versa.

Assessment

The proposed prospecting area overlaps with Block 1 held by Cairn South Africa (Pty) Ltd (Cairn) (the Petroleum Oil and Gas Corporation of South Africa (Pty) Ltd (PetroSA) has a 40 % interest in the block), Mid Orange held by Sungu Sungu, Block 2A held by Sunbird (PetroSA has a 24 % interest in the block) and Block 2B held by Africa Energy Corp and Simbo (refer to Figure 4-25 in Section 4). The proposed sampling activities could affect and disrupt activities in these blocks if the activities occur coincidentally in the same area. However, the likelihood of this happening is low.

The impact on petroleum exploration would be localised, short term and of low to medium intensity. The significance of impact is consequently very low to low, without mitigation and **VERY LOW** with mitigation (see Table 5-10).

Mitigation

- Notify Cairn, PetroSA, Sungu Sungu, Sunbird, Africa Energy Corp and Simbo and their contractors, as well as any other neighbouring petroleum exploration rights holders, prior to the commencement of activities; and
- Liaise with all petroleum exploration operators and any overlapping mineral prospecting rights holders to ensure that there is no overlapping of activities in the same area over the same time period.

TABLE 5-10: ASSESSMENT OF THE POTENTIAL IMPACT ON PETROLEUM EXPLORATION ACTIVITIES.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low to Medium	Low
Probability	Probable	Probable
Confidence	High	High
Consequence	Very Low to Low	Very Low
Significance	**Very Low to Low**	**VERY LOW**
Cumulative impact	No	No
Nature of cumulative impact	No cumulative impacts are expected.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Low	

5.3.5 Potential Impact on Marine Transport Routes

Description of impact

The presence of the sampling vessel(s) could interfere with shipping in the area.

Assessment

The majority of shipping traffic is located on the outer edge of the continental shelf, which is limited to the western portions of the concession area. The inshore traffic of the continental shelf along the West Coast is largely comprised of fishing and mining vessels, especially between Kleinzee and Oranjemund (see **Error! Reference source not found.**).

While it is unlikely that shipping transport routes would be affected by the proposed prospecting activities, interaction with fishing and mining vessels is possible. The impact on shipping traffic is considered to be localised, of low intensity in the short-term. The significance of this impact is therefore assessed to be **INSIGNIFICANT** with and without mitigation (Table 5-11).

Mitigation

- Prior to the commencement of activities, the vessel operator must notify relevant bodies including: DMRE, DEFF, SAMSA, the SAN Hydrographic Office and relevant Port Captains, providing the navigational coordinates of the sampling areas;
- The sampling vessel(s) 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
- A Notice to Mariners should provide the co-ordinates of the sampling areas.

TABLE 5-11: ASSESSMENT OF INTERFERENCE WITH MARINE TRANSPORT ROUTES

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Improbable	Improbable
Confidence	High	High
Consequence	Very Low	Very Low
Significance	**Insignificant**	**INSIGNIFICANT**
Cumulative impact	No	No
Nature of cumulative impact	No cumulative impacts are expected.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.4 SOCIO-ECONOMIC IMPACT

5.4.1 Impact on Cultural Heritage Material

Description of impact

Sampling activities could disturb cultural heritage material on the seabed, such as palaeontological and historical shipwrecks.

Assessment

As noted in Section 4.1.4.6.3, known seabed occurrences of fossilised yellowwood tree trunks occur in Sea Concession Areas 4C and 5C, the proposed sampling activities would not have any impact on the known locations of palaeontological material/fossilised yellowwood tree trunks.

The likelihood of disturbing a shipwreck is expected to be very small considering the vast size of the South African offshore area. In the area under consideration, there are at least five vessels that could possibly have been wrecked in the vicinity of the concession area (see Table 4-7), as well as a further 28 vessels that may be somewhere in the area. However, the precise location of all these wrecks is unknown as they have been documented only through survivor accounts, archival descriptions and eyewitness reports recorded in archives and databases. In the event that these shipwreck sites are disturbed during sampling activities, the impact would be at the national level, permanent and of high intensity. The significance of impact is consequently **Medium**, without mitigation. With the implementation of mitigation, shipwreck sites can be largely avoided and if sampling is terminated in the unlikely event of encountering a shipwreck, the impact is regarded as **INSIGNIFICANT** (see Table 5-12).

Mitigation

- Areas where shipwreck sites are identified during the previous geophysical surveys must be excluded prior to undertaking sampling activities.
- It is recommended that the onboard De Beers representative must undergo a short induction on archaeological site and artefact recognition, as well as the procedure to follow should archaeological material be encountered during sampling.
- The contractor must be notified that archaeological sites could be exposed during bulk sampling activities, as well as the procedure to follow should archaeological material be encountered.
- If shipwreck material is encountered during the course of bulk sampling in the concession area, the following mitigation measure should be applied:
  - > Cease work in the directly affected area to avoid damage to the wreck until the South African Heritage Resources Agency (SAHRA) has been notified and the contractor/De Beers has complied with any additional mitigation as specified by SAHRA; and
  - > Where possible, take photographs of them, 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.

TABLE 5-12: ASSESSMENT OF POTENTIAL IMPACT ON PALAEONTOLOGICAL MATERIAL AND SHIPWRECKS

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	National	National
Duration	Short-term	Short-term
Intensity	Medium	Low
Probability	Improbable	Improbable
Confidence	High	High
Consequence	Medium	Low
Significance	**Medium**	**INSIGNIFICANT**
Cumulative impact	No	No
Nature of cumulative impact	No cumulative impacts are expected.	
Degree to which impact can be reversed	Irreversible	

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	

5.4.2 Impact Related to Job Creation and Business Opportunities

Description of impact

The proposed project would create a small number of local employment and business opportunities. Direct revenues would be generated as a result of the proposed prospecting activities. Revenue generating activities are related to the actual prospecting operations and include refuelling, vessel / gear repair, port dues, hire of support vessel(s).

Assessment

Offshore prospecting is highly technical and requires specialised vessels and crews. Thus job opportunities during the activities would be limited. There would, however, be opportunities for local companies to provide support services during the course of operations, e.g. vessel supplies, support vessels, etc.

The overall positive impact of job creation and the generation of direct revenues are considered to be local in extent and of low intensity over the short-term. Thus the potential impact of job creation is considered to be ***LOW (positive)*** with and without mitigation (see Table 5-13). Should the prospecting operations be successful, future job creation and business opportunities would arise where the operations advance to mining (which would require a separate application for environmental authorisation).

Mitigation

The use of local companies for support services should be promoted as far as possible.

TABLE 5-13: IMPACT OF JOB CREATION AND THE GENERATION OF DIRECT REVENUES.

RATING SCALES	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Consequence	Very Low	Very Low
Significance	***Very Low***	***VERY LOW***
Status	Positive	Positive
Probability	Probable	Probable
Confidence	Medium	Medium
Cumulative impact	Yes	Yes
Nature of cumulative impact	Other activities that may contribute to the cumulative impact of job creation and the generation of direct revenues include other exploration and mining activities off the coast of South Africa. As there are few of these	

RATING SCALES	WITHOUT MITIGATION	WITH MITIGATION
	other activities currently being undertaken off the West Coast, the cumulative impact is considered to be of LOW (positive) significance.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	None	

5.5 NO-GO ALTERNATIVE

Description of impact

The implications of not going ahead with the proposed prospecting operations are as follows:

- Loss of opportunity to establish whether or not a viable offshore diamond resource exists off the West Coast of South Africa;
- Prevention of any socio-economic benefits associated with the continuation of prospecting activities; and
- Lost economic opportunities.

Assessment

The potential impact related to the lost opportunity to further delineate the offshore diamond resource on the west coast and maximise the use of South Africa's own resources is considered to be of **LOW** significance (see Table 5-14). The positive implications on the no-go option are that there would be no effects on the biophysical environment in the area proposed for the prospecting activities.

TABLE 5-14: ASSESSMENT OF IMPACT RELATED TO NO-GO ALTERNATIVE.

CRITERIA	WITHOUT MITIGATION
Extent	Regional
Duration	Permanent
Intensity	Low
Probability	Improbable
Confidence	Low
Consequence	Medium
Significance	**LOW**
Cumulative impact	Yes
Nature of cumulative impact	Potential loss of opportunity to expand South Africa's own mineral resources.
Degree to which impact can be reversed	Reversible
Degree to which impact may cause irreplaceable loss of resources	N/A
Degree to which impact can be mitigated	N/A

5.6 CUMULATIVE IMPACTS

Description of impact

Historical and future prospecting/mining activities, together with trawl fisheries and hydrocarbon exploration activities in the West Coast offshore has had and will continue to have an impact on benthic faunal communities. Impacts on benthic faunal communities include physical disturbance of the seabed and discharges to the benthic environment.

Assessment

Biological communities within marine habitats are largely ubiquitous throughout the southern African West Coast region. The West Coast is characterised by low marine species richness and low endemicity. Unique environments in the vicinity of the concession area include Child's Bank (located 150 km due south of the concession area) and Tripp Seamount (situated approximately 70 km west north-west), however no sampling will be undertaken in these areas.

It has been noted (Penney et al. 2007) that the current mining rates off the West Coast are comparable to the natural disturbances inherent in the Benguela ecosystem. Given this, as well as the uniformity of marine habitats offshore of the West Coast, it is considered unlikely that there will be any enduring cumulative impacts as a result of the sampling activities in relation to other offshore activities.

The proposed bulk sampling activities would, in the short-term, impact an additional area of 0.48 km^2. This is considered an insignificant percentage of the sea floor as a whole. The cumulative impact as a result of the proposed sampling activities is, thus considered to be **LOW**.

6 CONCLUSIONS AND RECOMMENDATIONS

De Beers is proposing to undertake bulk sampling activities within Sea Concession 6C, off the West Coast of South Africa.

SLR was appointed to act as the independent environmental consultant to undertake the necessary EIA process and associated public consultation process for the proposed project. The EIA has been undertaken so as to comply with the requirements of the EIA Regulations 2014 (as amended), NEMA and the MPRDA.

Specialist input was provided on the likely impact on the benthic environment and fisheries by the proposed prospecting activities. The findings of the specialist input and other relevant information have been integrated and synthesised into this draft EIR. The two main objectives of this draft EIR are, firstly, to assess the environmental significance of impacts resulting from the proposed prospecting activities and to suggest ways of mitigating negative impacts and enhancing benefits, and secondly to provide I&APs with an opportunity to comment on the proposed project.

This chapter summarises the key findings of the study and presents the recommendations in terms of mitigation measures that should be implemented if the proposed prospecting activities are authorised.

6.1 CONCLUSIONS

6.1.1 GENERAL CONCLUSIONS

A summary of the assessment of potential environmental impacts associated with the proposed prospecting activities and No-Go Alternative is provided in Table 6-1.

The majority of the impacts associated with the vessel operations would be of short-term duration and limited to the immediate sampling areas. As a result, the majority of the impacts associated with the sampling vessels are considered to be of **INSIGNIFICANT** to **LOW** significance after mitigation.

Potential impacts on marine fauna as a result of the proposed bulk sediment sampling activities would be of medium- to short-term duration and limited to the immediate sampling areas. As a result, the impacts on marine fauna associated with the sampling activities are considered to be of **VERY LOW** to **LOW** significance after mitigation.

The likelihood of disturbing a shipwreck is expected to be very low considering the vast size of the South African offshore area. In the event that any cultural heritage material is disturbed during bulk sampling operations, the impact would be at the national level, and of high intensity. Without mitigation this is of **Medium** significance. However, with the implementation of mitigation, cultural heritage sites can largely be avoided and if sampling is terminated in the unlikely event of encountering a shipwreck, the impact is regarded as **INSIGNIFICANT**.

The implications of not going ahead with the proposed prospecting operations relate to the lost opportunity to establish whether or not a viable offshore diamond resource exists off the West Coast and the lost economic opportunities. This potential impact of the No-Go Alternative is considered to be of **LOW** significance. The positive implications on the no-go option are that there would be no effects on the biophysical environment in the area proposed for the prospecting activities.

TABLE 6-1: SUMMARY OF THE SIGNIFICANCE OF THE POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED PROSPECTING ACTIVITIES AND NO-GO ALTERNATIVE.

Potential impact		Significance	
		Without mitigation	With mitigation
Impact on marine fauna:			
Noise associated with sampling operations		VL	**VL**
Crushing of benthic fauna and sediment removal		L	**L**
Generation of sediment plumes		VL	**VL**
Smothering of benthos by redepositing tailings		VL - M	**VL - L**
Impact on other users of the sea:			
Fishing industry	Exclusion of the demersal long-line, traditional line-fish, tuna pole and fisheries research	L	**L**
	Sediment plume impact on fish stock recruitment	Insig	**INSIG**
Fishery Research		VL	**VL**
Marine mining and prospecting		Insig	**INSIG**
Petroleum exploration		VL-L	**VL**
Marine transport routes		Insig	**INSIG**
Impact on cultural heritage material:			
Impact on historical shipwrecks		M	**INSIG**
Socio-Economic Impacts:			
Job creation and business opportunities		VL	**VL**
No-Go Alternative:			
Lost opportunity to establish whether or not a viable offshore diamond resources exists off the West Coast and the lost economic opportunities.		L	-
Cumulative Impact:			
Benthic environment		L	**L**

VH=Very High	H=High	M=Medium	L=Low	VL=Very low	Insig = insignificant	N/A= Not applicable

6.1.2 COMPARATIVE ASSESSMENT OF PROJECTS ALTERNATIVES

6.1.2.1 Site alternatives

De Beers holds a Prospecting Right in Sea Concessions 6C and is applying for Environmental Authorisation to undertaken bulk sampling in addition to the approved prospecting activities within the Concession Area in order to obtain an understanding of the geology of the seafloor. Based on the review of the existing geological data, as well as the results of other prospecting activities within Sea Concession 6C, De Beers would undertake bulk sampling activities in specific target areas within the concession area to determine whether the potential future mining of these mineral resources would be economically viable. Thus, the proposed prospection operations are more or less fixed by the location of the economic resources within the concession area.

This EIA has assessed the potential impacts associated with proposed prospecting activities within Sea Concession 6C. The potential impact on the marine benthic environment and significance thereof would be dependent on whether any vulnerable or sensitive benthic communities occur within the vicinity of the planned sampling footprints. As exploration sampling targets gravel bodies, they would avoid known sensitive habitats and high-profile, rocky-outcrop areas without a sediment veneer.

Similarly, the potential impact on cultural heritage material is dependent on whether any wrecks or palaeontological material is located near or would be affected by the proposed prospecting activities. In order to minimise the significance of these potential impacts, it is recommended that the final sampling areas would be adjusted, as needed, to avoid any significant vulnerable habitats / species or wrecks.

6.1.2.2 Bulk Sampling methodology alternatives

Section 3.4 sets out the two possible bulk sampling methodologies that would be employed for the proposed operations. It is anticipated that there are unlikely to be any additional impacts and very little difference in impact significance relating to the proposed sampling method. Due to the offshore location of the Sea Concession area and associated water depths, no other alternative sampling methods (e.g. diver-assisted sampling) were considered feasible for assessment in the EIA.

6.1.2.3 No-go alternative

The no-go alternative is the option of not undertaking the proposed prospecting operations. This would result in a decrease in commercial interest in South Africa's offshore diamond mining sector, and the loss of potential economic benefits including government revenues, taxes and employment.

Logically if the planned prospecting operations do not proceed, the residual impacts (i.e. impacts after implementation of mitigation measures) of the proposed activities would not occur.

The implications of not going ahead with the proposed prospecting operations in Sea Concession 6C relate to the lost opportunity to maximise the use of South Africa's own mineral resources. This potential impact of the No-Go Alternative is considered to be of **LOW** significance.

6.1.3 RECOMMENDATION / OPINION OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

The key principles of sustainability, including ecological integrity, economic efficiency, and equity and social justice, are integrated below as part of the supporting rationale for recommending an opinion on whether the proposed project should or should not be approved.

- Ecological integrity[3]

The disturbance of benthic fauna and associated biodiversity is considered to be of high intensity as the benthic biota within the sampling footprints would be lost or disturbed. However, the area of disturbance (0.48 km^2) is considered to be relatively small in comparison to the total available area of similar habitat in the Namaqua bioregion, and full recovery of benthic biodiversity within the disturbed footprints would take place within the medium term due to natural sedimentation processes and recolonization by benthic communities.

In summary, the proposed project would result in the loss of some ecological integrity in the study area, but it is considered to be a localised and medium-term under normal operating conditions.

- Economic efficiency

As noted in Section 3.2, marine and coastal resources in the Northern Cape provide the greatest value the mining and fishing sectors for the province. It is acknowledged in the Northern Cape PSDF that the province *"has an abundance of diamond deposits both onshore and in marine deposits"* and that *"this has led to the development of a large diamond mining sector, which has become the dominant activity of the coastal zone".*

The proposed prospecting activities could result in impacts on fishing as a result of the 500 m safety zones around the survey vessels (i.e. loss of access to fishing grounds), as well as fish avoidance of the sampling area. However, the demersal longline, tuna pole, and traditional linefish fisheries are the only fisheries that could potentially be affected by the proposed project and given the short-term duration of prospecting and that relatively low levels of fishing activity generally occur within Sea Concession 6C, the impact of the proposed project on fisheries is considered to be negligible.

Although offshore prospecting is highly technical and requires specialised vessels and crews, there would be a few opportunities for local companies to provide support services during the proposed operations, e.g. vessel supplies, support vessels, etc. As opportunities would be limited, the economic benefits (job creation and generation of direct revenues) associated with the project are considered to be only of ***LOW (positive)*** significance.

On the basis of the above, the proposed project is considered to be economically efficient, as it provides an opportunity to maximise the use of South Africa's own natural resources off the West Coast of South Africa while at the same time only having a negligible impact on one fishing sector.

- Equity and social justice

Due to the extent and offshore location of the proposed project, it would not unfairly discriminate, directly or indirectly, against any one party nor result in an unequal distribution of negative impacts.

With the implementation of the proposed mitigation measures, the nature and extent of the proposed prospecting activities are anticipated to have generally **VERY LOW to LOW** significant impacts. While the impact of crushing, sediment removal and generation of suspended sediment plumes on benthic macrofauna is assessed to be of **VERY LOW to LOW** significance, it is noted above that full recovery within the sampling footprints is expected to take place within the medium term due to natural sedimentation process and recolonisation by benthic communities. Given this, as well as the sustainability criteria described above, and the findings of the specialist studies, it is the opinion of SLR that a positive decision being made by the Minister of Mineral Resources (or delegated authority) regarding the approval of the proposed project can be supported.

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[3] Ecological integrity is the abundance and diversity of organisms at all levels, and the ecological patterns, processes and structural attributes responsible for that biological diversity and for ecosystem resilience.

6.2 RECOMMENDATIONS FOR MITIGATION

6.2.1 GENERAL MITIGATION RECOMMENDATIONS FOR THE PROSPECTING OPERATIONS

6.2.1.1 Compliance with Environmental Management Programme and MARPOL 73/78 standards

- All phases of the proposed project must comply with the Environmental Management Programme presented in Chapter 7; and
- The sampling and support vessels must ensure compliance with MARPOL 73/78 standards.

6.2.1.2 Notification and communication with key stakeholders

- Prior to the commencement of the proposed activities, De Beers should consult with the managers of the DEFF research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in order to minimise or avoid disruptions to both parties, where required.
- Notify Cairn, PetroSA, Sungu Sungu, Sunbird, Africa Energy Corp and Simbo and their contractors, as well as any other neighbouring petroleum exploration rights holders, as well as any companies undertaking marine prospecting or mining activities in the study area, prior to the commencement of activities.
- Liaise with all petroleum exploration operators and any overlapping mineral prospecting rights holders to ensure that there is no overlapping of activities in the same area over the same time period.
- Prior to the commencement of the proposed survey and/or sampling activities the following key stakeholders should be notified and informed of the proposed activities (including navigational co-ordinates of the sampling areas, timing and duration of proposed activities) and the likely implications thereof:
  - > Fishing industry / associations (these include South African Tuna Association, South African Tuna Longline Association, Fresh Tuna Exporters Association, South African Commercial Linefish Association, Hake Longline Association, National SMME Fishing Forum); and
  - > Other: DEFF, South African Maritime Safety Authority (SAMSA), South African Navy (SAN) Hydrographic office, overlapping and neighbouring exploration right holders and applicants, and Transnet National Ports Authority (ports of Cape Town and Saldanha Bay).
- The required safety zones around the sampling vessels should be communicated via the issuing of Daily Navigational Warnings for the duration of the sampling operations through the South African Naval Hydrographic Office.
- The SAN Hydrographic office should be notified when the programme is complete so that the Navigational Warning can be cancelled.

6.2.1.3 Discharges

- All process areas should be bunded to ensure drainage water flows into the closed drainage system.
- Undertake training and awareness of crew in spill management to minimise contamination.
- Low-toxicity biodegradable detergents and reusable absorbent cloths should be used in cleaning of all deck spillage.
- All hydraulic systems should be adequately maintained.
- Minimise the discharge of galley waste material should obvious attraction of marine fauna be observed.

6.2.1.4 Vessel seaworthiness and safety

- Vessels used during prospecting must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. Lloyds Register, Det Norske Veritas).
- 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.
- A Notice to Mariners should provide the co-ordinates of the sampling areas.

6.2.1.5 Bulk Sampling Activities

- Remote sensing data should be used to conduct a pre-sampling analysis of the seabed to identify high-profile, rocky-outcrop areas without a sediment veneer. Exploration sampling targets gravel bodies in unconsolidated sediments and does not target these high-profile rocky-outcrops.
- An appropriate buffer zone will be established around identified sensitive communities on the high-profile rocky-outcrops based on an independent ecological assessment. If this assessment cannot be conducted timeously then a 150m buffer will be applied around high-profile rocky-outcrop without a sediment veneer.

6.2.1.6 Cultural Heritage Material

- Areas where shipwreck sites are identified during the geophysical surveys must be excluded prior to undertaking sampling activities.
- The onboard De Beers representative must undergo a short induction on archaeological site and artefact recognition, as well as the procedure to follow should archaeological material be encountered during sampling.
- The contractor must be notified that archaeological sites could be exposed during sampling activities, as well as the procedure to follow should archaeological material be encountered during sampling.
- If shipwreck material is encountered during the course of sampling in the concession area, the following mitigation measure should be applied:
    - > Cease work in the directly affected area to avoid damage to the wreck until SAHRA has been notified and the contractor/De Beers has complied with any additional mitigation as specified by SAHRA; and
    - > Where possible, take photographs of artefacts found, noting the date, time, location and types. Under no circumstances may any artefacts be removed, destroyed or interfered on the site, unless under permit from SAHRA.

7 ENVIRONMENTAL MANAGEMENT PROGRAMME

As mentioned in Section 1.2, De Beers have an existing EA to undertake geophysical surveys and sampling operations within Sea Concession 6C. Thus, an approved Environmental Management Programme (EMPr) has already been compiled for these authorised activities. This approved EMPr has, where required, been updated to include mitigation measures for the proposed bulk sampling activities and is intended to cover all of the planned prospecting activities to be undertaken by De Beers when executing the Prospecting Right for Sea Concession 6C. Specific issues are addressed under each of the following sections:

7.1.	PLANNING PHASE	7.1.1. Preparation of subsidiary plans
		7.1.2. Stakeholder consultation and notification
		7.1.3. Permits / Exemptions
		7.1.4. Financial Provision
7.2.	ESTABLISHMENT PHASE	7.2.1. Compliance with the EMPr
		7.2.2. Environmental Awareness Training
		7.2.3. Notifying other users of the sea
		7.2.4. Onboard observer or MMO and PAM operator, where required
7.3.	OPERATIONAL PHASE	7.3.1. Adherence to the EMPr and Environmental Awareness
		7.3.2. Prevention of emergencies
		7.3.3. Communication with other users of the sea and resource managers
		7.3.4. Dealing with emergencies including major oil spills
		7.3.5. Survey Activities
		7.3.6. Sampling Activities
		7.3.7. Pollution control and waste management
		7.3.8. Equipment loss
		7.3.9. Oil bunkering / refuelling at sea
		7.3.10. Acoustic Emissions
		7.3.11. Vessel Lighting
		7.3.12. Monitoring and Auditing

7.4.	DECOMMISSIONING AND CLOSURE PHASE	7.4.1. Survey/sampling vessel to leave area
		7.4.2. Inform key stakeholders of survey completion
		7.4.3. Final waste disposal
		7.4.4. Rehabilitation and closure
		7.4.5. Information sharing

The fundamental elements of this management programme are to be implemented at all times, as and when appropriate.

7.1 PLANNING PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
7.1.1 PREPARATION OF SUBSIDIARY PLANS	Mobilisation	Preparation for any emergency that could result in an environmental impact	All plans to be finalised before start of mobilisation	Ensure the following plans are prepared and in place: • Shipboard Oil Pollution Emergency Plan (SOPEP) for the survey and sampling vessels, as required by MARPOL; • Emergency Response Plan (including MEDIVAC plan); • Waste Management Plan (see contents in Section 7.3.7). In addition to the above, ensure that: • An adequate system is in place to address oil pollution incidents; and • The survey and sampling vessel's seaworthiness certificate and/or classification stamp are in place.	De Beers	Prior to commencement of operation	A copy of all plans Confirm compliance and justify and omissions
7.1.2 FINALISATION OF SAMPLING AREA	Disturbance of sensitive features	Protection of sensitive features	No disturbance of sensitive features	• Remote sensing data should be used to conduct a pre-sampling analysis of the seabed to identify high-profile, rocky-outcrop areas without a sediment veneer. Exploration sampling targets gravel bodies in unconsolidated sediments and does not target these high-profile rocky-outcrops. • An appropriate buffer zone will be established around identified sensitive communities on the high-profile rocky-outcrops based on an independent ecological assessment. If this assessment cannot be conducted timeously then a 150m buffer will be applied around high-profile rocky-outcrop without a sediment veneer. • . • Exclude any areas where shipwrecks are identified (during geophysical surveys) from a planned sampling area.	De Beers	Prior to commencement of sampling	Geophysical survey data Mapping of completed sampling footprints
7.1.3 STAKEHOLDER CONSULTATION AND NOTIFICATION	Interaction, engagement and communication with key stakeholders	Department of Mineral Resources and Energy (DMRE) notification	Notify authority of upcoming activities	Compile the specific details of the prospecting operations into a Notification and submit to the DMRE. The notification should provide, *inter alia*, the details on the following: • Prospecting programme (timing, co-ordinates and duration); • Contractor details; and • Other information on request.	De Beers and sampling contractor	30 days prior to commencement of operations or as required by DMRE	Provide copies of all correspondence
		Stakeholder notification	Minimise disruption to the survey and	• Consult with the managers of the DEFF research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in	De Beers	30 days prior to commencement of operations	Provide copy of notification and list

7.1 PLANNING PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
			other users of the sea	order to minimise or avoid disruptions to both parties, where required. • Notify relevant government departments and other key stakeholders of the commencement of sampling operations (including navigational co-ordinates, timing and duration of proposed activities) and the restrictions related to the operation. Stakeholders include: > Fishing industry / associations: - South African Tuna Association; - South African Tuna Longline Association; - Fresh Tuna Exporters Association; - South African Commercial Linefish Association; - Hake Longline Association; and - National SMME Fishing Forum. > Local fishing operators; > SAMSA; > South African Navy (SAN) Hydrographic office; > DEFF, including the fisheries research managers; > Transnet National Ports Authority (ports of Cape Town and / or Saldanha Bay); and > Overlapping and/or adjacent prospecting / mining/ exploration right holders. • Any dispute arising with adjacent prospecting / exploration right holders should be referred to the DMRE or PASA for resolution.			of those to whom it was sent

7.1 PLANNING PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
7.1.4 PERMITS / EXEMPTIONS	Permitting	Compliance with legislative requirements	Receipt of required permits	If necessary, apply to DEFF for an exemption to approach or remain within 300 m of whales (see note below). The request for an exemption must be submitted to DEFF. <u>Note:</u> In terms of the Marine Living Resources Act, 1998 (No. 18 of 1998): • No person may approach within 300 metres of a whale by vessel, aircraft or other means without a permit; • A vessel approached by a whale is required to distance itself at 300 m from the whale, unless in possession of a permit; • A vessel may not proceed directly through a school of dolphins or porpoises; and • No person shall attempt to feed, harass, disturb or kill great white sharks, dolphins, seals or turtles.	De Beers and Appointed contractor	Prior to commencement of operations	Provide copies of relevant documentation
7.1.5 FINANCIAL PROVISION	Permitting	Compliance with legislative requirements	Confirmation of Financial Provision from DMRE	• Ensure that the requirements of NEMA in terms of financial provision for remediation of environmental damage are met by: - Allocating operational costs to meet EMPr requirements; - Ensure that the sampling vessels maintain adequate Protection and Indemnity (P&I) Insurance Cover to allow for clean-ups in the event of a hydrocarbon spill and other eventualities; and - Providing sufficient funds to execute the EMPr in the event of premature closure or in the event that, on closure, the EMPr has not been successfully executed.	De Beers	Prior to commencement of operations	Provide copies of relevant documentation/ correspondence from DMRE

7.2 ESTABLISHMENT PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
7.2.1 COMPLIANCE WITH EMPR	Training and allocation of responsibilities	Operator and contractor to commit to adherence to EMPr	Applicable staff receive training as part of their induction, refresher training and an ongoing awareness and behaviour system	• Verify that a copy of the approved EMPr is supplied to the appointed contractor and is on board the survey and sampling vessels during the operation. • Verify procedures and systems for compliance are in place. • Verify correct equipment and personnel are available to meet the requirements of the EMPr.	De Beers and appointed contractor	Prior to commencement of operation	Provide copies of relevant documentation
7.2.2 ENVIRONMENTAL AWARENESS TRAINING		Ensure personnel are appropriated trained		• Undertake Environmental Awareness Training to ensure the relevant vessel's personnel are appropriately informed of the purpose and requirements of the EMPr. • Verify responsibilities are allocated to the relevant personnel.	Appointed contractor	Before new staff commence with the start work on the project	Copy of attendance register and training records
7.2.3 NOTIFYING OTHER USERS OF THE SEA	Presence of survey / sampling vessel	Ensure that other users are aware of the survey/sampling programme	Zero maritime incidents	• Request, in writing, the SAN Hydrographic office to release Radio Navigation Warnings and Notices to Mariners throughout the survey/sampling period. The Notice to Mariners should give notice of (1) the co-ordinates of the surveying/sampling, (2) an indication of the proposed surveying/sampling timeframes, (3) an indication of the 500 m safety zone around the sampling vessel, and (4) provide details on the movements of support vessels servicing the operation.	De Beers	7 days prior to start	Provide copies of written notices and list of those to whom it was sent
7.2.4 ONBOARD OBSERVER OR MMO AND PAM OPERATOR, WHERE REQUIRED	Increase in underwater noise levels	Protect offshore marine fauna	Zero disturbance to cetaceans	• A designated onboard Marine Mammal Observer (MMO) shall ensure compliance with mitigation measures during geophysical surveying. • For the months of June and November appoint a Passive Acoustic Monitoring (PAM) operator.	De Beers	Prior to commencement of operations	MMO (and PAM, when used) operator reports

7.3 OPERATIONAL PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
7.3.1 ADHERENCE TO THE EMPr AND ENVIRONMENTAL AWARENESS	Implementation of EMPR	Operate in an environmentally responsible manner	Compliance with EMPR	• Undertake Environmental Awareness Training (including spill management) to ensure the relevant vessel's personnel are appropriately informed of the purpose and requirements of the EMPr. • Ensure the onboard De Beers representative undergoes a short induction on archaeological site and artefact recognition, as well as the procedure to follow should archaeological material be encountered during sampling. • Comply fully with the EMPr (compliance would mean that all activities were undertaken successfully and details recorded).	De Beers and Appointed contractor	Prior to and throughout operation	
7.3.2 PREVENTION OF EMERGENCIES	Presence of survey / sampling vessel	Minimise the chance of emergency and subsequent damage to the environment occurring	Zero maritime incidents	• Prevent collisions by ensuring that the survey and sampling vessels display correct signals by day and lights by night (including twilight), by visual radar watch and standby vessel(s). • Maintain 500 m safety zone around sampling vessel through Notices to Mariners and Navigation Warnings. • Call any fishing vessels that are deemed to be a risk to the survey and / or survey vessel via radio and inform them of the navigational safety requirements. • Ensure all hazardous materials are correctly labelled, stored, packed and sealed with proper markings for shipping.	Appointed contractor	Throughout operation	Provide record of any incidents and interaction with other vessels
				• Establish lines of communication with the following emergency response agencies / facilities: SAMSA, SAN Hydrographic Office (Silvermine), DEFF (Directorate of Marine Pollution) and DMR.	Appointed contractor	During operations as required	Provide record of any communications
7.3.3 CONTINUE TO COMMUNICATE WITH OTHER USERS OF THE SEA AND RESOURCE MANAGERS	Interaction, engagement and communication with key stakeholders	Promote co-operation and successful multiple use of the sea, including promotion of safe navigation	Zero maritime incidents	• Through normal communication channels, Radio Navigation Warnings and Notices to Mariners, keep relevant government departments and other key stakeholders (see Section 7.1.2) updated on the prospecting programme.	Appointed contractor	During operations as required	Provide record of any communications
				• Co-operate with other legitimate users of the sea to minimise disruption to other marine activities.	Appointed contractor	During operations as required	

7.3 OPERATIONAL PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
				• Keep constant watch for approaching vessels during the prospecting operation and warn by radio and support vessel, if required. • Keep a record of any interaction with other vessels.			
7.3.4 DEALING WITH EMERGENCIES INCLUDING OIL SPILLS (owing to collision, vessel break-up, refuelling etc.)	Diesel spills from refuelling or from tank rupture (e.g. vessel collision	Minimise damage to the environment by implementing response procedures efficiently	Zero spills or leaks	• Adhere to obligations regarding other vessels in distress. • Notify SAMSA about wrecked vessels (safety and pollution) and the Department of Finance with regard to salvage, customs and royalties). Provide location details to SAN hydrographer. • In the event of an oil spill immediately implement emergency plans (see Section 7.1.1). In the case of an oil spill to sea with serious potential consequences to marine and human life notify (a) the Principal Officer of the nearest SAMSA office, (b) the DEFF Chief Directorate of Marine & Coastal Pollution Management in Cape Town, and (c) PASA. Information that should be supplied when reporting a spill includes: > Name and contact details of person reporting the incident; > The type and circumstances of incident, ship type, port of registry, nearest agent representing the ships company; > Date and time of spill; > Location (co-ordinates), source and cause of pollution; > Type and estimated quantity of oil spilled and the potential and probability of further pollution; > Weather and sea conditions; > Action taken or intended to respond to the incident; and > Supply vessels must have the necessary spill response capability to deal with accidental spills in a safe, rapid, effective and efficient manner. • Where diesel, which evaporates relatively quickly, has been spilled, the water should be agitated or mixed using a propeller boat/dinghy to aid dispersal and evaporation. This	De Beers and Appointed contractor	In event of spill	Record of all spills (Spill Record Book), including spill reports; emergency exercise reports; audit reports. Incident log

7.3 OPERATIONAL PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
				is only to be undertaken where it does not pose a health and safety risk. • Dispersants should not be used without authorisation of DEFF. Dispersants should not be used: > On diesel or light fuel oil. > On heavy fuel oil. > On slicks > 0.5 cm thick. > On any oil spills within 5 nautical miles off-shore or in depths less than 30 metres. > In areas far offshore where there is little likelihood of oil reaching the shore. • Dispersants are most effective: > On fresh crude oils; under turbulent sea conditions (as effective use of dispersants requires mixing). > When applied within 12 hours or at a maximum of 24 hours. • The volume of dispersant application should not exceed 20-30% of the oil volume.			
7.3.5 SURVEY ACTIVITIES	Increased ambient underwater noise levels	Reduce disturbance of marine fauna, particularly cetaceans (whales and dolphins).	Minimise disturbance to cetaceans Zero fatalities or injury of cetaceans	• Ensure that geophysical survey activities are conducted in compliance with the following: – 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 survey operations. – The MMO should conduct visual scans for the presence of cetaceans around the survey vessel prior to the initiation of any acoustic impulses. – Pre-survey visual scans should be of least a 15-minute duration prior to the start of survey equipment. – 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.	Appointed contractor	Throughout surveying operations	MMO / PAM Operator Reports Record information on faunal observations, survey activities and any mitigation actions taken

7.3 OPERATIONAL PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
				– Where equipment permits, "soft starts" should be carried out for equipment with source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes. Where this is not possible, the equipment should be turned on and off over a 20 minute period to act as a warning signal and allow cetaceans to move away from the sound source. – Ensure that PAM (passive acoustic monitoring) is incorporated into any surveying taking place in June and / or November.			
7.3.6 SAMPLING ACTIVITIES	Impact of sampling operations	Reduce disturbance of sampling activities on benthic biodiversity	No impact on sensitive habitats in rocky-outcrop areas	• Implement buffer zones as per section 7.1.2. No bulk sampling may take place within the buffer area. • Where possible make available non-confidential data to relevant agencies / regional or national programmes involved in biodiversity conservation / evaluation and management of marine ecosystems.	Appointed contractor	Throughout sampling operations	Records of visual sampling programme undertaken prior to bulk sampling activities
		Protection of heritage and cultural features	Limit disturbance of cultural heritage material	• Avoid sampling in any areas where identified shipwrecks (from geophysical data) are located. • If shipwreck material is encountered during the course of sampling in the concession area, the following mitigation measure will be apply: – Cease work in the directly affected area to avoid damage to the wreck until SAHRA has been notified and the contractor/De Beers has complied with any additional mitigation as specified by SAHRA; and – Where possible, take photographs of artefacts found, noting the date, time, location and types. Under no circumstances may any artefacts be removed, destroyed or interfered on the site, unless under permit from SAHRA.	De Beers and Appointed contractor	In the event a shipwreck is encountered	Records of interactions with SAHARA and identified shipwreck material
7.3.7 POLLUTION CONTROL AND WASTE MANAGEMENT of	Discharge of liquid and solid waste to sea	Minimise pollution, and maximise recycling by implementing	Compliance with MARPOL standards	• Ensure that the vessel implements a Waste Management Plan (see Section 7.1.1). The plan must comply with legal requirements (including MARPOL) for waste management and pollution control (for air and water quality levels at sea) and ensure "good housekeeping" and monitoring practices:	Appointed contractor	Throughout prospecting operations	Provide summary of waste record book / schedule and receipts. Manifest required

7.3 OPERATIONAL PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
products disposed of: into the air (exhausts, CFCs and incinerators), to sea (sewage, food, oils), to land (used oils etc, metals, plastics, glass, etc.)		and maintain pollution control and waste management procedures at all times		> General solid waste: - Initiate a waste minimisation system. - No waste should be disposed overboard. - Ensure on-board solid waste storage is secure. > Galley (food) waste: - Ensure compliance with MARPOL Annex V standards. > Deck drainage: - Deck drainage should be routed to a separate drainage system (oily water catchment system). - Ensure all process areas are bunded to ensure drainage water flows into the closed drainage system. - Ensure that weather decks are kept free of spillage. - Mop up any spills immediately. - Low-toxicity biodegradable detergents should be used in cleaning of all deck spillage. - Ensure compliance with MARPOL standards. > Machinery space drainage: Vessels must comply with international agreed standards regulated under MARPOL. All machinery space drainage would pass through an oil/water filter to reduce the oil in water concentration to less than 15 ppm. > Sewage: > Ensure compliance with MARPOL Annex IV standards. Medical waste: Seal in aseptic containers for appropriate disposal onshore. > Metal: Send to shore for recycling or disposal. > Other waste: Dispose of remaining solid waste at a licensed landfill facility or an alternative approved facility. Ensure waste disposal is carried out in accordance with appropriate laws and ordinances. > Waste oil: Return used oil to a port with a registered facility for processing or disposal. > Minor oil spill: Use oil absorbent.			for all shipments to shore. Report occurrence of minor oil spills and destination of wastes.

7.3 OPERATIONAL PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
				> Emissions to the atmosphere Ensure compliance with MARPOL Annex VI standards. > Other hazardous waste: Ensure compliance with MARPOL Annex V standards. • Ensure all crew is trained in spill management.			
7.3.8 EQUIPMENT LOSS	Dropped or lost equipment	Minimise hazards left on the seabed or floating in the water column, and inform relevant parties	Zero loss and retrieval, where possible	• Where possible, attempt the recovery of any items lost overboard. • Keep a record of lost equipment and all items lost overboard and not recovered. • When any items that constitute a seafloor or navigational hazard are lost on the seabed, or in the sea: > Complete a standard form / record sheet, which records the location, date and cause of loss, details of equipment type, weather, sea state, etc. > Notify SAMSA and SAN Hydrographer. > Request that SAN Hydrographer send out a Notice to Mariners with this information.	Appointed contractor	Throughout sampling operation	Establish a hazards database listing: • the type of gear lost • date of abandonment / loss • location; and • where applicable, the dates of retrieval
7.3.9 USE OF HELICOPTERS for crew changes, servicing, etc.	Increased ambient noise levels	Minimise disturbance / damage to marine and coastal fauna.	Zero incidents of disturbance to bird and seal colonies and whale breeding areas	• Use flight paths that do not pass over coastal reserves (MacDougall's Bay) and seal colonies (Buchu Twins and Kleinzee). • Report deviations from set flight plans. • Low altitude coastal flights (< 762 m [2 500 ft] and within 1 nm of the shore) should also be avoided, particularly during the winter/spring (June to November inclusive) whale migration period and during the November to January seal breeding season. • Brief all pilots on ecological risks associated with flying at a low level along the coast or above marine mammals. • Comply with aviation and authority guidelines and rules.	De Beers and aircraft/ helicopter contractor	As required	Copy of flight path (including altitude). Helicopter logs Records of any deviations from set flight paths

7.3 OPERATIONAL PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
7.3.10 OIL BUNKERING / REFUELLING AT SEA	Spill of hydrocarbons to sea during bunkering	Minimise disturbance / damage to marine life.	Zero spills or leaks	• No discharge of any oil whatsoever is permitted. • Offshore bunkering is not permitted within the economic zone (i.e. 200 nm from the coast) without permission from SAMSA. • Submit an application in terms of Regulation 14 of GN R1276 under the Marine Pollution (Control and Civil Liability) Act, 1981 (No. 6 of 1981) to the Principal Officer at the port nearest to where the transfer is to take place. • Inform SAMSA of location, supplier and timing, 5 days prior to refuelling at sea.	Appointed contractor / Vessel Captain	As required, 5 days prior to refuelling	Copy of notice sent to SAMSA
7.3.11 VESSEL LIGHTING	Artificial lighting	Minimise attraction of marine fauna to sampling vessel.	No unnecessary visual impacts	• Lighting on-board prospecting vessels should be reduced to the minimum required for safety levels to minimise stranding of pelagic seabirds on the vessels at night. • Any stranded seabirds must be retrieved and released during daylight hours.	Appointed contractor	As required	Records of any seabird strandings
7.3.12 MONITORING AND AUDITING	Compliance with authorisation conditions	Ensure compliance with monitoring and auditing requirements for prospecting operations.	No non-compliance	• Undertake regular audits of the sampling operations as part of the Company's ISO14001 Environmental Management System to determine the level of compliance with the EMPr requirements and conditions of the environmental authorisation. • Prepare an environmental audit report and submitted to the DMRE every two years. The audit report must comply with legal requirements contained in Appendix 7 of the 2014 EIA Regulations, as amended (or any amendments thereto). • Calculate and report on annual and cumulative sampled areas.	De Beers must appoint an independent auditor to prepare the Environmental Audit Report	Audit annually. Submit to DMRE every 2 years.	Copies of Environmental Audit Reports

7.4 DECOMMISSIONING AND CLOSURE PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
7.4.1 SURVEY/ SAMPLING VESSEL TO LEAVE AREA	Presence of survey vessel	Ensure navigational safety	Zero maritime incidents	• Where possible, attempt the recovery of any items lost overboard. • Keep a record of lost equipment and all items lost overboard and not recovered. • When any items that constitute a seafloor or navigational hazard are lost on the seabed, or in the sea: > Complete a standard form / record sheet, which records the location, date and cause of loss, details of equipment type, weather, sea state, etc. > Notify SAMSA and SAN Hydrographer. > Request that SAN Hydrographer send out a Notice to Mariners with this information. The benefits of retrieval of debris or equipment must first be weighed up against the potential environmental impacts, health and safety risks.	Appointed contractor	On completion of surveying / sampling	Copy of hazards database (see Section 7.3.8)
7.4.2 INFORM RELEVANT PARTIES OF PROSPECTING COMPLETION		Ensure that relevant parties are aware that the prospecting operation is complete	All maritime stakeholders on project database notified	• Inform all key stakeholders (see Section 7.2.1.2) that the sampling vessel is off location. • Notify the SAN Hydrographic office when the programme is complete so that the Navigational Warning can be cancelled.	De Beers	Within four weeks after completion of prospecting	Copies of notifications
7.2.3 FINAL WASTE DISPOSAL	Discharge of liquid and solid waste to sea	Minimise pollution and ensure correct disposal of waste	Zero discharge of domestic waste, food waste, cooking oil, plastics and incinerator ash	• Dispose all waste retained onboard in compliance with MARPOL Annex V.	Appointed contractor	When vessel is in port	Inventory volume of waste generated and volume transferred for onshore disposal / incinerated Waste Receipts required from contractor

7.4 DECOMMISSIONING AND CLOSURE PHASE							
Project activities:	**Aspect**	**Environmental and Social Performance Objectives:**	**Impact Management Outcomes or Targets**	**Mitigation and Impact Management Actions**	**Frequency / Timing:**	**Timing:**	**Monitoring and record keeping requirements**
7.2.4 REHABILITATION AND CLOSURE	Seabed disturbance	Ensure compliance with EMPr	Issuing of a prospecting right closure certificate from DMRE	• 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 – A completed application form to transfer environmental responsibilities and liabilities, if such transfer has been applied for.	De Beers	On completion of prospecting	Copy of prospecting right closure certificate
7.2.4.5 INFORMATION SHARING	Increasing available information of benthic environment	Expand knowledge base	Increasing knowledge base of South Africa's benthic environment	Where feasible share non-confidential data collected during the sampling programme (e.g. ROV video footage of the benthic environment), if requested, to resource managers (including DEFF, South African National Biodiversity Institute and appropriate research institutes).	De Beers	On completion of prospecting	Records of relevant interactions

8 REFERENCES

Airoldi, L., 2003. The effects of sedimentation on rocky coast assemblages. *Oceanogr. Mar. Biol. Ann. Rev.,* 41: 161–236.

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

Augustyn C.J., Lipinski, M.R. And M.A.C. Roeleveld, 1995. Distribution and abundance of sepioidea off South Africa. *S. Afr. J. Mar. Sci.* 16: 69-83.

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

Bailey, G.W., 1991. Organic carbon flux and development of oxygen deficiency on the modern Benguela continental shelf south of 22°S: spatial and temporal variability. In: TYSON, R.V., PEARSON, T.H. (Eds.), Modern and Ancient Continental Shelf Anoxia. *Geol. Soc. Spec. Publ.*, 58: 171–183.

Bailey, G.W., 1999. Severe hypoxia and its effect on marine resources in the southern Benguela upwelling system. Abstract, *International Workshop on Monitoring of Anaerobic processes in the Benguela Current Ecosystem off Namibia.*

Bailey, G.W., Beyers, C.J. De B. And S.R. Lipschitz, 1985. Seasonal variation of oxygen deficiency in waters off southern South West Africa in 1975 and 1976 and its relation to catchability and distribution of the Cape rock-lobster *Jasus lalandii*. *S. Afr. J. Mar. Sci.*, 3: 197-214.

Banks, A. Best, P.B., Gullan, A., Guissamulo, A., Cockcroft, V. & K. Findlay, 2011. Recent sightings of southern right whales in Mozambique. Document SC/S11/RW17 submitted to IWC Southern Right Whale Assessment Workshop, Buenos Aires 13-16 Sept. 2011.

Barendse, J., Best, P.B., Thomton, M., Pomilla, C. Carvalho, I. And H.C. Rosenbaum, 2010. Migration redefined ? Seasonality, movements and group composition of humpback whales *Megaptera novaeangliae* off the west coast of South Africa. *Afr. J. mar. Sci.*, 32(1): 1-22.

Barendse, J., Best, P.B., Thornton, M., Elwen, S.H., Rosenbaum, H.C., Carvalho, I., Pomilla, C., Collins, T.J.Q. And M.A. Meÿer, 2011. Transit station or destination? Attendance patterns, regional movement, and population estimate of humpback whales *Megaptera novaeangliae* off West South Africa based on photographic and genotypic matching. *African Journal of Marine Science*, 33(3): 353-373.

Berg, J.A. And R.I.E. Newell, 1986. Temporal and spatial variations in the composition of seston available to the suspension-feeder *Crassostrea virginic*a. *Estuar. Coast. Shelf. Sci*., 23: 375–386.

Best, P.B., 2001. Distribution and population separation of Bryde's whale *Balaenoptera edeni* off southern Africa. *Mar. Ecol. Prog. Ser.*, 220: 277 – 289.

Best, P.B., 2007. Whales and Dolphins of the Southern African Subregion. Cambridge University Press, Cape Town, South Africa.

Best, P.B. And C. Allison, 2010. Catch History, seasonal and temporal trends in the migration of humpback whales along the west coast of southern Africa. IWC sc/62/SH5.

Best, P.B. And C.H. Lockyer, 2002. Reproduction, growth and migrations of sei whales *Balaenoptera borealis* off the west coast of South Africa in the 1960s. *South African Journal of Marine Science*, 24: 111-133.

Bianchi, G., Hamukuaya, H. And O. Alvheim, 2001. On the dynamics of demersal fish assemblages off Namibia in the 1990s. *South African Journal of Marine Science* 23: 419-428.

Birch G.F., Rogers J., Bremner J.M. And G.J. Moir, 1976. Sedimentation controls on the continental margin of Southern Africa. *First Interdisciplinary Conf. Mar. Freshwater Res. S. Afr.*, Fiche 20A: C1-D12.

Branch, T.A., Stafford, K.M., Palacios, D.M., Allison, C., Bannister, J.L., Burton, C.L.K., Cabrera, E., Carlson, C.A., Galletti Vernazzani, B., Gill, P.C., Hucke-Gaete, R., Jenner, K.C.S., Jenner, M.-N.M., Matsuoka, K., Mikhalev, Y.A., Miyashita, T., Morrice, M.G., Nishiwaki, S., Sturrock, V.J., Tormosov, D., Anderson, R.C., Baker, A.N., Best, P.B., Borsa, P., Brownell Jr, R.L., Childerhouse, S., Findlay, K.P., Gerrodette, T., Ilangakoon, A.D., Joergensen, M., Kahn, B., Ljungblad, D.K., Maughan, B., Mccauley, R.D., Mckay, S., Norris, T.F., Oman Whale And Dolphin Research Group, Rankin, S., Samaran, F., Thiele, D., Van Waerebeek, K. And R.M. Warneke, 2007. Past and present distribution, densities and movements of blue whales in the Southern Hemisphere and northern Indian Ocean. *Mammal Review*, 37 (2): 116-175.

Brandão, A., Best, P.B. And D.S. Butterworth, 2011. Monitoring the recovery of the southern right whale in South African waters. Paper SC/S11/RW18 submitted to IWC Southern Right Whale Assessment Workshop, Buenos Aires 13-16 Sept. 2011.

Breeze, H., Davis, D.S. Butler, M. and V. Kostylev, 1997. Distribution and status of deep sea corals off Nova Scotia. Marine Issues Special Committee Special Publication No. 1. Halifax, NS: Ecology Action Centre. 58 pp.

Bremner, J.M., Rogers, J. & J.P. WILLIS, 1990. Sedimentological aspects of the 1988 Orange River floods. *Trans. Roy. Soc. S. Afr*. 47 : 247-294.

Brown, P.C. and J.L. Henry, 1985. Phytoplankton production, chlorophyll a and light penetration in the southern Benguela region during the period between 1977 and 1980. In: SHANNON, L.V. (Ed.) South African Ocean Colour and Upwelling Experiment. Cape Town, SFRI : 211-218.

Bricelj, V.M. and R.E. Malouf, 1984. Influence of algal and suspended sediment concentrations on the feeding physiology of the hard clam *Mercenaria mercenari*a. *Mar. Biol.*, 84: 155–165.

Capicorn Marine Environmental. 2015. Impact Assessment on Fisheries: Basic Assessment Process For Marine Sediment Sampling Activities In Diamond Mining Concession Areas 2C – 5C, West Coast, South Africa.

CCA Environmental. 2007a. Environmental Impact Assessment for a proposed 2D seismic survey in the Northern Block, offshore Namibia. Ref. BHP/06/NS/EIR/1

CCA Environmental. 2007b. Proposed development of the Ibhubesi gas field and associated infrastructure, West Coast, South Africa. Final Environmental Impact Report. Volume 1: Main Report. Ref. FOR07IB/FEIR/VOL.1/1

CCA Environmental. 2011. Marine Prospecting Activities in Various Areas of the West Coast South Africa: Final basic Assessment Report. Ref. AM/01/PR/FBAR

Chapman, P. And L.V. Shannon, 1985. The Benguela Ecosystem. Part II. Chemistry and related processes. *Oceanogr. Mar. Biol. Ann. Rev.*, 23: 183-251.

Christie, N.D., 1974. Distribution patterns of the benthic fauna along a transect across the continental shelf off Lamberts Bay, South Africa. Ph.D. Thesis, University of Cape Town, 110 pp & Appendices.

Clark, M.R., O'shea, S., Tracey, D. And B. Glasby, 1999. New Zealand region seamounts. Aspects of their biology, ecology and fisheries. Report prepared for the Department of Conservation, Wellington, New Zealand, August 1999. 107 pp.

Cockcroft, A.C, Schoeman, D.S., Pitcher, G.C., Bailey, G.W. And D.L. Van ZyL, 2000. A mass stranding, or 'walk out' of west coast rock lobster, *Jasus lalandii*, in Elands Bay, South Africa: Causes, results and implications. In: Von Vaupel Klein, J.C.And F.R. Schram (Eds), *The Biodiversity Crisis and Crustacea: Proceedings of the Fourth International Crustacean Congress*, Published by CRC press.

Cockcroft, A.C., Van Zyl, D. And L. Hutchings, 2008. Large-Scale Changes in the Spatial Distribution of South African West Coast Rock Lobsters: An Overview. *African Journal of Marine Science 2008, 30 (1) : 149–159.*

Coetzee, J.C., Van Der Lingen, C.D., Hutchings, L. And T.P. Fairweather, 2008. Has the fishery contributed to a major shift in the distribution of South African sardine? *ICES Journal of Marine Science* 65: 1676–1688.

Colman, J.G., Gordon, D.M., Lane, A.P., Forde, M.J. And J.J. Fitzpatrick, 2005. Carbonate mounds off Mauritania, Northwest Africa: status of deep-water corals and implications for management of fishing and oil exploration activities. In: *Cold-water Corals and Ecosystems*, Freiwald, A and Roberts, J. M. (eds). Springer-Verlag Berlin Heidelberg pp 417-441.

Compagno, L.J.V., Ebert, D.A. And P.D. Cowley, 1991. Distribution of offshore demersal cartilaginous fish (Class Chondrichthyes) off the West Coast of southern Africa, with notes on their systematics. *S. Afr. J. Mar. Sci.* 11: 43-139.

Crawford, R.J.M., Shannon, L.V. And D.E. Pollock, 1987. The Benguela ecosystem. 4. The major fish and invertebrate resources. *Oceanogr. Mar. Biol. Ann. Rev.*, 25: 353 - 505.

Crowther Campbell & Associates Cc And Centre For Marine Studies (CCA & CMS). 2001. Generic Environmental Management Programme Reports for Oil and Gas Prospecting off the Coast of South Africa. Prepared for Petroleum Agency SA, October 2001.

David, J.H.M, 1989., Seals. In: Oceans of Life off Southern Africa, Eds. Payne, A.I.L. and Crawford, R.J.M. Vlaeberg Publishers. Halfway House, South Africa.

Day, J.H., Field, J.G. And M. Montgomerey, 1971. The use of numerical methods to determine the distribution of the benthic fauna across the continental shelf of North Carolina. *Journal of Animal Ecology* 40:93-126.

De Decker, A.H., 1970. Notes on an oxygen-depleted subsurface current off the west coast of South Africa. *Invest. Rep. Div. Sea Fish. South Africa*, 84, 24 pp.

Dingle, R.V., 1973. The Geology of the Continental Shelf between Lüderitz (South West Africa) and Cape Town with special reference to Tertiary Strata. *J. Geol. Soc. Lond*., 129: 337-263.

Dingle, R.V., Birch, G.F., Bremner, J.M., De Decker, R.H., Du Plessis, A., Engelbrecht, J.C., Fincham, M.J., Fitton, T, Flemming, B.W. Gentle, R.I., Goodlad, S.W., Martin, A.K., Mills, E.G., Moir, G.J., Parker, R.J., Robson, S.H., Rogers, J. Salmon, D.A., Siesser, W.G., Simpson, E.S.W., Summerhayes, C.P., Westall, F., Winter, A. And M.W. Woodborne, 1987. Deep-sea sedimentary environments around Southern Africa (South-east Atlantic and South-west Indian Oceans). *Annals of the South African Museum* 98(1).

Drake, D.E., Cacchione, D.A. And H.A. Karl, 1985. Bottom currents and sediment transport on San Pedro Shelf, California. *J. Sed. Petr*., 55: 15-28.

Duncan, C. And J.M. Roberts, 2001. Darwin mounds: deep-sea biodiversity 'hotspots'. *Marine Conservation* 5: 12.

Dundee, B.L., 2006. *The diet and foraging ecology of chick-rearing gannets on the Namibian islands in relation to environmental features: a study using telemetry*. MSc thesis, University of Cape Town, South Africa.

Elwen, S.H., Gridley, T., Roux, J.-P., Best, P.B. & M.J. Smale, (2013). Records of Kogiid whales in Namibia, including the first record of the dwarf sperm whale (*K. sima*). *Marine Biodiversity Records*. 6, e45 doi:10.1017/S1755267213000213.

Elwen, S.H. And R.H. Leeney, 2011. Interactions between leatherback turtles and killer whales in Namibian waters, including predation. *South African Journal of Wildlife Research,* 41(2): 205-209.

Elwen, S.H. Meÿer, M.A.M, Best, P.B., Kotze, P.G.H, Thornton, M. And S. Swanson, 2006. Range and movements of a nearshore delphinid, Heaviside's dolphin *Cephalorhynchus heavisidii* a determined from satellite telemetry. *Journal of Mammalogy*, 87(5): 866–877.

Elwen, S.H., Best, P.B., Reeb, D. And M. Thornton, 2009. Near-shore diurnal movements and behaviour of Heaviside's dolphins (*Cephalorhynchus heavisidii*), with some comparative data for dusky dolphins (*Lagenorhynchus obscurus*). *South African Journal of Wildlife Research,* 39(2): 143-154.

Elwen S.H., Reeb D., Thornton M. & P.B. Best, 2009. A population estimate of Heaviside's dolphins *Cephalorhynchus heavisidii* in the southern end of their range. *Marine Mammal Science* 25: 107-124.

Elwen S.H., Snyman L. & R.H. Leeney, 2010a. Report of the Nambian Dolphin Project 2010: Ecology and consevation of coastal dolphins in Namibia. Submitted to the Ministry of Fisheries and Marine Resources, Namibia. Pp. 1-36.

Elwen S.H., Thornton M., Reeb D. & P.B. Best, 2010b. Near-shore distribution of Heaviside's (*Cephalorhynchus heavisidii*) and dusky dolphins (*Lagenorhynchus obscurus*) at the southern limit of their range in South Africa. *African Journal of Zoology* 45: 78-91.

Emanuel, B.P., Bustamante, R.H., Branch, G.M., Eekhout, S. And F.J. Odendaal, 1992. A zoogeographic and functional approach to the selection of marine reserves on the west coast of South Africa. *S. Afr. J. Mar. Sci*., 12: 341-354.

Escaravage, V., Herman, P.M.J., Merckx, B., Włodarska-Kowalczuk, M., Amouroux, J.M., Degraer, S., Grémare, A., Heip, C.H.R., Hummel, H., Karakassis, I., Labrune, C. And W. Willems, 2009. Distribution patterns of macrofaunal species diversity in subtidal soft sediments: biodiversity-productivity relationships from the MacroBen database. *Marine Ecology Progress Series* 382: 253-264.

FAO, 2008. International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. SPRFMO-VI-SWG-INF01

Findlay K.P., Best P.B., Ross G.J.B. And V.C. Cockroft. 1992. The distribution of small odontocete cetaceans off the coasts of South Africa and Namibia. *S. Afr. J. Mar. Sci.* 12: 237-270.

Fossing, H., Ferdelman, T.G. And P. Berg, 2000. Sulfate reduction and methane oxidation in continental margin sediments influenced by irrigation (South-East Atlantic off Namibia). *Geochim. Cosmochim. Acta*. 64(5): 897–910.

Frankson, L, 2017. Operation Phakisa project completed at Port Nolloth. Infrastructure News. Online: Last updated on 21 November 2017) Available at: < https://infrastructurenews.co.za/2017/11/21/operation-phakisa-project-completed-at-port-nolloth/> [Accessed on 2 March 2020].

Gray, J.S. 1974. Animal-sediment relationships. *Oceanography and Marine Biology Annual Reviews* 12: 223-261.

Hall-Spencer, J., Allain, V. And J.H. Fossa, 2002. Trawling damage to Northeast Atlantic ancient coral reefs. *Proceedings of the Royal Society of London Series B – Biological Sciences* 269: 507–511.

Haney, J.C., Haury, L.R., Mullineaux, L.S. And C.L. Fey, 1995. Sea-bird aggregation at a deep North Pacific seamount. *Marine Biology*, 123: 1-9.

Hays, G.C. Houghton, J.D.R., Isaacs, C. King, R.S. Lloyd, C. And P. Lovell, 2004. First records of oceanic dive profiles for leatherback turtles, *Dermochelys coriacea*, indicate behavioural plasticity associated with long-distance migration. *Animal Behaviour,* 67: 733-743.

Hovland, M. And E. Thomsen, 1997. Cold-water corals – are they hydrocarbon seep related? *Marine Geology* 137: 159-164.

Hovland, M., Vasshus, S., Indreeide, A., Austdal, L. and Ø. NILSEN, 2002. Mapping and imaging deep-sea coral reefs off Norway, 1982-2000. *Hydrobiol*. 471: 13-17.

Howard, J.A.E., Jarre, A., Clark, A.E. And C.L. Moloney, 2007. Application of the sequential t-test algorithm or analyzing regime shifts to the southern Benguela ecosystem. *African Journal of Marine Science* 29(3): 437-451.

HUI, C,A., 1985. Undersea topography and the comparative distributions of two pelagic cetaceans. *Fishery Bulletin*, 83(3): 472-475.

Hutchings L., Nelson G., Horstmann D.A. And R. Tarr, 1983. Interactions between coastal plankton and sand mussels along the Cape coast, South Africa. *In: Sandy Beaches as Ecosystems.* Mclachlan A and T E Erasmus (eds). Junk, The Hague. pp 481-500.

Institute for Coastal and Marine Research, Nelson Mandela University, 2020. SA EBSA Status Assessment & Management [Online] Available at: <https://cmr.mandela.ac.za/EBSA-Portal/South-Africa/SA-EBSA-Status-Assessment-Management#ZMR> [Accessed 7 August 2020].

Kendall, M.A. And S. Widdicombe, 1999. Small scale patterns in the structure of macrofaunal assemblages of shallow soft sediments. *Journal of Experimental Marine Biology and Ecology*, 237:127-140.

Kenny, A.J., Rees, H.L., Greening, J. And S. Campbell, 1998. The effects of marine gravel extraction on the macrobenthos at an experimental dredge site off north Norfolk, U.K. (Results 3 years post-dredging). *ICES CM 1998/V*:14, pp. 1-8.

Kenyon, N.H., Akhmetzhanov, A.M, Wheeler, A.J., Van Weering, T.C.E., De Haas, H. And M.K. Ivanov, 2003. Giant carbonate mud mounds in the southern Rockall Trough. *Marine Geology* 195: 5-30.

Kopaska-Merkel D.C. And D.W. Haywick, 2001. Carbonate mounds: sedimentation, organismal response, and diagenesis. *Sedimentary Geology,* 145: 157-159.

Koslow, J.A., 1996. Energetic and life history patterns of deep-sea benthic, benthopelagic and seamount associated fish. *Journal of Fish Biology*, 49A: 54-74.

Lambardi, P., Lutjeharms, J.R.E., Menacci, R., Hays, G.C. And P. Luschi, 2008. Influence of ocean currents on long-distance movement of leatherback sea turtles in the Southwest Indian Ocean. *Marine Ecology Progress Series*, 353: 289–301.

Lane, S.B. And R.A. Carter, 1999. *Generic Environmental Management Programme for Marine Diamond MIning off the West Coast of South Africa*. Marine Diamond Mines Association, Cape Town, South Africa. 6 Volumes.

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

Lipinski, M.R., 1992. Cephalopods and the Benguela ecosystem: trophic relationships and impacts. *S. Afr. J. Mar. Sci.,* 12 : 791-802.

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

Ludynia, K., 2007. *Identification and characterisation of foraging areas of seabirds in upwelling systems: biological and hydrographic implications for foraging at sea*. PhD thesis, University of Kiel, Germany.

Macissac, K., Bourbonnais, C., Kenchington, E.D., Gordon Jr. And S. Gass, 2001. Observations on the occurrence and habitat preference of corals in Atlantic Canada. *In:* (eds.) J.H.M. Willison, J. Hall, S.E. Gass, E.L.R. Kenchington, M. Butler, And P. Doherty. Proceedings of the First International Symposium on Deep-Sea Corals. Ecology Action Centre and Nova Scotia Museum, Halifax, Nova Scotia.

MacLEOD, C.D. & A. D'amico, 2006. A review of beaked whale behaviour and ecology in relation to assessing and mitigating impacts of anthropogenic noise. *Journal of Cetacean Research and Management* 7(3): 211–221.

Macpherson, E. And A. GORDOA, 1992. Trends in the demersal fish community off Namibia from 1983 to 1990. *South African Journal of Marine Science* 12: 635-649.

Majiedt, P., Holness, S., Sink, K., Oosthuizen, A. & P. Chadwick, 2013. Systematic Marine Biodiversity Plan for the West Coast of South Africa. South African National Biodiversity Institute, Cape Town. Pp 46.

Mate, B.R., Best, P.B., Lagerquist, B.A. And , M.H. Winsor, 2011. Coastal, offshore and migratory movements of South African right whales revealed by satellite telemetry. *Marine Mammal Science*, 27(3): 455-476.

Matthews, S.G. And G.C. Pitcher, 1996. Worst recorded marine mortality on the South African coast. In: Yasumoto, T, Oshima, Y. And Y. Fukuyo (Eds), *Harmful and Toxic Algal Blooms*. Intergovernmental Oceanographic Commission of UNESCO, pp 89-92.

Mclachlan, A., 1980. The definition of sandy beaches in relation to exposure: a simple rating system. *S. Afr. J. Sci.*, 76: 137-138.

Miller, D.C. And R.W. Sternberg, 1988. Field measurements of the fluid and sediment dynamic environment of a benthic deposit feeder. *J. Mar. Res.*, 46: 771-796.

Mitchell-Innes, B.A. And D.R. Walker. 1991. Short-term variability during an Anchor Station study in the southern Benguela upwelling system. Phytoplankton production and biomass in relation to species changes. *Prog. Oceanogr.*, 28: 65-89.

Monteiro, P.M.S. And A.K. Van Der Plas, 2006. Low Oxygen Water (LOW) variability in the Benguela System: Key processes and forcing scales relevant to forecasting. In: SHANNON, V., HEMPEL, G., MALANOTTE-RIZZOLI, P., MOLONEY, C. and J. WOODS (Eds). *Large Marine Ecosystems*, Vol. 15, pp 91-109.

Oosthuizen W.H., 1991. General movements of South African (Cape) fur seals *Arctocephalus pusillus pusillus* from analysis of recoveries of tagged animals. *S. Afr. J. Mar. Sci.*, 11: 21-30.

Parry, D.M., Kendall, M.A., Pilgrim, D.A. And M.B. Jones, 2003. Identification of patch structure within marine benthic landscapes using a remotely operated vehicle. *J. Exp. Mar. Biol. Ecol.,* 285– 286: 497–511.

Payne, A.I.L. And R.J.M. Crawford, 1989. *Oceans of Life off Southern Africa.* Vlaeberg, Cape Town, 380 pp.

Penney, A.J., Krohn, R.G. And C.G. Wilke. 1992. A description of the South African tuna fishery in the southern Atlantic Ocean. *ICCAT Col. Vol. Sci. Pap.* XXIX(1) : 247-253.

Pillar, S.C., 1986. Temporal and spatial variations in copepod and euphausid biomass off the southern and and south-western coasts of South Africa in 1977/78. *S. Afr. J. mar. Sci.*, 4: 219-229.

Pillar, S.C., Barange, M. And L. Hutchings, 1991. Influence of the frontal sydtem on the cross-shelf distribution of Euphausia lucens and Euphausia recurva (Euphausiacea) in the Southern Benguela System. *S. Afr. J. mar. Sci*., 11 : 475-481.

Pitcher, G.C., 1998. *Harmful algal blooms of the Benguela Current*. IOC, World Bank and Sea Fisheries Research Institute Publication. 20 pp.

Plön, S., 2004. The status and natural history of pygmy (*Kogia breviceps*) and dwarf (*K. sima*) sperm whales off Southern Africa. PhD Thesis. *Department of Zoology & Entomology* (Rhodes University), p. 551.

POST, A.L., WASSENBERG, T.J.And V. PASSLOW, 2006. Physical surrogates for macrofaunal distributions and abundance in a tropical gulf. *Marine and Freshwater Research*, 57: 469-483.

Pulfrich, A. 2013a. Environmental Management Programme Report for South African Sea Areas 2C, 3C, 4C and 5C. Pisces Environmental Services (Pty) Ltd.

Pulfrich, A. 2013ba. Environmental Management Programme Report for South African Sea Areas 2C, 3C, 4C and 5C: Addendum for Sampling Operations. Pisces Environmental Services (Pty) Ltd.

Pulfrich, A. 2014. Basic Assessment for Marine Sediment Sampling Activities in Various Diamond Mining Concession Areas, West Coast, South Africa: Marine Faunal Assessment. Pisces Environmental Services (Pty) Ltd.

Shillington, F.A. 1998. The Benguela upwelling system off Southwestern Africa, coastal segment (16,E). In *The Sea*, vol.11. Robinson, A.R. and Brink, K.H. (eds). John Wiley & Sons, Inc.

Pulfrich, A., Penney, A.J., Brandão, A., Butterworth, D.S. And M. Noffke, 2006. Marine Dredging Project: FIMS Final Report. Monitoring of Rock Lobster Abundance, Recruitment and Migration on the Southern Namibian Coast. *Prepared for De Beers Marine Namibia, July 2006*. 149pp.

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

Roberts, J.M. And J.D. Gage, 2003. Scottish Association for Marine Science Work Package 3 of ACES project: To describe the deep-water coral ecosystem, its dynamics and functioning; investigate coral biology and behaviour and assess coral sensitivity to natural and anthropogenic stressors. Final Report to the Atlantic Coral Ecosystem Study," Internal SAMS Report, 2003.

Rogers, A.D., 1994. The biology of seamounts. *Advances in Marine Biology*, 30: 305–350.

Rogers, A.D., 2004. The biology, ecology and vulnerability of seamount communities. IUCN, Gland, Switzerland. Available at: www.iucn.org/themes/ marine/pubs/pubs.htm 12 pp.

ROGERS, A.D., CLARK, M.R., HALL-SPENCER, J.M. And K.M. GJERDE, 2008. The Science behind the Guidelines: A Scientific Guide to the FAO Draft International Guidelines (December 2007) For the Management of Deep-Sea Fisheries in the High Seas and Examples of How the Guidelines May Be Practically Implemented. IUCN, Switzerland, 2008.

Rogers, J., 1977. *Sedimentation on the continental margin off the Orange River and the Namib Desert.* Unpubl. Ph.D. Thesis, Geol. Dept., Univ. Cape Town. 212 pp.

Rogers, J. And J.M. Bremner, 1991. The Benguela Ecosystem. Part VII. Marine-geological aspects. *Oceanogr. Mar. Biol. Ann. Rev*., 29: 1-85.

Rosenbaum, H.C., Pomilla, C., Mendez, M., Leslie, M.S., Best, P.B., Findlay, K.P., Minton, G., Ersts, P.J., Collins, T., Engel, M.H., Bonatto, S., Kotze, P.G.H., Meÿer, M., Barendse, J., Thornton, M., Razafindrakoto, Y.,

Ngouessono, S., Vely, M. And J. Kiszka, 2009. Population structure of humpback whales from their breeding grounds in the South Atlantic and Indian Oceans. *PLoS One*, 4 (10): 1-11.

Ross, G.J.B., 1979. Records of pygmy and dwarf sperm whales, genus *Kogia*, from southern Africa, with biological notes and some comparisons. *Annals of the Cape Province Museum (Natural History)* 11: 259-327.

Roux, J-P., Best, P.B. And P.E. Stander. 2001. Sightings of southern right whales (*Eubalaena australis*) in Namibian waters, 1971-1999. *J. Cetacean Res. Manage. (Special Issue)*. 2: 181–185.

Roux, J-P., Brady, R. And P.B. Best, 2011. Southern right whales off Namibian and their relationship with those off South Africa. Paper SC/S11/RW16 submitted to IWC Southern Right Whale Assessment Workshop, Buenos Aires 13-16 Sept. 2011.

Salas, F., Marcos, C., Neto, J.M., Patricio, J., Pérez-Ruzafa, A. And J.C. Marques, 2006. User-friendly guide for using benthic ecological indicators in coastal and marine quality assessment. *Ocean and Coastal management* 49: 308-331.

Shannon, L.V., 1985. The Benguela Ecosystem. Part 1. Evolution of the Benguela, physical features and processes. *Oceanogr. Mar. Biol. Ann. Rev.*, 23: 105-182.

Shannon, L.J., C.L. Moloney, A. Jarre & J.G. Field, 2003. Trophic flows in the southern Benguela during the 1980s and 1990s. *Journal of Marine Systems*, 39: 83 - 116.

Shannon, L.V. & F.P. Anderson, 1982. Application of satellite ocean colour imagery in the study of the Benguela Current system. *S. Afr. J. Photogrammetry, Remote Sensing and Cartography*, 13(3): 153-169.

Shannon, L.V. & J.G. Field, 1985. Are fish stocks food-limited in the southern Benguela pelagic ecosystem ? *Mar. Ecol. Prog. Ser.*, 22(1) : 7-19.

Shannon L.V. & S. Pillar, 1985. The Benguela Ecosystem III. Plankton. *Oceanography & Marine Biology: An Annual Review*, 24: 65-170.

Shannon, L.V. & M.J. O'toole, 1998. BCLME Thematic Report 2: Integrated overview of the oceanography and environmental variability of the Benguela Current region. Unpublished BCLME Report, 58pp

Shaughnessy P.D., 1979. Cape (South African) fur seal. In: Mammals in the Seas. *F.A.O. Fish. Ser.*, 5, 2: 37-40.

Sheng, Y.P., Chen, X. And E.A. Yassunda, 1994. Wave-induced sediment resuspension and mixing in shallow waters. *Coastal Engineering* : 3281-3294.

Sink, K., Holness, S., Harris, L., Majiedt, P., Atkinson, L., Robinson, T., Kirkman, S., Hutchings, L., Leslie, R., Lamberth, S., Kerwath, S., Von Der Heyden, S., Lombard, A., Attwood, C., Branch, G., Fairweather, T., Taljaard, S., Weerts, S., Cowley, P., Awad, A., Halpern, B., Grantham, H. And T. Wolf, 2012. National Biodiversity Assessment 2011: Technical Report. Volume 4: Marine and Coastal Component. South African National Biodiversity Institute, Pretoria.

Smale, M.J., Roel, B.A., Badenhorst, A. And J.G. Field, 1993. Analysis of demersal community of fish and cephalopods on the Agulhas Bank, South Africa. *Journal of Fisheries Biology* 43:169-191.

Smith, G.G And G.P. Mocke, 2002. Interaction between breaking/broken waves and infragravity-scale phenomena to control sediment sediment suspension and transport in the surf zone. *Marine Geology*, 187: 320-345.

Sprfma, 2007. Information describing seamount habitat relevant to the South Pacific Regional Fisheries Management Organisation.

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

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

Steffani, C.N. And A. Pulfrich, 2007. Biological Survey of the Macrofaunal Communities in the Atlantic 1 Mining Licence Area and the Inshore Area between Kerbehuk and Lüderitz 2001 – 2004 Surveys. *Prepared for De Beers Marine Namibia, March 2007*, 288pp.

Tyack, P.L., Zimmer, W.M.X., Moretti, D., Southall, B.L., Claridge, D.E., Durban, J.W., Clark, C.W., *et al.*, 2011. Beaked Whales Respond to Simulated and Actual Navy Sonar, 6(3). doi:10.1371/journal.pone.0017009

United Nations Environmental Programme (UNEP), 1995. *Global biodiversity assessment*. UNEP Nairobi: Cambridge University Press.

Van Dalfsen, J.A., Essink, K., Toxvig Madsen, H., Birklund, J., Romero, J. And M. Manzanera, 2000. Differential response of macrozoobenthos to marine sand extraction in the North Sea and the Western Mediterranean. *ICES J. Mar. Sci.,* 57: 1439–1445.

Visser, G.A., 1969. Analysis of Atlantic waters off the coast of southern Africa. *Investigational Report Division of Sea Fisheries, South Africa*, 75: 26 pp.

Ward, L.G., 1985. The influence of wind waves and tidal currents on sediment resuspension in Middle Chesapeake Bay. *Geo-Mar. Letters*, 5: 1-75.

Walker, D.R. And W.T. Peterson, 1991. Relationships between hydrography, phytoplankton production, biomass, cell size and species composition, and copepod production in the southern Benguela upwelling system in April 1988. *S. Afr. J. mar. Sci.*, 11: 289-306

Warwick, R.M., 1993. Environmental impact studies on marine communities: Pragmatical considerations. *Australian Journal of Ecology,* 18: 63-80.

Weir, C.R., 2011. Distribution and seasonality of cetaceans in tropical waters between Angola and the Gulf of Guinea. *African Journal of Marine Science* 33(1): 1-15.

Wheeler, A.J., Kozachenko, M., Beyer, A., Foubert, A., Huvenne, V.A.I., Klages, M., Masson, D.G., Olu-Le Roy, K. And J. Thiede, 2005. Sedimentary processes and carbonate mounds in the Belgica Mound province, Porcupine Seabight, NE Atlantic. In: *Cold-water Corals and Ecosystems*, FREIWALD, A and J.M. ROBERTS, (eds). Springer-Verlag Berlin Heidelberg pp. 571-603.

Whitehead, H., 2002. Estimates of the current global population size and historical trajectory for sperm whales. *Marine Ecology Progress Series*, 242: 295-304.

Wickens, P., 1994. Interactions between South African Fur Seals and the Purse-Seine Fishery. *Marine Mammal Science*, 10: 442–457.

Zajac, R.N., Lewis, R.S., Poppe, L.J., Twichell, D.C., Vozarik, J., and M.L. Digiacomo-Cohen, 2000. Relationships among sea-floor structure and benthic communities in Long Island Sound at regional and benthoscape scales. *J. Coast. Res.,* 16: 627– 640.

Zettler, M.L., Bochert, R. and F. Pollehne. 2009. Macrozoobenthos diversity in an oxygen minimum zone off northern Namibia. Marine Biology 156:1949-1961.

Zoutendyk, P., 1992. Turbid water in the Elizabeth Bay region: A review of the relevant literature. CSIR Report EMAS-I 92004.

Zoutendyk, P., 1995. Turbid water literature review: a supplement to the 1992 Elizabeth Bay Study. CSIR Report EMAS-I 95008.

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