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

Fisheries Specialist Study

Capricorn Marine Environmental (Pty) Ltd

20 April 2023

Executive Summary

Samara Mining (Pty) Ltd is proposing to undertake prospecting operations within Sea Areas 4C and 5C. Before these activities can be undertaken, authorisation is required in terms of the National Environmental Management Act (NEMA), 1998 (No. 107 of 1998), as amended, and a Prospecting Right has to be obtained in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002). SRK Consulting (South Africa) (Pty) Ltd has been appointed to undertake the necessary application processes and in turn have asked Capricorn Marine Environmental (Pty) Ltd to provide a specialist report on potential impacts of the proposed prospecting operations on commercial fisheries in the area.

The project would be undertaken in a phased approach commencing as soon as the Environmental Authorisation has been obtained for an expected duration of 5 years. In-field operations within the concession area would include geophysical surveys and exploration sampling in target features of interest. Should the result of the survey(s) / exploration sampling indicate potential exists, then further follow-up sampling and infill survey may be undertaken to establish the distribution of the diamondiferous material. Exploration geophysical tools that may be used include swathe bathymetry systems, sub-bottom profilers, side-scan sonars, and electrical, magnetic, and electro-magnetic systems. Bulk sampling would be undertaken. It is estimated that approximately 20 seabed sampling trenches[1], each 240 m long, 20 m wide with a depth of between 1 m and 4 m, will be excavated in the concession areas as part of the prospecting programme. Non-invasive project activities including desktop analyses of available historic prospecting data, interpretation and techno-economic feasibility studies do not form part of this report.

Several aspects of the proposed activities were identified as posing a potential risk to the fishing industry and these risks were assessed with respect to each commercial fishing sector and small-scale fisheries that operate off the West Coast of South Africa. The following project-related impacts were identified: 1) temporary safety zone around survey and sampling vessels and impact of exclusion of fishing operations; 2) discharge of sediment into the marine environment and the resulting impact of the sediment plume on fish stock recruitment and 3) noise emissions during geophysical survey and acoustic impacts on fish stocks.

Various types of survey equipment alternatives have been proposed for the current project, some of which produce an acoustic signal that would fall within the hearing range of fish and crustaceans. The noise emissions from the geophysical sources are mid- to high-frequency and highly directional, spreading as a fan from the sound source. The anticipated radius of influence would thus be significantly less than that for a deeper penetration, low frequency seismic airgun array typically used during petroleum exploration activities. Based on the proximity of fishing grounds of each of the sectors in relation to the concession area, the significance of the impact is considered to be very low for the pole-and-line, traditional linefish, west coast rock lobster (nearshore), small-scale and netfish sectors, as well as on fisheries research surveys undertaken within the area twice a year by Department of Forestry, Fisheries and the Environment (DFFE). The impact was assessed to be insignificant for the demersal trawl and demersal longline sectors. No mitigation measures are possible or considered necessary for the proposed prospecting activities.

The spawn products 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, referred to as nursery areas. These areas provide a suitable niche for development of juveniles of these species. Most of the species potentially impacted are broadcast spawners, with large volumes of spawn products being dispersed over large areas. This would apply equally, for example, to west coast rock lobster, hake, and

[1] Exploration and geotechnical results will determine the requirement.

sardine. 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

During the project activities, fishing vessels would be required to maintain a safe operational distance of 1.5 nautical miles from the survey vessel and 500 m from the sampling vessel. The impact of potential exclusion was assessed for each commercial sector based on the affected area of fishing ground and the relative quantities of catch reported within the prospecting application area. The impact magnitude was assessed based on a combination of the intensity, duration, and extent of the impact. An impact consequence was assigned to the pre-mitigation impact (i.e., before additional mitigation measures are applied, and residual impacts after additional mitigation is applied. Thereafter the impact significance rating was determined as a function of the consequence and probability (likelihood) of the impact occurring.

The impact of exclusion from fishing grounds was assessed to be of overall insignificance to the pole-and-line, traditional linefish and small-scale sectors. There is no impact of exclusion expected on the remaining commercial fisheries sectors viz, demersal trawl, mid-water trawl, demersal longline, small pelagic purse-seine, large pelagic purse-seine, west coast rock lobster, abalone ranching, netfish (beach-seine and gillnet) and the harvesting of seaweed.

Stock biomass estimate surveys by DFFE would be expected within the prospecting application area over the period January/February (demersal trawl), November (acoustic survey for small pelagic species) and again during May/June (a pre-recruitment biomass survey for small pelagic species). Survey and sampling operations that coincide with scheduled fisheries research surveys could result in a negative impact, local in extent and of very low magnitude and significance. The most effective means of mitigation would be to ensure that the proposed prospecting activities do not coincide with the research surveys. It is recommended that prior to the commencement of the proposed activities, Samara consult with the managers of the DFFE research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in order to minimises or avoid disruptions to both parties, where required.

The table below provides a summary of the impacts of each of the identified project activities, where the impact significance range across fishing sectors is presented before and after the implementation of recommended mitigation measures.

Fishery Sector	Discharge of Sediment		Noise Effects on Catch Rates		Temporary Safety Zone	
	Pre-Mitigation	Residual Impact	Pre-Mitigation	Residual Impact	Pre-Mitigation	Residual Impact
Demersal Trawl	Insignificant	Insignificant	Insignificant	Insignificant	No impact	No impact
Mid-Water Trawl	No impact	No impact	No impact	No impact	No impact	No impact
Demersal Longline	Insignificant	Insignificant	Insignificant	Insignificant	No impact	No impact
Small Pelagic Purse-Seine	Insignificant	Insignificant	No impact	No impact	No impact	No impact
Large Pelagic Longline	No impact	No impact	No impact	No impact	No impact	No impact
Pole-and-Line	Insignificant	Insignificant	Very low	Very low	Insignificant	No Impact
Traditional Linefish	Insignificant	Insignificant	Very low	Very low	Insignificant	No impact
West Coast Rock Lobster	Very Low	Very Low	Very low	Very low	No impact	No impact
Abalone (Ranching)	Insignificant	Insignificant	No impact	No impact	No impact	No impact
Small-Scale Fisheries	Insignificant	Insignificant	Very low	Very low	Insignificant	No impact
Netfish	Very low	Very low	Very low	Very low	No impact	No impact
Seaweed (Kelp harvesting)	Insignificant	Insignificant	No impact	No impact	No impact	No impact
Fisheries Research	Insignificant	Insignificant	Very low	Very low	Very low	No impact

A process of notification and information-sharing should be followed with the relevant fishing industry associations including the SA Tuna Association; SA Tuna Longline Association, South African Deepsea Trawling Industry Association (SADSTIA), South African Hake Longline Association (SAHLLA), West Coast Rock Lobster Association, South African Linefish Associations (various) and SA Marine Linefish Management Association (SAMLMA). Other key stakeholders should be notified prior to commencement and on completion of the project. These include the South African Navy Hydrographic Office (SANHO), South African Maritime Safety Association (SAMSA), Ports Authority and the Department of Environment, Forestry and Fisheries Vessel Monitoring, Control and Surveillance Unit in Cape Town (Vessel Monitoring System Unit).

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.

Table of Contents

List of Tables

List of Figures

Appendices

Acronyms and Abbreviations

BA	Basic Assessment Process
CapMarine	Capricorn Marine Environmental (Pty) Ltd
CPUE	Catch Per Unit Effort
dB	Decibel
DFFE	Department of Forestry, Fisheries and Environment
EAP	Environmental Assessment Practitioner
EMPr	Environmental Management Programme
EIA	Environmental Impact Assessment
FLO	Fisheries Liaison Officer
GRT	Gross Registered Tonnage
Hz	Hertz
ICCAT	International Convention for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission
kg	Kilogram
kHz	Kilohertz
m	Metres
NEMA	National Environmental Management Act 107 of 1998, as amended
Pa	Pascal
SADSTIA	South African Deep-Sea Trawling Industry Association
SAHALLA	South African Hake Longline Association
SANHO	South African Navy Hydrographic Office
SAMLMA	South African Marine Linefish Management Association
SAPFIA	South African Pelagic Fishing Industry Association
SASMIA	South African Squid Management Industrial Association
SATLA	South African Tuna Longline Association
S&EIR	Scoping and Environmental Impact Reporting
SRK	SRK Consulting (South Africa) (Pty) Ltd
t	Tonnes
TAC	Total Allowable Catch
TAE	Total Allowable Effort
ToR	Terms of Reference
VMS	Vessel Monitoring System

Glossary

Baseline	Information gathered at the beginning of a study which describes the environment prior to development of a project, and against which predicted changes (impacts) are measured.
Construction Phase	The stage of project development comprising site preparation as well as all construction activities associated with the development.
Cumulative Impacts	Direct and indirect impacts that act together with current or future potential impacts of other activities or proposed activities in the area/region that affect the same resources and/or receptors.
Environment	The external circumstances, conditions and objects that affect the existence of an individual, organism or group. These circumstances include biophysical, social, economic, historical, and cultural aspects.
Environmental Authorisation	Permission granted by the competent authority for the applicant to undertake listed activities in terms of the NEMA EIA Regulations, 2014 (GN R982, as amended by GN R326)
Environmental Impact Assessment	A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.
Environmental Impact Assessment Report	The report produced to relay the information gathered and assessments undertaken during the Environmental Impact Assessment.
Environmental Management Programme	A description of the means (the environmental specification) to achieve environmental objectives and targets during all stages of a specific proposed activity.
Impact	A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.
Mitigation measures	Design or management measures that are intended to minimise or enhance an impact, depending on the desired effect. These measures are ideally incorporated into a design at an early stage.
Operational Phase	The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.
Scoping	A procedure to consult with stakeholders to determine issues and concerns and for determining the extent of and approach to an EIA and EMP (one of the phases in an EIA and EMP). This process results in the development of a scope of work for the EIA, EMP and specialist studies.
Specialist study	A study into a particular aspect of the environment, undertaken by an expert in that discipline.
Stakeholders	All parties affected by and/or able to influence a project, often those in a position of authority and/or representing others.

1 Introduction

1.1 Background

Samara Mining (Pty) Ltd (Samara) intends to undertake an exploration programme in Inshore Block 4C and 5C (the Block) located approximately 10 km offshore of the West Coast of South Africa. The application is for a Prospecting Right for bulk sampling for diamonds which will be undertaken in a phased approach.

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

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

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

Where geological features of interest (showing potential for diamond prospecting) have been identified, follow up surveys and sampling will be undertaken. Sampling will entail the extraction of diamonds from the seabed using fit-for purpose vessels, equipped with a crawler that will dredge materials from the seabed. The diamonds will be sorted from the dredged material in a mechanical treatment plant on board the vessel.

Before these activities can be undertaken, authorisation is required in terms of the National Environmental Management Act (NEMA), 1998 (No. 107 of 1998), as amended, and a Prospecting Right has to be obtained in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002). SRK Consulting (South Africa) (Pty) Ltd (SRK) has been appointed to undertake the necessary application processes in terms of the NEMA, as amended, and in turn have asked Capricorn Marine Environmental (Pty) Ltd to provide a specialist report on potential impacts of the proposed operations on commercial and small-scale fisheries in the area.

1.2 Terms of Reference

This specialist report was compiled as a desktop study on behalf of SRK, for their use in preparing a Basic Assessment Report for the proposed prospecting activities off the South African West Coast. The information from this study is intended to inform the EMP process through providing fisheries baseline data for the prospecting application area and surrounds, an expert opinion on the relevant fisheries sectors including proposed mitigation measures to be implemented to manage/mitigate potential impacts of the proposed exploration activities. The specific Terms of Reference (ToR) for the Fisheries Specialist Study are as follows:

- Provide a description of the existing baseline fisheries characteristics within Sea Areas 4C and 5C (distribution of fish stocks and commercial, subsistence and recreational fishing activities).
- An introduction presenting a brief background to the study and an appreciation of the requirements stated in the specific terms of reference for the study.
- Details of the approach to the study where activities performed, and methods used are presented.
- The specific identified sensitivity of fishing sectors related to the proposed activity.

- Map/s superimposing Sea Areas 4C and 5C on the spatial distribution of effort expended by each fishing sector.
- Calculation of the proportion of fishing ground that coincides with the proposed affected area.
- Assessment of potential impacts on fisheries using prescribed impact rating methodology.
- A description of any assumptions made and any uncertainties or gaps in knowledge.
- Recommendation of mitigation measures, where appropriate.

1.3 Content of Report

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

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

GNR 982, Appendix 6 Ref.:	Item	Report Section:
(1) (a) (i)	Details of the specialist who prepared the report;	1.1, App A
(1) (a) (ii)	Expertise of that specialist to compile a specialist report including a curriculum vitae;	App A
(1) (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority;	App B
(1) (c)	An indication of the scope of, and the purpose for which, the report was prepared;	1.2
(1) (cA)	An indication of the quality and age of base data used for the specialist report;	1.4 2.1
(1) (cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	6
(1) (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	2.1.1
(1) (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	2.1.3
(1) (f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	6
(1) (g)	An identification of any areas to be avoided, including buffers;	6, 7
(1) (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	5.4
(1) (i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	1.4
(1) (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	6
(1) (k)	Any mitigation measures for inclusion in the EMPr;	6
(1) (l)	Any conditions for inclusion in the environmental authorisation;	6
(1) (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	6

GNR 982, Appendix 6 Ref.:	Item	Report Section:
(1) (n) (i)	A reasoned opinion whether the proposed activity, activities or portions thereof should be authorised;	7.2
(1) (n) (iA)	A reasoned opinion regarding the acceptability of the proposed activity or activities;	7.2
(1) (n) (ii)	If the opinion is that the proposed activity, activities, or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	6
(1) (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	2.2
(1) (p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See EIA Report
(1) (q)	Any other information requested by the competent authority.	n/a
(2)	Where the government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

1.4 Assumptions and Limitations

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

- The official governmental record of fisheries data was used to display fishing catch and effort relative to the proposed project area. These data are derived from logbooks that are completed by skippers, and it is assumed that there will be a proportion of erroneous data due to mistakes in the capturing of these data into electronic format. The proportion of erroneous data is estimated to be up to 10% of the total dataset and would be primarily related to the accurate recording or transcription of the fishing position (latitude and longitude). Where obvious errors in the reporting of fishing positions were identified these were excluded from the analysis.
- Unlike other commercial fishing sectors, the reporting requirements for small-scale fishers do not include GPS-referenced fishing locations therefore the mapping of the spatial extent of fishing grounds used by this sector is less accurate than that of the commercial sectors. Fishing areas have been inferred from the spatial distribution of commercial sectors which share targeted fish stocks namely, the inshore and offshore west coast rock lobster trap sectors, the traditional and commercial linefish sector, the snoek-directed fishing activity reported by the tuna pole-line sector and the netfish sectors.
- The effects of sound on the Catch per unit effort (CPUE) of fish and invertebrates have been drawn from the findings of international studies. To date there have been no studies focused directly on the species found locally. Although the results from international studies are likely also to be representative for local species, current gaps in knowledge on the topic lead to uncertainty when attempting to accurately quantify the potential loss of catch for each type of fishery. Research into the effects of sound on marine fauna is ongoing.

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

2 Approach

2.1 Methodology

This section provides an outline of the approach and methodology used in the study.

2.1.1 Data Source

The description of the baseline environment in the study area is based on a review and collation of existing information. Catch and effort data were sourced from the Department of Forestry, Fisheries and Environment (Branch: Fisheries) (DFFE)[2] record for the years 2000 to 2021. All data were referenced to a latitude and longitude position and were redisplayed at an appropriate spatial resolution grid. Additional information was obtained from the Marine Administration System from DFFE and from the *South Africa, Namibia, and Mozambique Fishing Industry Handbook 2019 (47th Edition).*

2.1.2 Literature Review

The information for the identification of potential impacts on fish was primarily drawn from the marine fauna specialist reports for similar project applications (Pulfrich, 2023), as well as a number of scientific publications and primarily literature reviews by Carroll et al. (2017).

2.1.3 Data Analysis

The spatial distribution of fishing effort and catch was mapped at an appropriate resolution for each fishing sector (based on the fishing method and resulting area covered by fishing gear). Fishing catch and effort within the prospecting application area was expressed as a percentage of the total effort and catch figures for each sector. This provided an indication of the proportion of fishing ground that could be affected by the presence of the survey vessel in relation to each fishing sector.

2.2 Impact Assessment

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

The significance of the impacts was assessed using the prescribed SRK impact rating methodology (see Section 6.1). The convention used to evaluate the significance of the impact is provided in Section 6.1. The sensitivity of the receptor was derived from the baseline information. The impact magnitude (or consequence) was determined based on a combination of the “intensity”, “duration” and “extent” of the impact. Magnitude was assigned to the pre-mitigation impact (i.e., before additional mitigation measures are applied, but taking into account embedded controls specified as part of the project description) and residual impacts after additional mitigation is applied. Thereafter the impact significance rating was determined as a function of the intensity and the sensitivity of the impact. Significance was assigned to the predicted impact pre-mitigation and post-mitigation (residual) after considering all possible feasible mitigation measures in accordance with the mitigation hierarchy.

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[2] On 01 April 2021, the Department of Environment, Forestry and Fisheries (DEFF) changed names to the Department of Forestry, Fisheries, and the Environment (DFFE). The substitution and designation of names for National Department and Office of the Premiers and heads thereof was published in Government Gazette 44229 (Notice No. 172) in terms of the Public Service Act on 5 March 2021. References to DEFF appear within this report.

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

3 Project Description

The proposed prospecting activities would be undertaken within the Sea Areas 4C and 5C, located off the West Coast of South Africa (Figure 3-1). The co-ordinates of the boundary points of Sea Areas 4C and 5C are provided in Table 1-1 below. The total Prospecting Right area is approximately 781 362 hectares. The eastern boundary of the proposed concession area is located approximately 14.5 km from both Port Nolloth and Kleinsee. The western boundary of the Prospecting Right area is located between approximately 140 to 195 km offshore. The Prospecting area excludes the Namaqua Fossil Forest Marine Protected Area (as well as a 5 km buffer area around the MPA), located within the concession area.

To prospect for diamonds, Samara Mining intends to use both invasive and non-invasive methods. The non-invasive method will be made up of desktop (including analytical desktop) studies, geophysical surveys, 3D geological model and resource estimation. The proposed prospecting activities would be undertaken in a phased approach, with each phase dependant on results of the previous phase.

Phase 1 (Desktop Studies): This will entail combining available historic data to get a clear understanding of the proposed diamond deposit character.

Phase 2 (Geophysical Surveying): Conducting geophysical surveys to identify geological features where exploration sampling will be undertaken. The equipment for the survey will be deployed from a vessel appropriate for the depth and survey method to be used.

Phase 3 (Exploration Sampling): Where geological features of interest (showing potential for diamond prospecting) have been identified in Phase 1 and Phase 2, follow up surveys and sampling will be undertaken in the areas of interest. The sampling will entail the extraction of diamonds from the seabed using fit-for purpose vessels that are designed for the extraction of diamonds from the seabed. The vessel will be equipped with a crawler that will dredge materials from the seabed. The diamonds will be sifted from the dredged material in a treatment plant on board the vessel.

Phase 4 (Feasibility study): Mineral resource estimation and determination of the feasibility of the project when all factors have been considered.

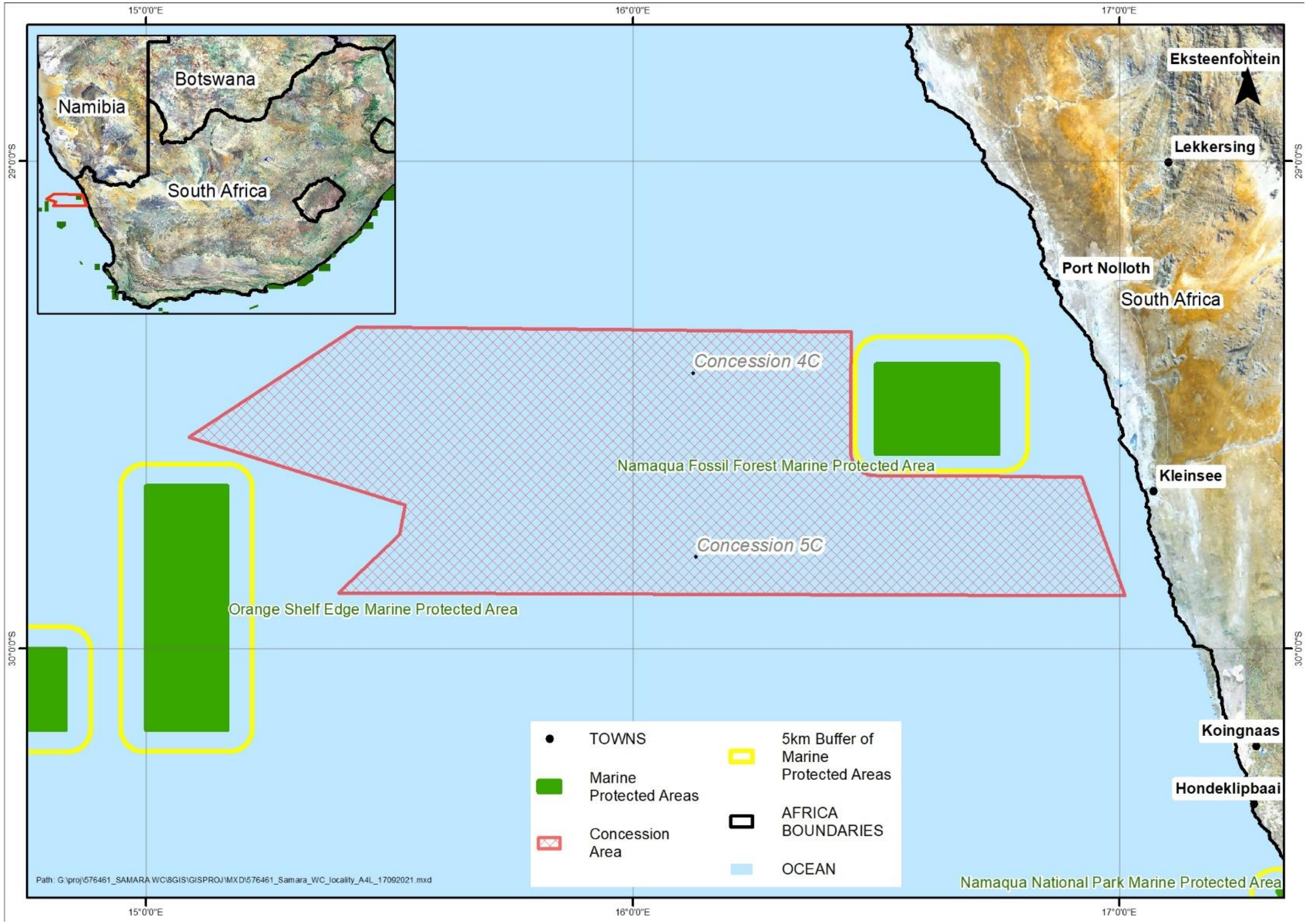

Figure 3-1: Site location (Source: SRK Consulting)

Table 3-1: Co-ordinates of the boundary points of Sea Areas 4C and 5C and the concession area.

POINT SEA AREA 4C	LONGITUDE	LATITUDE
A	15° 29' 25,928" E	29° 20' 33,856" S
B	16° 48' 18,676" E	29° 21' 5,979" S
C	16° 55' 59,101" E	29° 38' 24,614" S
D	15° 9' 5,264" E	29° 37' 9,661" S
E	15° 4' 58,99" E	29° 35' 44" S
SEA AREA 5C		
A	16° 55' 59,101" E	29° 38' 24,614" S
B	15° 9' 5,264" E	29° 37' 9,661" S
C	17° 4' 54,48" E	29° 54' 6,88" S
D	15° 39' 36,26" E	29° 54' 28,295" S
CONCESSION AREA		
A	15° 23' 41.729" E	29° 53' 9.292" S
B	17° 0' 39.610" E	29° 53' 30.475" S
C	16° 55' 17.297" E	29° 38' 55.884" S
D	16° 29' 4.514" E	29° 38' 36.963" S
E	16° 27' 3.580" E	29° 36' 45.392" S
F	16° 26' 57.021" E	29° 20' 59.416" S
G	15° 25' 59.395" E	29° 20' 25.185" S
H	15° 5' 18.746" E	29° 34' 0.002" S
I	15° 31' 55.313" E	29° 42' 21.062" S
J	15° 31' 15.615" E	29° 45' 55.726" S

The planned timeframe to complete the proposed prospecting work is provided in Table 3-2 below. Due to the dynamic nature of prospecting and evaluation, the work programme may have to be modified, extended, or curtailed as data and analyses become available.

Table 3-2: Proposed work programme.

Year	Activity	Timeframe
Phase 1	Desktop Studies, Geophysical Surveying	Month 01 – 23
Phase 2	Exploration Drilling (Sampling)	Month 24 – 37
Phase 3	Infill Geophysical Surveying, Exploration Drilling and Trench (Bulk) Sampling	Month 38 – 57
Phase 4	Feasibility Study	Month 58 – 60

3.1 Desktop Studies

Available historic prospecting data from previous exploration will be scrutinised to compile a working plan. This is data such as historical geological information, geophysical surveys and sampling which will be analysed and compiled. This is a non-invasive project activity. The desktop studies would take approximately 6 months to finalise.

3.2 Geophysical Surveying

Geophysical surveys will be conducted to identify geological features where bulk exploration sampling will be undertaken. Geophysical surveying would be undertaken over a period of 6 month. The equipment for the surveys will be deployed from a fit-for-purpose vessel suited to the water depths and survey methods.

Additional survey data acquisition will supplement existing geophysical data coverage. Various exploration geophysical tools could be used for reconnaissance surveys, including:

- Swathe bathymetry, which produces a digital terrain model of the seafloor; backscatter data may be acquired as part of the process to determine textural models. Typical multi-beam echo sounders (MBES) emit a fan of mid- to high-frequency acoustic beams from a transducer, providing depth sounding information on either side of the vessel's track across a swath width of approximately two times the water depth.
- Sub-bottom profiler (SBP) systems (e.g., "chirp" seismic systems) are low frequency echo-sounders, which generate profiles beneath the seafloor to give a cross section view of the upper sediment layers. SBP systems transmit acoustic energy to the seabed and use reflected or refracted sound energy from subsurface boundaries to infer information of seabed conditions relating to depth and shallow sub-surface geology. Penetrations typically varying between 5 to 100 m below the seabed, depending on the particular system being used.
- Side-scan sonar systems, which produce acoustic intensity images of the seafloor and are used to map the different sediment textures from associated lithology of the seafloor. A sonar device that emits conical or fan-shaped pulses toward the seafloor across a wide angle perpendicular to the path of the sensor through the water.
- Electrical, magnetic, electro-magnetic surveys, which measure local variations in the intensity of the Earth's magnetic fields (magnetometer), electrical impedance of the seabed layers (electrical resistivity) and variations in electrical properties of the seabed and bulk conductivity (electromagnetic).

The geophysical and remote sensing systems that may be utilised for the proposed geophysical surveys are described below. The likely geophysical survey equipment and its source frequencies, source noise levels and soft start capabilities are provided in Table 3-3.

Table 3-3: Specifications of acoustic equipment that may be used in the proposed geophysical surveys.

	Sound type	Frequency	Source level	Soft Start Capability
1	Multibeam Echo Sounder	40 - 100 kHz	BS = -20 dB NL = 45 dB	Yes
2	Sub Bottom Profiler – Chirp/Parametric	The two frequency ranges are typically 35 - 45 kHz and 1 to 10 kHz	>206 dB/1 μPa at 1m Dynamic range >110 dB	No

Wide spaced geophysical survey data (e.g., 100 – 2 000 km line spacing) may be acquired to refine the geological model and to identify geological features of interest for follow-up survey or sampling. Further localised geophysical survey may be undertaken, enabling refinement of the definition of the target features.

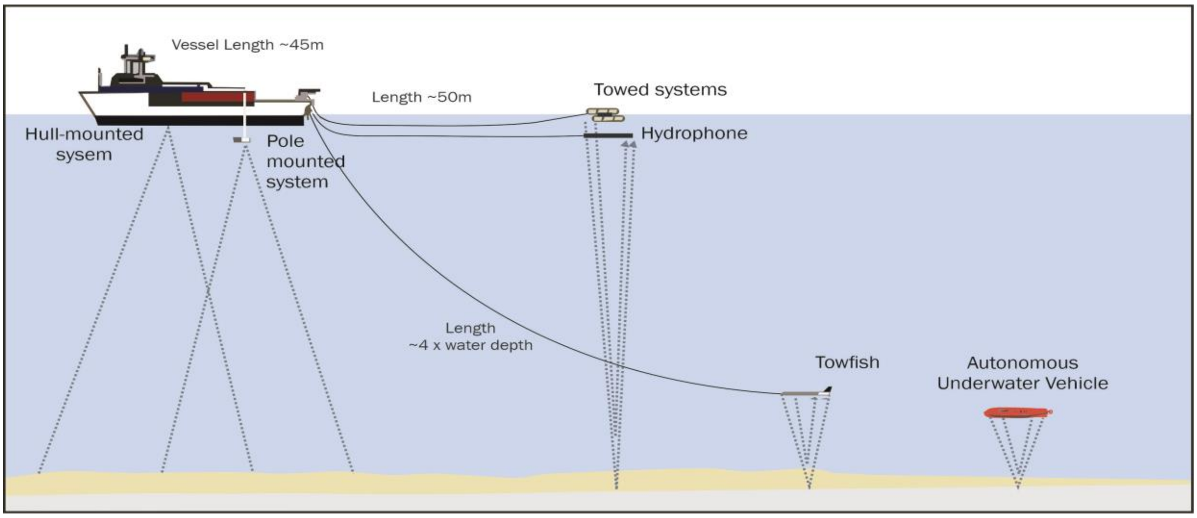

Figure 3-2: Diagram illustrating examples of the vessel-mounted, pole-mounted, and towed systems that could be used for geophysical surveys.

Multibeam Swath Bathymetry systems

The swath bathymetry system produces a digital terrain model of the seafloor and backscatter data may be acquired to determine textural models. The multi-beam system provides depth sounding information on either side of the vessel's track across a swath width of approximately two times the water depth. Typical multi-beam echo sounders emit a fan of acoustic beams from a transducer. This equipment has a variable power output and can therefore have the power ramped up in accordance with survey requirements and be contained within acceptable environmental noise levels. As a result, it is also capable of "soft starts".

Sub-bottom profiler systems

Sub-bottom profiler (SBP) systems are low frequency echo-sounders that provide profiles of the upper layers of the ocean floor. SBP systems use reflected or refracted sound energy to infer information of seabed conditions relating to depth and shallow sub-surface geology. The 2D acoustic survey involves transmitting acoustic energy to the seabed and recording energy reflected back from subsurface boundaries to acquire information on subsurface geology. These systems used for marine diamond exploration are focussed on the upper seabed layers, with penetrations typically varying between 5 to 100 m below the seabed, depending on the particular system being used. Chirp systems operate around a central frequency which is swept across a range of frequencies typically between 1.5 – 12.5 kHz. Penetrations are typically <15m below the seabed. This equipment is not capable of a "soft start". However, to mitigate this, one could start with turning on the equipment that has a soft start (e.g., Multibeam Echosounder) and then only once those are started, start the other equipment (such as the Chirp and Side Scan Sonar) that does not have a soft start.

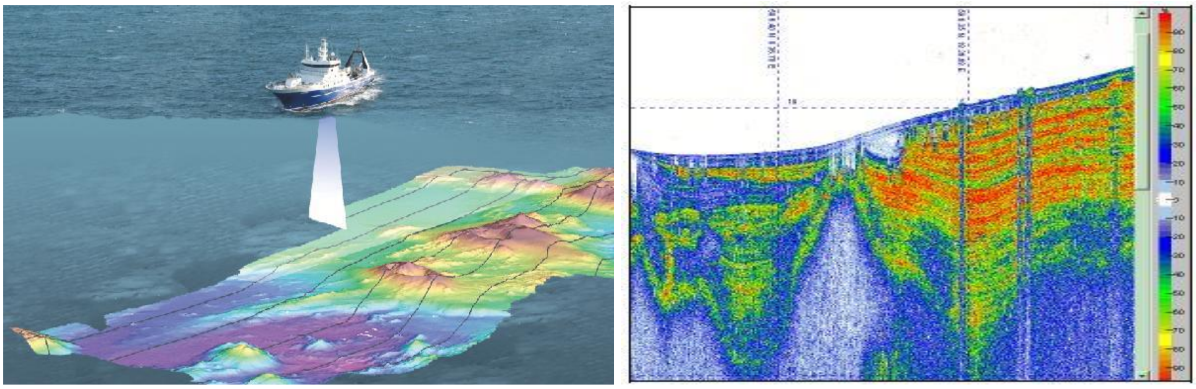

Figure 3-3: Illustration of swathe bathymetry (left) and sub-bottom profiling (right).

Side scan sonar

Side scan sonar systems produce acoustic intensity images of the seafloor and are used to map the different sediment textures of the seafloor. Side-scan uses a sonar device that emits conical or fan-shaped pulses down toward the seafloor across a wide angle perpendicular to the path of the sensor through the water. The intensity of the acoustic reflections from the seafloor of this fan-shaped beam is recorded in a series of cross-track slices. When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of the beam. This equipment is not capable of a "soft start". However, mitigation as proposed for the Chirp SBP system can be applied.

Electrical, Magnetic, Electro-Magnetic

Electrical, magnetic and/or electro-magnetic methods may possibly be used, some examples are given below:

- *Magnetometer*: A magnetometer measures local variations in the intensity of the Earth's magnetic field, which are caused by differences in composition of the sediment layers beneath the seafloor. A magnetometer is useful in defining magnetic anomalies which represent ore (direct detection), or minerals associated with ore deposits (indirect detection).
- Electrical Resistivity: Marine Resistivity surveys measure variations in the electrical resistance of layers in the seabed, through the application of electrical current into the seabed using current electrodes. Potential electrodes are then used to measure the resulting potential difference between them, which measures the electrical impedance of the seabed layers.
- Electro-magnetic (EM): EM surveys measure variations in electrical properties of the seabed and bulk conductivity. In EM survey currents are induced into the seabed through the application of time-varying magnetic fields. A towed dipole-source transmits a time-varying electro-magnetic field into the seabed and an array of receivers placed on the seabed or behind the towed transmit array then measure the seabed layers response changes in the field.

3.3 Exploration Sampling

Where geological features of interest (showing potential diamond resources) have been identified, follow up surveys and sampling will be undertaken in the areas of interest. Trench sampling may be conducted to confirm the economic viability of the resource for mining. The sampling will entail the extraction of diamonds from the seabed using fit-for-purpose vessels. Trenching would be undertaken by a seabed crawler, deployed off a dedicated mining vessel, e.g., the MV *Ya Toivo* which has a length of 150 m (see Figure 3-4, left). The vessel is equipped with a track-mounted subsea crawler capable of working to depths up to 200 m below sea level (see Figure 3-4, right).

The crawler, which is fitted with highly accurate acoustic seabed navigation and imaging systems, and equipped with an anterior suction system, is lowered to the seabed, and is controlled remotely from the surface support vessel through power and signal umbilical cables. Water jets in the crawler's suction loosen seabed sediments, and sorting bars filter out oversize boulders. The sampled sediments are pumped to the surface for shipboard processing. The area of the seabed to be sampled by crawler can only be determined following analysis of drill samples and development of a resource model.

Figure 3-4: The MV *Ya Toivo* (left) and its MK2 seabed crawler (right).

It is estimated that approximately 20 seabed sampling trenches[3], each 240 m long, 20 m wide with a depth of between 1 m and 4 m, will be excavated in the concession areas as part of the prospecting programme. The area to be disturbed in the concession would be up to 20ha or 0.003% of the overall concession extent. The aim of the trench sampling is to determine the geotechnical characteristics of the footwall and overburden which is essential in establishing the optimal approach to mining in these areas.

3.4 Feasibility Study

Geological interpretation and exploration data will be subject to statistical and geostatistical analyses over a period of 3 months. A block model of the resource will be completed, and an estimated diamond grade and diamond size will be assigned to a block. Each block will then be assigned a resource class.

Feasibility studies to define the mineral resource estimation and determine the feasibility of the project will take approximately 9 months to complete.

Prospecting results will guide the design aspects for potential future mining, depending on the class of the resource. During the third and final year all data will be compiled, interpreted, summarized, and evaluated in a final report. Several additional studies will need to be completed to inform a decision whether to proceed with development.

[3] Exploration and geotechnical results will determine the requirement.

4 Applicable Legislation and Policy

4.1 Legislative Requirements

Key legislative requirements that the proposed prospecting activities must comply with, include the following:

- Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA); and
- National Environmental Management Act (No. 107 of 1998) (NEMA).

Other legislation that may have minor relevance is listed below:

International Marine Pollution Conventions

- International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL);
- Amendment of the International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL) (Bulletin 567 – 2/08);
- International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention);
- United Nations Convention on Law of the Sea, 1982 (LOSC); and
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the London Convention) and the 1996 Protocol (the Protocol).

Other South African legislation

- Carriage of Goods by Sea Act, 1986 (No. 1 of 1986);
- Dumping at Sea Control Act, 1980(No. 73 of 1980);
- Hazardous Substances Act, 1983 and Regulations (No. 85 of 1983);
- Marine Living Resources Act, 1998 (No. 18 of 1998);
- Marine Traffic Act, 1981 (No. 2 of 1981);
- Marine Pollution (Control and Civil Liability) Act, 1981 (No. 6 of 1981);
- Marine Pollution (Prevention of Pollution from Ships) Act, 1986 (No. 2 of 1986);
- Marine Pollution (Intervention) Act, 1987 (No. 65 of 1987);
- Maritime Safety Authority Act, 1998 (No. 5 of 1998);
- Maritime Safety Authority Levies Act, 1998 (No. 6 of 1998);
- Maritime Zones Act 1994 (No. 15 of 1994);
- Merchant Shipping Act, 1951 (No. 57 of 1951);
- National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004);
- National Environmental Management: Integrated Coastal Management Act, 2008 (No. 24 of 2008);
- National Heritage Resources Act, 1999 (No. 25 of 1999);
- Occupational Health and Safety Act, 1993 (No. 85 of 1993);
- Sea-Shore Act, 1935 (No. 21 of 1935);

- Sea Birds and Seals Protection Act, 1973 (No. 46 of 1973);
- Ship Registration Act, 1998 (No. 58 of 1998);
- Water Act, 1998 (No. 36 of 1998); and
- Wreck and Salvage Act, 1995 (No. 94 of 1995).

5 Baseline

5.1 Overview of Fisheries Sectors

South Africa has a coastline that spans two ecosystems[4] over a distance of 3 623 km, extending from the Orange River in the west on the border with Namibia, to Ponta do Ouro in the east on the Mozambique border. The western coastal shelf has highly productive commercial fisheries similar to other upwelling ecosystems around the world, while the East Coast is considerably less productive but has high species diversity, including both endemic and Indo-Pacific species. The concession area lies within the southern zone of the Benguela Current region characterised by the cool Benguela upwelling system. Massive offshore movement of surface water is driven by dominant southerly and south-easterly winds in summer. This results in strong upwelling of nutrient-rich bottom waters.

South Africa's fisheries are regulated and monitored by the DFFE. All fisheries in South Africa, as well as the processing, sale in and trade of almost all marine resources, are regulated under the Marine Living Resources Act, 1998 (No. 18 of 1998) (MLRA).

Approximately 22 different fisheries sectors currently operate within South African waters. Table 5-1 lists these along with ports and regions of operation, catch landings and the number of active vessels and rights holders (2017). The proportional volume of catch and economic value of each of these sectors for 2017 is shown in Figure 5-1. The 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-directed purse-seine fishery targeting pilchard (*Sardinops sagax)*, anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whitheadii*). Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African waters by the pelagic long-line and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). The traditional line fishery targets a large assemblage of species close to shore including snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii)*, geelbek (*Atractoscion aequidens)*, kob (*Argyrosomus japonicus)*, yellowtail (*Seriola lalandi)* and other reef fish. Crustacean fisheries comprise a trap and hoop net fishery targeting West Coast rock lobster (*Jasus lalandii*), a line trap fishery targeting the South Coast rock lobster (*Palinurus gilchristi*) and a trawl fishery based solely on the East Coast targeting penaeid prawns, langoustines (*Metanephrops andamanicus* and *Nephropsis stewarti*), deep-water rock lobster (*Palinurus delagoae*) and red crab (*Chaceon macphersoni*). Other fisheries include a mid-water trawl fishery targeting horse mackerel (*Trachurus trachurus capensis*) predominantly on the Agulhas Bank (South Coast) and a hand-jig fishery targeting chokka squid (*Loligo vulgaris reynaudii*) exclusively on the South Coast.

There are more than 230 small-scale fishing communities on the South African coastline (DFFE, 2020). Small-scale fisheries commonly use boats but occur mainly close to the shore. In addition to commercial and small-scale sectors, recreational fishing occurs along the coastline comprising. Recreational fisheries comprise shore-based, estuarine, and boat-based line fisheries as well as spearfishing and net fisheries, including cast, drag and hoop net techniques.

The commercial and recreational fisheries are reported to catch over 250 marine species, although fewer than 5% of these are actively targeted by commercial fisheries, which comprise 90% of the

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[4] The Benguela Current Large Marine Ecosystem off the west coast of the country is characterised by cold water currents which support high biomass of fish stocks, whereas the Agulhas Current Large Marine Ecosystem off the east coast is characterised by warm waters and high species diversity.

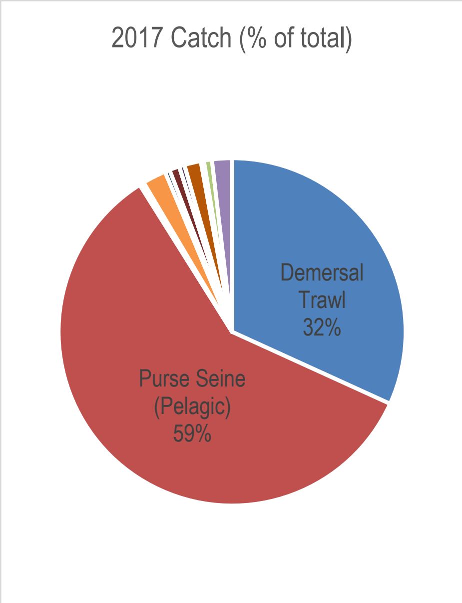
landed catch. Most commercial fish landings must take place at designated fishing harbours. For the larger industrial vessels targeting hake, only the major ports of Saldanha Bay, Cape Town, Mossel Bay and Port Elizabeth are used. On the West Coast, St. Helena Bay and Saldanha Bay are the main landing sites for the small pelagic fleets. These ports also have significant infrastructure for the processing of anchovy into fishmeal as well as the canning of sardine. Smaller fishing harbours on the West / South-West Coast include Port Nolloth, Hondeklip, Laaiplek, Hout Bay and Gansbaai harbours. On the East Coast, Durban and Richards Bay are deployment ports for the crustacean trawl and large pelagic longline sectors.

Seaweed is also regarded as a fishery, with harvesting of kelp (*Ecklonia maxima)* and (*Laminaria pallida)* in the Western and Northern Cape and hand-picking of *Gelidium* sp. in the Eastern Cape. The seaweed industry employs over 1700 people, most of whom are previously disadvantaged. *E. maxima* is primarily used by the abalone aquaculture industry as abalone feed.

Aquaculture in the marine environment ("mariculture" or "marine aquaculture") refers to the farming of marine plants and animals which is conducted in the open ocean, in enclosed sections of the ocean, or in tanks, ponds or raceways which are filled with seawater. This means that marine aquaculture sites are either directly located in the marine environment (sea-based marine aquaculture) or located on land, which abstract/utilise seawater to cultivate the produce in suitable facilities (land-based marine aquaculture). Marine aquaculture is still in its infancy in South Africa but has been identified by government as a growth industry worthy of support.

Table 5-1: South African offshore commercial fishing sectors: number of rights holders, landings, and wholesale value of production in 2017 (adapted from DEFF, 2019).

Sector	No. of Rights Holders (Vessels)	Catch (tons)	Landed Catch /sales (tons)	Wholesale Value of Production in 2017 (R'000)	% of Total Value
Small pelagic purse-seine	111 (101)	313476	313476	2164224	22.0
Demersal trawl (offshore)	50 (45)	163743	98200	3891978	39.5
Demersal trawl (inshore)	18 (31)	4452	2736	90104	0.9
Mid-water trawl	34 (6)	17545			
Demersal long-line	146 (64)	8113	8113	319228	3.2
Large pelagic long-line	30 (31)	2541	2541	154199	1.6
Tuna pole	170 (128)	2399	2399	97583	1.0
Linefish	422 (450)	4931	4931	122096	1.2
Longline shark demersal		72	72	1566	0.0
South coast rock lobster	13 (12)	699	451	*337912*	3.4
West coast rock lobster	240 (105)	1238	1238	*531659*	5.4
Crustacean trawl	6 (5)	310	310	32012	0.3
Squid jig	92 (138)	11578	11578	1099910	11.2
Miscellaneous nets	190 (N/a)	1502	1502	25589	0.3
Oysters	146 pickers	42	42	3300	0.0
Seaweeds	14 (N/a)	9877	6874	27095	0.3
Abalone	N/a (N/a)	86	86	*61920*	0.6
Aquaculture		3907	3907	881042	9.0
Total		**528966**	**458456**	**9841417**	**100**



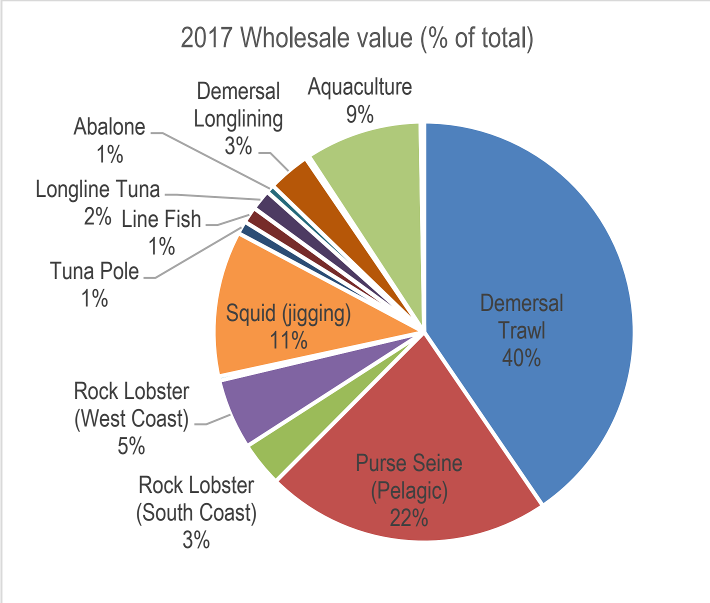


Figure 5-1: Pie chart showing percentage of landings by weight (left) and wholesale value (right) of each commercial fishery sector as a contribution to the total landings and value for all commercial fisheries sectors combined (2017). Source: DEFF, 2019.

Table 5-2: South African commercial fishing sectors that operate off the west coast, deployment ports and target species (DEFF, 2019).

Sector	Areas of Operation	Main Ports in Priority	Target Species
Small pelagic purse-seine	West, South Coast	St Helena Bay, Saldanha, Hout Bay, Gansbaai, Mossel Bay	Anchovy (*Engraulis encrasicolus*), sardine (*Sardinops sagax*), Redeye round herring (*Etrumeus whiteheadi*)
Demersal trawl (offshore)	West, South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth	Deepwater hake (*Merluccius paradoxus*), shallow-water hake (*Merluccius capensis*)
Mid-water trawl	West, South Coast	Cape Town, Port Elizabeth	Adult horse mackerel (*Trachurus capensis*)
Demersal long-line	West, South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth, Gansbaai	Shallow-water hake (*Merluccius capensis*)
Large pelagic long-line	West, South, East Coast	Cape Town, Durban, Richards Bay, Port Elizabeth	Yellowfin tuna (*T. albacares*), big eye tuna (*T. obesus*), Swordfish (*Xiphius gladius),* southern bluefin tuna (*T. maccoyii*)
Tuna pole	West, South Coast	Cape Town, Saldanha	Albacore tuna (*T. alalunga*)
Linefish	West, South, East Coast	All ports, harbours, and beaches around the coast	Snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii)*, geelbek (*Atractoscion aequidens)*, kob (*Argyrosomus japonicus)*, yellowtail (*Seriola lalandi),* Sparidae, Serranidae, Carangidae, Scombridae, Sciaenidae
West coast rock lobster	West Coast	Hout Bay, Kalk Bay, St Helena	*Jasus lalandii*
Gillnet	West Coast	False Bay to Port Nolloth	Mullet / harders (*Liza richardsonii*)
Beach seine	West, South, East Coast	Coastal	Mullet / harders (*Liza richardsonii*)
Seaweeds	West, South, East	Coastal	Beach-cast seaweeds (kelp, *Gelidium* spp. and *Gracilaria* spp.

Sector	Areas of Operation	Main Ports in Priority	Target Species
Abalone	West Coast	Coastal	*Haliotis midae*

5.2 Spawning and Recruitment of Fish Stocks

Spawning is the process by which fish lay and fertilize eggs, which then develop into new individuals. This process is critical for maintaining and replenishing fish populations. In South Africa, the timing and location of spawning for many fish species is influenced by environmental factors such as water temperature, light levels, and ocean currents.

Recruitment, on the other hand, is the process by which juvenile fish grow and mature, and eventually join the adult population. This is an important stage in the life cycle of a fish, as the survival and growth of young fish can have a major impact on the overall health of the population.

The southern African coastline is characterized by strong ocean currents. On the eastern seaboard, the warm western boundary Agulhas Current flows close to the coast before moving away from the coast on the Agulhas Bank and eventually returning to the Indian Ocean. On the western seaboard, powerful jet currents form in the southern Benguela region due to the strong thermal differences caused by upwelling and the influence of the Agulhas Current and its eddies. Generally, the surface waters in the Benguela Current flow northward and are subject to strong losses off the coast near Lüderitz, where upwelling is particularly active.

There are several mechanisms that contribute to the dispersal and loss of productive shelf waters, such as eddies, filaments, retroflections, and offshore Ekman drift, which pose challenges for the successful retention of planktonic eggs and larvae from broadcast spawners. To overcome these challenges, most fish species in southern Africa have evolved selective reproductive patterns that ensure sufficient progeny are retained or reach the nursery grounds along the coastline. Three important and one minor reproductive habitat occur between Mozambique and Angola and are utilized by a wide range of pelagic, demersal, and inshore-dwelling fish species, comprising spawning areas, transport mechanisms, and nursery grounds. The three key nursery grounds for commercially important species can be identified in South African waters as a) the Natal Bight b) the Agulhas Bank and 3) the inshore Western Cape coasts. Each is linked to a spawning area, a transport and/or recirculation mechanism, a potential for deleterious offshore or alongshore transport and an enriched productive area of coastal or shelf-edge upwelling (Hutchings et al., 2002). According to Hutchings (1992, 1994), despite the wide shelf and high primary productivity in southern Africa, fish yields are not particularly high. This suggest that the oceanographic climate is potentially restrictive to spawning success.

There are a number of factors that can negatively affect the success of recruitment in South Africa's marine fisheries, including overfishing, habitat destruction, pollution, and changes in ocean temperature and chemistry. In order to sustain healthy fish populations, it is important for management agencies to monitor and understand the factors that influence spawning and recruitment, and to implement measures to protect and conserve these processes. Most research on spawning and recruitment of commercially important species was completed in the 1990s to early 2000s, with no follow up to see if these patterns may have changed as a result of the negatively factors mentioned above.

The West Coast spawning ground

Hake, sardines, anchovy, and horse mackerel are broadcast spawners, producing large numbers of eggs that are widely dispersed in ocean currents (Hutchings et al., 2002). These principal commercial fish species undergo a critical migration pattern in the Agulhas and Benguela ecosystems.

Many species of pelagic fish that are commonly found in the major upwelling systems in the region use the central or western Agulhas Bank as a spawning area. This area is known for its surface waters that flow towards the northwest and coastal upwelling that occurs during late summer. The convergent water mass formed by this process turns into a coastal jet current that moves along the west coast, including the highly active upwelling centers at Cape Town and Cape Columbine. This jet current plays a crucial role in transporting eggs and larvae to the west coast nursery grounds, where the young fish can grow and mature. At Cape Columbine, the jet current appears to diverge, with different components flowing offshore, alongshore, and inshore. As the eggs drift, hatching takes place followed by larval development. Settlement of larvae occurs in the inshore areas, in particular the bays that are used as nurseries. Refer to Figure 5-2 for an overview of the main fish spawning grounds and nursery areas off the West and South Coasts of South Africa.

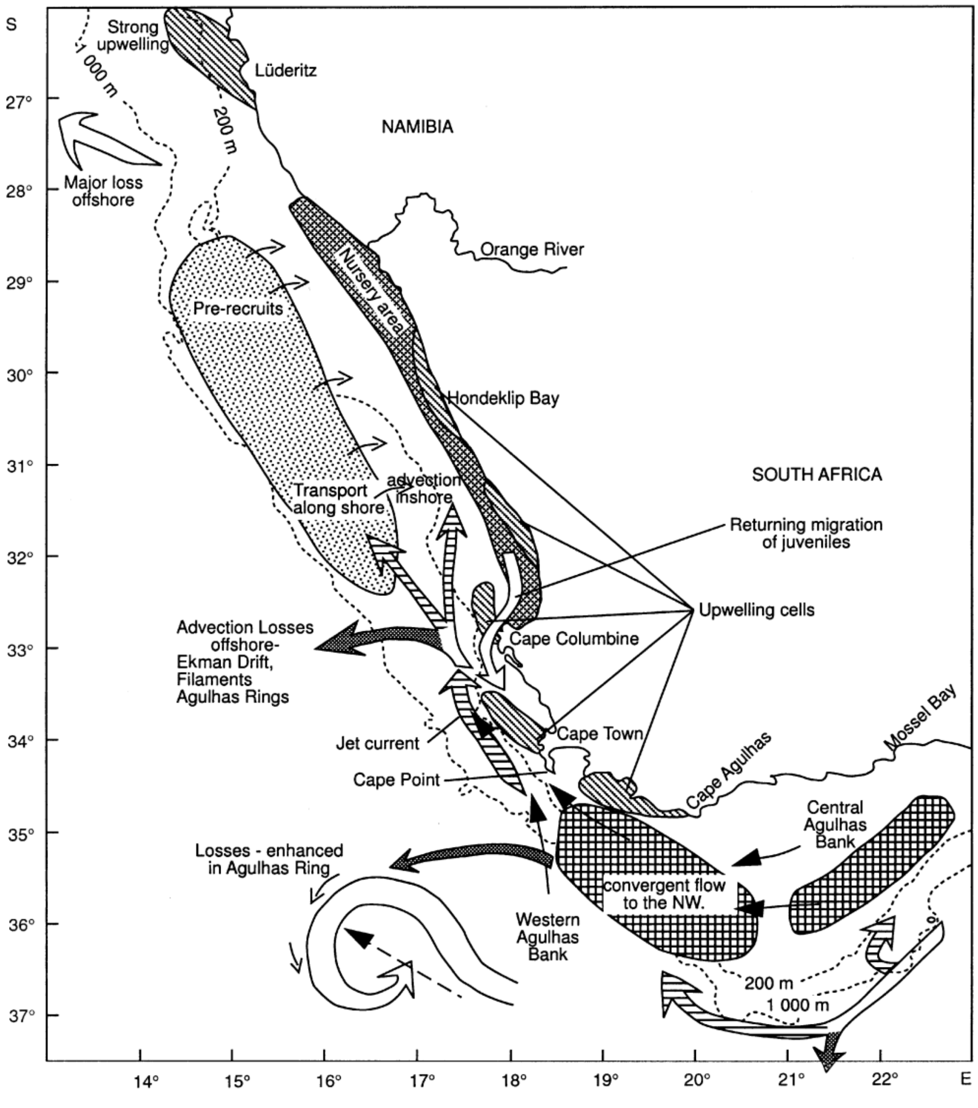


Figure 5-2: Generalised figure of the main fish recruiting process for species caught on the West Coast of South Africa (after Hutchings et al., 2002). Figure shows the West Coast nursery area and the western/central Agulhas Bank spawning grounds. Light stippled area on the West Coast marks the main recruiting area for the small pelagic fishery and dark stippled area on the Agulhas Bank marks the main spawning grounds for small pelagic fish.

Horse mackerel

Horse mackerel spawns in the east/central Agulhas Bank during the winter months and the young juveniles can be found close inshore along the southern Cape coastline (20–26°E) However, during the summer months, there is a significant overlap with the inshore west coast nursery habitat (Barange et al. 1998). As the horse mackerel mature, they become more demersal and move offshore before migrating back to the Agulhas Bank as adults.

Anchovies

Anchovies spawn on the entire Agulhas Bank from October to March with the highest spawning activity occurring during mid-summer (November–December; van der Lingen and Huggett, 2003; See Figure 5-3). In some years, when the Agulhas Bank water strongly intrudes north of Cape Point, there is a shift in the anchovy spawning to the west coast (van der Lingen et al. 2001). The bulk of the anchovy recruits can be found along the west coast, with less than 5% found on the inshore south coast (Hampton 1992; See Figure 5-4). Older anchovies tend to shift further east to the central and eastern parts of the Agulhas Bank and often spawn between the cool ridge and the Agulhas Current (Roel et al. 1994). Since 1994, there has been a noticeable eastward shift in the anchovy spawning distribution to the east-central Agulhas Bank. While anchovies are known to spawn on the east coast shelf, the narrow shelf limits the population size of the spawners (Armstrong et al. 1991; Beckley and Hewitson 1994).

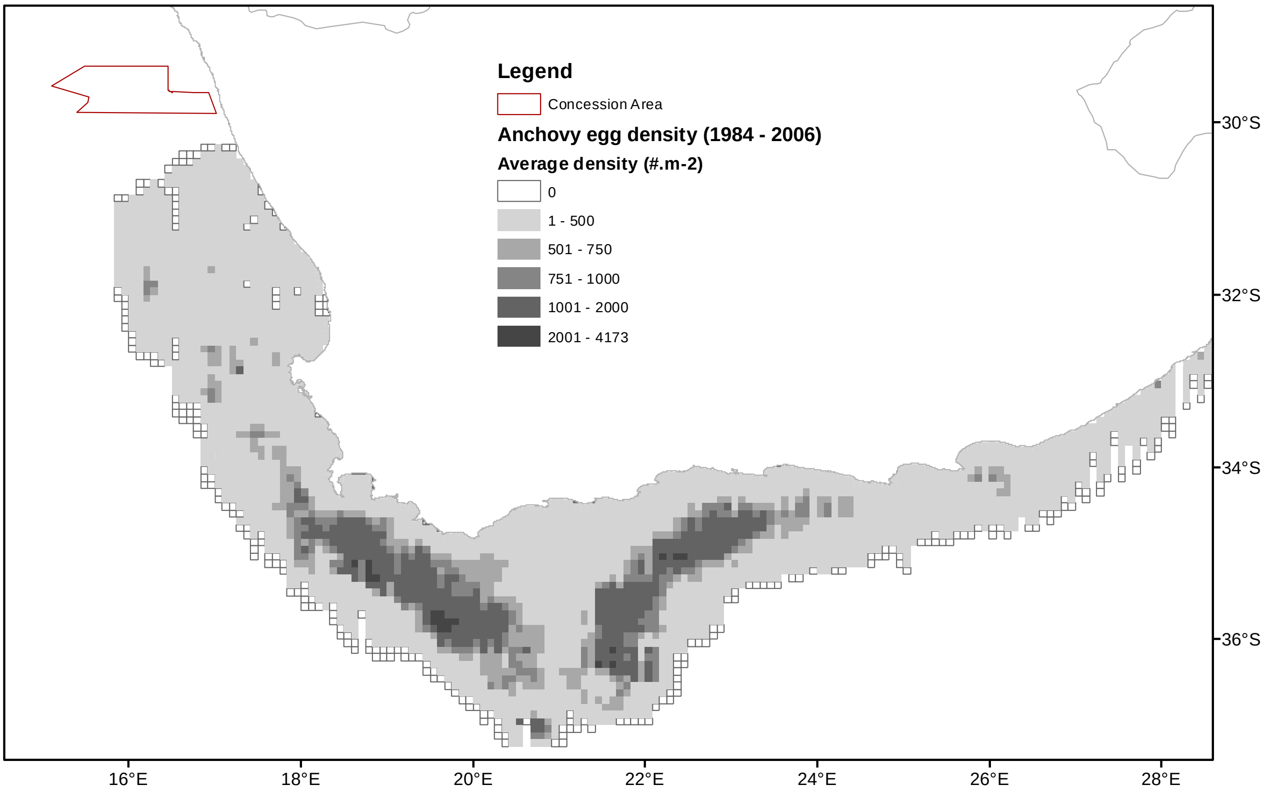


Figure 5-3: The concession area (red polygon) in relation to the distribution of anchovy spawning areas, as measured by egg densities (DFFE).

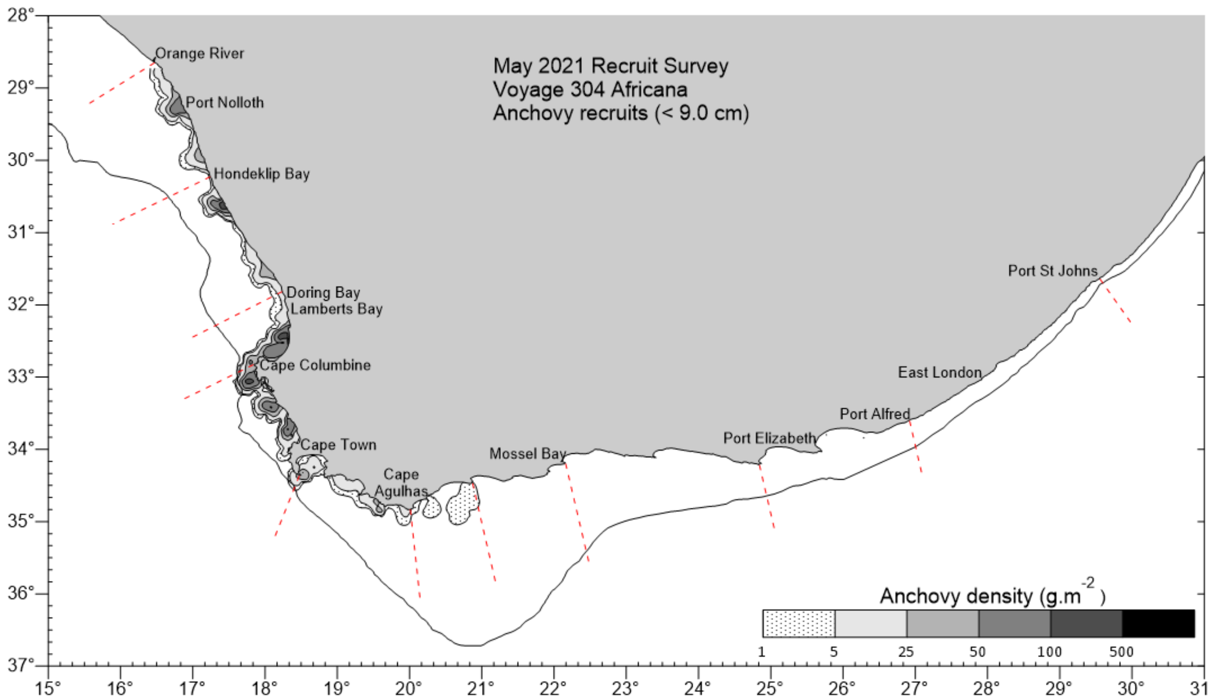


Figure 5-4: Distribution and relative abundance of anchovy recruits (< 9 cm) (Source: DFFE Small Pelagic Scientific Working Group FISHERIES/2021/JUL/SWG-PEL/51draft

Sardines

There are two stocks of sardine off South Africa; the Cool Temperate Sardine (CTS) off the west coast and Warm Temperate Sardine (WTS) off the south coast, with some mixing (in both directions) between the two (Teske et al. 2021; See Figure 5-5). In the West Coast Spawning Ground, the stock of interest is the CTS.

Sardines spawn in a similar area to anchovies during November and generally have two spawning peaks in early spring and autumn, which occur on either side of the peak anchovy spawning period. There has been a recent shift westward in the sardine spawning distribution in November, with the majority of spawning now occurring on the west coast between latitudes 31°S and 35°S, and to a lesser extent, off the central and eastern Agulhas Bank, concurrent with anchovy (Beckley and van der Lingen 1999; See Figure 5-6). Sardine spawning also occurs on the east coast and even off KwaZulu-Natal, where sardine eggs can be found from July to November. Importantly, the eggs of both anchovies and sardines are frequently found far offshore on the Agulhas Bank, sometimes extending over the shelf break, and they spawn in a narrow zone between the cool upwelling ridge and the rapidly flowing Agulhas Current.

On the western seaboard, the sardine eggs that are deposited in the peripheral shelf areas are susceptible to being moved away from the coast by powerful equatorial winds that cause Ekman drift. Additionally, the eggs and larvae can be caught up in filaments or Agulhas Rings and transported further out to sea. Sardines have a lengthy spawning season that spans from late winter to spring and from autumn, when the southern winds are not at their strongest. The majority of the new recruits on the west coast likely originate from eggs laid either before or after the summer southern wind peak (See Figure 5-7). Juveniles shoal and then begin a southward migration. It is at this stage that both anchovy and sardine are targeted by the small pelagic purse seine fishery.

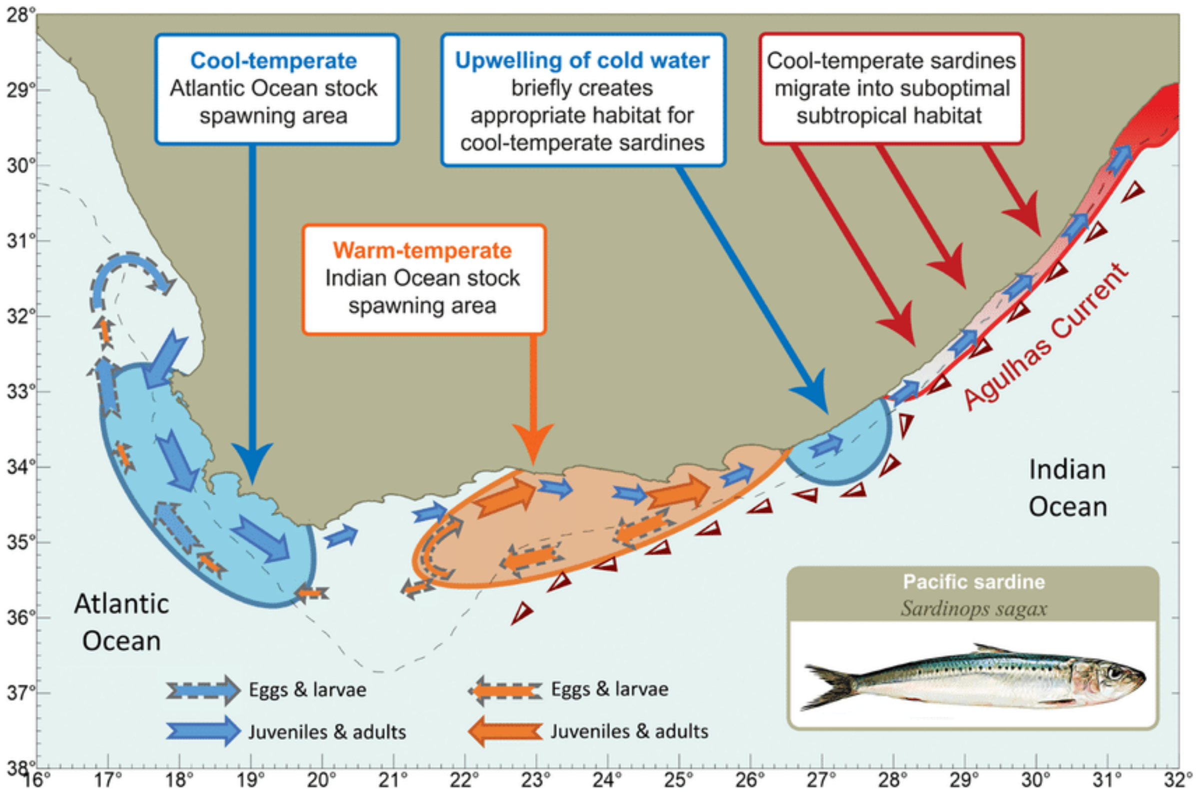


Figure 5-5 Stock structure of Pacific sardine, *S. sagax*, in South African waters. The spawning area in the Atlantic Ocean (blue) is numerically dominated by cool-temperate sardine, and the spawning area in the Indian Ocean (orange) is dominated by warm-temperate sardines (Source: Teske et al. 2021)

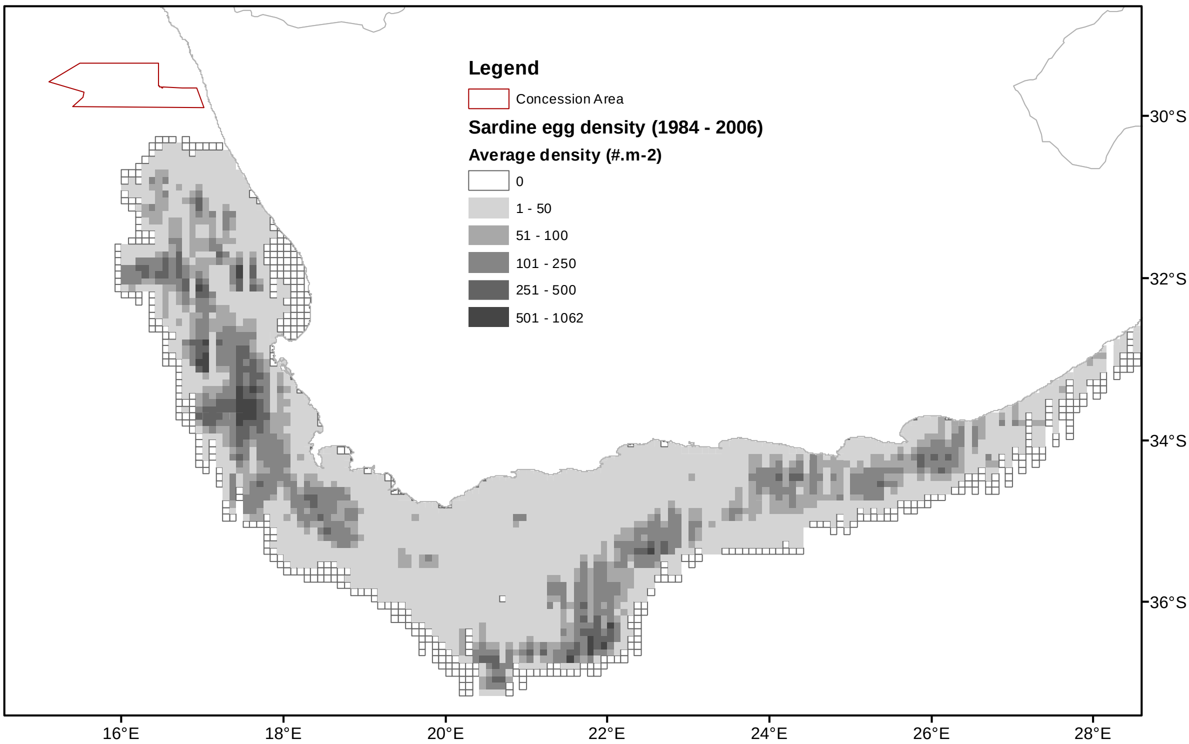


Figure 5-6: The concession area (red polygon) in relation to the distribution of sardine spawning areas, as measured by egg densities (collected during spawner biomass surveys by DFFE over the period 1984 to 2006).

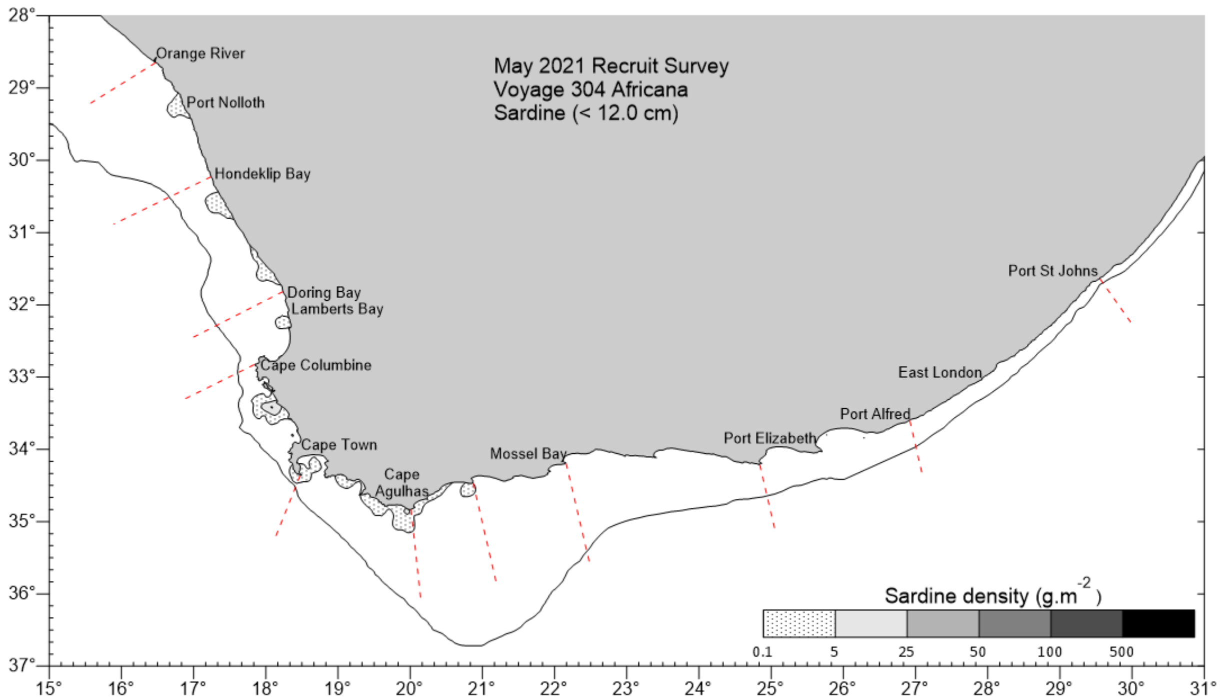


Figure 5-7: Distribution and relative abundance of sardine recruits (< 12 cm) (Source: DFFE Small Pelagic Scientific Working Group FISHERIES/2021/JUL/SWG-PEL/51draft.

Hake species

The two hake species, shallow-water hake (*M. capensis*) and deep-water hake (*M. paradoxus*), have different spawning patterns in terms of depth and timing. Hake spawn throughout the year, with peaks in October/November and March/April, and are serial spawners (Johann Augustyn, SADSTIA and Dave Japp, CapMarine pers com.). Although the Namibian spawning ground will be discussed separately it is important to note that deep-water hake (*M. paradoxus*) do not spawn in Namibian waters, but shallow-water hake (*M. capensis*) does. Adult hakes generally migrate offshore during June to August, and it is here that they are targeted by commercial fisheries. However, it's important to note that the timing and extent of adult hake movements can vary depending on factors such as water temperature, food availability, and environmental conditions.

Shallow-water hake spawn mainly over the shelf, at depths less than 200 m, while deep-water hake spawn in deeper waters beyond the shelf. Although both species spawn throughout their distributional range, high spawning concentrations occur mid-shelf off Cape Columbine and on the western Agulhas Bank, with peak spawning areas observed at 31.0°-32.5°S and 34.5°-36.0°S (Jansen et al., 2015; Refer to Figure 5-8).

The depth at which the hake species spawn differs as well, with *M. paradoxus* spawning at bottom depths between 200 m and 650 m, and *M. capensis* spawning at an average depth of 180 m. The distribution of their eggs also varies, with *M. paradoxus* eggs distributed over greater bottom depths (340 m – 1500 m) than *M. capensis* eggs (120 m to 300 m) (Stenevik et al., 2008; See Figure 5-9).

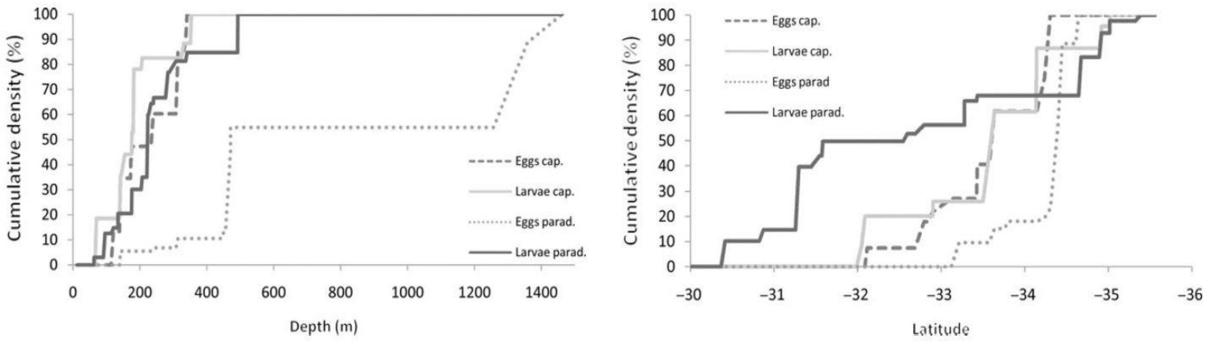


Figure 5-8: Cumulative density plots of Cape hake eggs and larvae sorted by (left panel) increasing seafloor depth and (right panel) increasing latitude (degrees south) (Source: Stenevik et al., 2008).

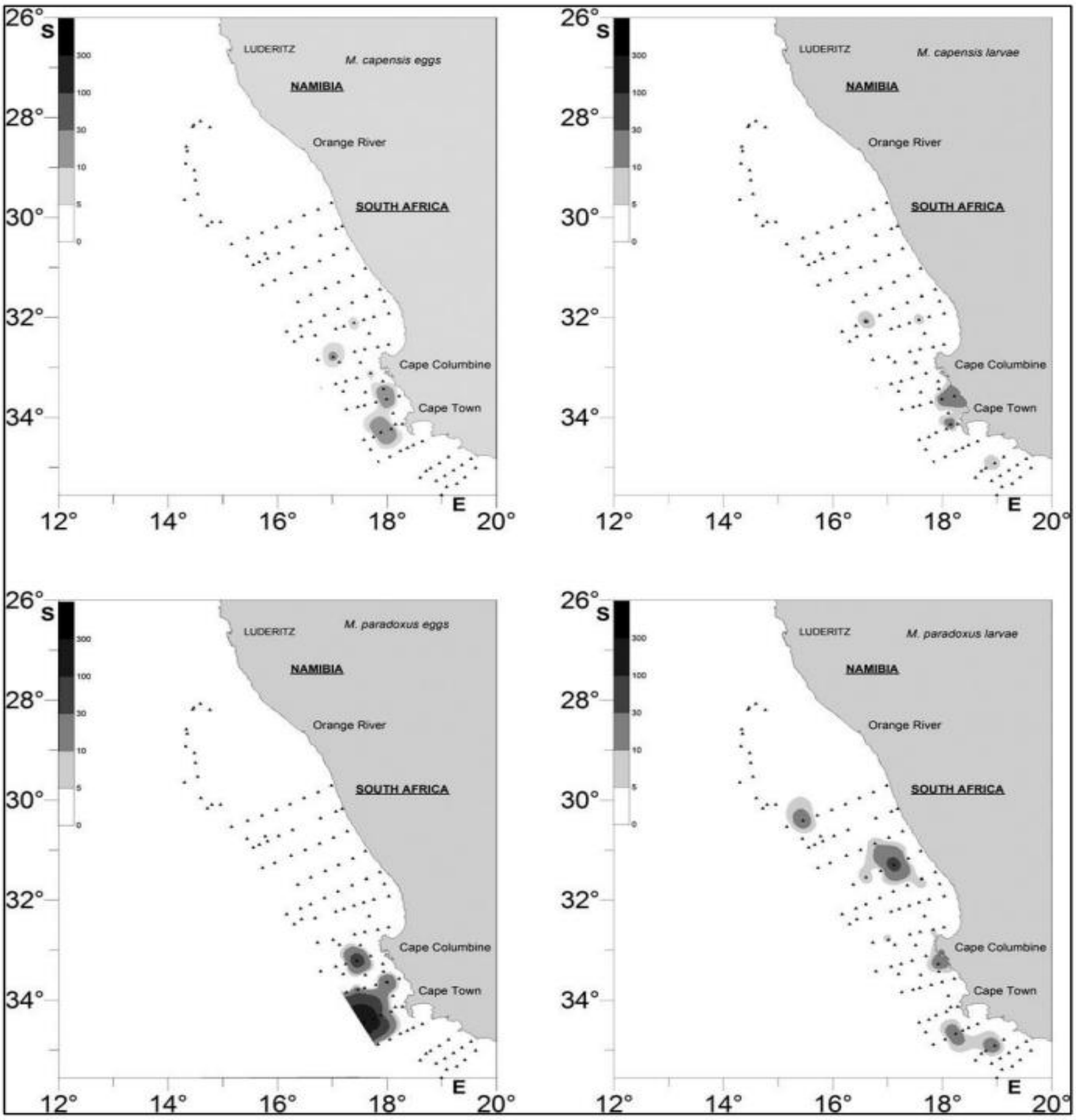


Figure 5-9: Station map showing the distribution of eggs (left) and larvae (right) of Cape hakes (*M. capensis* upper and *M. paradoxus* lower) during a research survey conducted between September and October 2005. Numbers per 10 m^2 (Stenevik et al., 2008).

Water currents play a crucial role in the transport of hake spawning products. The offshore drift route along the outer shelf carries the eggs and larvae of both species away from the coast and into the deep ocean, while inshore drift transports larvae along the west coast to the Orange Banks, with *M. paradoxus* mainly concentrated around the 100 m depth contour (Stromme et al., 2015). Eggs spawned inshore are likely to be transported in the slower inshore branch of the current from the western Agulhas Bank to inshore areas farther north (Grote et al., 2012 in Jansen et al., 2015). The vertical distribution of hake eggs and larvae is between the surface and 200 m depth, with the highest concentrations in the 50 – 100 m depth range (Stenevik et al., 2008). Compared to pelagic species, the eggs and larvae of hake are found deeper in the water column, making them less vulnerable to Ekman transport (Sundby et al., 2001; Hutchings et al., 2002 in Stenevik et al., 2008).

Snoek

Snoek (*Thyrsites atun*) is a valuable commercial species and is targeted during their inshore migration period by the linefishery and small-scale fishers. It is also landed by the demersal trawl fishery as a by-catch species. Snoek is also a significant predator of small pelagic fish in the Benguela ecosystem. The South African population reaches 50% sexual maturity at a fork length of around 73 cm (3 years). Spawning takes place offshore during winter-spring (June to October) along the shelf break (150-400 m) of the western Agulhas Bank and the South African west coast. Eggs and larvae are transported by prevailing currents to a primary nursery ground located north of Cape Columbine and a secondary nursery area situated to the east of Danger Point, both shallower than 150 m (Figure 5-10). Juveniles grow between 33 and 44 cm in their first year (3.25 cm/month) and remain on the nursery grounds until maturity. Their onshore-offshore distribution between 5 and 150 m isobaths is determined primarily by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment.

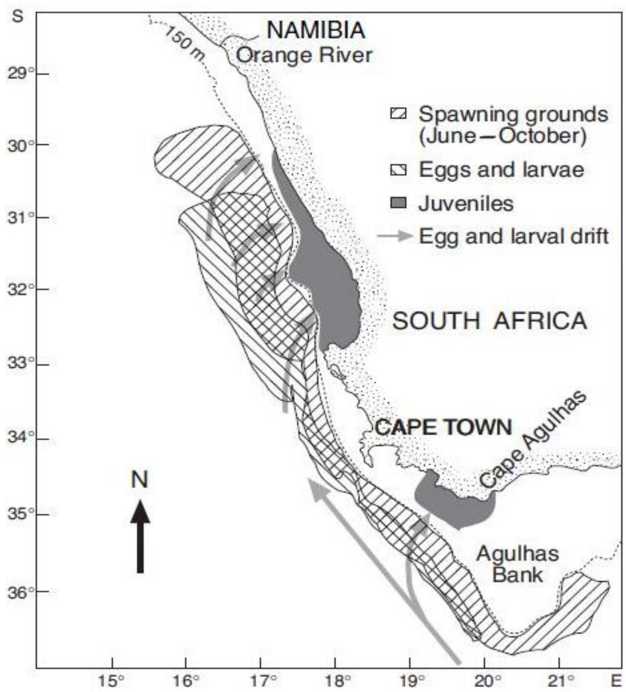


Figure 5-10: Conceptual model depicting the life history of snoek (Source: Griffiths, 2002) in the southern Benguela ecosystem, including spawning grounds, distribution and transport of eggs and larvae, and the nursery areas.

Adults can be found throughout the distribution range of the species, and while they move offshore to spawn, there is a southward dispersion as the spawning season progresses. Their longshore movement is apparently random and without a seasonal basis. The relative condition of both sexes declines significantly during spawning, with females experiencing higher mesenteric fat loss despite consuming prey at a greater rate. Sex ratios and indices of prey consumption suggest that females on the west coast move inshore to feed between spawning events, while those found farther south along the western Agulhas Bank remain on the spawning ground throughout the season. This difference in behavior is attributed to the higher offshore abundance of clupeid prey on the western Agulhas Bank, as determined from diet and prey consumption rates (Griffiths, 2002; refer to Figure 5-10 for the spawning grounds and nursery areas for snoek).

Other important linefish

The inshore area of the Agulhas Bank, especially between the cool water ridge and the shore, serves as an important nursery area for numerous linefish species (e.g., elf *Pomatomus saltatrix*, leervis *Lichia amia*, geelbek *Atractoscion aequidens*, carpenter *Argyrozona argyrozona*) (Wallace et al. 1984; Smale et al. 1994). A significant proportion of these eggs and larvae originate from spawning grounds along the east coast, as adults undertake spawning migrations along the South Coast into KwaZulu-Natal waters (van der Elst 1976, 1981; Griffiths 1987; Garratt 1988; Beckley & van Ballegooyen 1992). The eggs and larvae are subsequently dispersed southwards by the Agulhas Current, with juveniles occurring on the inshore Agulhas Bank, using the area between the cold-water ridge and the shore as nursery grounds (van der Elst 1976, 1981; Garratt 1988). In the case of the carpenter, a high proportion of the reproductive output comes from the central Agulhas Bank and the Tsitsikamma Marine Protected Area (MPA), and two separate nursery grounds exist, one near Gqeberha and a second off the deep reefs off Cape Agulhas, with older fish spreading eastwards and westwards (van der Lingen et al. 2006).

For breeding season and locality of prominent commercial, recreational and artisanal linefish species associated with the Western Cape please refer to the Table 5-3. Table 5-4 shows known spawning periods of key commercial species off the West Coast of South Africa.

Table 5-3 Summary breeding season and locality for important linefish species in Western Cape. Information adapted from Marine Linefish Species Profiles (Mann et al. 2013).

Common Name	*Scientific Name*	*Concerned Fishery*	*Breeding/spawning Season*	*Breeding/spawning Locality*
Blue Hottentot	*Pachymetopon blochii*	Artisanal line fishery, Recreational shore anglers and ski-boat fishers, bycatch of the gill-net fishery.	Throughout the year, with peaks in winter and summer (Pulfrich and Griffiths1988)	Throughout its distribution range (Pulfrich and Griffiths 1988)
Carpenter	*Argyrozona argyrozona*	Commercial line fishery, bycatch in demersal trawl (Attwood et al. 2011)	Summer and autumn (Brouwer and Griffiths 2005)	Throughout its distribution range (Brouwer and Griffiths 2005)
Dusky Kob	*Argyrosomus japonicus*	Mostly recreational shore, estuarine and ski boat anglers but also a component of commercial and artisanal line fishery.	October to January in the Eastern and Western Cape (Griffiths 1996)	Inshore reefs, pinnacles and wrecks (mainly at night) in KZN, Transkei and EC (Griffiths 1996, Connell 2012)
Geelbek	*Atractoscion aequidens*	Boat-based commercial and recreational line fishery. To a lesser extent, artisanal line fishery. Bycatch of the inshore demersal trawl.	Aug-Nov with a peak in Sep-Oct (Garratt 1988, Griffiths and Hecht 1995b, Connell 2012)	KZN offshore reefs 40-60m (Griffiths and Hecht 1995b, Connell 2012)
Red Roman	*Chrysoblephus laticeps*	Commercial and recreational line fishery.	Oct-Jan (Buxton 1990) observed Nov-Feb in the Goukamma area, WC (Götz 2005)	Eastern and Western Cape
Silver Kob	*Argyrosomus inodorus*	Recreational and commercial line fishery in SA and Namibia, bycatch of inshore trawl, taken by artisanal beach seine fishery.	Throughout the year, mainly from Aug-Dec with a peak between Sep-Nov (Griffiths 1997)	Inshore throughout distribution (Griffiths 1997)
White stumpnose	*Rhabdosargus globiceps*	Commercial and Recreational line fishery, occasional bycatch to artisanal net fisheries.	Summer, Sep-Mar (Griffiths et al. 2002).	Throughout the distribution range (Griffiths et al. 2002)
Yellowtail	*Seriola lalandi*	Large component of commercial line fishery, recreational fishery and artisanal beach seine fishers off Simonstown.	November to February.	Southern KZN to Cape Point.

Table 5-4: Summary table of known spawning periods for key commercial species off the West Coast of South Africa, which have been detailed in section 5.4.

Species	*Breeding/Spawning Season*	*Breeding/Spawning Locality*	*Recruits*
Horse mackerel	June to August	Central/ Eastern Agulhas Bank	Inshore southern Cape
Anchovy	October to March, peaks November to December	Agulhas Bank and West Coast nursery grounds	Inshore West Coast
Sardine	August to February	West Coast and Agulhas nursery grounds	Migrate South East back to Agulhas Bank
Hake spp.	Throughout the year, peaks in March/April and October/November	Throughout SA distribution, concentrated mid-shelf Cape Columbine and W Agulhas Bank	Inshore, migrate to depth as adults
Snoek	June to October	West Coast and Agulhas Bank	Cape Columbine and Danger Point nursery
Squid	Throughout the year with peaks in November and December	Nearshore Eastern Agulhas Bank	Offshore and Westward

5.3 Research Surveys

Swept-area trawl surveys of demersal fish resources are carried out twice a year by DFFE in order to assess stock abundance. Results from these surveys are used to set the annual TACs for demersal fisheries. First started in 1985, the West Coast survey extends from Cape Agulhas (20°E) to the Namibian maritime boarder and takes place over the duration of approximately one month between January and March. The survey of the Southeast coast (20°E – 27°E longitude) takes place in April/May. Following a stratified, random design, 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. Trawl positions are randomly selected to cover specific depth strata that range from the coast to the 1 000 m isobath. Figure 5-11 shows the spatial distribution of research trawls in relation to the concession area. Over the period 2013 to 2021 an average of six trawls per survey were undertaken within the concession area at a depth range of 120 m to 200 m. Research activity within the area takes place during February/March.

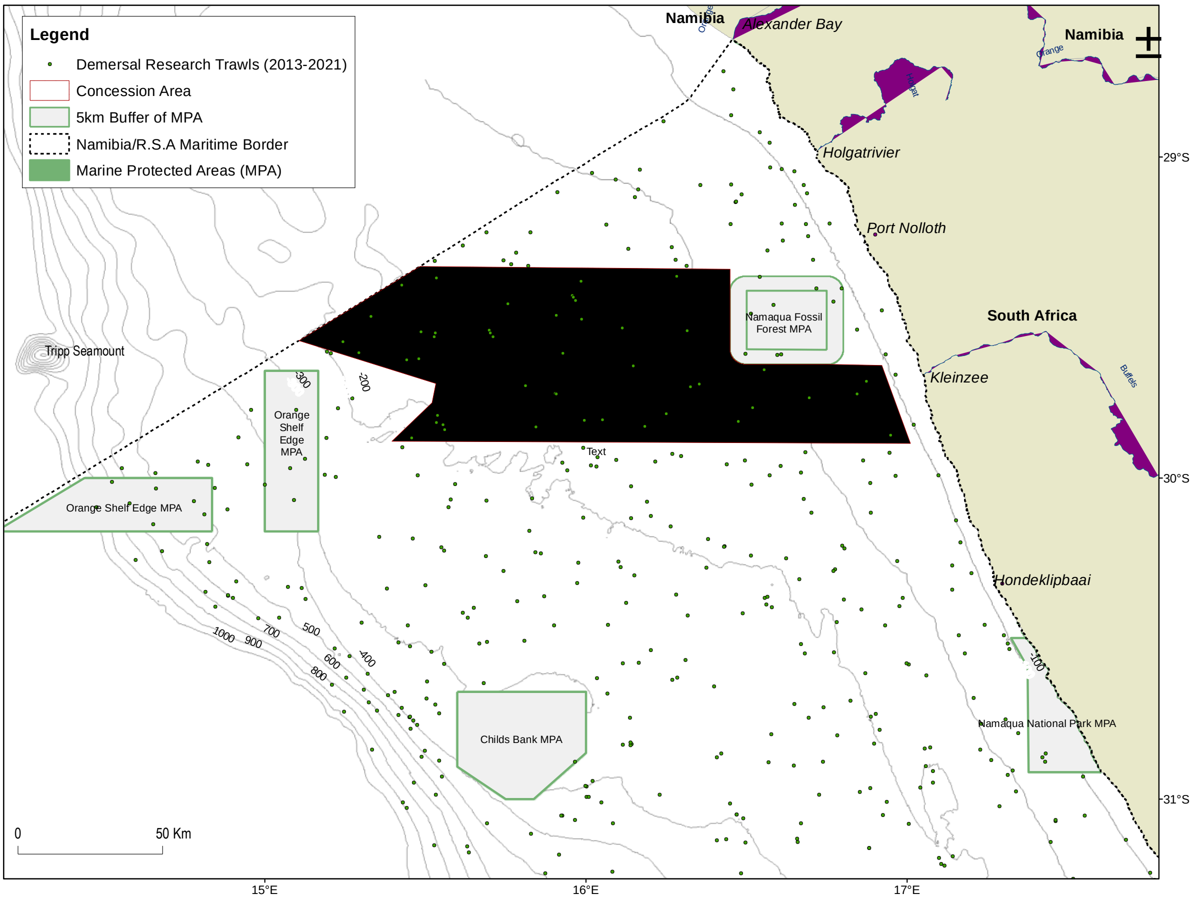


Figure 5-11: Spatial distribution of trawling effort expended by DFFE over the period 2013 to 2021 in assessing the biomass of demersal fish species.

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. 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 DFFE survey vessel progresses systematically from the Northern border Southwards, around Cape Agulhas and on towards the east. 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. There are a few occasions that the transects off Cape Point will just extend to about 1000 m, with the shelf being so narrow there and the offshore fish distribution being dictated by strong frontal features, there would be occasions where the survey would go even further offshore than the 1000 m. Figure 5-12 shows the abundance of anchovy recruits as measured in the most recent 2020 pelagic recruitment survey undertaken by DFFE. Figure 5-13 shows that up to five research survey transects are undertaken by DFFE within Sea Areas 4C and 5C.

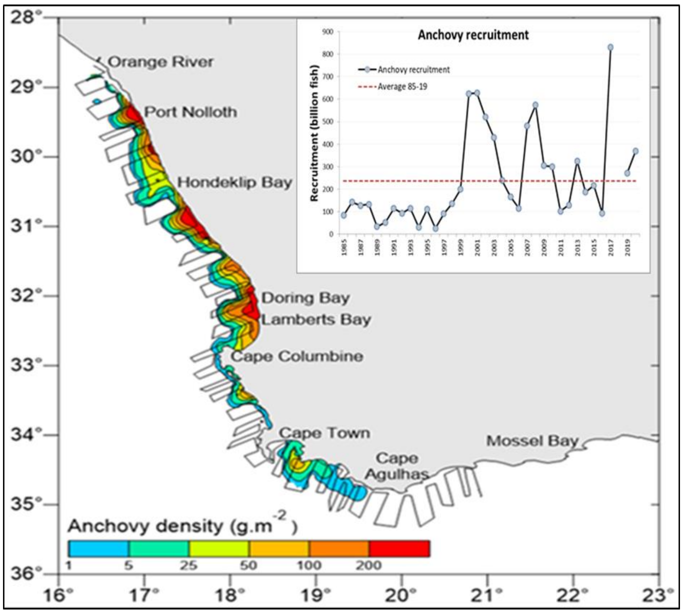


Figure 5-12: Recruitment survey results (May 2020) for anchovy and recruitment trend (inset). The red dotted line is the running average level of recruitment since 1985 and is used as one of the stock status indicators (information and figure provided by J. Coetzee and D. Merkel of DFFE).

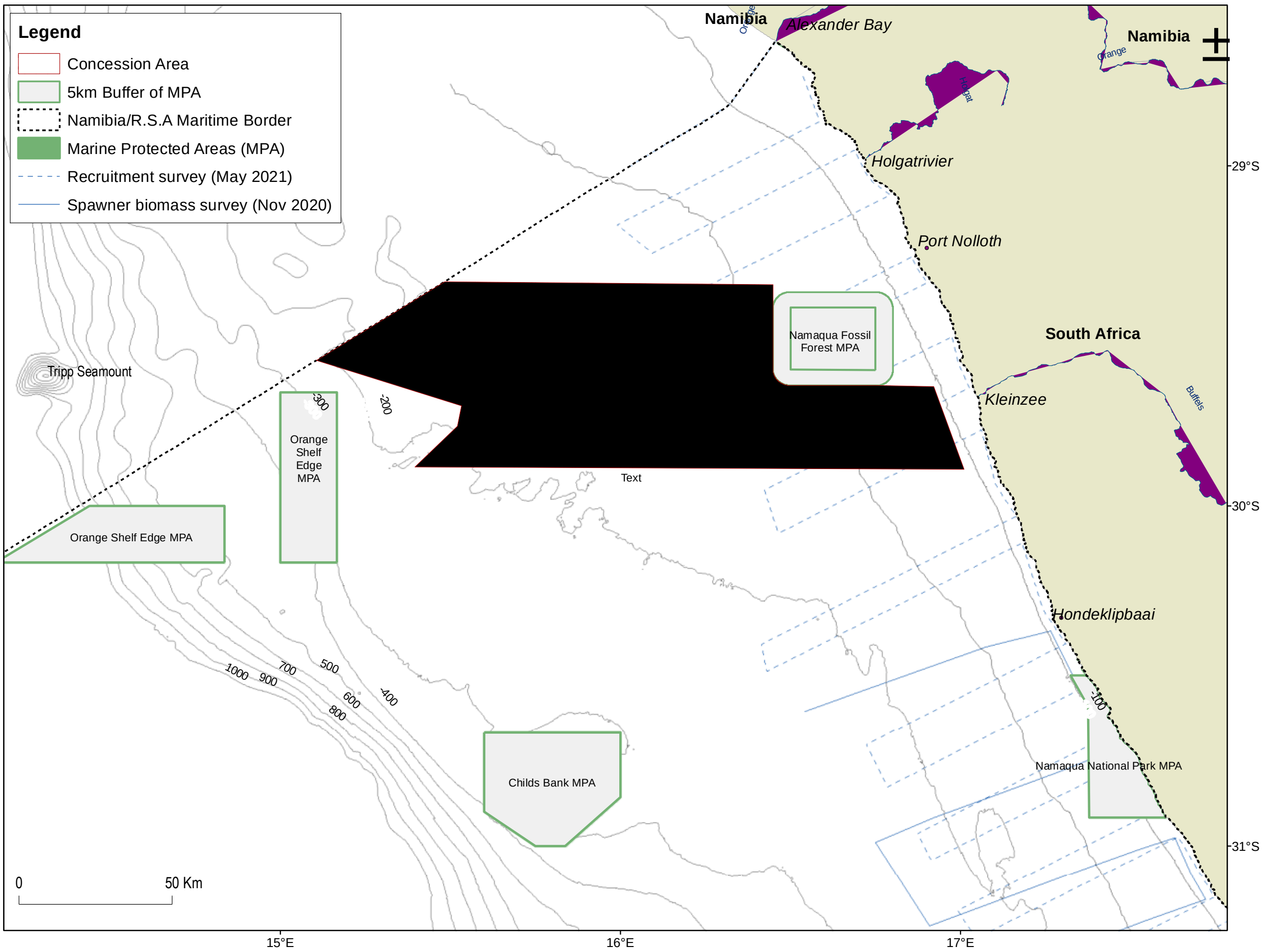


Figure 5-13: Spatial distribution of survey transects undertaken by DFFE during November 2020 and May 2021 during the research surveys of recruitment and spawner biomass of small pelagic species, respectively.

5.4 Commercial Fishing Sectors

5.4.1 Demersal Trawl

The primary fisheries in terms of highest economic value are the demersal (bottom) trawl and longline fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*). Secondary species include a large assemblage of demersal fish of which monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*) and snoek (*Thyrsites atun*) are the most commercially important. The demersal trawl fishery comprises an offshore (deep-sea) and inshore fleet, which differ primarily in terms of vessel capacity and the areas in which they operate. The wholesale value of catch landed by the inshore and offshore demersal trawl sectors, combined, during 2017 was R3.982 billion, or 40.5% of the total value of all fisheries combined.

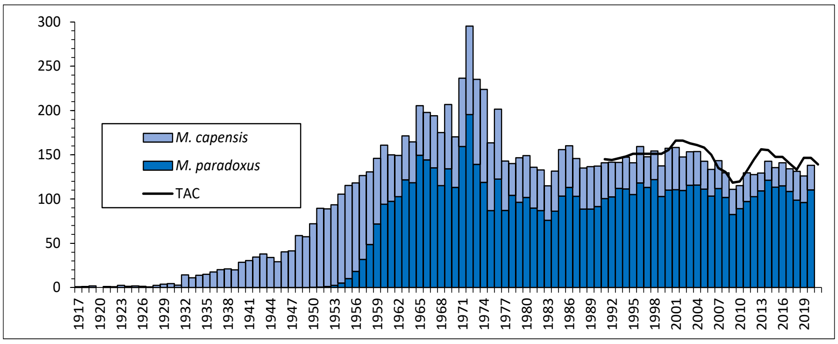
The 2022 TAC for hake is set at 132 154 tons, of which 84% and 6% is allocated to the offshore and inshore trawl sectors, respectively. (The remaining 10% is allocated to the hake demersal longline sector – refer to section 5.4.2).

The annual TAC limits and landings of hake (both species) by the trawl and longline sectors is listed in Table 5-5. A time-series of total hake catch as well as hake catch by sector is shown in Figure 5-14.

Table 5-5: Annual total allowable catch (TAC) limits and catches (tons) of the two species of hake by the hake-directed fisheries on the West (WC) and South (SC) coasts (Adapted from DEFF, 2020[5]).

Year	TAC	*M. paradoxus*					*M. capensis*						TOTAL both species
		Deep-sea		Longline		TOTAL	Deep-sea		Inshore	Longline		TOTAL	
		WC	SC	WC	SC		WC	SC	SC	WC	SC		
2010	119831	69709	15457	2394	1527	89087	10186	4055	5472	3086	3024	26098	115185
2011	131780	76576	17904	2522	140	97142	15673	4086	6013	3521	3047	35525	129667
2012	144671	81411	16542	4358	306	102616	12928	4584	3223	2570	1737	25050	127666
2013	156075	74341	28859	6056	60	109316	8761	4475	2920	2606	1308	20071	129387
2014	155280	73252	41156	6879	8	121295	9671	6286	2965	2123	315	21361	142656
2015	147500	77521	31745	4001	18	113286	12727	4085	3077	2325	53	22217	135503
2016	147500	93173	18968	2806	1	114948	14744	2810	3973	4360	2	25889	140837
2017	140125	72326	30961	5288	25	108600	15273	4466	2812	2807	126	25488	134088
2018	133119	64252	29218	5217	90	98777	12689	12863	3983	2615	481	32668	131370
2019	146431	70608	22201	5328	34	98171	14193	9454	4149	3623	299	31718	129898
2020	146400	97093	10061	5847	47	113048	18115	3500	4536	2348	321	28820	141872
2021	139109	102865	15597	5892	18	124372	15585	2937	4517	2932	194	26165	150537
2022	132154												

[5] FISHERIES/2022/OCT/SWG-DEM/35rev: Ross-Gillespie (2022). Update to the hake Reference Case Operating Model with corrected longline data, and 2021 commercial and 2022 survey data. Marine Resource Assessment and Management Group, University of Cape Town, Rondebosch, 7701



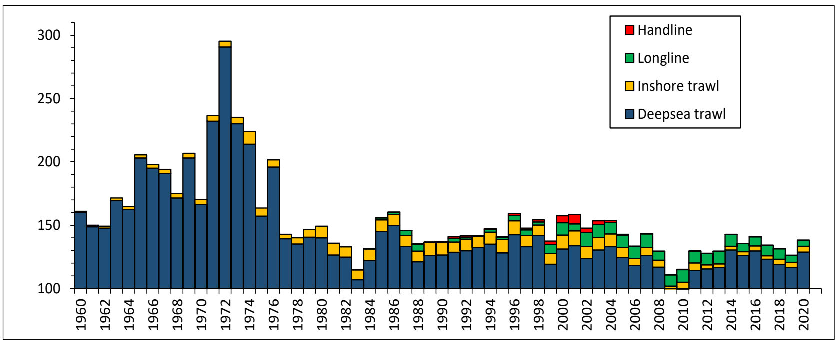


Figure 5-14: (upper) Total catches ('000 t) of Cape hakes split by species over the period 1917–2020 and the TAC set each year since the 1991. (lower) Catches of Cape hakes per fishing sector for the period 1960–2020. Prior to 1960, all catches are attributed to the deep-sea trawl sector (Source DFFE, 2022).

The offshore fishery comprises 45 vessels that operate from most major harbours on both the West and South Coasts. On the West and South-West Coasts, these grounds extend in a continuous band along the shelf edge between the 200 m and 1 000 m bathymetric contours although most effort is in the 300 m to 600 m depth range. Monkfish-directed trawlers tend to fish shallower waters than hake-directed vessels on mostly muddy substrates. The deep-sea sector is prohibited from operating in waters shallower than 110 m or within five nautical miles of the coastline.

The inshore fishery consists of 31 vessels, which operate on the South Coast mainly from the harbours of Mossel Bay and Gqeberha. Inshore grounds are located on the Agulhas Bank and extend towards the Great Kei River in the east. Vessels also target sole close inshore between Struisbaai and Mossel Bay, between the 50 m and 80 m isobaths. Hake is targeted further offshore in traditional grounds between 100 m and 200 m depth in fishing grounds known as *the Blues* located on the Agulhas Bank.

The 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. Demersal trawling is centred along the 500 m bathymetric contour but ranges to 300 m and to 200 m in places. Figure 5-15 shows an overview of the spatial distribution of fishing activity within the EEZ and in relation to Sea Areas 4C and 5C. Figure 5-16 shows the demersal trawling activity in the vicinity of the concession area. Over the period 2017 to 2021, there has been no fishing effort reported within the concession area; however, trawling activity may be expected offshore of the prospecting application area in waters deeper than 200 m on both the Namibian and South African sides of the maritime border. The concession area coincides with recruitment areas for hake and other demersal species (see Figure 5-2).

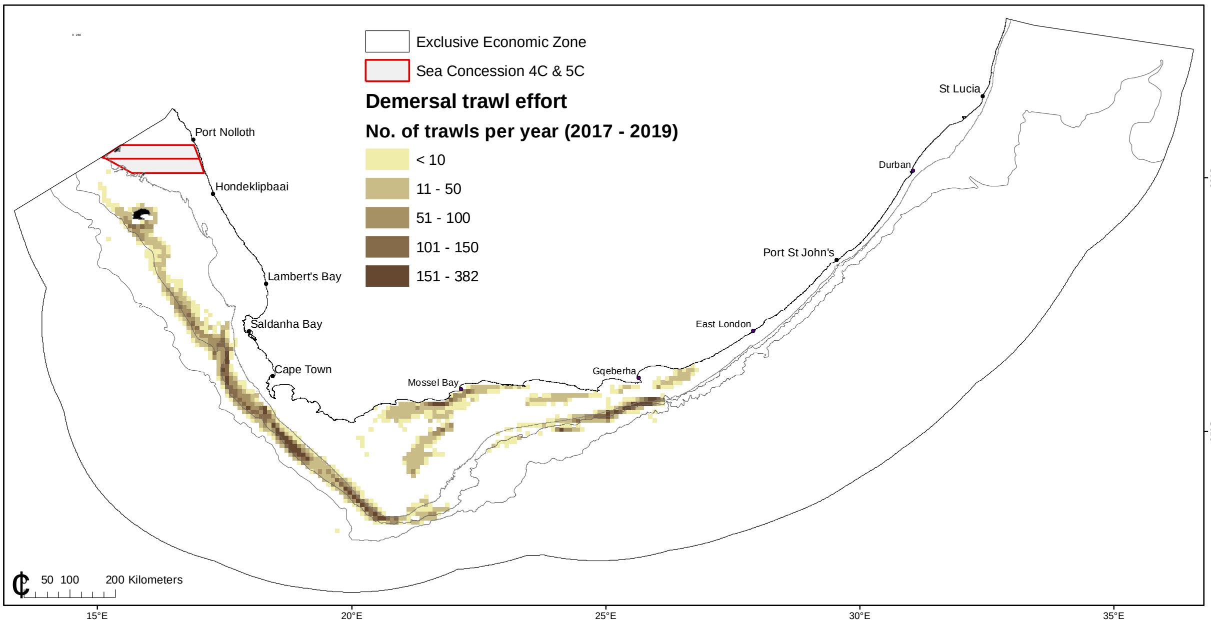


Figure 5-15: Overview of the spatial distribution of fishing effort expended by the demersal trawl sector within the South African EEZ and in relation to Sea Areas 4C and 5C.

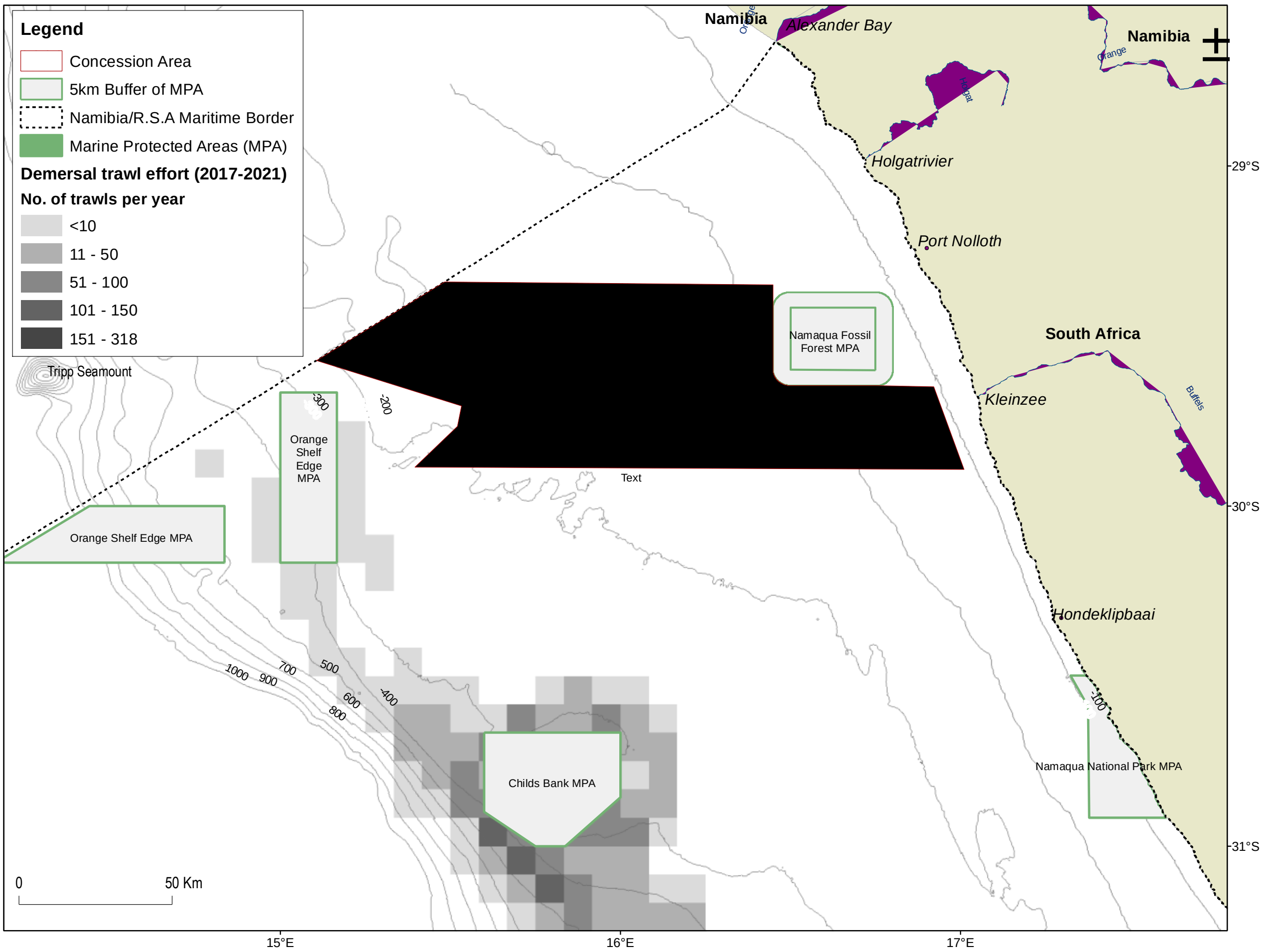


Figure 5-16: Spatial distribution of fishing effort expended by the demersal trawl sector in relation to the concession area (2017 – 2021).

5.4.2 Demersal Longline

Like the demersal trawl fishery, the target species of the longline fishery is the Cape hakes, with a small non-targeted commercial by-catch that includes kingklip. In 2017, 8113 tons of catch was landed with a wholesale value of R319.2 million, or 3.2% of the total value of all fisheries combined. Landings of 8563 tons of hake were reported for the longline sector in 2020 and 9036 tons in 2021. Refer to Table 5-5 for the landings of hake by the demersal longline fishery over the period 2010 to 2021.

A demersal longline vessel may deploy either a double or single line which is weighted along its length to keep it close to the seafloor. 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. Since the top-line (polyethylene, 10 – 16 mm diameter) is more buoyant than the bottom line, it is raised off the seafloor and minimizes the risk of snagging or fouling. The purpose of the top-line is to aid in gear retrieval if the bottom-line breaks at any point along the length of the line. 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. A schematic representation of the gear configuration used by the demersal longline fleet is shown in Figure 5-17.

Currently 64 hake-directed vessels are active within the fishery, most of which operate from the harbours of Cape Town and Hout Bay. Fishing grounds are similar to those targeted by the hake-directed trawl fleet. The hake longline footprint extends down the west coast from approximately 150 km offshore of Port Nolloth (15°E, 29°S). It lies inshore to the south of St Helena Bay moving offshore once again as it skirts the Agulhas Bank to the south of the country (21°E, 37°S). Along the South Coast the footprint moves inshore again towards Mossel Bay. The eastern extent of the footprint lies at approximately (26°E, 34.5°S). Lines are set parallel to bathymetric contours, along the shelf edge up to the 1 000 m depth contour in places. The more patchy nature of effort in the north western extents of the footprint and the eastern edge of the Agulhas Bank may be attributed to proximity to fishing harbours. Figure 5-18 shows the spatial extent of demersal longline grounds within the South African EEZ.

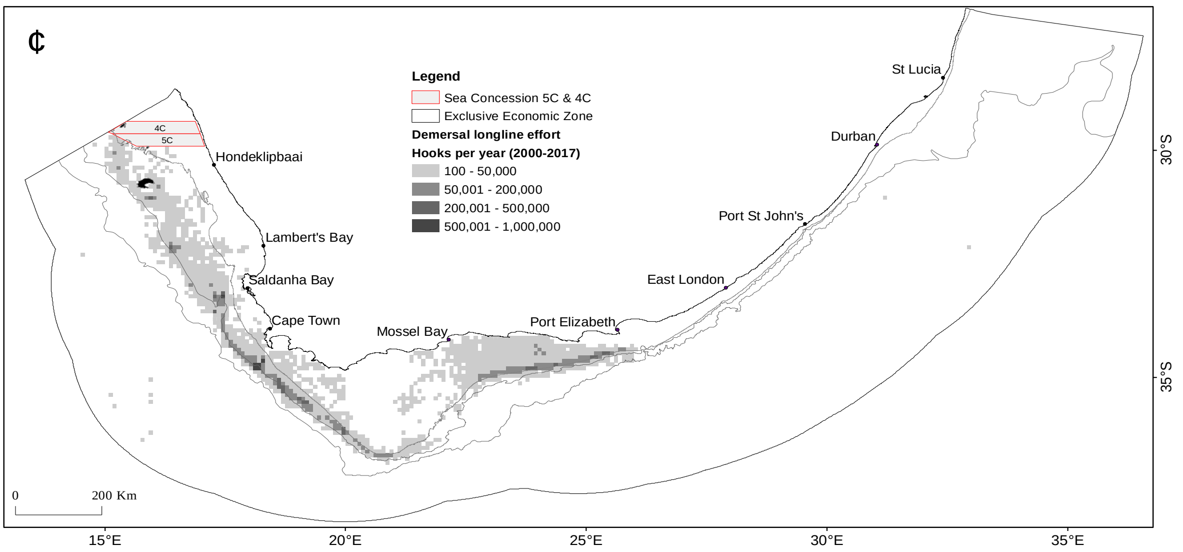


Figure 5-17: An overview of the spatial distribution of fishing effort expended by the demersal longline sector within the South African EEZ and in relation to Sea Areas 4C/ 5C.

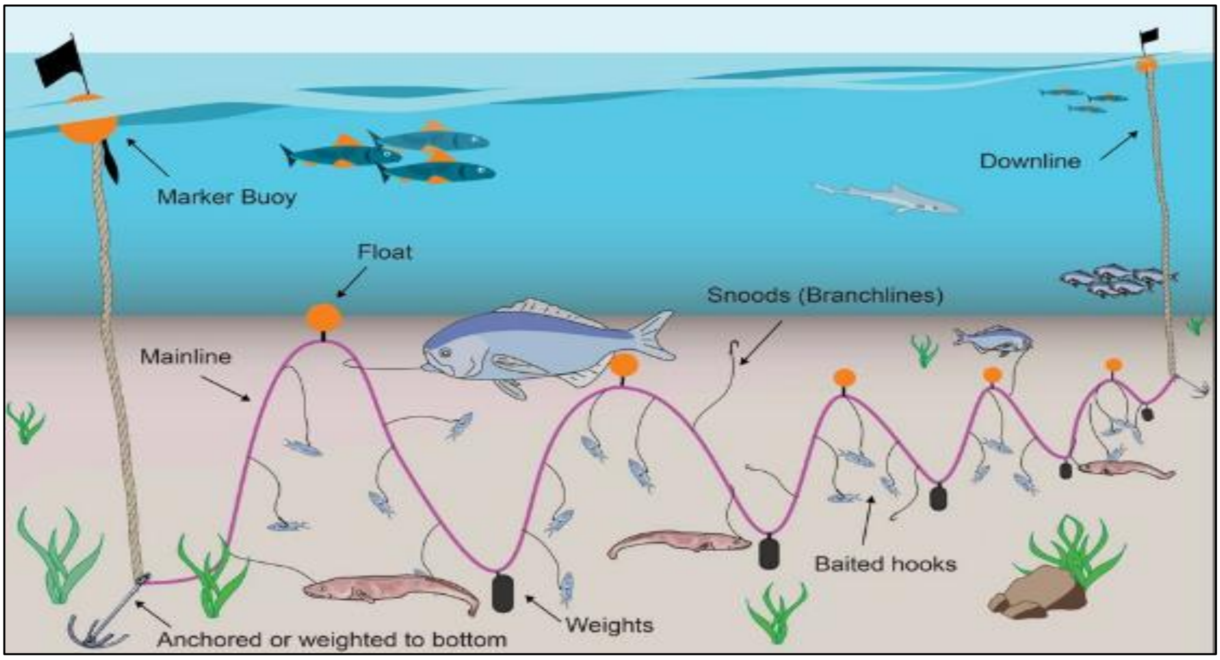


Figure 5-18: Photograph of a registered hake longline fishing vessel (above) and typical configuration of demersal longline gear used in the South African hake-directed fishery (below: http://www.afma.gov.au/portfolio-item/longlining).

Figure 5-19 shows the spatial distribution of demersal longline fishing areas in Namibian and South African waters in the vicinity of the concession area. A Namibian-registered fleet of demersal longline vessels operate on the Namibian side of the maritime border at a depth range of 200 m to about 500 m. As such, fishing activity can be expected along the boundary of Sea Area 4C which runs along the maritime border with Namibia. The South African fleet of demersal longline vessels also operate at a similar depth range and therefore only minimal amounts of fishing activity were reported within the prospecting application area, which falls inshore of the main fishing grounds.

Over the period 2018 to 2020, an average of 128 000 hooks per year were set within the deep-water portion of the concession area yielding 21.9 tonnes of hake. This is equivalent to 0.47% of the overall effort and 0.47% of the overall catch reported nationally by the sector.

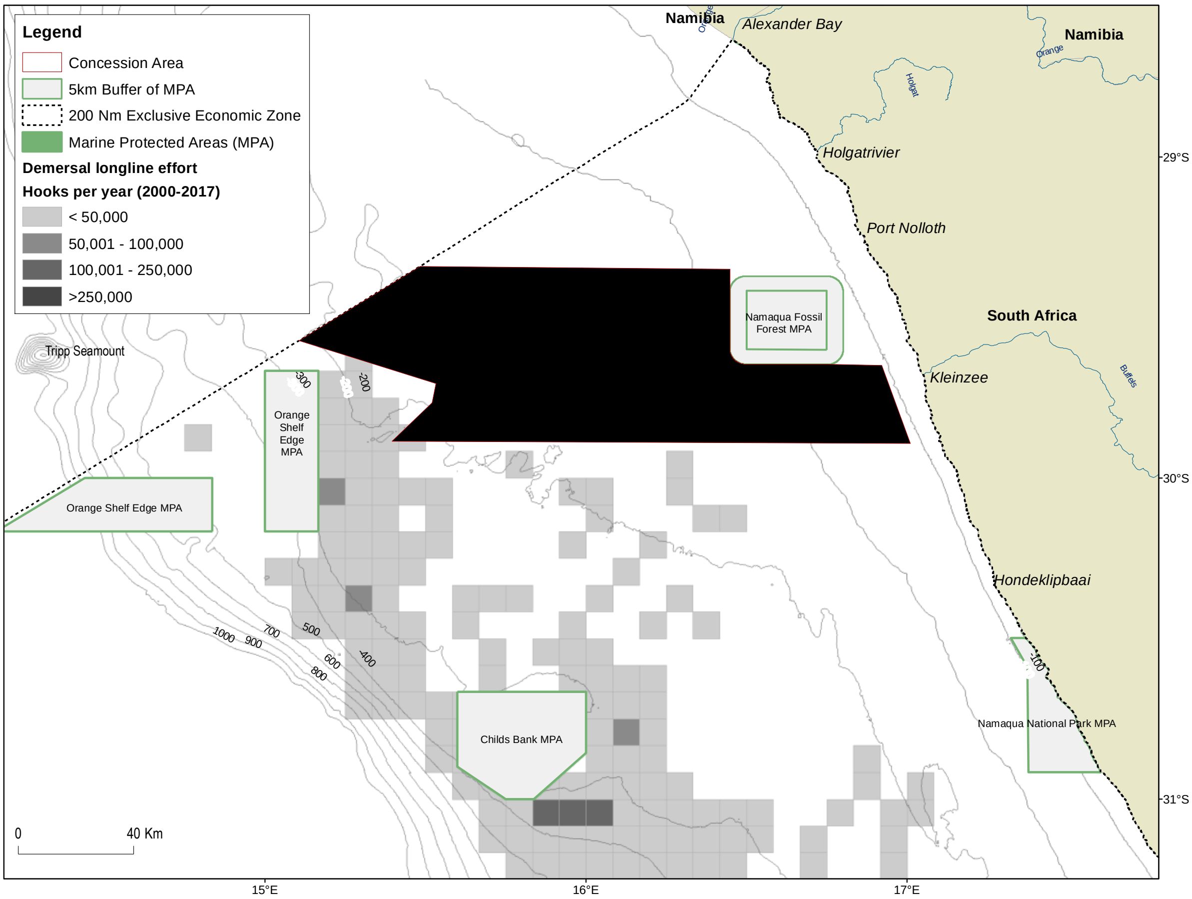


Figure 5-19: Spatial distribution of fishing effort expended by the longline sector targeting demersal fish species in the vicinity of the concession area.

5.4.3 Mid-Water Trawl

This sector included six vessels and 34 rights holders which target adult horse mackerel (*Trachurus capensis*) of which a total catch of 19 710 tons were landed in 2020. Mid-water trawl is defined in the Marine Living Resources Act (No. 18 of 1998) (MLRA) as any net which can be dragged by a fishing vessel along any depth between the seabed and the surface of the sea without continuously touching the bottom. In practice, mid-water trawl gear does occasionally come into contact with the seafloor. Mid-water trawling gear configuration is similar to that of demersal trawlers, except that the net is manoeuvred vertically through the water column (refer to Figure 5-20 for a schematic diagram of gear configuration). Several demersal trawlers are able to undertake mid-water trawling by switching gear and operating under dual rights, but currently the FMV *Desert Diamond* is the only dedicated mid-water trawler and is the largest registered South African commercial fishing vessel. The *Desert Diamond* is 120 m in length and has a Gross Registered Tonnage (GRT) of 8 000 t. The towed gear may extend up to 1 km astern of the vessel and comprises trawl warps, net and cod end. Trawl warps are between 32 mm and 38 mm in diameter. The trawl doors (3.5 t each) maintain the net opening which ranges from 120 to 130 m in width and from 40 m to 80 m in height. Weights in front of, and along the ground-rope provide for vertical opening of the trawl. The cable transmitting acoustic signal from the net sounder might also provide a lifting force that maximizes the vertical trawl opening. To reduce the resistance of the gear and achieve a large opening, the front part of the trawls is usually made from very large rhombic or hexagonal meshes. The use of nearly parallel ropes instead of meshes in the front part is also a common design. Once the gear is deployed, the net is towed for several hours at a speed of 4.8 to 6.8 knots predominantly parallel with the shelf break.

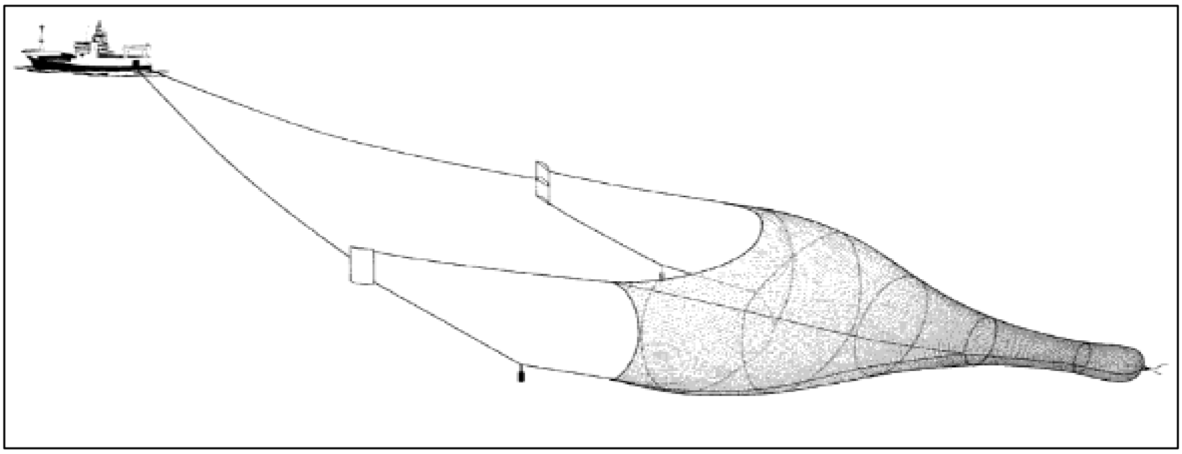


Figure 5-20: Schematic diagram showing the typical gear configuration of a mid-water trawler.

The fishery operates predominantly on the edge of the Agulhas Bank, where shoals are found in commercial abundance. Fishing grounds off the South Coast are situated along the shelf break and three dominant areas can be defined. The first lies between 22 °E and 23 °E at a distance of approximately 70 nm offshore from Mossel Bay and the second extends from 24 °E to 27 °E at a distance of approximately 30 nm offshore. The third area lies to the south of the Agulhas Bank 21 °E and 22 °E. These grounds range in depth from 100 m to 400 m and isolated trawls are occasionally recorded up to 650 m. From 2017, DFFE has permitted experimental fishing to take place westward of 20°E. Figure 5-21 shows the spatial extent of grounds fished by mid-water trawlers within the EEZ and in relation to Sea Areas 4C/5C. The concession area is situated approximately 330 km from grounds fished by the sector and there is no expected overlap of project activities with these grounds.

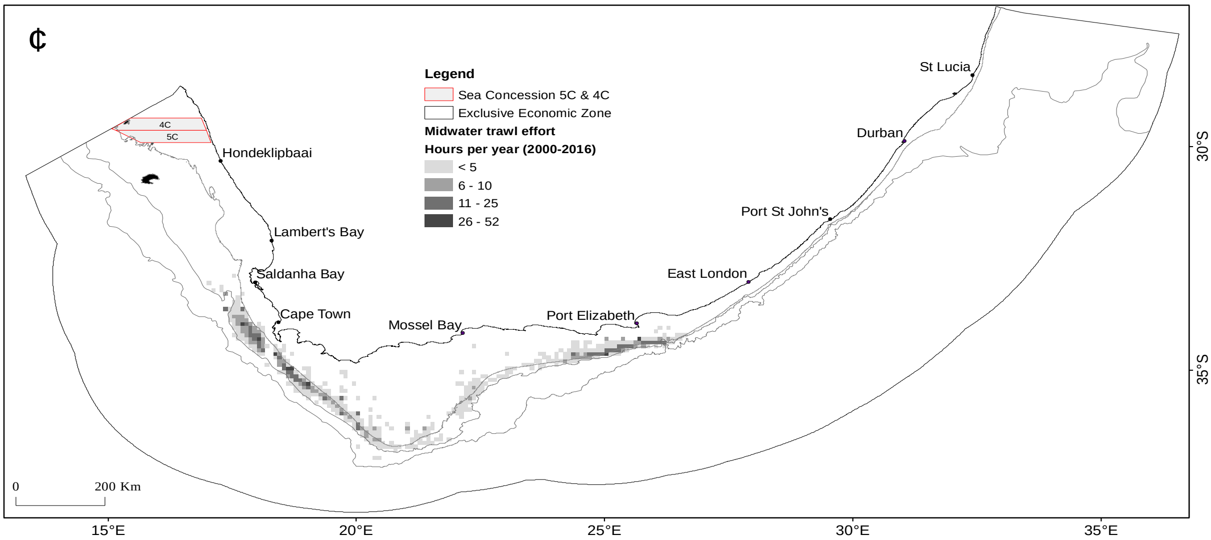


Figure 5-21: Overview of the spatial distribution of fishing effort expended by the mid-water trawl sector targeting horse mackerel within the South African EEZ and in relation to Sea Areas 4C and 5C.

5.4.4 Small Pelagic Purse-Seine

The pelagic-directed purse-seine fishery targets adult sardine (*Sardinops sagax)* and anchovy (*Engraulis encrasicolus*). Right Holders may also target round herring (*Etrumeus whitheadi*) and meso pelagic species (Lantern and Lightfish combined) which have industry precautionary upper catch limits

(PUCLs) – currently set at 100 000 t for round herring and 50 000 t for Lantern and Lightfish (combined). Bycatch species are mainly juvenile sardine, horse mackerel and chub mackerel. It is the largest South African fishery by volume (tons landed) and the second most important in terms of economic value. The wholesale value of catch landed by the sector during 2017 was R2.164 billion, or 22% of the total value of all fisheries combined.

The total combined catch of anchovy, sardine and round herring landed by the pelagic fishery has decreased by 38% from 395 000 t in 2016 to just 243 000 t in 2021 (Figure 5-22). This is below both long-term (338 000 t) and short-term (294 000 t) averages. In 2019 and 2020, both the sardine and anchovy management procedures required "exceptional circumstances" due the low abundance levels. Refer to Figure 5-23 for the time-series of biomass estimates for anchovy, sardine, and round herring from 1984 to 2020 (Coetzee et al., 2020).

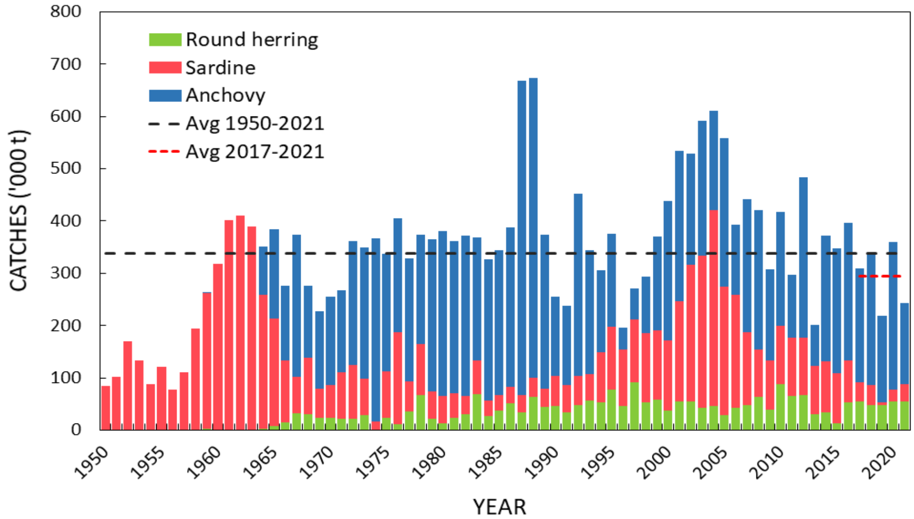


Figure 5-22: The annual combined catch of anchovy, sardine, and round herring. Also shown is the average combined catch since the start of the fishery (1950-2021; black dashed line) and for the past five years (red solid line). Source DFFE, 2022.

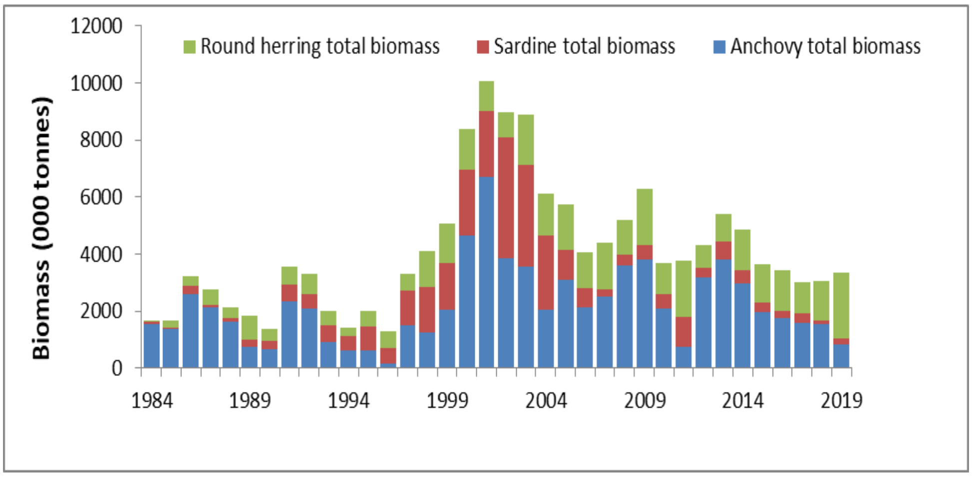


Figure 5-23: Biomass estimates of anchovy, sardine, and round herring from the DFFE recruitment surveys from 1984 to 2020 (Source: Coetzee et al., 2020).

The abundance and distribution of these small pelagic species fluctuates in accordance with the upwelling ecosystem in which they exist. Fish are targeted in inshore waters, primarily along the West and South Coasts of the Western Cape and the Eastern Cape coast, up to a maximum offshore distance of about 100 km. The majority of the fleet operate from St Helena Bay, Laaiplek, Saldanha

Bay and Hout Bay with fewer vessels operating on the South Coast from the harbours of Gansbaai, Mossel Bay and Port Elizabeth. Ports of deployment correspond to the location of canning factories and fish reduction plants along the coast.

The geographical distribution and intensity of the fishery is largely dependent on the seasonal fluctuation and distribution of the targeted species. The sardine-directed fleet concentrates effort in a broad area extending from Lambert's Bay, southwards past Saldanha and 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 Lambert's Bay to Kleinbaai (19.5°E) and similarly the intensity of this fishery is dependent on fish availability and is most active in the period from March to September. Red-eye round herring (non-quota species) is targeted when available and specifically in the early part of the year (January to March) and is distributed from Lambert's Bay to south of Cape Point. This fishery may extend further offshore than the sardine and anchovy-directed fisheries.

The fishery operates throughout the year with a short seasonal break from mid-December to mid-January. Figure 5-24 shows the species composition by month of landings over the period 2000 to 2016, as well as the average fishing effort by month.

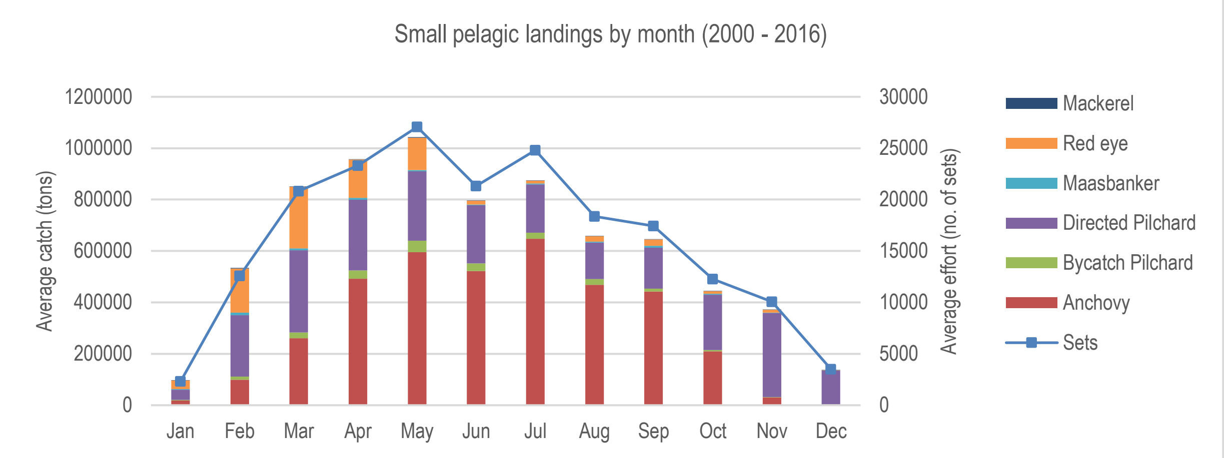


Figure 5-24: Graph showing average monthly catch (tons) and effort (number of sets) reported for the small purse-seine fleet over the period 2000 to 2016.

The fleet consists of approximately 64 wooden, glass-reinforced plastic and steel-hulled vessels ranging in length from 11 m to 48 m (J. de Goede, pers. comm, 2023). The targeted species are surface-shoaling and once a shoal has been located the vessel will steam around it and encircle it with a large net, extending to a depth of 60 m to 90 m (refer to Figure 5-25). Netting walls surround aggregated fish, preventing them from diving downwards. These are surface nets framed by lines: a float line on top and lead line at the bottom. Once the shoal has been encircled the net is pursed, hauled in and the fish pumped on board into the hold of the vessel. it is important to note that after the net is deployed, the vessel has no ability to manoeuvre until the net has been fully recovered on board and this may take up to 1.5 hours. Vessels usually operate overnight and return to offload their catch the following day.

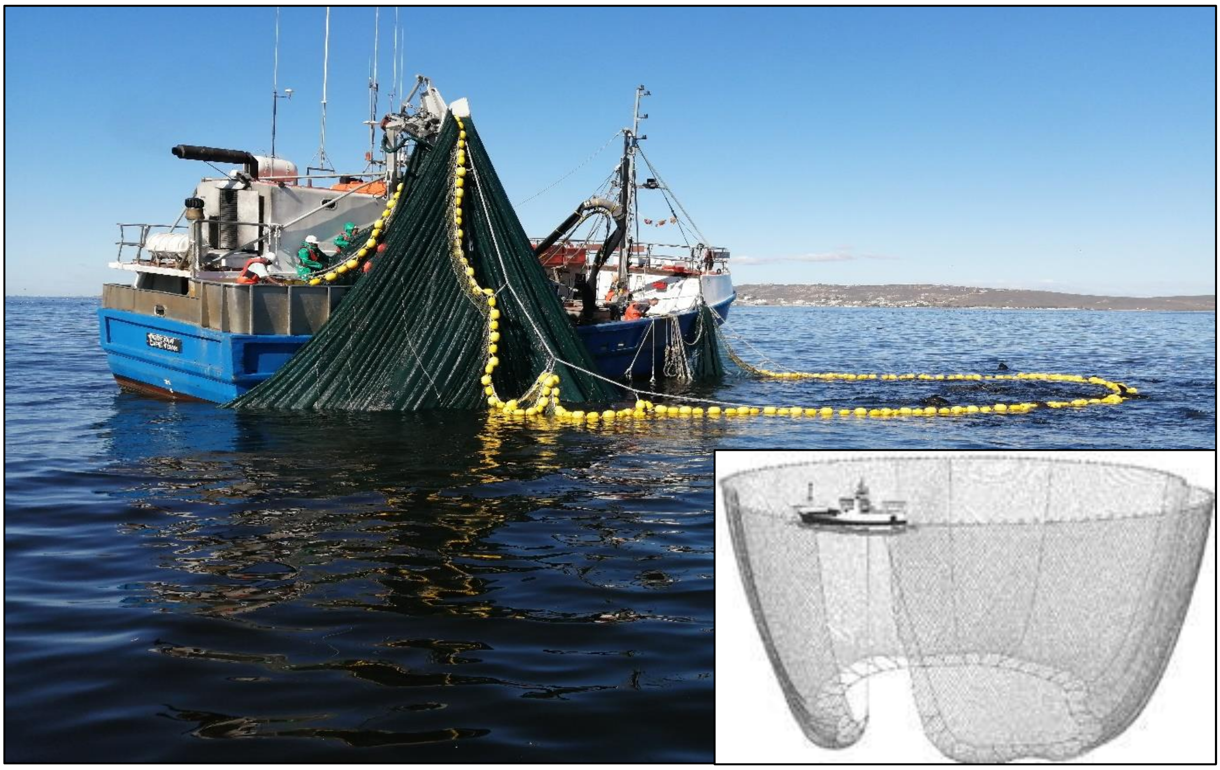


Figure 5-25: Photograph of a purse-seine vessel registered to fish for small pelagic species. Inset shows schematic diagram of typical configuration and deployment of a small pelagic purse-seine for targeting anchovy and sardine as used in South African waters.

Figure 5-26 shows the spatial extent of fishing grounds within the South African EEZ and Figure 5-27 shows grounds in relation to the concession area. The main fishing areas are situated at least 150 km south of the concession area and there is no spatial overlap with the expected fishing activity of the small pelagic purse-seine sector.

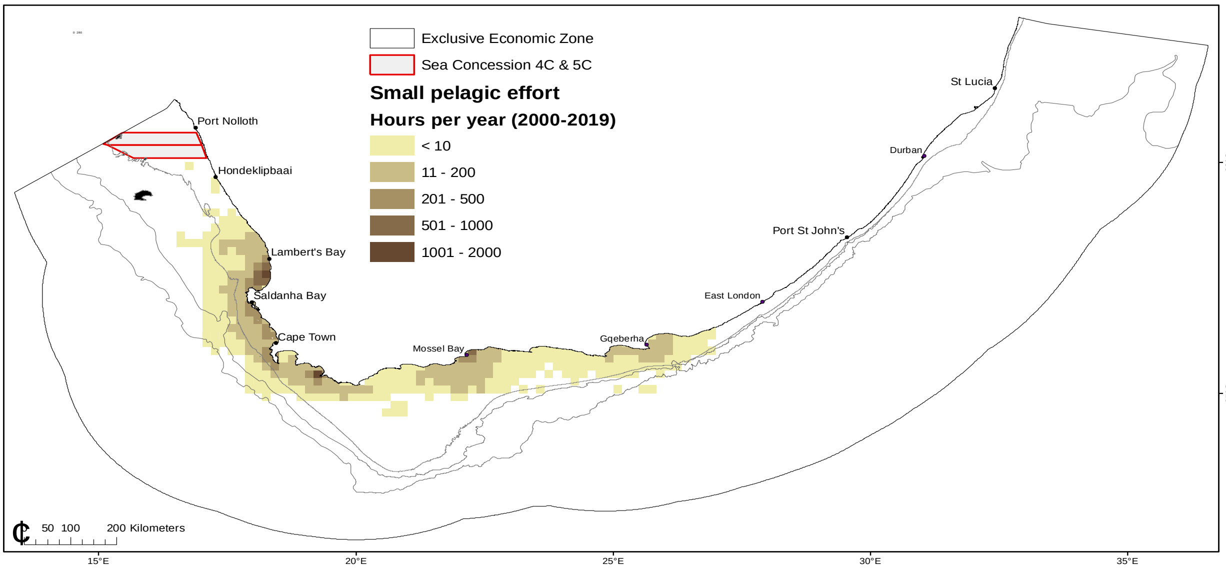


Figure 5-26: An overview of the spatial distribution of fishing effort reported by the purse-seine sector targeting small pelagic species over the period 2000 to 2019 within the South African EEZ and in relation to Sea Areas 4C and 5C.

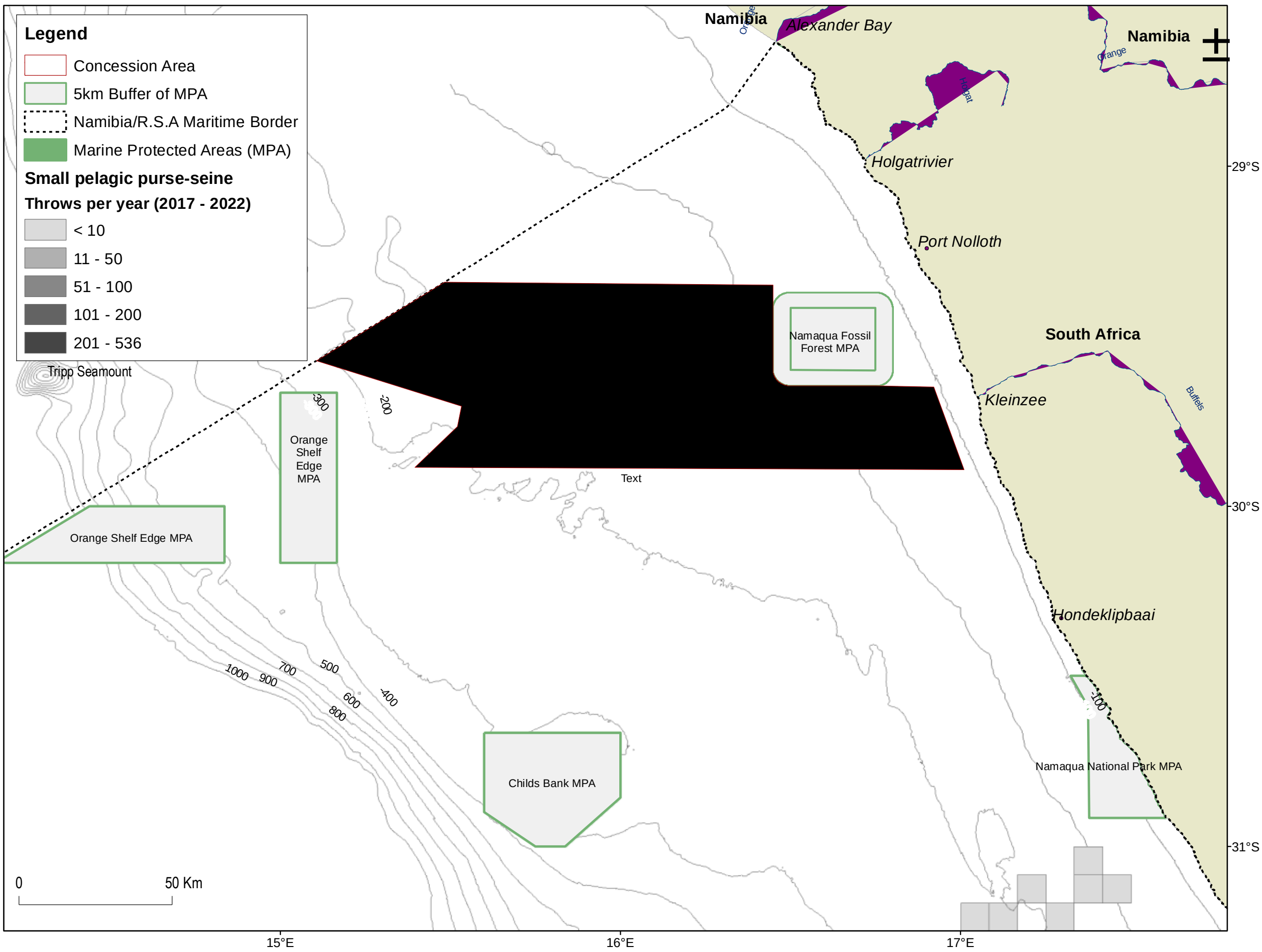


Figure 5-27: Spatial distribution of fishing grounds of the small pelagic purse-seine sector in relation to the concession area. Fishing activity is reported by 10 x 10 nautical minute grid block and average annual effort is shown for the period 2017 to 2022.

5.4.5 Large Pelagic Longline

Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African Exclusive Economic Zone (EEZ) by the pelagic longline and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). The wholesale value of catch landed by the sector during 2017 was R154.2 million, or 1.6% of the total value of all fisheries combined, with landings of 2541 tonnes (2017) and 2815 tonnes (2018). Tuna, tuna-like species, and billfishes are migratory stocks and are therefore managed as a “shared resource” amongst various countries under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). In the 1970s to mid-1990s the fishery was exclusively operated by Asian fleets (up to 130 vessels) under bilateral agreements with South Africa. From the early 1990s these vessels were banned from South African waters and South Africa went through a period of low fishing activity as fishing rights issues were resolved. Thereafter a domestic fishery developed, and 50 fishing rights were allocated to South Africans only. These rights holders now include a fleet of local long-liners and several Japanese vessels fishing in joint ventures with South African companies. In 2017, 60 fishing rights were allocated for a period of 15 years. The total number of active long-line vessels within South African waters is 22, 18 of which fished in the Atlantic (West of 20°E) during 2017. These were exclusively domestic vessels, with three Japanese vessels fishing exclusively in the Indian Ocean (East of 20°E) during 2017 (DAFF, 2018).

Gear consists of monofilament mainlines of between 25 km and 100 km in length which are suspended from surface buoys and marked at each end. As gear floats close to the water surface it would present a potential obstruction to surface navigation as well as a snagging risk to the gear array towed by the geophysical survey vessel. The main fishing line is suspended about 20 m below the water surface via dropper lines connecting it to surface buoys at regular intervals. Up to 3 500 baited hooks are attached to the mainline via 20 m long trace lines, targeting fish at a depth of 40 m below the surface. 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 the line position for later retrieval. Typical configuration of set gear is shown in Figure 5-28 below.

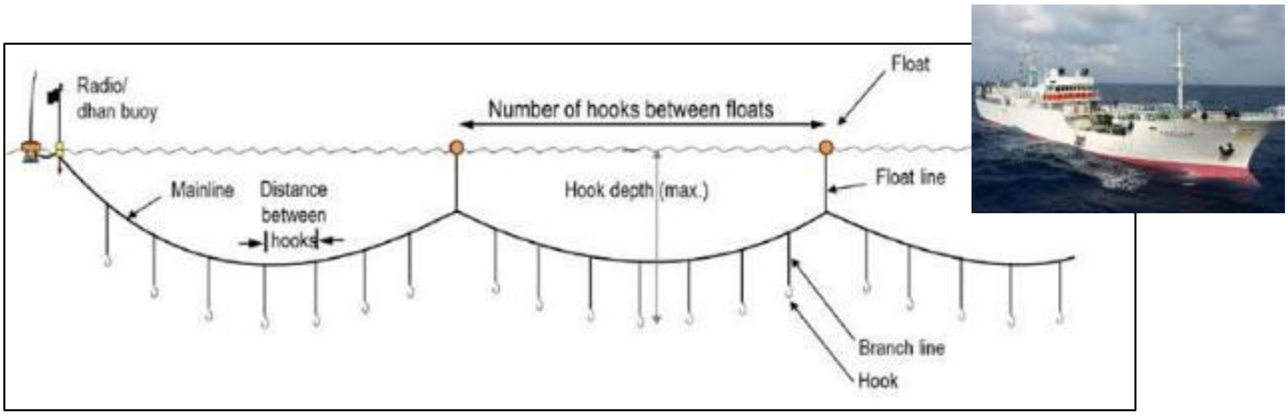


Figure 5-28: Schematic diagram showing typical configuration of long-line gear targeting pelagic species (left), and photograph of typical high seas longline vessel (upper right).

Lines are usually set at night and may be left drifting for a considerable length of time before retrieval, which is done by means of a powered hauler at a speed of approximately one knot. During hauling, vessel manoeuvrability is severely restricted. In the event of an emergency, the line may be dropped and hauled in at a later stage.

The fishery operates year-round with a relative increase in effort during winter and spring. Catch per unit effort (CPUE) variations are driven both by the spatial and temporal distribution of the target species and by fishing gear specifications. Variability in environmental factors such as oceanic thermal structure and dissolved oxygen can lead to behavioural changes in the target species, which may in turn influence CPUE (Punsly and Nakano, 1992). During the period 2000 to 2016, the sector landed an average catch of 4 527 tonnes and set 3.55 million hooks per year. Total catch and effort figures reported by the fishery for the years 2000 to 2018 are shown in Figure 5-29. Catches landed by the South African fleet operating in the ICCAT region (i.e., off the West Coast) from 1998 – 2020 are shown in Figure 5-30. Eighteen vessels were active in 2018.

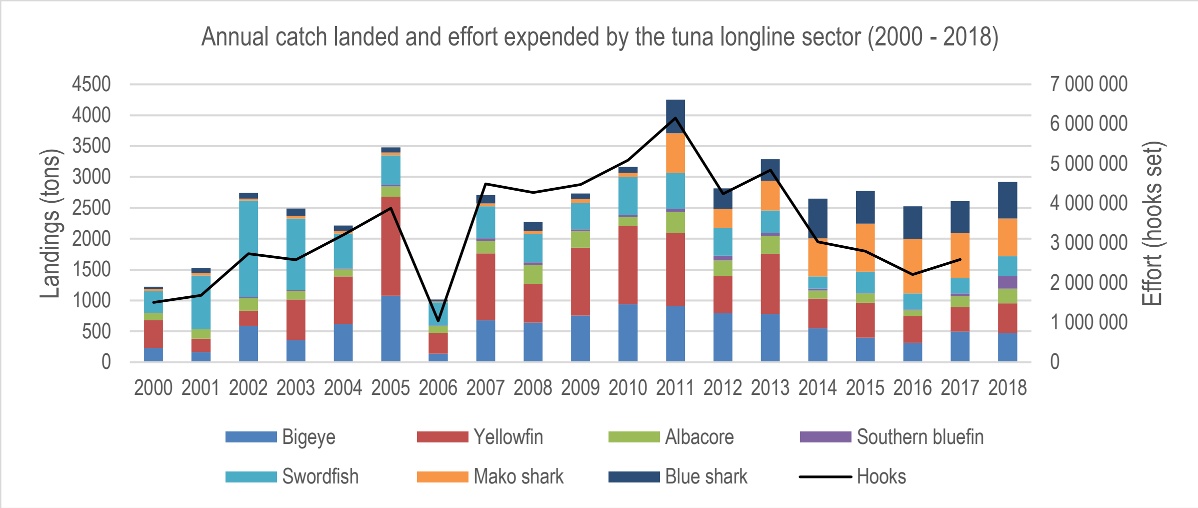


Figure 5-29: Inter-annual variation of catch landed, and effort expended by the large pelagic longline sector in South African waters as reported to the two regional management organisations, ICCAT and IOTC (2000 – 2018).

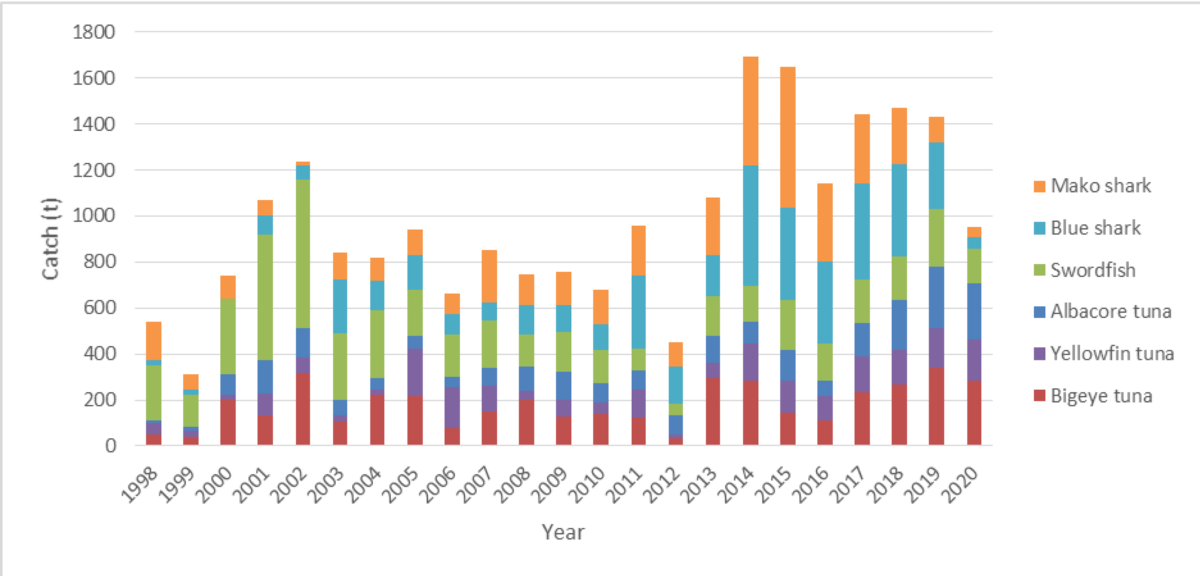


Figure 5-30: Inter-annual variation of catch landed by the large pelagic longline sector operating in the ICCAT region of South African waters (i.e., West of 20°E from 1998 – 2020).

Rights Holders in the large pelagic longline fishery are required to complete daily logs of catches, specifying catch locations, number of hooks, time of setting and hauling, bait used, number and estimated weight of retained species, and data on bycatch. The fishery operates extensively within the South African EEZ, primarily along the continental shelf break and further offshore (see Figure 5-31). Over the period 2000 to 2019, no fishing activity was reported within the concession area and targeted areas were situated at least 50 km from the prospecting application area offshore of the 500 m bathymetric contour. The Namibian fleet of large pelagic longline vessels are permitted to target pelagic shark species in addition to tuna and therefore also operate inshore of the shelf break. The Namibian fleet would be expected to operate offshore of the 200 m depth contour adjacent to the South African maritime border and Sea Area 4C.

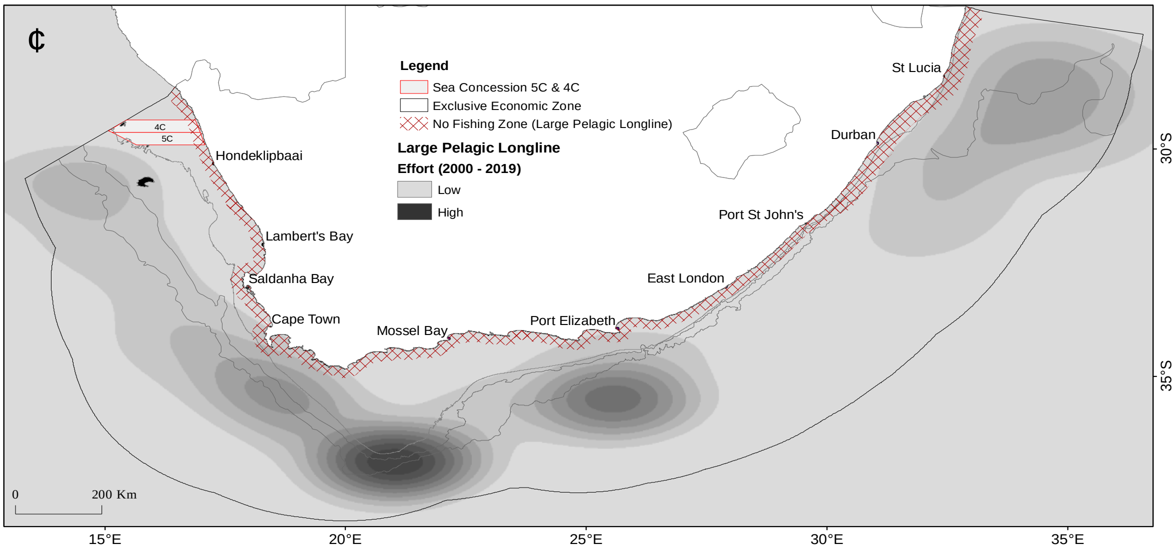


Figure 5-31: An overview of the spatial distribution of fishing effort expended by the longline sector targeting large pelagic fish species in the South African EEZ.

The spatial distribution of catch by both the Namibian and South African pelagic longline fleets is shown in Figure 5-32. Catch by reported fishing position is shown in the vicinity of the concession area at a grid resolution of 10 by 10 nautical miles.

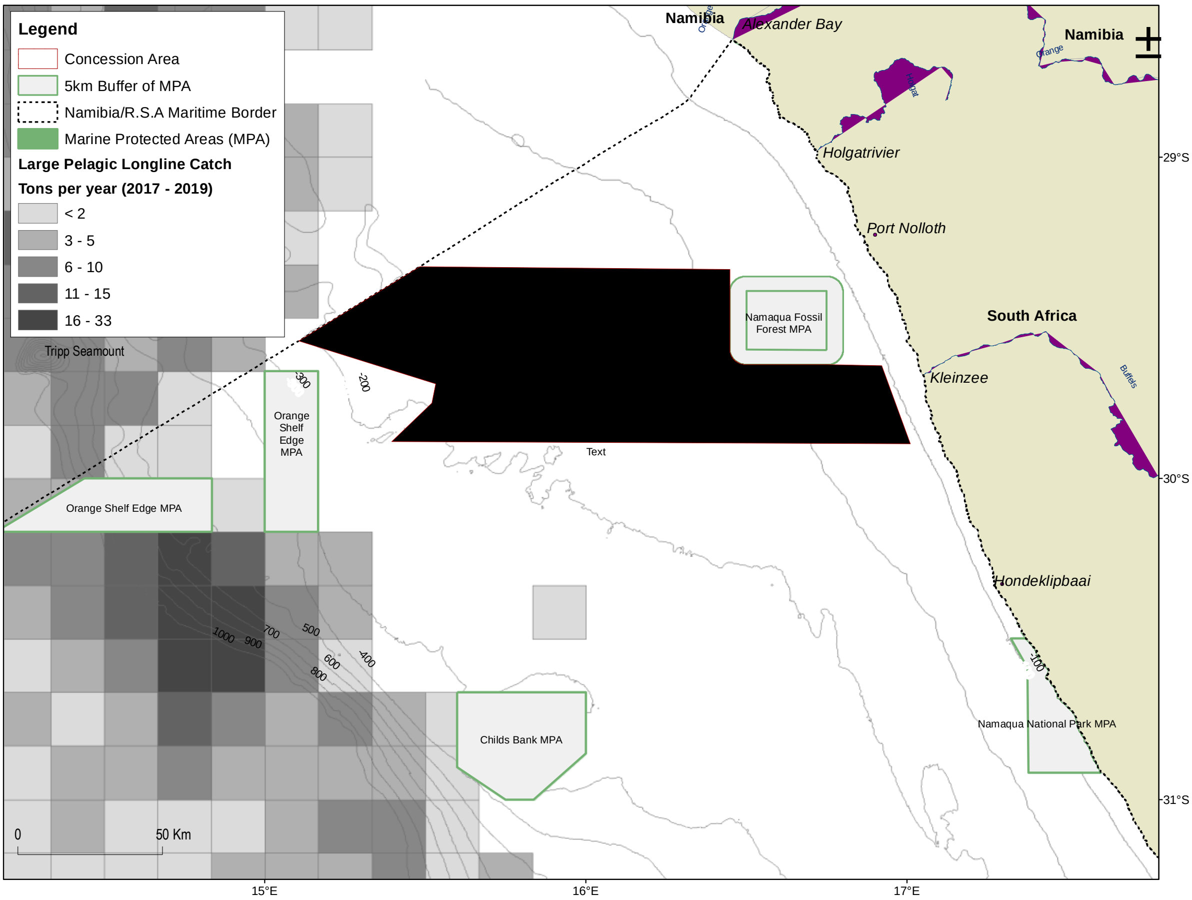


Figure 5-32: Spatial distribution of catch reported by the Namibian and South African longline sectors targeting large pelagic fish species in relation to the concession area.

5.4.6 Tuna Pole-and-Line

Poling for tuna is predominantly based on the southern Atlantic longfin tuna stock also referred to as albacore (*T. alalunga*). Other catch species include yellowfin tuna, bigeye tuna, and skipjack tuna (*Katsuwonus pelamis*). The fishery is seasonal with vessels active predominantly between November and May and peak catches recorded from November to January. Due to the seasonality of tuna in South Africa's waters the tuna pole fishery is also allowed access to snoek (*Thyrsites atun*) and yellowtail (*Seriola lalandi*). Snoek-directed fishing activity (commercial) is seasonal, taking place in coastal areas during the period March to July, with a peak in activity during the months of April and May. Access to these additional species has caused conflict with the traditional linefish sector.

The reported wholesale value of the fishery in 2018 was R124 Million in 2018, or 1.2% of the total value of all fisheries combined. Landings of albacore in 2020 amounted to 3941 tons. A historical time series of catch and effort reported by the South African sector operating within the Atlantic region is shown in Table 5-6 and Figure 5-33. The total effort of 4131 catch days within the ICCAT convention area in 2019 represents an increase in effort of 9% compared to 2018.

Table 5-6: Total number of fishing days (effort), active vessels and total catch (t) of the main species caught by tuna pole vessels in the ICCAT region (West of 20E), 2010 – 2020 (ICCAT, 2022).

	Total Effort		Catch (t)			
Year	Fishing days	Active vessels	Albacore	Yellowfin tuna	Bigeye tuna	Skipjack tuna
2010	4408	116	4087	177	8	1
2011	5001	118	3166	629	15	5
2012	5157	123	3483	162	12	8
2013	4114	107	3492	374	142	3
2014	4416	95	3620	1351	50	5
2015	4738	91	3898	885	57	2
2016	4908	98	2001	599	10	2
2017	3062	92	1640	235	22	7
2018	3751	92	2353	242	14	2
2019	4131	91	2190	378	91	2
2020	3975	97	3941	534	71	1

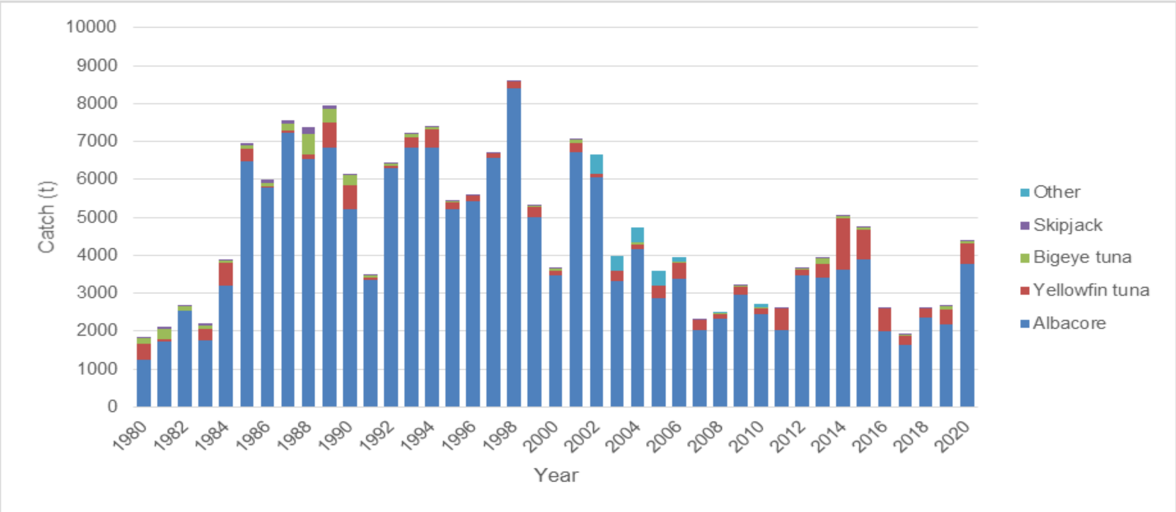


Figure 5-33: Catches (tons) of pelagic species by the South Africa pole-line ("Baitboat") fleet between 1980 and 2020 (ICCAT, 2022).

The active fleet consists of approximately 92 pole-and-line vessels (also referred to as "baitboat"), which are based at the ports of Cape Town, Hout Bay and Saldanha Bay. Vessels normally operate within a 100 nm (185 km) radius of these locations with effort concentrated in the Cape Canyon area (South-West of Cape Point), and up the West Coast to the Namibian border with South Africa.

Vessels are typically small (an average length of 16 m but ranging up to 25 m). Catch is stored on ice, refrigerated sea water or frozen at sea and the storage method often determines the range of the vessel. Trip durations average between four and five days, depending on catch rates and the distance of the fishing grounds from port. 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 is caught with hand-held fishing poles. The ends of the 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 5-34).

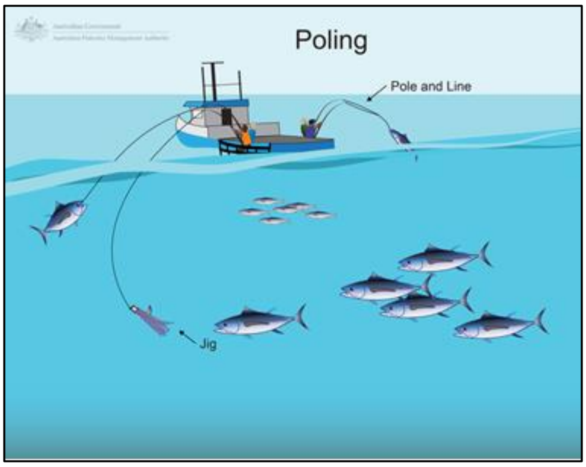


Figure 5-34: Schematic diagram of pole and line operation (Source: http://www.afma.gov.au/portfolio-item/minor-lines).

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 for tuna occurs along the entire West Coast beyond the 200 m bathymetric contour, along the shelf break with favoured fishing grounds including areas north of Cape Columbine and between 60 km and 120 km offshore of Saldanha Bay. Snoek-directed fishing activity is coastal and seasonal in nature – taking place inshore of the 100 m depth contour during the period March to July.

Figure 5-35 shows the location of fishing activity within the South African EEZ and in relation to Sea Areas 4c and 5c. Fishing records received from DFFE over the reporting period 2007 to 2019 indicate that tuna-directed fishing takes place offshore of the concession area whereas snoek-directed fishing activity takes place inshore of the concession area but that there is no evidence of catch taken within the concession area (see Figure 5-36).

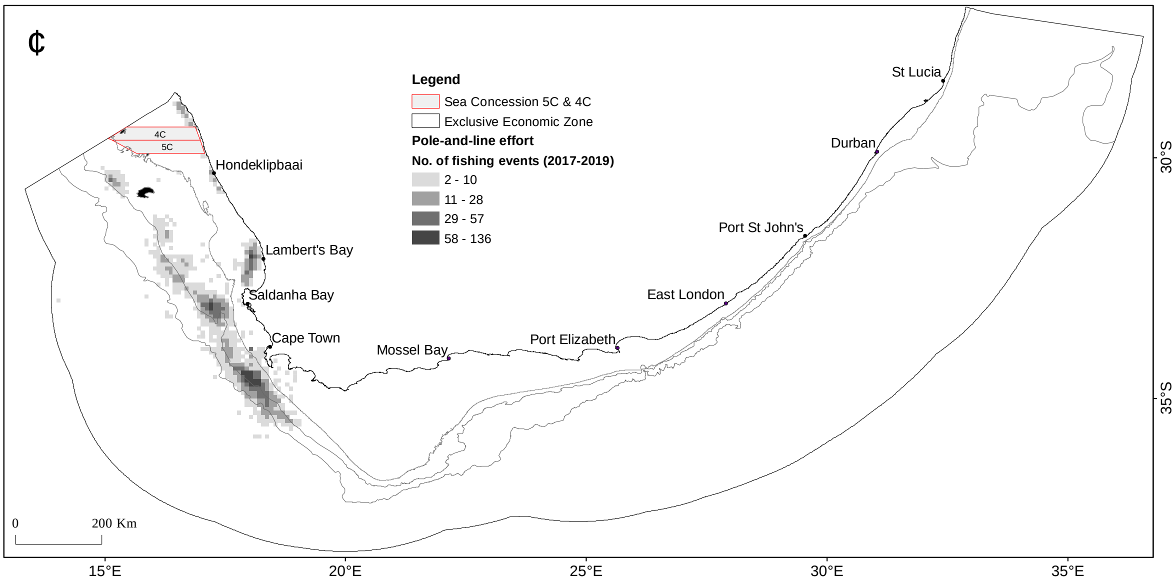


Figure 5-35: An overview of the spatial distribution of fishing effort expended by the pole-and-line sector targeting pelagic tuna and snoek within the South African EEZ and in relation to Sea Areas 4C and 5C.

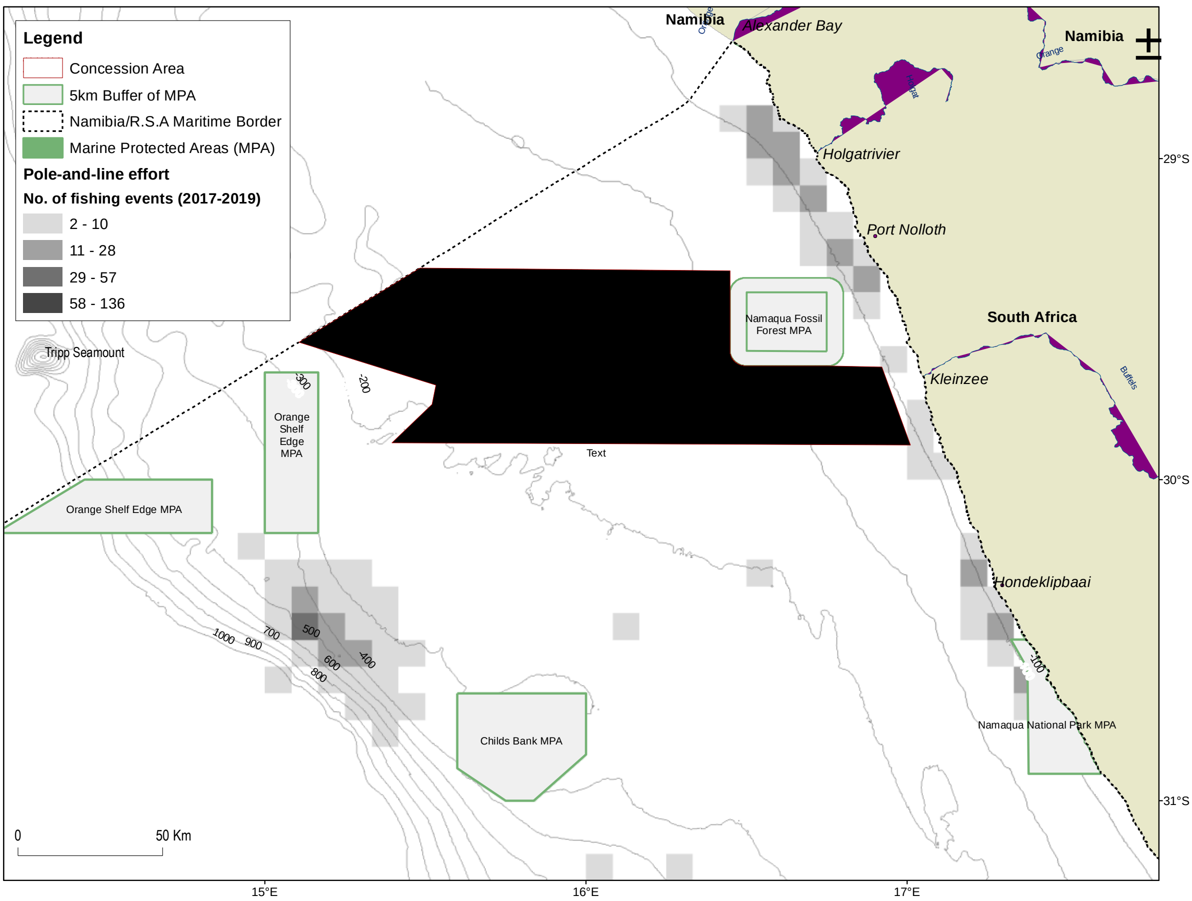


Figure 5-36: An overview of the spatial distribution of fishing effort expended by the pole-and-line sector targeting pelagic tuna and snoek in relation to the concession area.

5.4.7 Commercial or Traditional Linefish

The commercial linefish sector is one of the oldest fisheries in South Africa and has its origins from the recreational sector. Essentially recreational line-fishers commercialised resulting in a systematic decline in the "linefish" stocks. The Minister of Fisheries in the 1980's reformed the sector. This was done by creating a smaller commercial linefish sector, as well as introducing a moratorium on the exploitation of many species that were collapsed or near collapse. The commercial linefish sector now only allows a limited number of key species to be exploited using hook and line but excludes the use of longlines[6]. Target species of the linefishery include temperate, reef-associated seabreams (e.g., carpenter, hottentot, santer and slinger), coastal migrants (e.g., geelbek and dusky kob) and nomads (e.g., snoek and yellowtail). More than 90% of the current linefish catch is derived from the aforementioned eight species and almost all of the traditional line fish catch is consumed locally. **Table** 5**-**7 lists the catch of important linefish species for the years 2010 to 2021.

Table 5-7: Annual catch (t) of the eight most important linefish species for the period 2010 to 2021 (DFFE, 2022).

Year	Snoek	Yellowtail	Kob	Carpenter	Slinger	Hottentot seabream	Geelbek	Santer	Total catch
2010	6360	171	419	263	180	144	408	69	13688
2011	6205	204	312	363	214	216	286	62	12530
2012	6809	382	221	300	240	160	337	82	11855
2013	6690	712	157	481	200	173	263	84	9142
2014	3863	986	144	522	201	192	212	74	6849
2015	2045	594	121	519	175	142	238	68	4421
2016	1643	474	133	690	211	209	246	65	4289
2017	2055	377	111	844	218	204	158	74	4391
2018	2089	654	213	723	173	213	214	68	5304
2019	1879	439	454	604	215	188	132	78	N/A*
2020	2356	548	635	533	183	222	158	66	N/A*
2021	2747	239	352	441	186	151	88	64	N/A*

Figure 5-37 shows the variability in catches of the eight most importance species by the linefish sector over the period 1985 to 2021. In the Western Cape the predominant catch species is snoek (*Thyrsites atun*) while other species such as Cape bream (hottentot) (*Pachymetopon blochii)*, geelbek (*Atractoscion aequidens)*, kob (*Argyrosomus japonicus)* and yellowtail (*Seriola lalandi)* are also important. Towards the East Coast the number of catch species increases and includes resident reef fish (Sparidae and Serranidae), pelagic migrants (Carangidae and Scombridae) and demersal migrants (Sciaenidae and Sparidae).

Of all South African marine fisheries, the linefishery is the most vulnerable to external impacts. Linefish resources are at risk of overcapacity as they are directly or indirectly exploited by other sectors, including the recreational, small-scale linefishery, inshore and offshore trawl fisheries, tuna pole-line fishery, the inshore netfishery and the demersal shark longline fishery (DEFF, 2020). The increased expectation of commercial access to linefish resources combined with the localised anticipation of community ownership by small-scale fishers may impact linefish stocks.

[6] To distinguish between line fishing and long-lining, line fishers are restricted to a maximum of 10 hooks per line.

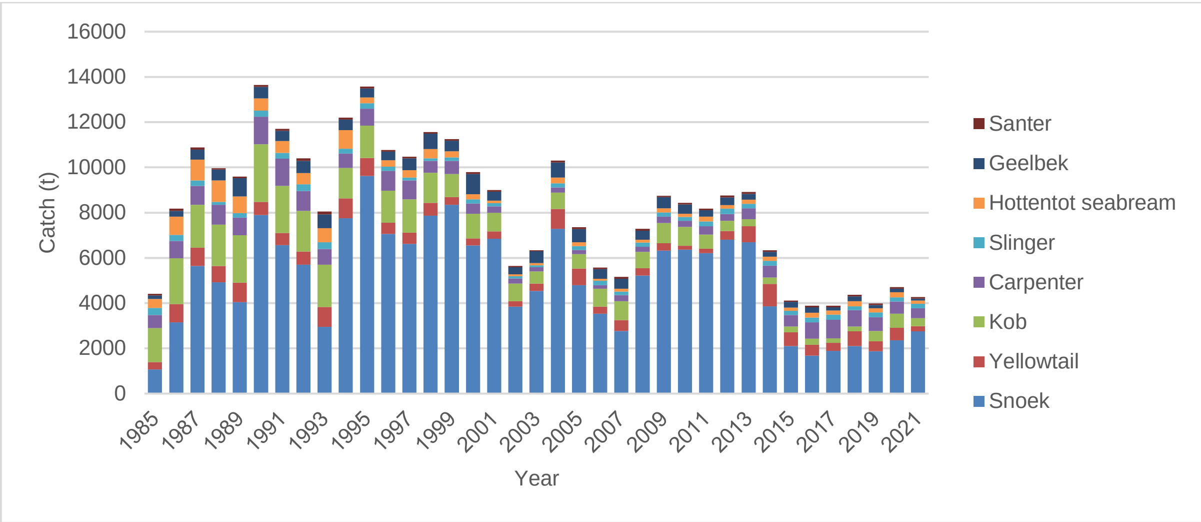


Figure 5-37: Annual catch (t) of the eight most important linefish species for the period 1985-2021 (DFFE, 2022).

Figure 5-38: Fishermen landing snoek on board a vessel operating in the traditional linefishery (photo credit Jaco Barendse).

The traditional commercial line fishery is a relatively low-cost and labour-intensive industry, and important from an employment and human livelihood point of view. Although the commercial linefishery has the largest fleet, it contributes only 6% of the total estimated value of all South African marine fisheries (DFFE, 2020). In 2017, the wholesale value of catch was reported as R122.1 million. Annual catches prior to the reduction of the commercial effort were estimated at 16 000 tons for the traditional commercial line fishery. The fishery is widespread along the country's shoreline from Port Nolloth on the West Coast to Cape Vidal on the East Coast. Most of the catch (up to 95%) is landed by the Cape commercial fishery, which operates on the continental shelf from the Namibian border on the West Coast to the Kei River in the Eastern Cape. Effort is managed geographically with the spatial effort divided into three zones. Zone A extends from Port Nolloth to Cape Infanta, Zone B extends from

Cape Infanta to Port St Johns and Zone C covers the KwaZulu-Natal region. Sea Areas 4C and 5C fall within Zone A.

The commercial line fishery is a nearshore boat-based activity which is currently managed through a total allowable effort (TAE) allocation, based on boat and crew numbers. The number of rights holders[7] is currently 425. For the 2021/2022 fishing season, 325 vessels were apportioned to commercial fishing, whilst 122 vessels apportioned to small-scale fishing[8] (refer to Section 5.4.11).

A standard vessel is defined as a vessel that can carry a crew of 7. Vessels with a maximum length overall of 10 m and a maximum crewing capacity of 12, including the skipper. The maximum standard vessel allocation for the commercial linefishery within the three management Zones (2021/2022) is 340 vessels for Zone A (Port Nolloth to Cape Infanta), 64 vessels for Zone B (Cape Infanta to Port St Johns) and 51 vessels for Zone C (KwaZulu-Natal). Table 5-8 lists the annual Total Allowable Effort (TAE) and activated effort per linefish management zone from 2007 to 2019.

Table 5-8: Annual total allowable effort (TAE) and activated commercial linefish effort per management zone from 2010 to 2019 (DEFF, 2020).

Total TAE boats (fishers). Upper limit: 455 boats or 3450 crew			Zone A: Port Nolloth to Cape Infanta		Zone B: Cape Infanta to Port St Johns		Zone C: KwaZulu-Natal	
Allocation	455 (3182)		301 (2136)		103 (692)		51 (354)	
Year	Allocated	Activated	Allocated	Activated	Allocated	Activated	Allocated	Activated
2010	455	335	298	210	105	82	51	43
2011	455	328	298	207	105	75	51	46
2012	455	296	298	192	105	62	51	42
2013	455	289	301	189	103	62	51	38
2014**	455	399	340	293	64	58	51	48
2015**	455	356	340	291	64	61	51	45
2016**	455	278	340	274	64	59	51	45
2017**	455	329	340	232	64	60	51	37
2018**	455	324	340	232	64	50	51	42
2019**	455	306	340	218	64	50	51	38

** In the finalisation of the 2013 commercial Traditional Linefish appeals, the effort apportioned for the small-scale fisheries sector was allocated to the commercial sector. All the small-scale Rights were considered to be activated on allocation

Fishing takes place throughout the year but there is some seasonality in catches. Vessels range in length between 4.5 m and 11 m and the offshore operational range is restricted by vessel category. Operating ranges vary but most of the activity is conducted within 15 km of a launch site.

This fishery's operational footprint may at times be limited by operating costs and is sensitive to local reports of fish availability. Figure 5-39 shows the spatial extent of traditional linefish grounds at a

[7] The Traditional Linefish sector was allocated 7-year rights during Fishing Rights Allocations Process (FRAP) in 2013. These were due to expire during 2020; however, the Deputy Director-General exempted the current Right Holders from Section 18 of the Marine Living Resources Act, 1998 (Act no 18 of 1998), by granting them extensions of their current fishing rights until 31 December 2021. This extension was granted while the DFFE would conclude a FRAP in terms of Section 18 of the MLRA. At the time of this report the FRAP is still underway. Having regard for the decline in the resources caught in this fishery and the need to apportion these among this and the emerging Small-Scale fishery, fishing rights in the Commercial Traditional Linefish Sector will be granted for a period of 7 years, commencing on 1 March 2022, and terminating on 28 February 2029, whereafter they shall automatically terminate and revert back to the State.

[8] DFFE increased the apportionment of TAE to small-scale fishing from 13% in 2019/20 to 26% in 2021/22 in order to boost economic possibilities for coastal communities.

national scale and Figure 5-40 shows catch in relation to the concession area. Vessels operate from Port Nolloth, Doring Bay and Hondeklipbaai and fishing activity is directed in waters shallower than 100 m and in proximity to these launch sites. Records over the period 2017 to 2019 show that fishing activity within this area is seasonal – March to September – and that catches are exclusively snoek9.

Due to the largely informal nature of the snoek fishery, a TAE approach has been used to manage the sector, which places constraints on the maximum level of fishing effort that can be applied to a fish stock during a specific period through limitations on the total number of vessels permitted in the sector, size of the vessel (maximum length 10 m), number of crew members per vessel, and geographic zone(s) which can be fished. In 2019, 340 rights were allocated for the area Port Nolloth to Cape Infanta with 218 rights activated. Besides the economic importance of direct landings to fishing communities, snoek provides indirect benefits through a combined formal and informal value chain, where snoek is processed and sold in different forms. Snoek reaches consumers through retail outlets supplied by large hawkers and processors or directly through small hawkers.

Fishing effort has not been reported inshore of the concession area but no within the area itself. Approximately 57.8 tonnes per year were reported in the vicinity of Doring Bay and Port Nolloth combined and 0.7 tonnes per year off Hondeklipbaai. Note that the spatial mapping of effort and catches in the line fishery is less accurate than in other sectors because of the reporting structure implemented by DFFE. Fishing locations are described by skippers in relation to numbered sections along the coast and estimated distance offshore. No bearings are given, and no GPS data are recorded. Furthermore, due to the large number of vessels, reporting complexities and the unwillingness of local fisherman to share fishing locations, inaccuracies in the spatial representation are to be expected. Although there is no evidence from the DFFE dataset of fishing having taken place within the prospecting application area, vessels could be expected to range to a distance of 15 km from the launch sites of Doring Bay, Port Nolloth and Hondeklipbaai and fishing activity within the inshore portions of the prospecting application area is possible.

[9] Snoek is regarded as mesopelagic predators and are found from the surface to depths of ~550m. In southern Africa, snoek has been known to occur from northern Angola to Algoa Bay but is mostly concentrated along the West Coast within the Benguela Ecosystem (Isaacs 2013). Snoek is the main predator for anchovy and sardine, placing direct top-down control on prey species and indirectly on populations which anchovy and sardine feed upon (mainly zooplankton), and forms a vital fishery sector in South Africa. Therefore, they are important from both an ecological and fisheries perspective. The spatial distribution of snoek is highly variable with fish moving between the inshore and offshore, depending on the season, spawning characteristics and availability of prey items. It is widely accepted that snoek populations within the Benguela ecosystem comprise a single population and undergo a seasonal longshore migration, moving southwards to South Africa from southern Angola waters to spawn before returning north (Isaacs 2013). Spawning occurs during winter when most exploitation within fisheries occurs, and populations return to southern Angola in Spring. However, work by Griffiths (2002) has shown that adult snoek is targeted by commercial line fishermen throughout the year, and instead availability of snoek in trawling grounds is seasonal as a result of spawning migrations. Therefore, the results of Griffiths (2002) suggest that snoek comprises two subpopulations, with limited interaction and exchange. Additionally, the results from ovarian analysis and migration patterns show that snoek spawn between 150- and 400-m isobaths of the western Agulhas Bank. The northward flow of the Benguela current acts as a transport vector for epipelagic snoek eggs and larvae from spawning grounds to nursery areas north of Cape Columbine and to the east of Danger Point, where juveniles remain until mature (growing between 33 and 44 cm). The distribution of juveniles within nursery areas is largely determined by prey availability, with a seasonal inshore migration in autumn due to the recruitment of clupeoid. Although longshore movement has been noted to occur during spawning season, there is no evidence connecting the movement to seasonal components and is thought to be random.

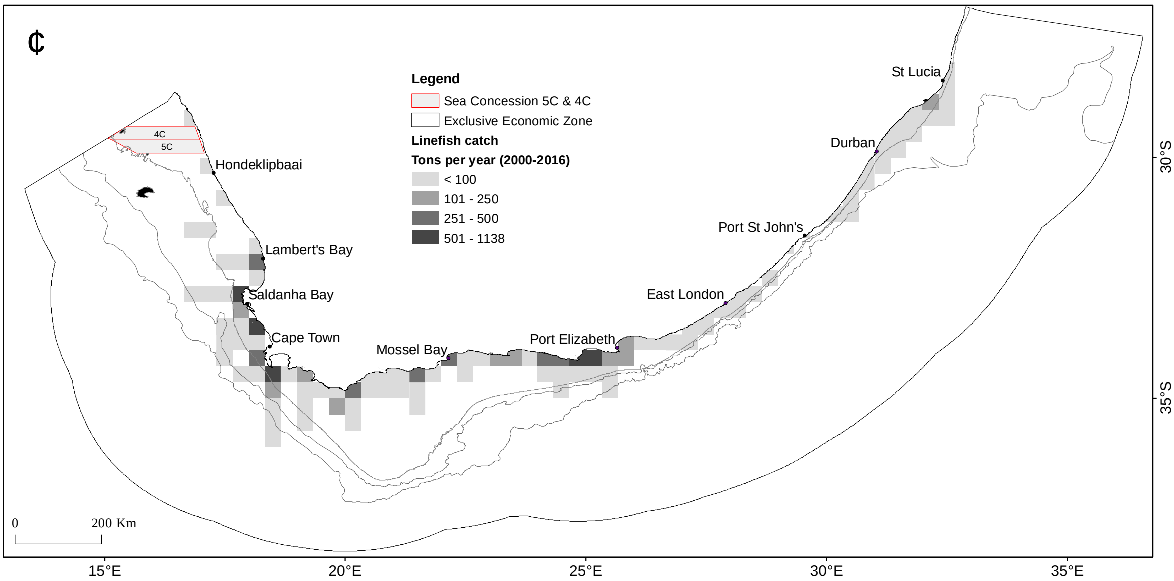


Figure 5-39: An overview of the spatial distribution of catch taken by the traditional linefish sector in the South African EEZ and in relation to Sea Areas 4C and 5C.

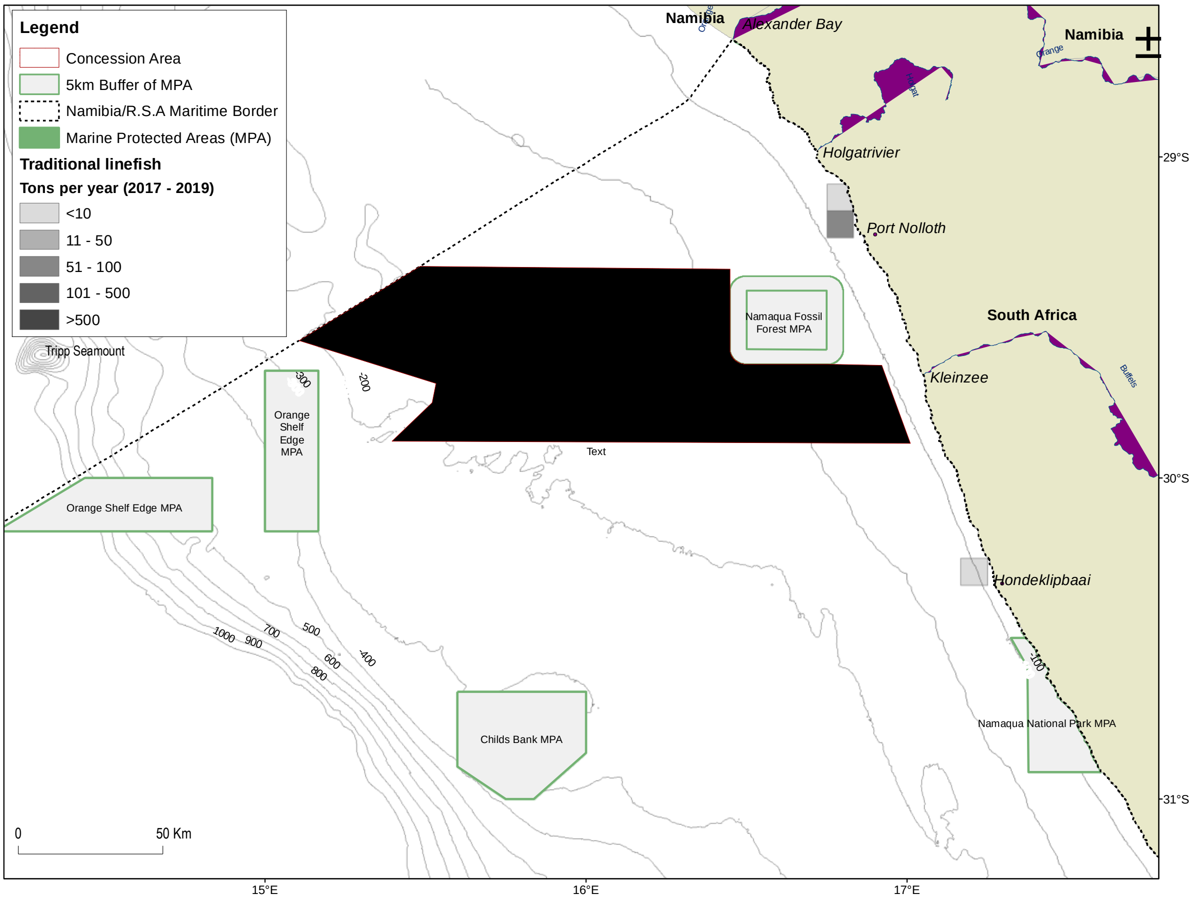


Figure 5-40: Spatial distribution of catch taken by the line-fish sector in relation to the concession area.

5.4.8 West Coast Rock Lobster

The West Coast rock lobster (*Jasus lalandi*) is a valuable resource of the South African West Coast and consequently an important income source for West Coast fishermen. The resource occurs inside the 200 m depth contour along the West Coast from Namibia to East London on the East Coast of South Africa. Fishing grounds stretch from the Orange River mouth to east of Cape Hangklip in the South-Eastern Cape.

The fishery Is comprised of four sub-sectors – commercial offshore, commercial nearshore, small-scale, and recreational, all of which have to share from the same national TAC. The 2021/22 TAC was set at 600 tonnes and apportionment of TAC by sub-sector is listed in Table 5-9. The TAC for the 2021/2022 fishing season was reduced by 28% from the previous fishing season (2020/2021). The updated stock assessment for the resource has indicated that it is further depleted than was thought to be the case two years ago, and poaching[10] is one of the major contributors to the recently exacerbated depleted status of the resource. The resource has over recent decades been at about 2.5% of the pristine level, but that over the last few years this had dropped to about 1.5%. Annual TAC and average monthly landings over the period 2006 to 2020 are shown in Figure 5-41 and Figure 5-42, respectively. A historical time-series of TACs and landings is listed in Table 5-10.

Table 5-9: Apportionment of TAC of rock lobster by sub-sector (DEFF, 2021).

Description	2019/2020 TAC (t)	2020/2021 TAC (t)	2021/2022 (t)
Commercial fishing (offshore)	563.91	435.88	301.28
Commercial fishing (nearshore)	170.25	131.03	100.92
Recreational fishing	38.76	30.08	21.57
Subsistence (interim relief measure) fishing Small-scale fishing sector (nearshore)	170.25	131.03	100.92
Small-scale fishing sector (offshore)	140.83	108.97	75.32
Total	1084	837.0	600

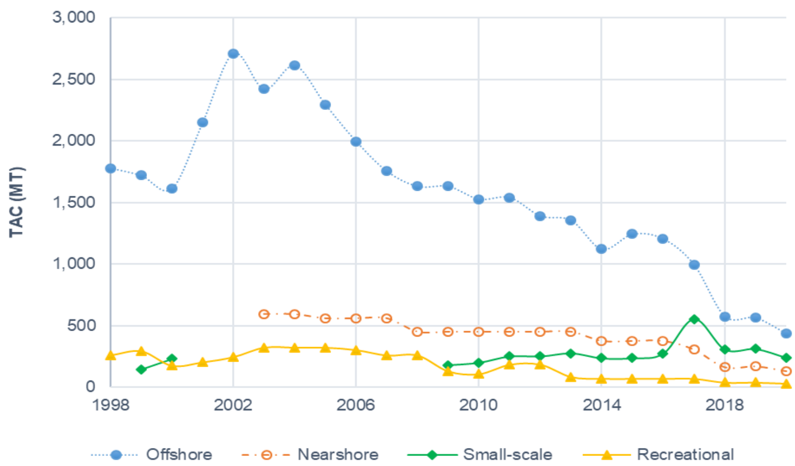


Figure 5-41: Graph showing the total allowable catch (TAC) of west coast rock lobster.

[10] In 2017, the poached rock lobster was estimated at 2 747 tonnes.

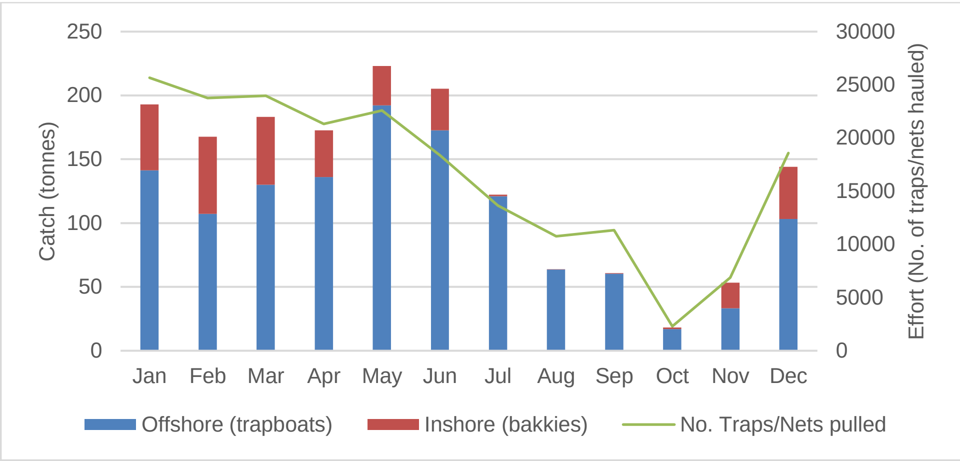


Figure 5-42: Graph showing the average monthly catch (tonnes) and effort (number of traps hauled) reported by the offshore (trapboat) and inshore (bakkie) rock lobster sectors over the period 2006 to 2020.

Table 5-10: Total allowable catch, fishing sector landings and total landings for West Coast rock lobster (DEFF, 2020).

	TAC (t)					
Season	**Global TAC**	**Offshore allocation**	**Nearshore allocation**	**Interim Relief**	**Recreational**	**Total catch**
1999/00	2 156	1720		145	291	2152
2000/01	2 018	1614		230	174	2154
2001/02	2 353	2151		[1]	202	2410
2002/03	2 957	2713		[1]	244	2706
2003/04	3 336	2422	594	[1]	320	3258
2004/05	3 527	2614	593	[1]	320	3222
2005/06	3 174	2294	560	[1]	320	2291
2006/07	2 857	1997	560	[2]	300	3366
2007/08	2 571	1754	560	[2]	257	2298
2008/09	2 340	1632	451	[2]	257	2483
2009/10	2 393	1632	451	180	129	2519
2010/11	2 286	1528	451	200	107	2208
2011/12	2 426	1541	451	251	183	2275
2012/13	2 276	1391	451	251	183	2308
2013/14	2 167	1356	451	276	83	1891
2014/15	1 800	1120	376	235	69	1688
2015/16	1 924	1243	376	235	69	1524
2016/17	1 924	1204	376	274	69	1564
2017/18	1 924	994	305	554	69	1355
2018/19	1 084	564	170	170	39	
2019/20	1 084	564	170	170	39	
2020/21	837	436	131	131	30	
2021/22	600	301	101	101	22	

[1] No Interim Relief allocated / [2] Interim Relief accommodated under Recreational allocation

The resource is managed geographically, with TACs set annually for different management areas. The commercial and small-scale fishing sectors are authorised to undertake fishing for four months in each management zone therefore closed seasons are applicable to different management zones. The start and end dates for the 2021/22 fishing season per sector and zone are shown in Table 5-11.

Table 5-11: Start and end dates for the fishing season 2021/22 by management zone. Special Project Report on the review of the TAC for West Coast Rock Lobster for the 2021/22 fishing season by the Consultative Advisory Forum for Marine Living Resources.

Area	Catch period	
	Commercial nearshore, interim relief, small-scale: nearshore	Commercial offshore, small-scale: offshore
Area 1 + 2	15 Oct, Nov, Dec, Jan, 15 Feb	
Area 3 + 4	15 Nov, Dec, Jan, Feb, 15 Mar	15 Nov, Dec, Jan, Feb, 15 Mar
Area 5 + 6	15 Nov, Dec, Jan, Feb, 15 Mar	
Area 7		Dec, Jan, Feb, Mar
Areas 8 and 11	15 Nov, Dec, Jan, Feb, 15 Mar	Jan, Mar, Apr, May
Area 8 (deep water)		Jun, Jul
Areas 12, 13 and 14	15 Nov, Dec, Jan, Feb, 15 Mar	

The commercial offshore sector operates at a depth range of approximately 30 m to 100 m, making use of traps consisting of rectangular metal frames covered by netting. These traps are set at dusk and retrieved during the early morning. Approximately 138 vessels participate in the offshore sector. The commercial nearshore sector makes use of hoop nets to target lobster at discrete suitable reef areas along the shore at a water depth of up to 30 m. These are deployed from a fleet of small dinghies/bakkies which operate from the shore and coastal harbours. Approximately 653 boats participate in the sector.

The delineation of management zones is shown in Figure 5-43. The five super-areas are: areas 1–2, corresponding to zone A; areas 3–4, to zone B; areas 5–6, to zone C; area 7, being the northernmost area within zone D; and area 8+, comprising area 8 of zone D as well as zones E and F.

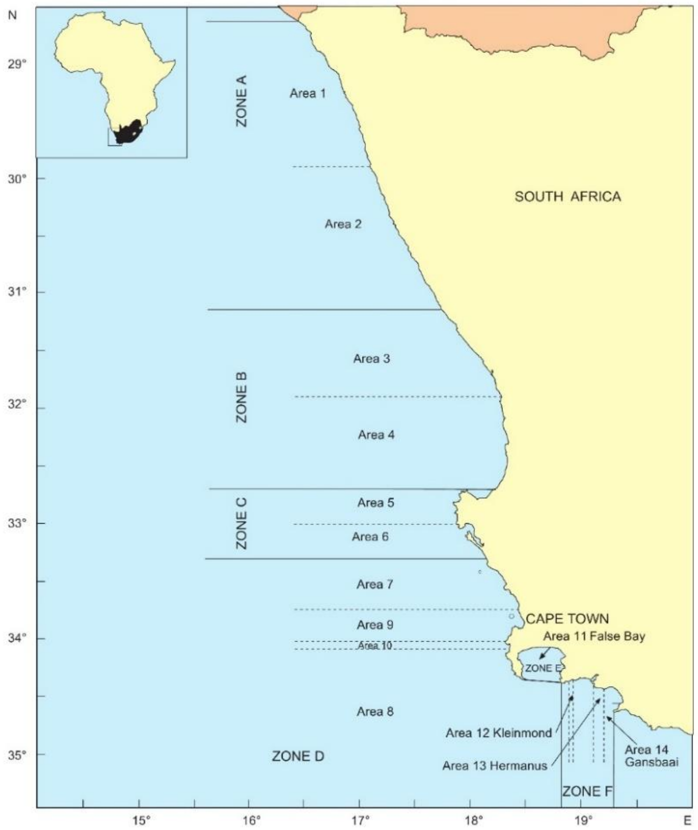


Figure 5-43: West Coast rock lobster fishing zones and areas. The five super-areas are: areas 1–2, corresponding to zone A; areas 3–4, to zone B; areas 5–6, to zone C; area 7, being the northernmost area within zone D; and area 8+, comprising area 8 of zone D as well as zones E and F.

As there is currently no commercial offshore fishing permitted within Management Areas 1 and 2, the proposed project activities would not coincide with areas targeted by the offshore commercial sub-sector.

Figure 5-44 shows the spatial distribution of fishing effort expended by the nearshore commercial sub-sector in the vicinity of the prospecting application area over the period 2016 to 2020. The concession area is situated offshore of rock lobster management zone 1 (Port Nolloth) and management zone 2 (Hondeklipbaai). Over the period 2005 to 2016, the nearshore sector reported an annual average of 742 nets set and 2.7 tonnes of lobster caught within the management areas adjacent to the prospecting application area. The amount of catch and effort reported within the area amounted to 0.7% and 1.4%, respectively, of the total national landings and overall effort expended by the nearshore sub-sector. A fleet of small dinghies/bakkies target lobster at discrete suitable reef areas along the shore at a water depth of up to 15 m. Fishing activity is expected to only be outside of the concession area. Management zones 1 and 2 have a seasonal operational window from 15 October to 15 February.

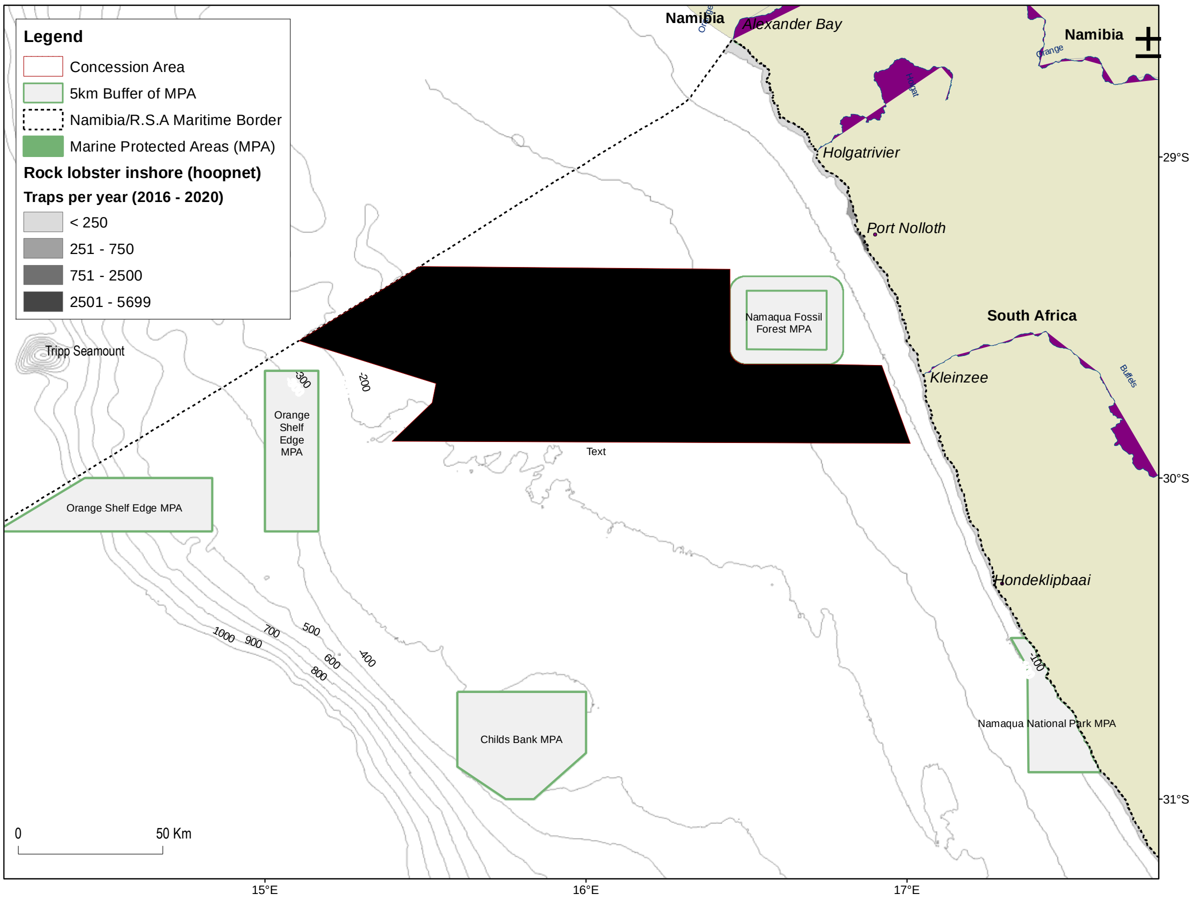


Figure 5-44: Spatial distribution of fishing effort expended by the west coast rock lobster inshore (bakkies/hoopnets) sector in relation to Sea Areas 4C and 5C. Lobster management zones are demarcated and labelled. Bathymetric contours shown are 50 m, 100 m and 150 m.

5.4.9 Abalone Ranching

The Abalone *Haliotus midae*, is endemic to South Africa and referred to locally as "perlemoen". The natural population extends along 1500 km of coastline 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). *H. midae* inhabits intertidal and subtidal rocky reefs, with the highest densities found in kelp forests (Branch et al., 2010). Kelp forests are a key habitat for abalone, as they provide a source of food and ideal ecosystem for abalone's life cycle (Branch et al., 2010). Light is a limiting factor for kelp beds, which are therefore limited to depths of 10m on the Namaqualand coast (Anchor Environmental, 2012). Habitat preferences change as abalone develop. Larvae settle on encrusted coralline substrate and feed on benthic diatoms and bacteria (Shepherd and Turner, 1985). Juveniles of 3-10 mm are almost entirely dependent on sea urchins for their survival, beneath which they conceal themselves from predators such as the West Coast rock lobster (Sweijd, 2008; Tarr et al., 1996). Juveniles may remain under sea urchins until they reach 21-35 mm in size, after which they move to rocky crevices in the reef. Adult abalone remain concealed in crevices, emerging nocturnally to feed on kelp fronds and red algae (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).

The commercial (diver) fishery for abalone started in the late 1940s and catches were initially unregulated, reaching a peak of close to 3 000 tonnes in 1965. By 1970, catches had declined rapidly, although the fishery remained stable, with a total annual catch of around 700 tonnes, until the mid-1990s, after which there were continuous declines in commercial catches (DAFF, 2016). The continued high levels of illegal fishing and declines in the resource led to the introduction of diving prohibitions in selected areas and the closure of the commercial fishery in 2008. The fishery was subsequently reopened in 2010, with TAC allocations of 150 tonnes. Latest published figures of abalone landings are 89.6 tonnes (2016/17). Historically, the resource was most abundant in the region between Cape Columbine and Quoin Point (refer to Figure 5-45). Along the East Coast, the resource was considered to be discontinuous and sparsely distributed and as a result no commercial fishery for abalone was implemented there.

Figure 5-45: Distribution of abalone (insert) and abalone fishing Zones A–G (Source DAFF, 2016).

South Africa is the largest producer of abalone outside of Asia (Troell et al., 2006). For example, in 2001, 12 abalone farms existed, generating US$12 million at volumes of 500-800 tonnes per annum (Sales & Britz, 2001). By 2006, this number had almost doubled, with 22 permits granted and 5 more being scheduled for development (Troell et al., 2006). Until recently, abalone cultivation has been primarily onshore, but abalone ranching provides more cost-effective opportunities for production (Anchor Environmental, 2012). Bannister (1991) defines marine ranching (reseeding) as “Identifiable stock released with the intention of being harvested by the releasing agency” (Government Gazette, 2010 No. 33470). Translocation is “where hatchery-produced seed are stocked into kelp beds outside the natural distribution” (Troell et al., 2006). Translocation of abalone occurs along roughly 50 km of the Namaqualand coast in the Northern Cape due to the seeding of areas using cultured spat specifically for seeding of abalone in designated areas (ranching) (Anchor Environmental, 2012). The potential to increase this to seeded area to 175 km has been made possible through the issuing of “Abalone Ranching Rights” (Government Gazette, 20 August 2010 No. 729) in four concession zones for abalone ranching between Alexander Bay and Hondeklipbaai (Diamond Coast Abalone 2016).

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 DFFE issued rights for each of four Concession Area Zones (refer to Figure 5-46).

Abalone ranching includes the spawning, larval development, seeding and harvest. An onshore hatchery supports the ranching in the adjacent sea (Anchor Environmental, 2012). Two hatcheries exist in Port Nolloth producing up to 250 000 spat. To date, there has been no seeding in Zones 1 or 2. Seeding has taken place in Zones 3 and 4. Sea Area 4C coincides with Zone 2 and Sea Area 5C coincides with Zone 3 (refer to Figure 5-46). As the maximum depth of seeding is considered to be approximately 10 m, which this lies inshore of the concession area, the proposed area of operations would not coincide with abalone seeding areas.

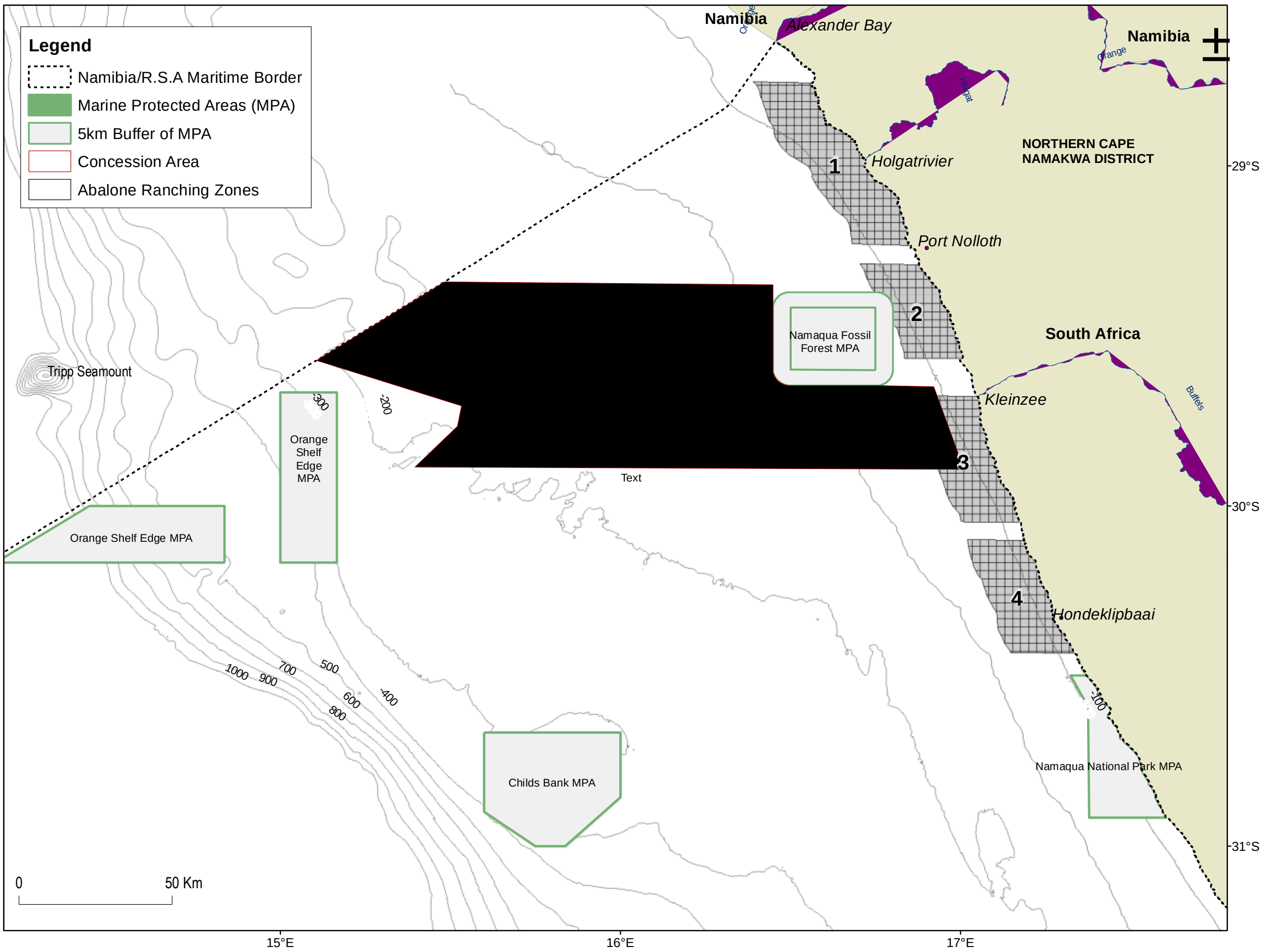


Figure 5-46: An overview of the spatial distribution of abalone ranching concession areas in relation to the concession area.

5.4.10 Beach Seine and Gillnet Fisheries (Netfish)

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 utilize 1 373 registered and 458 illegal 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% "bycatc" species such as galjoen (*Dichistius capensis*), yellowtail (*Seriola landii*) and white steenbras (*Lithognathus lithognathus*). Catch-per-unit-effort declines eastwards from 294 and 115 kg·net-day^{-1} for the beach-seine and gillnet fisheries respectively off the West Coast to 48 and 5 kg·net-day^{-1} off KwaZulu-Natal. Consequently, the fishery changes in nature from a largely commercial venture on the West Coast to an artisanal/subsistence fishery on the East Coast (Lamberth et al. 1997).

The fishery is managed on a Total Allowable Effort (TAE) basis with a fixed number of operators in each of 15 defined areas (see Table 5-12 for the number of rights issued and Figure 5-47 for the fishing areas). The number of Rights Holders for 2014 was listed as 28 for beach-seine and 162 for gillnet (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 linefish species that they traditionally exploited.

Table 5-12: Recommended Total Allowable Effort (TAE, number of rights and exemption holders) and rights allocated in 2016-17 for each netfish area. Levels of effort are based on the number of fishers who could maintain a viable income in each area (DAFF 2017).

Area	Locality	Beach-seine	Gillnet/driftnet	Total	Rights allocated
A	**Port Nolloth**	**3**	**4**	**7**	**4**
B	**Hondeklipbaai**	**0**	**2**	**2**	**0**
C	Olifantsriviermond-Wadrifsoutpansmond	2	8	10	4
D	Wadrifsoutpansmond-Elandsbaai-Draaihoek	3	6	9	6
E	Draaihoek, (Rochepan)-Cape Columbine, including Paternoster	4	80	84	84
F	Saldhana Bay	1	5	6	5
G	Langebaan Lagoon	0	10	10	10
H	Yzerfontein	2	2	4	1
I	Bokpunt (Melkbos)-Milnerton	3	0	3	1
J	Houtbay beach	2	0	2	0
K	Longbeach-Scarborough	3	0	3	1
L	Smitswinkel Bay, Simonstown, Fishoek	2	0	2	2
M	Muizenberg-Strandfontein	2	0	2	2
N	Macassar*	0	0	0	(1)
OE	Olifants River Estuary	0	45	45	45

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 three rights issued for Area A (Port Nolloth) and 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, four operate within Area A (Port Nolloth) and two operate within Area B (Hondeklipbaai).

Sea Area 5C is situated offshore of management area B, however the range of gillnets (50 m) and that of beach-seine activity (20 m) is not likely to directly overlap with the prospecting application area which is situated in waters deeper than 50 m. Figure 5-48 shows the expected range of gillnet and beach-seine fishing activity in relation to the prospecting application area.

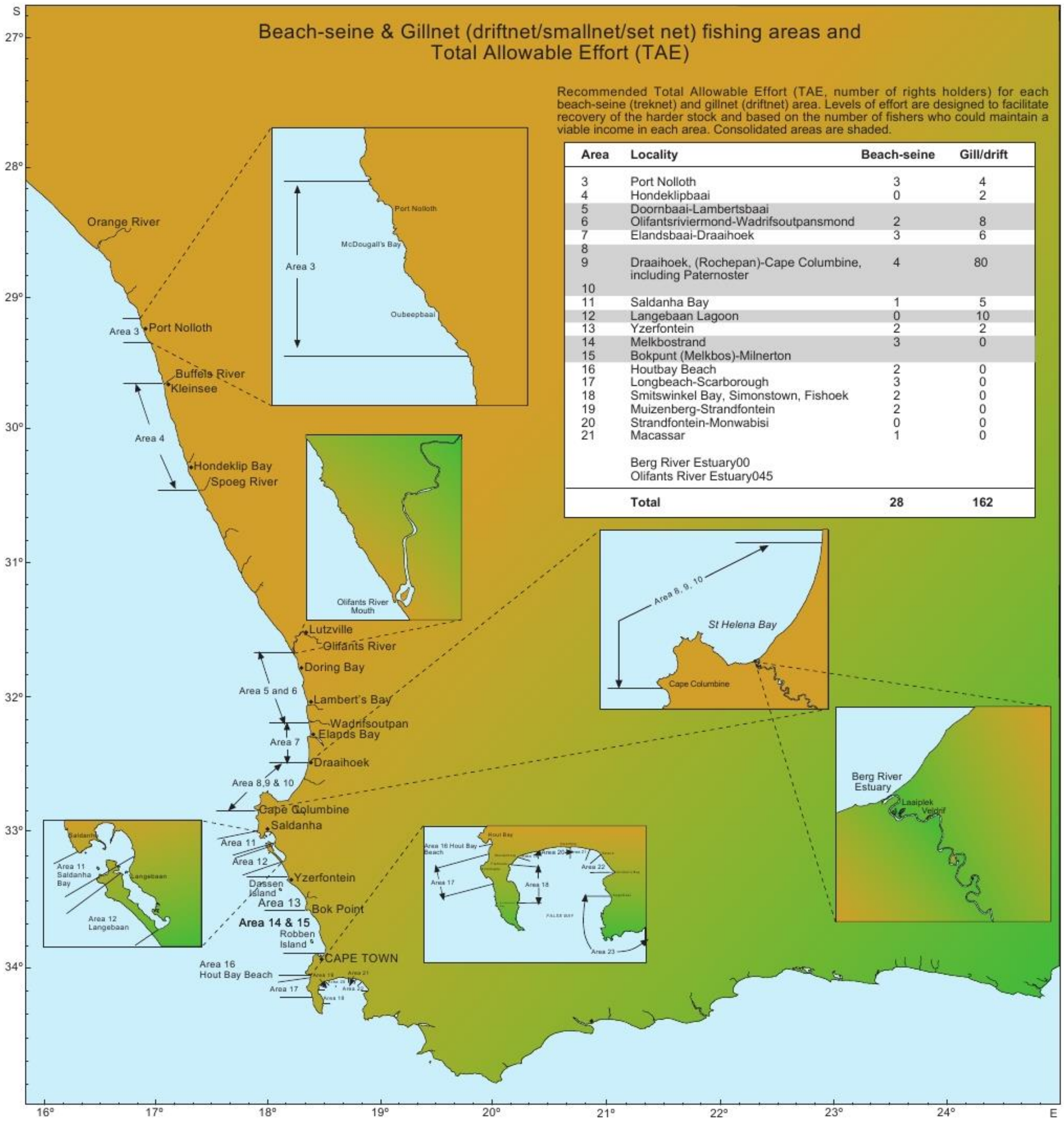


Figure 5-47: Beach-seine and gillnet fishing areas and TAE (DAFF, 2014).

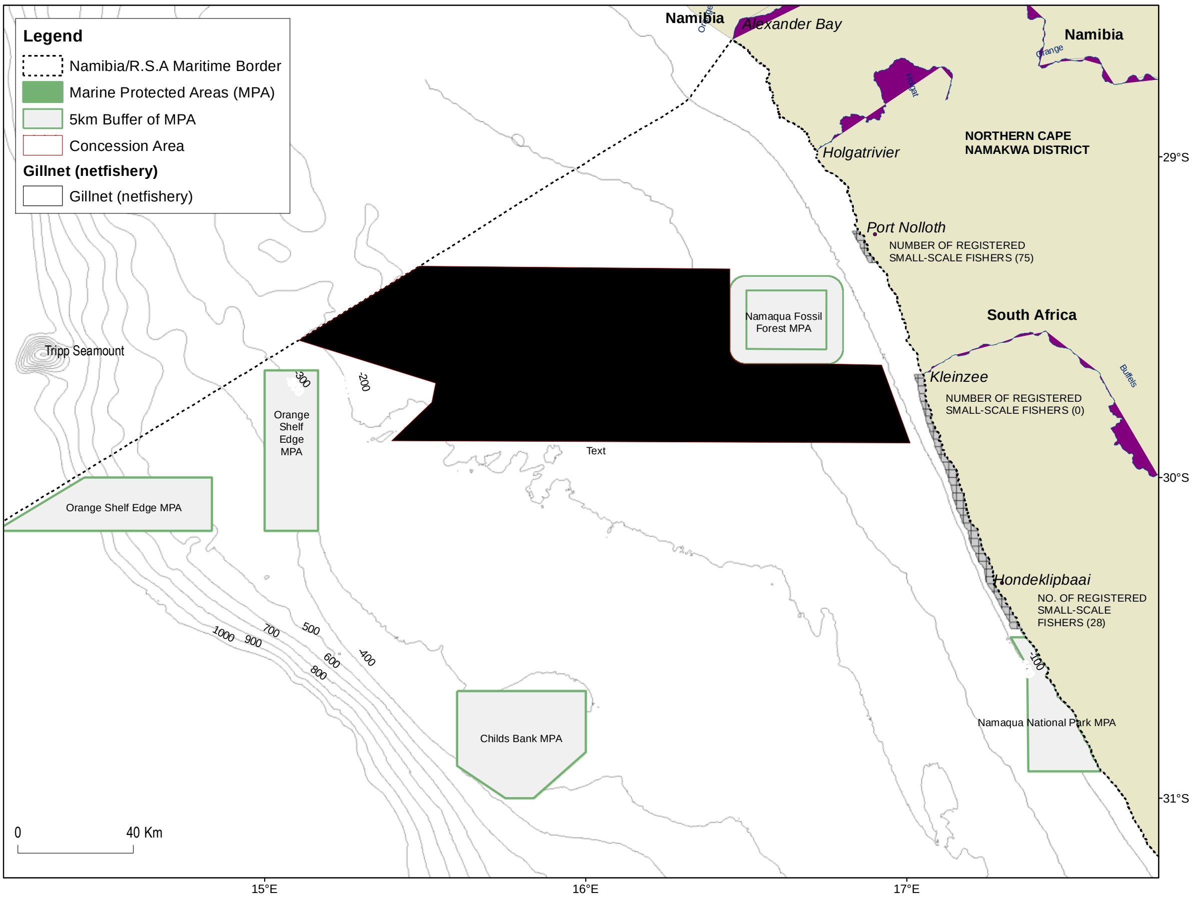


Figure 5-48: Number of rights issued for gillnet fishing areas A (Port Nolloth) and B (Hondeklipbaai) to a maximum fishing depth of 50 m (DAFF, 2016/17) in relation to the concession area.

5.4.11 Small-Scale Fisheries

The concept of Small-Scale Fisheries (SSF) is a relatively new addition to the fisheries complexity in South Africa. The concept has its origin in a global initiative supported by the Food and Agricultural Organisation of the United Nations (FAO). In South Africa, there is a long history of coastal communities utilizing marine resources for various purposes. Many of these communities have been marginalized through apartheid practices and previous fisheries management systems. In 2007 government was compelled through an equality court order to redress the inequalities suffered by these traditional fishers. The development of a SSF sector aims in part to compensate previously disadvantaged fishing communities that have been displaced either politically, economically or by the development of large-scale commercial fisheries. This led to the development of the Small-Scale Fisheries Policy (SSFP), the aim of which is to redress and provide recognition of the rights of small-scale fishers (DAFF, 2015). The SSFP was gazetted in May 2019 under the Marine Living Resources Act, 1998 (Act No. 18 of 1998). It is only now (2021/2022) in an advanced process of implementation. It is a challenging process that has been exacerbated by the conflict and overlap with another fisheries-related process of fishing rights allocations (known as Fishery Rights Allocation Process or “FRAP”). As of August 2022, neither process has been concluded and the issues at stake are highly politicised. The SSF overlaps other historical fisheries in South Africa, leading to legal challenges where the SSF rights allocations are in conflict with other established commercial fishing sectors, most notably the commercial squid fishing sector. SSF is defined as a fishery although specific operations and dynamics are not yet fully defined as they are subject to an ongoing process by DFFE. The SSF regulations

(DAFF, 2016) do however define the fishing area for SSF as "near-shore", meaning "the region of sea (including seabed) within close proximity to the shoreline". The regulations further specify under Schedule 5 *Small-scale fishing areas and zones* in which "5. (1) In order to facilitate the establishment of areas where small-scale fishers may fish, the Department must set up a procedure to engage and consult with the small-scale fishing community in proposing demarcated areas that may be established as areas where small-scale fishers may fish and which under section 5 (2)b. "*take into account the mobility of each species in the allocated basket of species with sessile species requiring smaller fishing areas while nomadic and migratory species requiring larger area.*

Small-scale fishers fish to meet food and basic livelihood needs, but may also directly be involved in fishing for commercial purposes[11]. These fishers traditionally operate on nearshore fishing grounds to harvest marine living resources on a full-time, part-time, or seasonal basis. Fishing trips are usually of short-duration and fishing/harvesting techniques are labour intensive[12].

Small-scale fishers are an integral part of the rural and coastal communities in which they reside, and this is reflected in the socio-economic profile of such communities. 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 areas (Sunde & Pedersen C., 2007; Sunde, 2016.).

Many communities living along the coast have, over time, developed local systems of rules to guide their use of coastal lands, forests and waters. These local rules are part of their systems of customary law. Rights to access, use, and own different natural resources arise from local customary systems of law. These systems of law are not written down as in Western law, but are passed down from generation to generation through practice (https://www.masifundise.org/wp-content/uploads/2011/06/vissernet-eng-news-3-final.pdf). South Africa's Constitution recognises customary law together with common law and state law. Section 39 (3) makes provision for a community that has a system of customary rights arising from customary law to be recognised as long as these rights comply with the Bill or Rights. In line with this, the SSFP also recognises rights arising in terms of customary law. Customary fishers are normally associated with discrete groups (tribes or communities with unique identities and associations with the sea) who may be defined by traditions and beliefs (see also Pretorius, 2022). These traditions are increasingly being challenged as stocks and marine resources have been depleted. This would include, for example, intertidal harvesting of seaweed, mussels, oysters, cephalopods and virtually any species available to these communities. These fishers are generally localised and do not range far beyond the areas in which they live[13].

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[11] There is no formal designation of artisanal (or traditional/subsistence) fishing in South Africa, which is generally considered as fishing or resource extraction for own use. As fisheries have evolved and the commercial benefit realised, subsistence fishers have increasingly moved to commercialisation aimed at supporting their livelihoods. This group can now, therefore, also include shore and boat-based anglers and spear-fishers who target a wide range of line fish species, some of which are also targeted by commercial operations, skin divers who collect rock lobsters and other subtidal invertebrates, bait collectors (mussels, limpets, red bait) and non-subsistence collectors of intertidal organisms. The high value of many intertidal and subtidal resources (e.g., rock lobster, abalone, and mussels) has resulted in an increase in their production through aquaculture and small-scale harvesting in recent years (Clark, et al., 2010).

[12] The equipment used by small scale fishers includes rowing boats in some areas, motorized boats on the south and west coast and simple fishing gear including hands, feet, screw drivers, hand lines, prawn pumps, rods with reels, gaffs, hoop nets, gill nets, seine/trek nets and semi-permanently fixed kraal traps.

[13] It can include foot-fishers, but also boat fishers who may have difficult or restricted options for launching sites. Note that in some areas fishers are increasingly using more sophisticated technology such as fish finders and

SSF 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 SSF is to be implemented along the coast in series of community co-operatives. Only a co-operative is deemed to be a suitable legal entity for the allocation of small-scale fishing rights[14]. These community co-operatives will be given 15-year small-scale fishing Rights. The criteria to be applied in determining whether a person is a small-scale fisher are that the person must (a) be a South African citizen who associates with or resides in the relevant small-scale fishing community; (b) be at least 18 years of age; (c) historically have been involved in traditional fishing operations, which include catching, processing or marketing of fish for a cumulative period of at least 10 years; and (d) derive the major part of his or her livelihood from traditional fishing operations and be able to show historical dependence on fish, either directly or in a household context, to meet food and basic livelihoods needs..

More than 270 communities have registered an Expressions of Interest (EOI) with the Department and approximately 10 000 small-scale fishers have been identified around the coast. DFFE has split SFF by communities into district municipalities and local municipalities. These fishers are generally localised and do not range far beyond the areas in which they live. Port Nolloth and Hondeklipbaai being the closest communities to the concession area.

In the Northern Cape, there are 103 fishers registered in the Namakwa district, comprising the Richtersveld and Kamiesberg local municipalities. Western Cape districts include 1) West Coast (Berg River, Saldanha Bay, Cederberg, Matzikama and Swartland local municipalities; 2) Cape Metro; 3) Overberg (Overstrand and Cape Agulhas); and 4) Eden (Knysna, Bitou and Hessequa). In total there are 2748 fishers registered in the Western Cape. In the Eastern Cape, the communities are again split up, broadly as 1) Nelson Mandela Bay, 2) Sarah Baartman, 3) Buffalo City, 4) Amathole, 5) O.R. Tambo and 6) Alfred Nzo. There are 5154 fishers registered in the province. KwaZulu-Natal has 2008 registered small-scale fishers divided by district into 1) Ugu, 2) Ethekwini Metropolitan, 3) Ilembe, 4) King Shwetshayo/Uthungula, and 5) Umkhanyakude.

The SSFP requires a multi-species approach to allocating rights, which entails the allocation of rights for a basket of species that may be harvested or caught within particular designated areas[15]. Section 6 of the regulations covers access *Management of the rights of access*. Co-operatives can only request access to species found in their local vicinity. DFFE recommends 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.

The mix of species to be utilised by small-scale fishers includes species that are exploited by existing commercial sectors viz; traditional linefish, west coast rock lobster, squid, hake handline16, abalone,

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Larger motorised boats. This ability means their activities may be increasingly commercialised and may overlap with more established commercial fishery sectors.

[14] A co-operative is jointly owned and democratically controlled by small-scale fishers.

[15] Under the SSF regulations the species that may be included in the "basket" are provided in Annexures 2, 3 & 4 that includes fish species that are listed on the non-saleable list, and those that 2 shall only be caught for own consumption within the corresponding limits.

[16] Hake handline is a small subsector of the hake fishery and requires a fishing right apportionment. The fishery has in recent years not been active because of resource availability. It is perceived as having potential for allocation as part of the SSF and as part of their "basket".

KZN beach seine, netfish (gillnet and beach-seine), seaweed and white mussel. An apportionment of TAE/TACs for these species will be transferred from existing commercial rights to SSF[17], whereas white mussels will become the exclusive domain of SSF. Species nominated for commercial use will be subject to TAE and/or TAC allocation. Species nominated for own use will be available to all members of a particular co-operative, but subject to output controls.

The small-scale fishery rights cover the nearshore area (defined in section 19 of the MLRA as being within close proximity of shoreline). Small-scale fishermen along the Northern Cape and Western Cape coastlines are typically involved in the traditional line, west coast rock lobster and abalone fisheries, whereas communities on the South Coast would be involved in traditional line, squid jig and oyster harvesting. The small-scale communities on the West Coast, with long family histories of subsistence fishing, prioritise the harvest of nearshore resources (using boats) over the intertidal and subtidal resources.   An example of such boats is shown in Figure 5-49.

**Figure 5-49:	Fishing boats outside the Hondeklipbaai small-scale community co-operative (photo credit Carika van Zyl).**

Snoek (*Thyrsites atun*), Cape bream / hottentot (*Pachymetopon blochii*) and yellowtail (*Seriola lalandi*) are important linefish species that are targeted by small-scale fishers operating nearshore along the West and South-West Coast of South Africa (refer to Section 5.4.7 for traditional linefish).

Snoek is targeted by small-scale fishers during the snoek seasonal migration between April and June, during which time they shoal nearshore and are therefore available to handline fishermen[18]. Snoek

[17] DFFE proposes that 50% of the overall TAE and TAC for the traditional linefish and abalone sectors, respectively, will be apportioned to small-scale fishing whereas 25% of the overall TAE for squid will be apportioned to small-scale fishing (DEFF 2020).

[18] Snoek is known to undertake migrations in a southward direction from the waters of the northern Benguela into the southern Benguela towards the cape west and southern coasts. These migrations have certainly been long taken advantage of by fishers, including traditional linefishers and communities along the west coast. Commercial fishers as well as the Small-Scale Fishery (SSF) sector capitalise on the inshore availability, but this opportunity is lost once the snoek move offshore in mid-winter and start their northward migration. Snoek is primarily a "winter" fish, moving systematically southwards in autumn and commercial linefish, recreational, and community-based boats exploit this shoaling species mostly in the nearshore. Snoek is also caught by the hake trawl fleets in significant numbers at times as snoek may undertake diurnal migrations feeding or spawning in deeper waters (and are not accessible to surface line fishers at these times). There is however no definitive description of snoek migrations with regard to their exact spatial and temporal movements.

availability coincides with peaks in the availability of other small pelagic species, notably anchovy and sardine (Nepgen, 1979). As shown by Crawford et al. (1987) [19][20] snoek stays inshore on their southward migration (i.e., April through to June) and then move offshore into deeper waters to spawn[21] in July and August (and are not available to linefishers during these times as the fish are beyond the depth range of surface linefishers).

Small-scale fishers also target west coast rock lobster (*Jasus66alandii*) using hoopnets set by small "bakkies" on at a water depth of less than 30 m. Fishing activity may range up to 100 m water depth by the larger vessels that participate in the offshore commercial rock lobster trap sector (refer to Section 5.4.8).

The small-scale fishery rights cover the nearshore area (defined in section 19 of the MLRA as being within close proximity of shoreline). These in reality are unlikely to extend beyond 3 nm from the coast. Small-scale fishermen along the Northern Cape coast are typically involved in the traditional line, west coast rock lobster and net fisheries (refer to sections 5.4.7, 5.4.8 and 5.4.10).

5.4.12 Seaweed

Seaweed is also regarded as a fishery, with harvesting of kelp (*Ecklonia maxima*) and (*Laminaria pallida*) in the Western and Northern Cape and hand-picking of *Gelidium* sp. in the Eastern Cape. The seaweed industry employs over 1 700 people, most of whom are previously disadvantaged. Although both species are harvested, *E. maxima* are most in demand and constitute most of the biomass, which is primarily used by the abalone aquaculture industry as abalone feed. However, the demand placed on the resource outweighs what is available for harvest, particularly in areas close to abalone farms. Seaweed harvesting is highly regulated in South Africa and is managed in the form of concession areas. Each concession area is awarded to a rights holder with a limit set for that particular area on the amount (biomass) of kelp that can be legally harvested. Seaweed is either harvested in situ or from beaches in the form of kelp-wrack. Kelp-wrack consists of kelps dislodged from the substratum during times of high wave energy and are transported by ocean currents towards the coast, eventually depositing on beaches. The quality of in situ kelp is considered higher than that of kelp-wrack; therefore, in situ kelp is the preferred option; however, kelp-wrack is targeted when in situ harvesting is not possible. Kelp can also be harvested by the general public by hand from beaches and shorelines, provided they have the appropriate permit.

The biogeographical distribution of kelps is limited by several environmental factors, with seawater temperature being the main limitation. Due to this limiting factor, the two main species of kelp in South Africa, *Ecklonia maxima* and *Laminaria pallida*, are distributed along the south coast from De Hoop, extending westward around the Cape Peninsula and further extending north into Namibia (Molloy and Bolton, 1996; Stegenga, 1997). Temperature around the coastline varies as one moves from Namibia

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[19] The Benguela ecosystem: Part IV. pgs 438

[20] See also Nepgen (1979) in Fish. Bull. S Afr. 12:35-43

[21] Snoek spawning occurs offshore during winter-spring, along the shelf break (150-400 m) of the western Agulhas Bank and the South African west coast. Prevailing currents transport eggs and larvae to a primary nursery ground north of Cape Columbine and to a secondary nursery area to the east of Danger Point; both shallower than 150 m. Juveniles remain on the nursery grounds until maturity, growing to between 33 and 44 cm in the first year (3.25 cm/month). Onshore-offshore distribution (between 5- and 150-m isobaths) of juveniles is determined largely by prey availability and includes a seasonal inshore migration in autumn in response to clupeoid recruitment. Adults are found throughout the distribution range of the species, and although they move offshore to spawn - there is some southward dispersion as the spawning season progresses - longshore movement is apparently random and without a seasonal basis (Griffiths, 2002).

towards the Cape Peninsula and De Hoop, where coastal temperature increases. False Bay is a region of warmer temperatures where *E. maxima* and *L. pallida* have extended their distribution eastwards in recent years (Bolton et al., 2012), which has thought to be related to climate change effects (Bolton et al., 2012). Upwelling is an essential oceanographic process in the marine environment, which supplies cool, nutrient-rich water from the deep ocean into coastal regions (Rouault et al. 2010). The increased frequency of upwelling along the coastline, as a result of climate change, has created a temperature environment suitable for kelp populations (Bolton et al., 2012). The extension of kelp species has these endemic species in a unique position relative to other kelp species worldwide, where populations have declined significantly (Krumhansl et al. 2016). The expansion of kelp biomass along the coastline provides the opportunity for further exploitation and harvesting activities. Also, it expands the habitat for economically important species, such as abalone and West Coast rock lobster.

Although both species (*E. maxima* and *L. pallida*) occur together for most of the coastline, their resource needs vary. Generally, E. maxima occur between depths of 4-10 m deep and extend to the surface to form a canopy, while L. pallida occupy depths greater than 10 m and do not extend to the surface but instead form a subsurface canopy (Coppin et at. 2020). In general, kelp species are known for their resilience to environmental changes and are able to adapt rapidly to changing environmental conditions. Rapid adaptation is achieved through developing morphological characteristics which reduce drag forces, and ultimately, the probability of dislodgement (Coppin *et at.* 2020). In high wave energy environments, kelps take on morphological characteristics that either increase strength of attachment to the substrate or reduce drag forces on structural components (Coppin *et at*. 2020). The reduction of surface area (drag reducing trait) comes at a physiological cost which in turn reduces the amount of light and nutrients which can be absorbed. Therefore, kelps must balance their photosynthetic need with that of reducing probability of dislodgment (Coppin et at. 2020). Warmer temperatures affect important kelp physiological processes such as photosynthesis and respiration which influences growth and productivity (Bearham et al. 2013; Gao et al. 2013). Although kelps are highly resilient species, there is a threshold beyond which kelps will no longer be able to adapt (Coppin *et at*. 2020).

The larger species, *E. maxima*, is a conspicuous organism along the coastline and dominates the biomass of the nearshore, while *L. pallida* are limited to the sub-surface for most of the coastline. Towards the north along the west coast, from approximately Hondeklipbaai, *L. pallida* replaces *E. maxima* as the dominant kelp species (Velimirov et al., 1977; Stegenga, 1997) and occupy increasingly shallow subtidal regions. The northern populations also exhibit an increase in stipe hollowness compared to the solid stipe morphs in the species' southern distributions (Molloy and Bolton, 1996). This variation in morphology was thought to represent two distinct species, with the northern populations formerly described as Laminaria schinzii Foslie (Molloy and Bolton, 1996). Genetic work has subsequently shown that the two morphs are, in fact, the same species (Rothman et al., 2017b). Although the mechanism which influences morphology between populations of *L. pallida* has not been empirically established, it has been suggested that the distinct morphology and replacement of *E. maxima* further north of the coast is a result of turbidity (Rothman et al., 2017a). Light is a significant influencer of kelp populations, with *E. maxima* requiring more light than *L. pallida* which can exploit low-light habitats (Rothman et al., 2017a). The lower light requirement of *L. pallida* allows this species to outcompete *E. maxima* along the west coast and ultimately dominate the biomass of the coastline further North and into Namibia.

The biggest threat to kelp forests is temperature and wave exposure which may thin populations over time. Warmer temperatures (rising ocean temperatures and marine heatwaves) cause physiological stress to individuals, and high wave energy (storms) dislodges kelps from the substrate (Graham, 2004; Byrnes et al. 2011). Kelps with air-filled structures, which allow them to remain upright within the water column, may float to the surface once dislodged and are transported via ocean currents to near and distant offshore areas and coastlines (Smith, 2002). The dispersion of kelp to near and distant ecosystems has been recognised as an important organic subsidy that many organisms rely on (Bustamante and Branch, 1996; Krumhansl and Scheibling, 2012). Along with the organic subsidy, kelps also provide a vital economic resource for coastal populations (Troell et al. 2016).

Much of the harvest is sun-dried, milled and exported for the extraction of alginate. Fresh kelp is also harvested in large quantities in the Western Cape as feed for farmed abalone. This resource, with a market value of about R6 million is critically important to local abalone farmers. Fresh kelp is also harvested for high-value plant-growth stimulants that are marketed locally and internationally.

Harvesting rights are issued by management area. Whilst the Minister annually sets both a TAC and TAE for the sector, the principal management tool is effort control and the number of right holders in each seaweed harvesting area is restricted. Fourteen commercial seaweed harvesting rights are currently allocated and each concession area is limited to one right-holder for each functional group of seaweed (e.g., kelps, *Gelidium* spp. and Gracilarioids). In certain areas there are also limitations placed on the amounts that may be harvested.

Table 5-13 lists the annual yields of commercial seaweeds in South Africa between 2003 and 2018. The South African coastline is divided between the Orange River and Port St Johns into 23 seaweed Rights areas (Figure 5-50).

Table 5-14 lists the yield of kelp by area for the 2018 season. Permit conditions stipulate that beach cast kelp may be collected by hand within these management areas and that kelp may be harvested using a diver deployed from a boat or the shore.

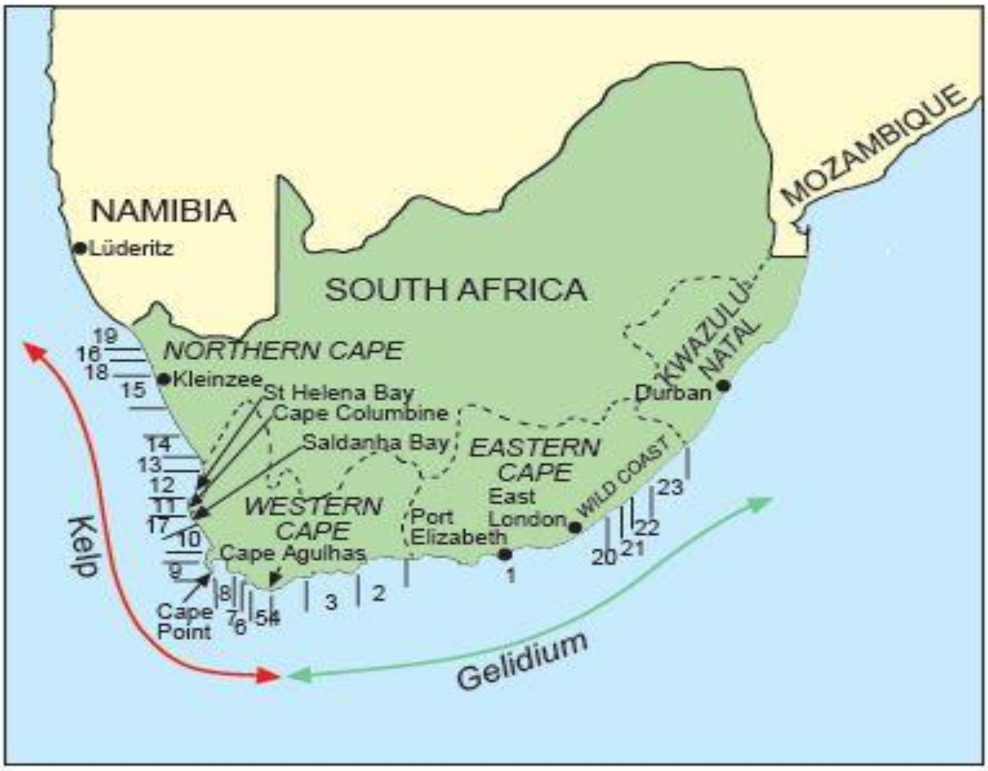

Figure 5-50: Map of seaweed rights areas in South Africa (DEFF, 2020).

Table 5-13: Annual yields of commercial seaweeds in South Africa (2003 – 2018). "Kelp beach cast' refers to material that is collected in a semi-dry state, whereas 'kelp fresh beach cast' refers to clean, wet kelp fronds that, together with 'kelp fronds harvest', are supplied as abalone feed (DEFF, 2020).

Year	*Gelidium* (kg dry weight)	Gracilarioids (kg dry weight)	Kelp beach cast (kg dry weight)	Kelp fronds harvest (kg fresh weight)	Kelp fresh beach cast (kg fresh weight)	Kelpak (kg fresh weight)
2003	113 869	92 215	1 102 384	4 050 654	1 866 344	957 063
2004	119 143	157 161	1 874 654	3 119 579	1 235 153	1 168 703
2005	84 885	19 382	590 691	3 508 269	126 894	1 089 565
2006	104 456	50 370	440 632	3 602 410	242 798	918 365
2007	95 606	600	580 806	4 795 381	510 326	1 224 310
2008	120 247	0	550 496	5 060 148	369 131	809 862
2009	115 502	0	606 709	4 762 626	346 685	1 232 760
2010	103 903	0	696 811	5 336 503	205 707	1 264 739
2011	102 240	0	435 768	6 023 935	249 651	1 617 915
2012	108 060	0	1 063 233	6 092 258	1 396 227	1 788 881
2013	106 182	0	564 919	5 584 856	253 033	2 127 659
2014	75 900	0	775 625	4 555 704	244 262	1 610 023
2015	95 200	0	389 202	3 974 100	249 014	1 930 654
2016	102 500	0	411 820	4 044 759	100 018	2 166 293
2017	102 802	0	482 082	3 254 561	63 276	3 001 611
2018	89 253	0	540 498	4 803 358	552 691	1 886 691

Table 5-14: Maximum sustainable yield of harvested kelp for all areas for the 2018 season (1 March 2018 – 28 February 2019). Source DFFE, 2020.

Area Number	Whole kelp (t fresh weight)	Kelp fronds (t fresh weight)
5	0	2 625
6	174	4 679
7	1 421	710
8	2 048	1 024
9	2 060	2 080
10	188	94
11	3 085	1 543
12	50	25
13	113	57
14	620	310
15	2 200	1 100
16	620	310
18	2 928	1 464
19	765	383
Total	18 371	16 404

Figure 5-51: Sea Areas 4C and 5C in relation to management areas 16 and 15, situated offshore of Port Nolloth and Hondeklipbaai, respectively.

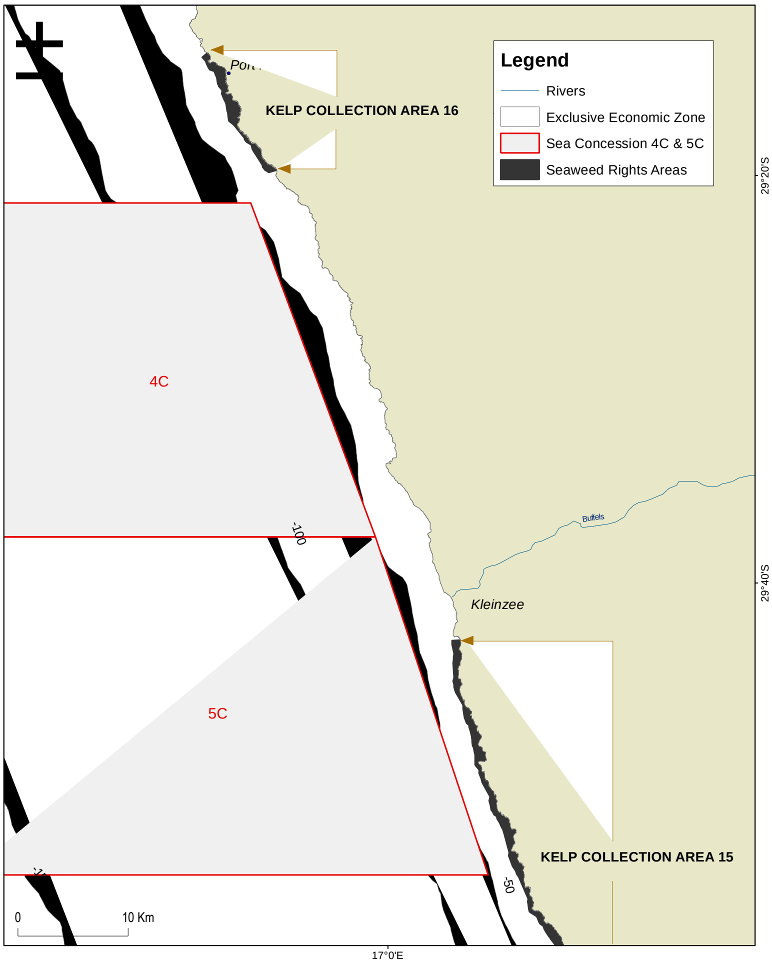

Figure 5-52: Location of seaweed rights areas in relation to Sea Areas 4C and 5C.

Permit conditions stipulate that beach cast kelp may be collected by hand within these management areas and that kelp may be harvested using a diver deployed from a boat or the shore. Over the period 2000 to 2017, an average of 40.33 tonnes per annum of dry harvested kelp (beach cast) and 34.67 tonnes per annum of wet harvested kelp were reported within collection area 15. An average of 37 tonnes per annum of dry harvested kelp and 37.33 tonnes of wet harvested kelp were reported within collection area 16. Amounts harvested within these collection areas amounts to approximately 16.3% of the total kelp harvests, nationally. The harvesting areas are not expected to coincide with the prospecting application area, which lies beyond the depth range at which divers could harvest kelp.

5.5 Summary of Fisheries Seasonality

The seasonality of each of the fishing sectors that operate in the vicinity of the concession area is indicated in Table 5-15 – also presented is the relative intensity of fishing effort on a month-by-month basis.

Table 5-15: Summary table showing seasonal variation in fishing effort expended by each of the main commercial fisheries sectors in the vicinity of Sea Areas 4C and 5C.

Sector	Fishing Intensity by Month in the Vicinity of Sea Areas 4C and 5C H = high; M = Low to Moderate; N = None											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demersal Trawl	H	H	H	H	H	H	H	H	H	H	H	H
Demersal Longline	M	H	H	H	H	M	H	H	H	H	H	H
Large Pelagic Longline	M	M	M	M	H	H	H	H	H	H	H	M
Pole-and-line (tuna pole)	N	N	M	M	M	M	M	N	N	N	N	N
Traditional Linefish	N	N	M	M	M	M	M	M	M	N	N	N
West Coast Rock Lobster (nearshore)	M	M	N	N	N	N	N	N	N	M	M	M
Small-scale (linefish & rock lobster nearshore sectors)	M	M	M	M	M	M	M	M	M	M	M	M
Research survey (trawl)	M	M	N	N	N	N	N	N	N	N	N	N
Research survey (acoustic)	N	N	N	N	M	M	N	N	N	N	M	N

6 Impact Assessment

6.1 Impact Assessment Methodology

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

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

The criteria used to determine impact consequence are presented in the table below.

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

Rating	Definition of Rating	Score
A. *Extent*– *the area (distance) over which the impact will be experienced*		
Local	Confined to project or study area or part thereof (e.g., the development site and immediate surrounds)	1
Regional	The region (e.g., Municipality or Quaternary catchment)	2
(Inter) national	Nationally or beyond	3
B. ***Intensity***– *the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered and/or irreplaceable resources[22] are lost	3
C. Duration– *the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years (i.e. reversible impact)	1
Medium-term	2 to 15 years (i.e. reversible impact)	2
Long-term	More than 15 years (state whether impact is irreversible)	3

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

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

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

Once the consequence was derived, the probability of the impact occurring was considered, using the probability classifications presented in the table below.

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

Table 6-3: Probability classification

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

The overall **significance** of impacts was determined by considering consequence and probability using the rating system prescribed in the table below.

Table 6-4: Impact significance ratings

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

Finally, the impacts were also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below.

Table 6-5: **Impact status and confidence classification**

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

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

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

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

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

6.2 Potential Impacts: Geophysical Survey Phase

The following potential impacts were identified and assessed:

- Increase in ambient noise; and
- Exclusion from fishing ground.

6.2.1 Potential Impact: Increase in Ambient Noise

The presence and operation of the survey vessel will introduce a range of underwater noises into the surrounding water column that may potentially contribute to and/or exceed ambient noise levels in the area. The survey vessel would be equipped with a medium- to high-frequency multi-beam echo sounder (MBES) and medium- to high-frequency sub-bottom profiler. The likely geophysical survey equipment and its source frequencies, source noise levels and soft start capabilities are provided in Table 3-3 under the project description (section 3.2).

The ocean is a naturally noisy place and marine animals are continually subjected to both physically produced sounds from sources such as wind, rainfall, breaking waves, and natural seismic noise, or biologically produced sounds generated during reproductive displays, territorial defence, feeding, or in echolocation (see references in McCauley 1994). Of all human-generated sound sources, the most persistent in the ocean is the noise of shipping. Depending on size and speed, the sound levels radiating from vessels range from 160 to 220 dB re 1 µPa at 1 m (NRC 2003). Especially at low frequencies between 5 to 100 Hz, vessel traffic is a major contributor to noise in the world's oceans, and under the right conditions, these sounds can propagate 100s of kilometres thereby affecting very large geographic areas (Coley 1994, 1995; NRC 2003; Pidcock et al. 2003). Other forms of anthropogenic noise include aircraft flyovers, multi-beam sonar systems, seismic acquisition, hydrocarbon and mineral exploration/prospecting and recovery and noise associated with underwater blasting, pile driving, and construction (Figure 6-1).

Elevated noise levels could impact marine fauna by:

- Causing direct physical injury to hearing or other organs, including permanent (PTS) or temporary threshold shifts (TTS) in hearing;
- Masking or interfering with other biologically important sounds (e.g., communication, echolocation, signals, and sounds produced by predators or prey); and
- Causing disturbance to the receptor resulting in behavioural changes or displacement from important feeding or breeding areas.

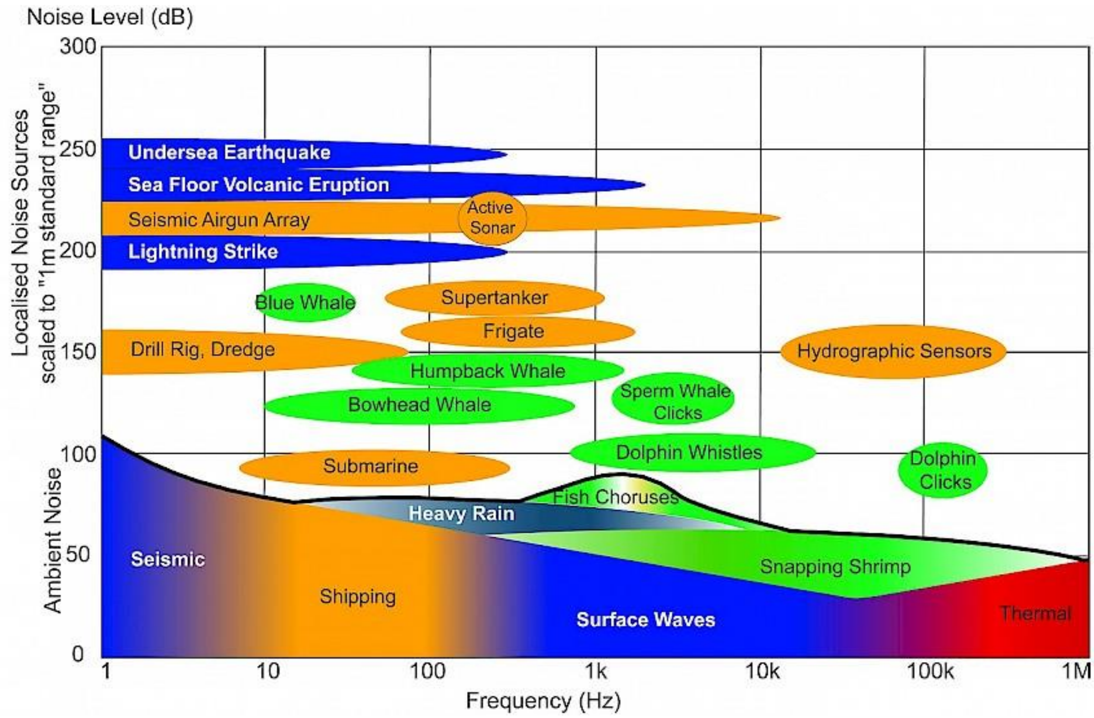

Figure 6-1: Comparison of noise sources in the ocean (Goold & Coates 2001).

A review of the literature and guidance on appropriate thresholds for assessment of underwater noise impacts are provided in the 2014 Acoustical Society of America (ASA) Technical Report *Sound Exposure Guidelines for Fishes and Sea Turtles* (ASA, 2014)[23]. The ASA Technical Report includes noise thresholds for mortality (or potentially mortal injury) as well as degrees of impairment such as TTS or PTS. Separate thresholds are defined for peak noise and cumulative impacts (due to continuous or repeated noise events) and for different noise sources (e.g., explosives, seismic airguns, pile driving, low- and mid-frequency sonar). As surveys using the MBES, sub-bottom profiling and side scan sonar sources have much lower noise emissions compared with seismic airgun sources, no specific considerations have been put in place in developing assessment criteria for these.

Whereas experiments have been carried out to define the levels of sound that cause mortality, injury, or hearing damage; it is more difficult to determine the threshold levels that cause behavioural effects, which are likely to take place over wider areas. Reactions of fish to different types of anthropogenic sounds have been reviewed by Hawkins et al. (2015), who concluded that more information is required on the effects of man-made sounds on the distribution of fishes and their capture by different fishing gears as effects differ across species, fishing ground and habitat type.

Due to the more deleterious effects of loud, low frequency sounds such as those emitted in seismic surveys, research has focused on these effects. Due to the paucity of research into the effects of geophysical survey tools on fish and crustaceans and their related fisheries, effects are inferred by comparing the sounds that these organisms produce and are capable of detecting, and evidence of noise thresholds that can cause them harm or disturbance such that their fishery might be affected.

In general terms, sound sources that have high sound pressure and low frequency will travel the greatest distances in the marine environment. Conversely, sources that have high frequency will tend

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[23] See also: Hawkins, A.D., Pembroke, A.E. and A.N. Popper. 2014. Information gaps in understanding the effects of noise on fishes and invertebrates. Rev Fish Biol Fisheries (2015) 25:39-64

to have greater attenuation over distance due to interference and scattering effects (Anon 2007). It is for this reason that the acoustic footprint of sonar survey tools (such as those Samara has proposed using) is considered to be much lower than that of deeper penetration low frequency seismic surveys that are used for petroleum exploration and in addition have lower sound pressure levels. The proposed multibeam survey produces frequencies between 40 kHz and 100 kHz (ultrasonic), with source sound levels ranging between 190 – 232 dB re 1 μPa at 1m and is capable of soft starts (refer to Table 3-3). Research into the effects of these multibeam swath bathymetry on fish and other fisheries-relevant organisms is lacking. However, as the frequencies produced fall well outside of the range of hearing of most marine fish, it is assumed to have little impact on fisheries. Furthermore, the intensity of such high-frequency sound attenuates rapidly, meaning that any potential effects of the sound will be localised to near their source. The soft start capacity of this technology may encourage animals capable of detecting high frequencies to move out of the range of the sound.

Urchins exposed to three hours of one-second sweeps of 100 – 200kHz at 145 and 160 dB re 1μPa (within the range of multibeam echosounders) showed signs of physiological stress (Vazzana et al 2020.) This suggests that invertebrates may be sensitive to high frequency sound, which might cause ecosystem effects on fisheries. However, urchins are less mobile than fish and crustaceans, which may be able to avoid noise disturbance, especially if soft starts are used.

Sub-bottom profilers include a variety of survey techniques that produce sound ranging from low frequencies (boomer, sparker and sleeve-gun systems) to medium frequencies (chirp and IXSEA) and ultrasonic frequencies (Innomar and Parametric systems). The low frequency techniques are capable of soft starts. Lower frequencies have the potential to travel large distances underwater and may interfere directly with fish and crustacean sound detection. The survey equipment proposed for use by Samara in the prospecting activities is considered to be medium- to high- frequency.

Marine organisms tend to be able to detect sounds that fall within the range produced by their species, prey or predators. High frequency, ultrasonic sound (>20kHz) sound is less commonly produced by marine animals. Some cetaceans and mantis shrimps produce ultrasonic sound and there is evidence that some fish species are capable of detecting it.

The sub-bottom profiling equipment that has been proposed for the current project may produce an acoustic signal that would coincide with the hearing range of fish and crustaceans (refer to Table 6-6). At a frequency range of 200 Hz to 3 kHz and source levels of up to 229 dB re 1 Pa at 1m, the parametric method of sub-bottom profiling that would produce an acoustic signal that would be detectable by crustaceans and fish. At a frequency range of 200 Hz to 3 kHz (noted that two frequency ranges to be used by Samara typically range between 35 -45 kHz and 1 to 10 kHz) and source levels of up to 229 dB re 1 Pa at 1m, the parametric method of sub-bottom profiling that would produce an acoustic signal that would be detectable by crustaceans and fish. The proposed multibeam survey produces frequencies between 40 kHz and 100 kHz (ultrasonic), with source sound levels ranging between 140 – 221dB re 1 μPa at 1m. These frequencies fall well outside of the range of hearing of most marine fish; however, members of the genera Alosa and Brevoortia (shads and menhadens) have shown specialisations that enable them to detect ultrasound. The American shad (Alosa sapidissima) is an example of a clupeoid species that shows a behavioural response to ultrasonic frequencies. American shad have been reported to respond with changes in schooling behaviour at 200-800Hz and 25-150 kHz (Velez, 2015). Behavioural responses have also been shown by blueback herring (Alosa aestivalis) at a sonar frequency range of 110 kHz to 140 kHz at sound levels above 180 dB re 1 Pa (peak) (Nestler et al. 1992, in Popper et al., 2014).

Table 6-6: Known hearing frequency and sound production ranges of various fish taxa (Pulfrich 2020 adapted from Koper & Plön 2012; Southall et al. 2019).

Taxa	Order	Hearing frequency (kHz)	Sound production (kHz)
Shellfish	Crustaceans	0.1 – 3	
Snapping shrimp	*Alpheus/ Synalpheus* spp.		0.1 - >200
Ghost crabs	*Ocypode* spp.		0.15 – 0.8
Fish	Teleosts		0.4 – 4
Hearing specialists		0.03 - >3	
Hearing generalists		0.03 – 1	
Sharks and skates	Elasmobranchs	0.1 – 1.5	Unknown

The noise generated by the acoustic equipment utilized during geophysical surveys falls within the hearing range of most fish, and at sound levels of between 190 to 232 dB re 1 µPa at 1 m, will be audible for considerable distances (in the order of tens of km) before attenuating to below threshold levels (Findlay 2005). Similarly, the sound level generated by sampling 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 depending on sea state would be audible for up to 20 km around the vessel before attenuating to below threshold levels[24].

The noise emissions from the geophysical sources are highly directional, spreading as a fan from the sound source, predominantly in a cross-track direction. Based on the rapid attenuation of high-frequency sound in the ocean, the spatial extent of the impact of noise on catch rates is expected to be localised. Based on the location of fishing grounds of the various fisheries sectors in respect to the prospecting application area, the effects of acoustic disturbance on catch rates would be considered to be of negligible significance for most sectors. However, in the case of the pole-and-line, traditional linefish, west coast rock lobster, beach-seine and gillnet fisheries, small-scale fisheries and fisheries research, the spread of sound into fishing grounds may affect catch rates. The impact of multi-beam and sub-bottom profiling sonar on these sectors is assessed to be of very low consequence and overall, very low significance (Table 6-7). No mitigation measures are possible or considered necessary for the generation of noise by the geophysical survey methods proposed in the current project. The impact is considered to be highly reversible – any disturbance of behaviour that may occur as a result of survey noise would be temporary.

[24] Typical natural ambient noise levels in the study area are estimated to have overall root-mean-square sound pressure levels (RMS SPLs) in the range of 80 – 120 dB re 1 µPa, with a median level around 100 dB re 1µPa upon calm to strong sea state conditions (Li & Lewis 2020 in Pulfrich, 2021).

Table 6-7: Significance of impacts of multi-beam and sub-bottom profiling sonar on fisheries.

<table>
<tr><th></th><th>Extent</th><th>Intensity</th><th>Duration</th><th>Consequence</th><th>Probability</th><th>Significance</th><th>Status</th><th>Confidence</th></tr>
<tr><td>Without mitigation</td><td>Local
1</td><td>Medium
2</td><td>Short-term
1</td><td>Very Low
4</td><td>Probable</td><td>VERY LOW</td><td>– ve</td><td>Medium</td></tr>
<tr><td colspan="9">Essential mitigation measures:
• "Soft starts" should be carried out for any equipment of source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes to give adequate time for marine fauna to leave the vicinity.
Recommended mitigation measures:
• The pole-and-line sector targets snoek inshore of the concession area during the period March to July. Timing of the survey activities to avoid taking place within the inshore extent of the concession area during this fishing period could reduce the impact on the sector.
• The traditional linefish sector operates in close proximity to Port Nolloth and Doringbaai over the period March to September. Timing of the survey activities to avoid taking place within the inshore extent of the concession area during this fishing period could reduce the impact on the sector.
• A demersal research survey is undertaken each year and trawls are expected to be undertaken within the concession area over the period January/February. Acoustic surveys for small pelagic species are carried out twice a year and may be expected within the concession area any time from mid-May to mid-June and from mid-October to mid-December. It is recommended that prior to the commencement of the proposed activities, Samara consult with the managers of the DFFE research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in order to minimises or avoid disruptions to both parties, where required.</td></tr>
<tr><td>With mitigation</td><td>Local
1</td><td>Medium
2</td><td>Short-term
1</td><td>Very Low
4</td><td>Probable</td><td>VERY LOW</td><td>– ve</td><td>Medium</td></tr>
</table>

6.2.2 Potential Impact: Temporary Exclusion of Fishing Operations

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), a vessel that is engaged in surveying is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel used for the purpose of exploiting the seabed falls under the definition of an "offshore installation" and as such it is protected by a 500 m safety zone. It is an offence for an unauthorised vessel to enter the safety zone. In addition to a statutory 500 m safety zone, a vessel operator would request a safe operational limit (that is greater than the 500 m safety zone) that it would like other vessels to stay beyond.

While the survey and sampling vessels are 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 marine sampling operations would operate using dynamic positioning or typically operate on a 3 or 4 anchor spread with unlit anchor mooring buoys. For the duration of operations, a coastal navigational warning would be issued by the South African Navy Hydrographic Office (SANHO) requesting a 1.5 nautical mile and 500 m clearance from the survey and sampling vessels, respectively. The safety zones aim to ensure the safety both of navigation and of the project vessel, avoiding or reducing the probability of accidents caused by the interaction of fishing boats and gears and the survey and sampling vessels.

The exclusion of vessels from entering the safety zone poses a direct impact to fishing operations in the form of loss of access to fishing grounds or displacement of fishing effort into alternative fishing grounds.

An overview of the South African fishing industry and a description of each commercial sector is presented in Sections 5.1 and 5.3, respectively. The affected fisheries sectors have been identified based on the extent of overlap of fishing grounds with the concession area. The demersal longline sector is the only commercial fishery that currently shows activity in the area and operates only in the deepwater extent of the area around the 200 m bathymetric contour. Fisheries research surveys have routinely been conducted across the extent of the concession area each year between January and March. A research vessel could therefore be affected by the presence of survey and sampling vessels within the area through navigational exclusion.

Pole-and-line (snoek-directed) and traditional linefish (snoek-directed) fishing activity occur inshore of the concession area and these sectors are not expected to be affected by the navigational exclusion zone around survey or sampling vessels. Similarly, rock lobster fishing, netfishing and abalone ranching are nearshore activities and would not extend into the concession area.

The sensitivity of a particular fishing sector to the impact of the exclusion zone would differ according to the degree of disruption to that fishing operation. The current assessment considers this to be related to the type of gear used by the particular fishery, the mobility of fishing operations and the probability that the fishing operation can be relocated away from the affected area into alternative fishing areas. For instance, those that set fishing gear for extended periods (i.e., rock lobster traps anchored at seabed or drifting long-lines) are more susceptible to exclusion than those more mobile operations (i.e., trawl nets are towed directly behind the vessel). The sensitivity of fisheries research surveys is considered to be medium and that of the demersal longline sector, high.

The exclusion of vessels from entering the safety zone around a vessel engaged either in survey or sampling poses a direct impact to fishing operations in the form of loss of access to fishing grounds.

Demersal trawlers operate on both the Namibian and South African sides of the maritime border but at a seabed depth range of approximately 200 m to 1000 m. The inshore extent of demersal trawl grounds is situated about 10 km from the offshore boundary of the concession area and there is no direct overlap of the area with trawling grounds. The demersal longline fleet operates in similar areas, however slightly shallower than the trawler fleet and, in places, on hard grounds not accessible to trawlers. Namibian-registered vessels operate on the Namibian side of the maritime border at a depth range of 200 m to about 500 m. As such, fishing activity can be expected along the boundary of Sea Area 4C which runs along the maritime border with Namibia. The South African fleet of demersal longline vessels also operate at a similar depth range and there is minimal overlap of fishing ground with the offshore portions of the prospecting application area. Over the period 2018 to 2020, an average of 128 000 hooks per year were set within the prospecting application area yielding 21.9 tonnes of hake. This is equivalent to 0.47% of the overall effort and 0.47% of the overall catch reported nationally by the sector.

There is no overlap of the concession area with fishing grounds of the midwater trawl and small pelagic purse-seine sectors, which are situated at least 330 km and 150 km, respectively, southwards of the area.

In the vicinity of the prospecting application area, the South African fleet of the pelagic longline fishery targets fishing areas offshore of the 500 m bathymetric contour and the closest activity would be expected 50 km from the offshore boundary of the concession area. However, the Namibian fleet of large pelagic longline vessels are permitted to target pelagic shark species in addition to tuna and therefore also operate in shallower waters inshore of the shelf break. The Namibian fleet would be expected to operate offshore of the 200 m depth contour adjacent to the South African maritime border and Sea Area 4c.

Vessels registered under the pole-and-line sector target either albacore in favoured areas off the shelf break, or they target snoek and yellowtail in coastal waters. Tuna-directed fishing is not expected to coincide with the prospecting application area. A significant amount of snoek-directed fishing activity occurs inshore of the 100 m depth contour over the period March to July.

Boat-based fishing for linefish takes place in close proximity to launch sites at Port Nolloth and Doringbaai. Over the period March to September, snoek is targeted in nearshore waters. Although unlikely to extend into the concession area, the possibility of fishing activity extending into the shallow water areas of the concession areas cannot be excluded.

Although the prospecting application area coincides with the designated management areas of the nearshore west coast rock lobster, abalone ranching, netfish and seaweed sectors, the depths exploited by these fisheries are less than 50 m and therefore would not be expected to coincide with the areas of operation for the proposed survey and sampling activities.

Certain areas on the coast are prioritized and demarcated by DFFE as small-scale fishing areas. Small-scale fishermen along the Northern Cape coast are typically involved in the fisheries for linefish and west coast rock lobster. Approximately 103 small-scale fishers are registered with the Port Nolloth fishing community co-operative. The small-scale fishery rights cover the nearshore area (defined in section 19 of the MLRA as being within close proximity of shoreline). Since the grounds fished by the nearshore rock lobster sector are situated inshore of the concession area, fishing activity is not expected to be affected by the proposed survey and sampling activities. However, the impact of potential disruption of fishing activities for linefish species cannot be excluded and is assessed to be of very low magnitude and of overall negligible significance.

Research trawls are undertaken by DFFE on a national scale to establish the stock status of key commercial species. The demersal trawl survey would be expected to take place within the prospecting application area over the period January to March whereas the acoustic survey for small pelagic species would be expected to operate within the area during November and again during May/June (a pre-recruitment biomass survey for small pelagic species). The magnitude of the impact on the sector is expected to be very low and, due to the medium sensitivity of the sector, of overall very low significance.

A process of notification and information-sharing should be followed with key identified fishing industry associations including the SA Tuna Association; SA Tuna Longline Association, South African Deepsea Trawling Industry Association (SADSTIA), South African Hake Longline Association (SAHLLA), West Coast Rock Lobster Association, South African Linefish Associations (various) and SA Marine Linefish Management Association (SAMLMA). Other key stakeholders: SANHO, South African Maritime Safety Association, representatives of small-scale local fishing co-operatives and DFFE Vessel Monitoring, Control and Surveillance (VMS) Unit in Cape Town. These stakeholders should again be notified on completion of the project when the survey/sampling vessel is off location.

The required safety zones around the survey and 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 impact is assessed to be insignificant and would remain insignificant with the implementation of the proposed mitigation measures (Table 6-8).

Table 6-8: Significance of impact of temporary exclusion of fishing operations during survey and sampling operations.

<table>
<tr><th></th><th>Extent</th><th>Intensity</th><th>Duration</th><th>Consequence</th><th>Probability</th><th>Significance</th><th>Status</th><th>Confidence</th></tr>
<tr><td>Without mitigation</td><td>Local
1</td><td>Medium
2</td><td>Short-term
1</td><td>Very Low
4</td><td>Possible</td><td>INSIGNIFI-CANT</td><td>– ve</td><td>Medium</td></tr>
<tr><td colspan="9">Essential mitigation measures:
• A process of notification and information-sharing should be followed with key identified fishing industry associations including the SA Tuna Association; SA Tuna Longline Association, South African Deepsea Trawling Industry Association (SADSTIA), South African Hake Longline Association (SAHLLA), West Coast Rock Lobster Association, South African Linefish Associations (various) and SA Marine Linefish Management Association (SAMLMA). Other key stakeholders: SANHO, South African Maritime Safety Association, representatives of small-scale local fishing co-operatives and DFFE Vessel Monitoring, Control and Surveillance (VMS) Unit in Cape Town. These stakeholders should again be notified on completion of the project when the survey/sampling vessel is off location.
• The required safety zones around the survey and 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.
Recommended mitigation measures:
• The pole-and-line sector targets snoek inshore of the concession area during the period March to July. Timing of the survey activities to avoid taking place within the inshore extent of the concession area during this fishing period could reduce the impact on the sector.
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</table>

6.3 Potential Impacts: Exploration Sampling Phase

The following potential impacts were identified and assessed:

- Increase in ambient noise;
- Discharge of sediment; and
- Exclusion from fishing ground.

6.3.1 Potential Impact: Increase in Ambient Noise

Please refer to section 6.2.1 for a discussion of the nature of the impact of noise on marine fauna.

The impact is assessed to be of **Very Low** significance and with the implementation of mitigation remains of **Very Low** significance (Table 6-9).

Table 6-9: Significance of impact of noise from sampling/trenching operations on fisheries.

<table>
<tr><th></th><th>Extent</th><th>Intensity</th><th>Duration</th><th>Consequence</th><th>Probability</th><th>Significance</th><th>Status</th><th>Confidence</th></tr>
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</table>

6.3.2 Potential Impact: Discharge of Sediment

The proposed sampling activities are expected to result in the disturbance of sediments by the crawler suction head. Up to 50 bulk samples are proposed, disturbing an area of 0.2 km^2.

The sampled seabed sediments are pumped to the surface and discharged onto sorting screens on the sampling vessel. The screens separate the fine sandy silt and large gravel and cobbles from the size fraction of interest, the 'plantfeed' (usually 2 - 20 mm). The fine sediments are immediately discarded overboard where they form a suspended sediment plume in the water column which dissipates with time. The 'plantfeed' is mixed with a high-density ferrosilicon (FeSi) slurry and pumped under pressure into a Dense Medium Separation (DMS) plant resulting in a high-density concentrate. The majority of the ferrosilicon is magnetically recovered for re-use in the DMS plant and the fine sediments (-2 mm) from the DMS process are similarly deposited overboard. Furthermore, fine sediment re-suspension by the sampling tools will generate suspended sediment plumes near the seabed. The main effect of plumes is an increase in water column turbidity. It is noted that the sampling is not contiguous and therefore there will be a delay in time whilst the seabed tool is transferred to the new sampling site before additional sediment is released overboard with the next sample. The relevance of this in terms of effects on fisheries is the potential impairment of egg and/or larval development through high sediment loading.

Sedimentation has been shown to have significant adverse effects on fish spawning and recruitment patterns (Newell et al. 1998; Wilber and Clark 2001; Wengeret al. 2017; Spearman 2015). Several studies have demonstrated the smothering of fish eggs and larvae occurring during times of dreading operations Newell et al. 1998; Wilber and Clark 2001; Wengeret al. 2017; Spearman 2015. Although the relative effects of sedimentation on fish larvae are species-specific, the overall effects are largely adverse on fish recruitment patterns. Fish eggs and larvae are not capable of swimming and hence, cannot avoid the impact. The effects of smothering due to sedimentation also severely impact benthic communities (Norkko et al 2001). Unlike mobile marine organisms such as fish, invertebrates are slow swimming or sessile and, therefore, cannot avoid sediment plumes to the extent mobile organisms can. Sea urchins, abalone, and rock lobster are also affected negatively by smothering and ingesting particulate matter, albeit at much higher concentrations than many fish species. Invertebrate larvae are impacted in the same manner as that of fish larvae (smothering and abrasion).

The direct physical impacts on fish species can be considered negligible as mobile species can avoid impacts; however, the same is not true for sessile and invertebrate species. Previous work has shown drilling activities have significant effects on invertebrate species diversity and abundance, which can persist for up to 4 months after drilling activities (Currie et al. 2005). Adverse effects occur within 500 meters of drilling locations, after which the impacts become less pronounced, and invertebrate communities are able to recover after a period of time (~4 months) (Currie et al. 2005). Therefore, the highly localised nature of the impact and the ability of invertebrate communities to recover makes the overall direct physical effects of drilling negligible on marine invertebrate communities.

Sedimentation impacts would be limited to the proposed bulk sampling (trenching) activities. In Phase 3 (localised drilling and disposal of excess sediment at the surface), the sediment plume footprint will be considerable due to the height in the water column in which sediments are disposed. Sediments released at the surface can travel further distances from the source compared to sediments released from seafloor operations. Still, they will also be more diluted as the concentration of sediment is spread over a larger area when released from the surface. Smothering and abrasion impacts from surface-released sediments will most likely be insignificant to minimal as the concentration within the water column is not enough to cause harm to fish and invertebrate species, including spawning and recruitment patterns (Wilber and Clark 2001).

The taxa most vulnerable to increased turbidity and reduced light penetration are phytoplankton. Due to the location of the prospecting application area within the Namaqua upwelling cell, the abundance of phytoplankton can be expected to be seasonally high. Being dependent on nutrient supply, plankton abundance is typically spatially and temporally highly variable and is thus considered to have a low sensitivity. Pelagic fish likely to be encountered in the water column are highly mobile and would be expected to avoid elevated suspended sediment plumes in the water column. Likewise demersal fish would be expected to avoid elevated suspended sediment plumes near the seabed. These fauna are thus considered to have a low sensitivity.

Typically, fisheries stock recruitment is highly variable and shows a strong spatial and temporal signal. For example, this variability would apply to the small pelagic species that comprise the largest commercial fishery by volume on the West Coast of South Africa. Spawning and recruitment of these small pelagic species as well as of many demersal species occurs primarily well to the south of Sea Areas 4c and 5c. 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.

Two species that migrate along the West Coast following the shoals of small pelagic species are snoek and chub mackerel. 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). 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.

The spawn products 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, referred to as nursery areas. These areas provide a suitable niche for development of juveniles of these species. Most of the species potentially impacted are broadcast spawners, with large volumes of spawn products being dispersed over large areas. This would apply equally, for example, to west coast rock lobster, hake, and sardine. 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. However, wind has been shown to be a significant influencer of sediment plume dispersal (Geyer et al. 2004; Fernandes et al. 2021). Given the prevailing wind conditions within the concession area, the sediment plume may move shoreward and towards sensitive nursery areas. Additionally, longshore sediment transport occurs primarily through wave-induced currents, while cross-shore transport is mainly through the direct effect of waves and undertow from breaking waves in the nearshore (Geyer et al. 2004; Fernandes et al. 2021). The movement of sediment into nursery and recruitment areas could have significant detrimental effects on fish early life stages of fish and invertebrate species. Sediment plumes can damage eggs and larvae through abrasion and inhibiting environmental cues that control growth and development. The developmental stages of fish and invertebrate larvae are prone to predation, and prolonged periods of development could increase the probability of predation and lower abundance. The mortality and damage of larvae through abrasion, extended time in larvae forms, and increased risk of predation could significantly reduce the recruitment potential of fish and invertebrate species within the concession area.

Whereas sediment plumes would result in a negative impact on stock recruitment, the impact on fish recruitment is considered to be of very low consequence and of overall insignificance due to the localised nature of the proposed sampling events in relation to fish nursery areas. Since the impact is unlikely to result in a significant impact on fish stock recruitment, mitigation against this impact is not considered necessary.

In terms of seaweeds, sediment plumes could significantly reduce the photosynthetic ability, spore settlement, and spore survival of E. maxima and L. pallida. The sediment plume would need to persist for an extended time for kelp populations within the concession area to be negatively affected. However, the sediment plume may enhance cumulative impacts of turbidity, as high amounts of turbidity characterise the West Coast. The high turbidity in the area is a result of the combination of the presence of sand on the seafloor, the hydrodynamic environment, and the cumulative effects of anthropogenic activities along the West Coast.

The medium-intensity negative impact of sediment removal during sampling operations and its effects on the associated communities is unavoidable, but as it will be extremely localised amounting to a total of only 0.2 km^2 should all anticipated 50 bulk samples be taken. The area disturbed constitutes ~0.003 % of the overall concession area. The impact can confidently be rated as being of **Very Low** significance without mitigation.

The impact is assessed to be of Very Low significance to the demersal trawl, demersal longline, pole-and-line, small pelagic purse-seine, traditional linefish, abalone ranching, small-scale fisheries, seaweed, west coast rock lobster and netfish sectors. No mitigation measures are proposed (Table 6-10).

Table 6-10: Significance of impact of sediment plume on fish stock recruitment

Sectors	Demersal trawl, demersal longline, pole-and-line, small pelagic purse-seine, traditional linefish, abalone ranching, west coast rock lobster, netfish, small-scale fisheries, seaweed							
	Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
Without mitigation	Local 1	Medium 2	Short-term 1	**Very Low** **4**	Probable	**VERY LOW**	– ve	Medium
Essential mitigation measures: • No mitigation is proposed.								
With mitigation	Local 1	Medium 2	Short-term 1	**Very Low** **4**	Probable	**VERY LOW**	– ve	Medium

6.3.3 Potential Impact: Temporary Exclusion of Fishing Operations

Please refer to section 6.2.2 for a discussion of the nature of the impact of temporary exclusion of fishing operations.

6.4 Cumulative Impacts

6.4.1 Introduction

For the purposes of this report, cumulative impacts are defined as 'direct and indirect impacts that act together with existing or future potential impacts of other activities or proposed activities in the area / region that affect the same resources and / or receptors.

For the most part, cumulative effects or aspects thereof are too uncertain to be quantifiable, due mainly to a lack of data availability and accuracy. This is particularly true of cumulative effects arising from potential or future projects, the design, or details of which may not be finalised or available and the direct and indirect impacts of which have not yet been assessed.

For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognised as important on the basis of scientific concerns and/or concerns of affected communities.

6.4.2 Activities Considered

Although no development or production from the South African West Coast offshore, exploration for oil and gas (hydrocarbons) has been and continues to be undertaken in the Benguela offshore environment (Refer to Figure 6-2 for a map showing the spatial distribution of geophysical survey transects undertaken historically off the West Coast of South Africa). Such activities present the potential impacts of both increased ambient noise and temporary exclusion of fishing operations in the vicinity of the survey vessel.

Figure 6-3 shows the location of exploration wells (abandoned) that have been drilling off the West Coast of South Africa, as well as offshore leases and open acreages. Oil and gas operators have an interest in offshore petroleum lease blocks, and these licence blocks overlap minerals mining/prospecting concession areas. Wellheads pose a potential impact on fisheries operations in the form of permanent exclusion to trawling/anchoring in the vicinity of a wellhead (500 m radius).

Both marine diamond prospecting and mining occurs near the proposed 4c and 5c concession area. These activities present a potential impact of increased ambient noise, temporary exclusion of fishing operations, as well as the removal/alteration of benthic habitat, sediment discharge and plume effects (increased water turbidity) during the dredging of unconsolidated seabed sediment. Figure 6-4 shows the location of prospecting and mining application areas in the vicinity of the concession area.

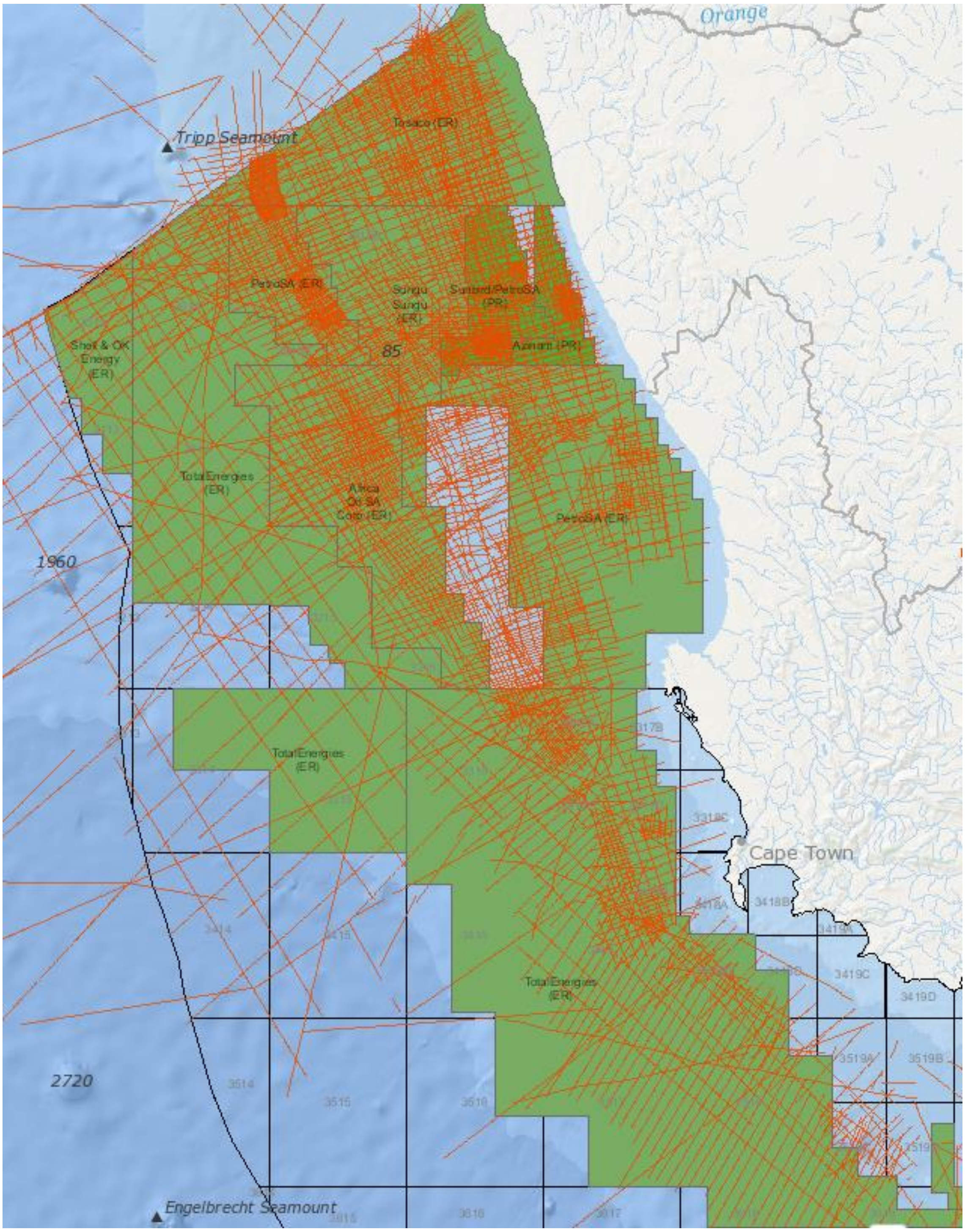

Figure 6-2: Spatial distribution of acquired 2D seismic survey transect data, offshore leases and open acreages off the west coast of South Africa (Source: Petroleum Agency of South Africa https://geoportal.petroleumagencysa.com/Storefront/Viewer/index_map.html).

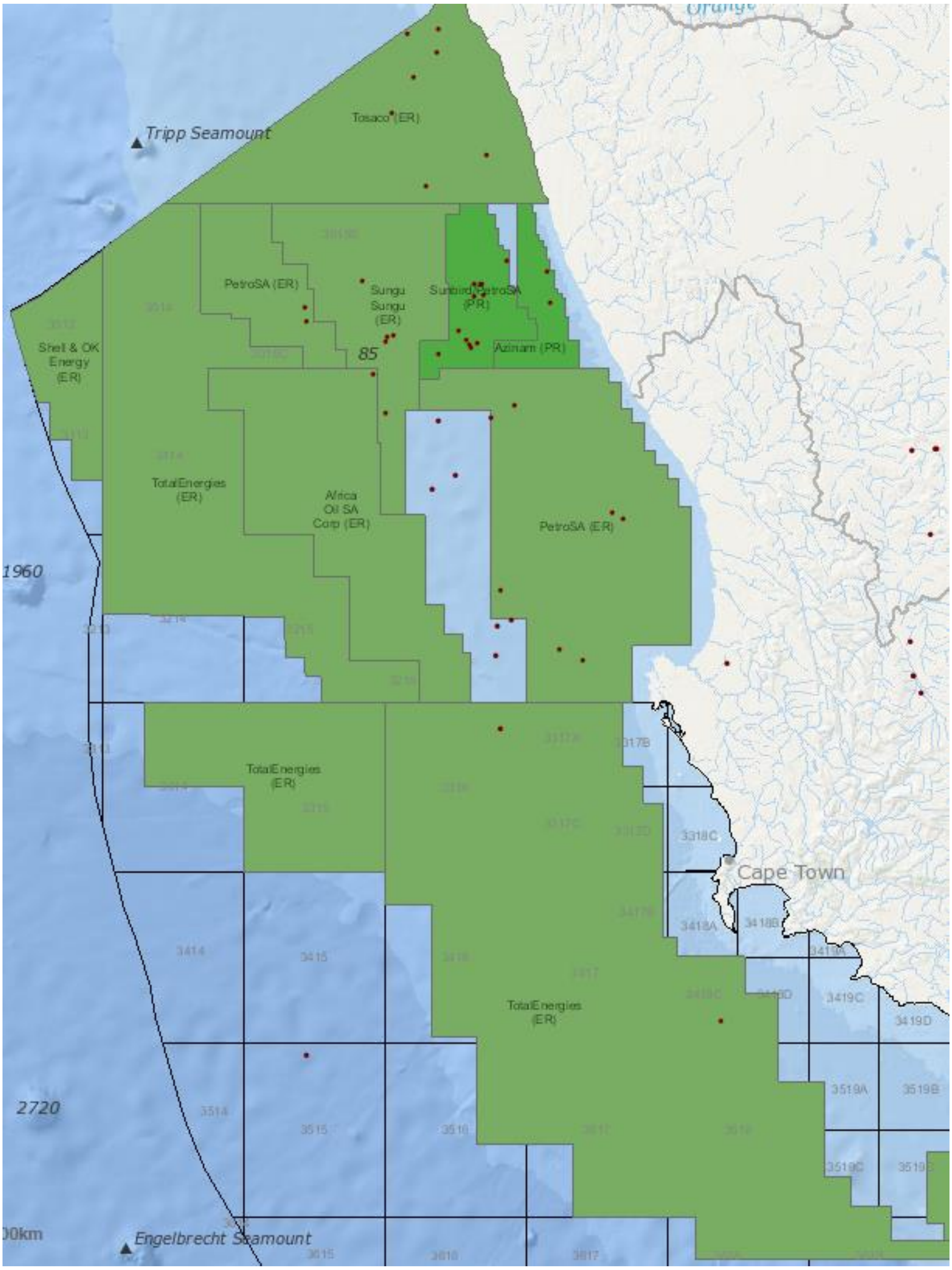

Figure 6-3: **Location of wells (abandoned), offshore leases and open acreages off the west coast of South Africa (Source: Petroleum Agency of South Africa https://geoportal.petroleumagencysa.com/Storefront/Viewer/index_map.html**).

Table 6-11: Applications for hydrocarbon exploration and mineral prospecting rights in the Southern Benguela region (South African West Coast and southern Namibia) since 2007, indicating which of these have been undertaken.

YEAR	RIGHT HOLDER / OPERATOR	BLOCK	ACTIVITY	APPROVAL	CONDUCTED / COMPLETED
SOUTH AFRICAN SEA AREAS MINERALS PROSPECTING AND MINING					
2011	Aurumar	SASA 1C-9C SASA 12C, 14C-18C, 20C	Heavy minerals coring	Yes	Jan-Mar 2011 2C-5C: Geophysical & coring 7C-10C: Geophysical & coring 12C, 14C-18C & 20C: Only desktop
2013-2014	Belton Park Trading	SASA 2C-5C	Geophysical surveys, coring, bulk sampling	Yes	Survey: ongoing in 2C and 3C Sampling: ongoing in 2C and 3C Various prospecting operations undertaken over duration of prospecting right
2017	Belton Park Trading	SASA 2C (3C was incorporated into mining right area in 2019)	Mining	Yes	Ongoing prospecting and mining has taken place over various campaigns to date: SASA 2C: 9 Aug – 7 Nov 2018 SASA 2C: 13 Mar – 5 May 2019; SASA 2C: 9 Jul – 25 Oct 2019 SASA 2C & 3C: 27 Feb – 31 Aug 2020 Mining is currently ongoing
2018	De Beers Marine	SASA 6C	Geophysical surveys, coring, bulk sampling	Yes	Survey: May-Jul 2021 Sampling: Dec 2021 – Jan 2022
2020	Belton Park Trading	SASA 14B, 15B, 17B	Geophysical surveys, coring, bulk sampling	Yes but appeal still under review	
2020	Belton Park Trading	SASA 13C, 15C, 16C, 17C, 18C	Geophysical surveys, coring, bulk sampling	Yes but appeal still under review	
2021	De Beers Marine	SASA 4C & 5C	Geophysical surveys, coring, bulk sampling	Application in prep.	
2021-2022	Moonstone Diamond Marketing	SASA 11B, 13B	Geophysical surveys, coring, bulk sampling	Applications delayed. Second round EIAs in prep.	
2022	Trans-Atlantic Diamonds	SASA 14A	Geophysical surveys, coring, sampling	Yes	
2022	Trans-Atlantic Diamonds	SASA 11C	Geophysical surveys, coring, sampling	FBAR submitted to DMRE on 2 March 2022	
2023	Samara Mining	SASA 4C & 5C	Geophysical surveys, coring, bulk sampling	Application in prep.	
SOUTH AFRICAN WEST COAST PETROLEUM EXPLORATION					
2007	PASA	Orange Basin	2D Seismic	Yes	Nov-Dec 2007
2008	PASA	West Coast	2D Seismic	Yes	Sep 2008
2008	PetroSA	Block 1	3D Seismic	Yes	Jan-Apr 2009
2011	Forest Oil (Ibhubesi)	Block 2A	3D Seismic	Yes	May-Jul 2011
2011	PetroSA / Anadarko	Block 5/6 (ER224); Block 7 (ER228)	2D / 3D Seismic and CSEM	Yes	2D: Dec 2012 – Feb 2013 3D: Jan–Apr 2020

YEAR	RIGHT HOLDER / OPERATOR	BLOCK	ACTIVITY	APPROVAL	CONDUCTED / COMPLETED
2011	PetroSA	Block 1	Exploration drilling	Yes	unknown
2012	BHP Billiton (now Ricocure Azinam & Africa Oil)	Block 3B/4B	2D and 3D Seismic	Yes	unknown
2013	Spectrum	West Coast regional	2D Seismic	Yes	2D: April 2015
2013	PetroSA	Block 1	2D and 3D Seismic	Yes	3D: Feb-May 2013 (conducted by Cairn)
2013	Anadarko	Block 2C	2D and 3D Seismic, MBES, heat flow, seabed sampling	Yes	unknown
2013	Anadarko	Block 5/6/7	MBES, heat flow, coring	Yes	Jan-Mar 2013
2014	OK/Shell	Northern Cape Ultra Deep ER274	2D and 3D Seismic, MBES, magnetics, seabed sampling	Yes	2D: Feb-Mar 2021
2014	Shell	Deep Water Orange Basin	Exploration drilling	Yes	No (Shell relinquished block to TEEPSA)
2014	Cairn	ER 12/3/083	2D Seismic	Yes (obtained by PetroSA)	2D: Feb-Mar 2014
2014	Cairn	Block 1	Seabed sampling	Yes	unknown
2014 - 2015	Thombo	Block 2B (ER105)	Exploration drilling	Yes	No (Africa Energy preparing to drill in late 2022/23)
2014	New Age Energy	Southwest Orange Basin	2D Seismic	unknown	unknown
2015	Cairn	Block 1	Exploration drilling	unknown	unknown
2015	Sunbird	West Coast	Production pipeline (Ibhubesi)	Yes	No (EA was renewed for an additional 5 years on 30 June 2022)
2015	Rhino	Southwest coast (inshore)	2D Seismic, MBES	unknown	unknown
2015	Rhino	Block 3617/3717	2D and 3D Seismic, MBES	Yes	unknown
2017	Impact Africa / TEEPSA	Southwest Orange Deep	2D and 3D Seismic	unknown	unknown
2018	PGS	West Coast regional	2D and 3D Seismic	Yes	
2019	Anadarko	Block 5/6/7	2D Seismic	Yes	
2021	Searcher	West Coast regional	2D and 3D Seismic	Yes (currently appealed)	2D: Jan 2022 (incomplete)
2021	TGS	West Coast regional	2D Seismic	Yes	No
2021	Tosaco	Block 1, ER362	3D Seismic	Withdrawn	-
2022	Ion	Deep Water Orange Basin	3D Seismic	Application in prep.	No
2022	Searcher	Deep Water Orange Basin	3D Seismic	Basic Assessment ongoing	No
2022	Shearwater	Deep Water Orange Basin	3D Seismic	Basic Assessment ongoing	No
2022	TGS	Deep Water Orange Basin	3D Seismic	Basic Assessment ongoing	No
2022	TEEPSA	Block 5/6/7	Exploration drilling	EIA ongoing	No - current project
2022	TEEPSA	Deep Water Orange Basin	2D and 3D Seismic, drilling	EA application yet to be submitted	No

YEAR	RIGHT HOLDER / OPERATOR	BLOCK	ACTIVITY	APPROVAL	CONDUCTED / COMPLETED
SOUTHERN NAMIBIA PETROLEUM EXPLORATION					
2011	Signet	Block 2914B (now part of PEL39)	2D and 3D Seismic; development of production facility	unknown	unknown
2011	PGS	Block 2815	3D Seismic	Yes	3D: 2011 (HRT)
2013	Spectrum Namibia	Orange Basin multiclient	2D Seismic	Yes	2D: April 2014
2014	Shell Namibia	2913A; 2914B	3D Seismic	Yes	3D: 2015
2016	Spectrum	Southern Namibia regional	2D Seismic	Yes	2D: April 2019
2017	Shell Namibia	PEL39	Exploration drilling	Yes	2021 and 2023
2019	Galp Namibia	PEL83	Exploration drilling	Yes	No (Applying for ECC extension)
2019	TEEPNA	Block 2913B (PEL56)	Exploration drilling	Yes	Drilling: Nov 2021 – Mar 2022
2020	TEEPNA	Block 2912, 2913B (PEL91; PEL56)	3D Seismic	Yes	Planned for Jan 2023
2020	TGS Namibia	Blocks 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2913B in the Orange Basin	3D Seismic	Pending	No
2020	Tullow Namibia (Harmattan Energy Ltd)	Block 2813B (PEL90)	3D Seismic	EIA ongoing	No

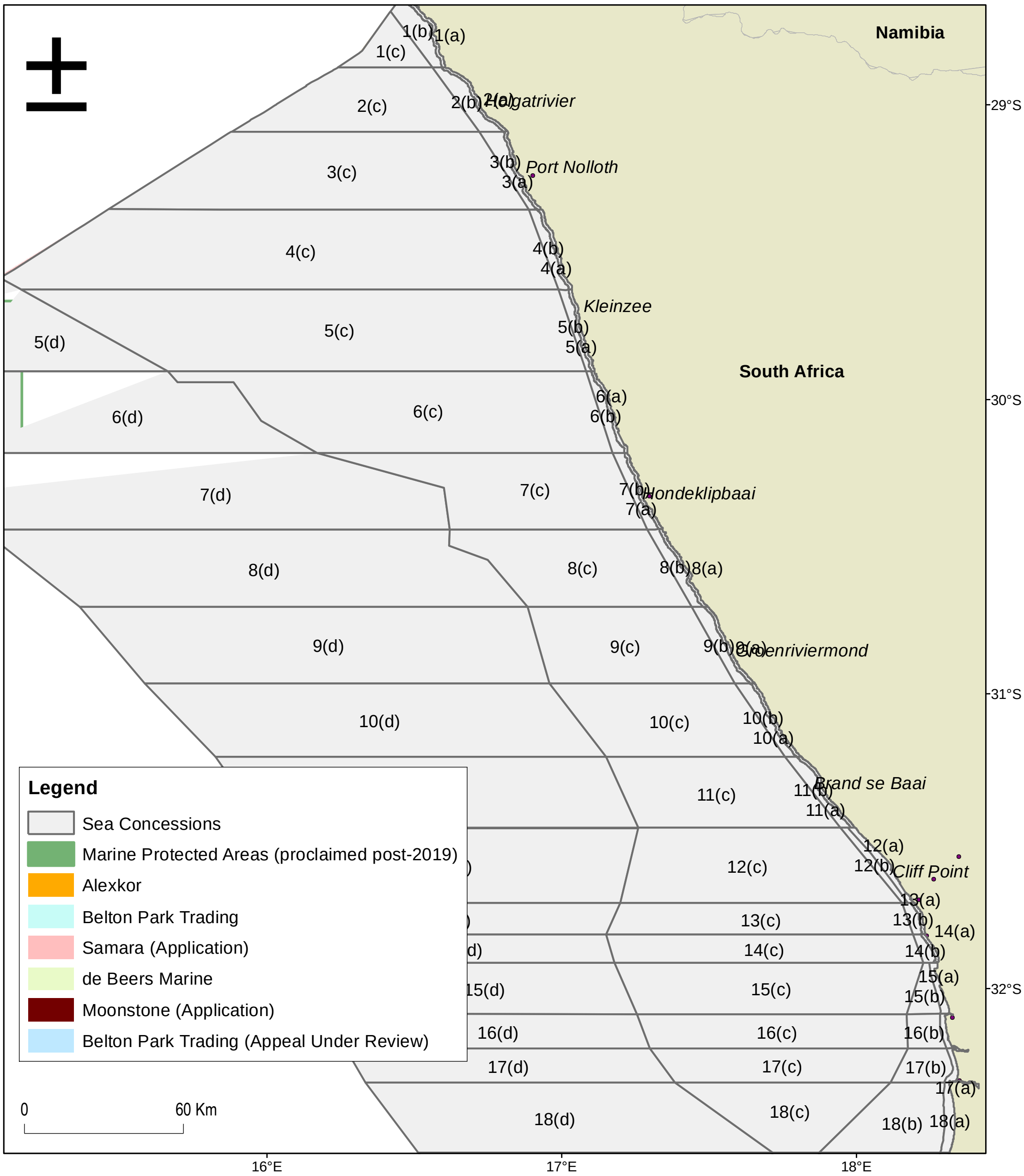

Figure 6-4: South African Sea Concession Areas, the proposed Samara concession area and the minerals rights application areas. Current MPAs are also shown.

6.4.3 Cumulative Impact Analysis

The impacts on each of the above fishing sectors could be increased due to the combination of impacts from other projects that may take place during the same period. Cumulative impacts include past, present, and future planned activities which result in change that is larger than the sum of all the impacts. Cumulative effects can occur when impacts are additive (incremental), interactive, sequential, or synergistic and would include anthropogenic impacts (including fishing and hydrocarbon industries) as well as non-anthropogenic effects such as environmental variability and climate change[25] .

[25] Refer to Augustyn et al. (2018) for a synopsis of climate change impacts on South African Fisheries.

In the Benguela region, fisheries are at risk of additional disruption due to accumulated pressure should new exploration and mining activities commence (by other applicants or existing exploration right holders) during the same period within which the exploration activities in SASA 4C/5C are proposed. Table 6-12 lists the applications for petroleum exploration and mineral prospecting rights in the Southern Benguela region (South African West Coast and southern Namibia) since 2007, indicating which of these have been undertaken. Concurrent activities such as geophysical surveys, coring, bulk sampling, mining and other planned speculative or proprietary seismic surveys in the southern Benguela region could add to the cumulative impact on fisheries.

Oil and gas exploration could be undertaken in various licence blocks off the West, South and East coasts of South Africa, although very little drilling has been undertaken in the last 10 years. In the order of 358 wells have been drilled in the South African offshore environment to date (based on information provided by PASA in 2023), the majority of which have been drilled off the South Coast on the Agulhas Bank. There is no current development or production from the South African West Coast offshore. The Ibhubesi Gas Field (Block 2A) (off West Coast, approximately 100 km south of the proposed concession area) and Kudu Gas Field (off southern Namibia) have been identified for development. On the South Coast, PetroSA operates the F-A production platform, which was brought into production in 1992. The F-A platform is located 85 km south of Mossel Bay in a water depth of 100 m. Gas and associated condensate from the associated gas fields are processed through the platform. The produced gas and condensate are exported through two separate 93 km pipelines to the PetroSA GTL plant located just outside the town of Mossel Bay. It is widely reported that the gas supplying the Mossel Bay GTL plant from Block 9 was due to cease in late 2020 and it seems likely to close unless a domestic gas supply is identified or a large bail out by the South Africa taxpayer is agreed to fund processing of higher cost feedstocks.

There are a number of reconnaissance permit application and EIA / Basic assessments being undertaken for proposed seismic surveys off the West Coast (Ion, Shearwater and TGS), although it is unlikely that all these will be undertaken as they are targeting similar areas in the Deep-Water Orange Basin. The reconnaissance permit application areas for these proposed surveys are situated westward of SASA 4c/5c and are unlikely to have any overlapping impacts.

In relation to SASA 4c and 5c, neighbouring mining/prospecting right holders include Belton Park Trading 127 (Pty) Ltd (3c), de Beers Consolidated Mines Limited (6c) and Alexkor (1a, 1b, 1c, 2a, 3a,4a, 4c) – Refer to Figure 6-4.

In the Benguela region, it has been suggested that the seasonal movement of Longfin Tuna northwards from the West Coast of South Africa into southern Namibia may be disrupted by the noise associated with an increasing number of seismic surveys. While the potential exists to disrupt the movement of albacore tuna in the Benguela, this disruption, if it occurs, would be localised spatially and temporarily, and would be compounded by environmental variability. In Australia, no direct cause and effect in changes in movement or availability of Bluefin Tuna could be attributed to seismic surveys (Evans et al., 2018), with observed changes being attributed to inter-annual variability. Due to the dearth of information on the impacts of seismic noise on truly pelagic species links between changes in migration patterns and subsequent catches thus remains speculative.

Noise, operational lighting, and discharges associated with the proposed exploration programme would also have cumulative impact on marine fauna, and possible indirect impact on fishing in the area of interest. Due to the licence area being located within the main vessel traffic routes that pass around southern Africa, ambient noise levels are naturally elevated. Fishing receptors are unlikely to be significantly additionally affected as fish behaviour will not be affected beyond the nearfield around the survey and sampling vessels. Most of the potential impacts will be of short duration, typically ceasing once the activity is completed. Such impacts are, therefore, considered unlikely to contribute to future cumulative impacts, and thus no more significant than assessed in the preceding sections.

7 Findings and Conclusions

The sources of potential impacts on the fishing industry were identified as 1) noise emissions generated during survey and sampling activities; 2) temporary exclusion of fishing operations around the survey and sampling vessels and 3) increased ambient noise generated during survey and sampling activities. The summary table below (Table 7-1) lists the overall significance of each of the identified project impacts before and after the implementation of mitigation measures listed in Table 7-2.

Due to the higher frequency emissions utilised in marine diamond multi-beam and sub-bottom profiling operations, the associated sound pressure tends to be dissipated to safe levels over a relatively short distance. The anticipated radius of influence of multi-beam sonar would thus be significantly less than that for a deeper penetration low frequency seismic airgun array, such as those used by the Petroleum industry. Sound levels from the multibeam survey equipment would range from 190 to 232 dB re 1 μPa at 1 m. The operating frequency range of 70 kHz and 455 kHz (ultrasonic) falls beyond the hearing range of most fish species. At a frequency range of 200 Hz to 3 kHz and source levels of up to 229 dB re 1 Pa at 1m, the "sparker" method of sub-bottom profiling that would produce sounds detectable by crustaceans and fish and would be audible for considerable distances (in the order of tens of km) before attenuating to below threshold levels. Similarly, the sound generated by sampling operations[26] falls within the hearing range of most fish and depending on sea state would be audible for up to 20 km around the vessel before attenuating to below threshold levels.

The emission of underwater noise from geophysical surveying and vessel activity would not be considered to be of sufficient amplitude to cause auditory or non-auditory trauma in marine fauna in the region. Only directly below the systems (within metres of the sources) would sound levels be in the range where exposure could result in trauma. As most species likely to be encountered within the prospecting application area are highly mobile, they would be expected to flee and move away from the sound source before trauma could occur. For most fisheries sectors, the effects of acoustic disturbance on catch rates would be considered to be insignificant. However, in the case of the demersal longline, pole-and-line, traditional linefish, west coast rock lobster, beach-seine and gillnet fisheries, small-scale fisheries and fisheries research, the spread of sound into fishing grounds may affect catch rates and the impact on these sectors has been assessed to be of very low consequence and of overall very low significance.

Fishing vessels would be required to maintain a safe operational distance of 1.5 nautical miles from the survey vessel and 500 m from the sampling vessel. The impact of potential exclusion was assessed for each commercial sector based on the affected area of fishing ground and the relative quantities of catch reported within the concession area. The impact of exclusion from fishing grounds was assessed to be of overall insignificance to the pole-and-line, traditional linefish and small-scale sectors. The impact on the pole-and-line, traditional linefish and small-scale sectors can be avoided by timing the proposed activities to take place during periods of seasonal low fishing activity during October to February, inclusive. However, as noted above it may not be technically possible to avoid undertaking prospecting operations over this period, thus the pre-mitigation impact significance remains the same.

[26] Sound levels of 120-190 dB re 1 μPa at the sampling unit, with main frequencies between 3 – 10 Hz.

There is no impact of exclusion expected on the remaining commercial fisheries sectors viz, demersal trawl, mid-water trawl, small pelagic purse-seine, large pelagic purse-seine, west coast rock lobster, abalone ranching, netfish (beach-seine and gillnet) and the harvesting of seaweed.

Stock biomass estimate surveys by DFFE would be expected within the concession area over the period January/February (demersal trawl), November (acoustic survey for small pelagic species) and again during May/June (a pre-recruitment biomass survey for small pelagic species). Survey and sampling operations that coincide with scheduled fisheries research surveys could result in a negative impact, local in extent and of very low consequence and significance.

Table 7-1: Summary of the impacts on fisheries of each of the identified project activities.

Fishery Sector	Discharge of Sediment		Noise Effects on Catch Rates		Temporary Safety Zone	
	Catch	Effort	Pre-Mitigation	Residual Impact	Pre-Mitigation	Residual Impact
Demersal Trawl	Insignificant	Insignificant	Insignificant	Insignificant	No impact	No impact
Mid-Water Trawl	No impact	No impact	No impact	No impact	No impact	No impact
Demersal Longline	Insignificant	Insignificant	Insignificant	Insignificant	No impact	No impact
Small Pelagic Purse-Seine	Insignificant	Insignificant	No impact	No impact	No impact	No impact
Large Pelagic Longline	No impact	No impact	No impact	No impact	No impact	No impact
Pole-and-Line	Insignificant	Insignificant	Very low	Very low	Insignificant	No Impact
Traditional Linefish	Insignificant	Insignificant	Very low	Very low	Insignificant	No impact
West Coast Rock Lobster	Very Low	Very Low	Very low	Very low	No impact	No impact
Abalone (Ranching)	Insignificant	Insignificant	No impact	No impact	No impact	No impact
Small-Scale Fisheries	Insignificant	Insignificant	Very low	Very low	Insignificant	No impact
Netfish	Very low	Very low	Very low	Very low	No impact	No impact
Seaweed (Kelp harvesting)	Insignificant	Insignificant	No impact	No impact	No impact	No impact
Fisheries Research	Insignificant	Insignificant	Very low	Very low	Very low	No impact

Table 7-2: Summary of the proportion of overlap of fishing grounds with the concession area.

Fishery Sector	% Overlap with concession area		
	Catch	Effort	Comment
Demersal Trawl	0	0	No activity reported within the concession area
Mid-Water Trawl	0	0	No activity reported within the concession area
Demersal Longline	0.47	0.47	Minimal activity within the concession area
Small Pelagic Purse-Seine	0	0	No activity within the concession area
Large Pelagic Longline	0	0	No activity reported within the concession area
Pole-and-Line	0	0	No activity reported within the concession area. Snoek catches reported inshore of the 100 m depth contour.
Commercial or Traditional Linefish	unknown	unknown	No activity reported within the concession areas. However, due to comparatively poor spatial resolution of DFFE data records for this sector, fishing activity may occur within the inshore portions of the prospecting application area. Closest deployment sites are Port Nolloth and Hondeklipbaai.

West Coast Rock Lobster	0	0	No activity reported within the concession areas (fishing activity reported inshore of the concession areas)
Abalone (Ranching)	0	0	No activity reported within the concession areas (fishing activity reported inshore of the concession areas
Small-Scale Fisheries	0	0	Refer to commercial or traditional linefish, west coast rock lobster, netfish, seaweed sectors
Netfish	0	0	No activity reported within the concession areas (fishing activity reported inshore of the concession areas)
Seaweed (Kelp harvesting)	0	0	No activity reported within the concession areas (fishing activity reported inshore of the concession areas)
Fisheries Research	N/A	N/A	Concession areas coincide with research surveys for small pelagic species (recruitment survey) which occur from the coastline to the 200 m depth conour. Research surveys for demersal species take place across the full extent of the concession areas.

Mitigation

A process of notification and information-sharing should be followed with key identified fishing industry associations including the SA Tuna Association; SA Tuna Longline Association, South African Deepsea Trawling Industry Association (SADSTIA), South African Hake Longline Association (SAHLLA), West Coast Rock Lobster Association, South African Linefish Associations (various) and SA Marine Linefish Management Association (SAMLMA). Other key stakeholders: SANHO, South African Maritime Safety Association, representatives of small-scale local fishing co-operatives and DFFE Vessel Monitoring, Control and Surveillance (VMS) Unit in Cape Town. These stakeholders should again be notified on completion of the project when the survey vessel is off location.

The required safety zones around the survey and sampling vessels should be communicated via the issuing of Daily Navigational Warnings for the duration of the sampling operations through SANHO

7.1 Findings

A summary of impacts and mitigation / optimisation measures is provided in Table 7-3.

Table 7-3: Summary of impacts and mitigation / optimisation measures

Impact	Significance rating		Key mitigation / optimisation measures
	Before mitigation/ optimisation	After mitigation/ optimisation	
OPERATION PHASE IMPACTS			
Increased Ambient Noise	Very Low	Very Low (-ve)	**Essential mitigation measures:** • "Soft starts" should be carried out for any equipment of source levels greater than 210 dB re 1 μPa at 1 m over a period of 20 minutes to give adequate time for marine fauna to leave the vicinity. **Recommended mitigation measures:** • The pole-and-line sector targets snoek inshore of the concession area during the period March to July. Timing of the survey activities to avoid taking place within the inshore extent of the concession area during this fishing period could reduce the impact on the sector. • The traditional linefish sector operates in close proximity to Port Nolloth and Doringbaai over the period March to September. Timing of the survey activities to avoid taking place within the inshore extent of the concession area during this fishing period could reduce the impact on the sector. • A demersal research survey is undertaken each year and trawls are expected to be undertaken within the concession area over the period January/February. Acoustic surveys for small pelagic species are carried out twice a year and may be expected within the concession area any time from mid-May to mid-June and from mid-October to mid-December. It is recommended that prior to the commencement of the proposed activities, Samara consult with the managers of the DFFE research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in order to minimises or avoid disruptions to both parties, where required.
Discharge of Sediment	Very Low (-ve)	Very Low (-ve)	• No mitigation proposed
Navigational Safety Zone / Fisheries Exclusion	Insignificant	Insignificant	**Essential mitigation measures:** • A process of notification and information-sharing should be followed with key identified fishing industry associations including the SA Tuna Association; SA Tuna Longline Association, South African Deepsea Trawling Industry Association (SADSTIA), South African Hake Longline Association (SAHLLA), West Coast Rock Lobster Association, South African Linefish Associations (various) and SA Marine Linefish Management Association (SAMLMA). Other key stakeholders: SANHO, South African Maritime Safety Association, representatives of small-scale local fishing co-operatives and DFFE Vessel Monitoring, Control and Surveillance (VMS) Unit in Cape Town.

Impact	Significance rating		Key mitigation / optimisation measures
	Before mitigation/ optimisation	**After mitigation/ optimisation**	
			These stakeholders should again be notified on completion of the project when the survey/sampling vessel is off location. • The required safety zones around the survey and 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. **Recommended mitigation measures:** • The pole-and-line sector targets snoek inshore of the concession area during the period March to July. Timing of the survey activities to avoid taking place within the inshore extent of the concession area during this fishing period could reduce the impact on the sector. • The traditional linefish sector operates in close proximity to Port Nolloth and Doringbaai over the period March to September. Timing of the survey activities to avoid taking place within the inshore extent of the concession area during this fishing period could reduce the impact on the sector. • A demersal research survey is undertaken each year and trawls are expected to be undertaken within the concession area over the period January/February. Acoustic surveys for small pelagic species are carried out twice a year and may be expected within the concession area any time from mid-May to mid-June and from mid-October to mid-December. It is recommended that prior to the commencement of the proposed activities, Samara consult with the managers of the DFFE research survey programmes to discuss their respective programmes and the possibility of altering the prospecting programme in order to minimises or avoid disruptions to both parties, where required.

7.2 Conclusion and Authorisation Opinion

If all environmental guidelines, and appropriate mitigation measures and management actions advanced in this report, and the EIA and EMPr for the proposed prospecting operations as a whole, are implemented, there is no reason why the proposed prospecting activities should not proceed.

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Appendices

Appendix A: Specialist CV

CURRICULUM VITAE: SARAH WILKINSON

SACNASP-Registered Professional Natural Scientist (Membership number 115666)

Geographical information systems, mapping and data analysis of southern African fisheries

Date of Birth: 20 June 1979

Nationality: South African

Academic Record: University of Cape Town, South Africa; BSc Honours (2001)

University of Cape Town; BSc (Oceanography and Botany 1998 – 2000)

Employment Record: Capricorn Marine Environmental (Pty) Ltd (2003 – present)

Languages: English (First language); Afrikaans & French (Basic written & spoken)

Key Experience:

- Geographical information systems, mapping and data analysis with focus on fisheries in the Benguela and Agulhas Current Large Marine Ecosystems.
- Specialist assessments on the impact of offshore hydrocarbon exploration, installation activities and marine infrastructure on fisheries in South Africa, Namibia, Mozambique and Angola (in accordance with scoping and EIA requirements).

Marine Minerals			
Moonstone Diamonds Marketing	Marine Prospecting	11B. 13B	2022
Belton Park Trading 127 Pty Ltd	Marine Prospecting	14B, 15B, 17B, West Coast, SA	2021
De Beers Marine	Marine Mining	West Coast, SA	2021
LK Mining	Marine Mining	EPL5965, Namibia	2021
Belton Park Trading 127 Pty Ltd	Marine Prospecting	13C, 15C, 16C, 17C, 18C, SA	2020
Belton Park Trading 127 Pty Ltd	Marine Mining	2C & 3C, SA	2018
De Beers Consolidated Mining	Marine Mining	6C, SA	2018
Alexkor	Marine Mining	1A-C,2A,3A,4A-B, SA	2017
West Coast Resources Pty Ltd	Marine Mining	6A-8A, SA	2016
Belton Park Trading 127 Pty Ltd	Marine Mining	2C, SA	2016
LK Mining	Marine Mining	EPL5965, Namibia	2016

Subsea Cables and Pipelines			
Applicant	**Activity**	**Area**	**Date**
Alcatel Submarine Networks	Subsea Cable	2AFRICA West, South Africa	2021
Alcatel Submarine Networks	Subsea Cable	2AFRICA East, South Africa	2021
Equiano	Subsea Cable	Regional, Namibia	2020
Telkom SA SOC Ltd/Equiano	Subsea Cable	West Coast, South Africa	2019

METISS Cable System	Subsea Cable	East Coast, South Africa	2019
IOX	Subsea Cable	South Coast, South Africa	2018
PetroSA (Pty) Ltd	Subsea Pipeline	E-BK, Block 9, South Africa	2017
ACE Cable / MTN (Pty) Ltd	Subsea Cable	West Coast, South Africa	2016
Xaris Energy Namibia	Subsea Pipeline	Walvis Bay, Namibia	2015
Oil & Gas Exploration & Extractive			
TGS	Seismic Survey	Orange Basin	2022
TEEPSA	Well Drilling	DWOB, SA	2023
TEEPSA	Well Drilling	Block 5/6/7, SA	2021
CGG	Seismic Survey	Transkei Basin, SA	2021
Searcher Seismic	Seismic Survey	West Coast, SA	2021
Spectrum	Seismic Survey	Orange Basin, SA	2021
Shearwater Geo-Services	Seismic Survey	East Coast, SA	2021
Tosaco Energy	Seismic Survey	Block 1, South Africa	2021
Tullow Ltd	Seismic Survey	PEL90, Namibia	2021
Total E&P South Africa	Well Drilling	Block 11B/12B, SA	2020
Total E&P South Africa	Seismic Survey	South Outeniqua, SA	2020
Total E&P Namibia	Seismic Survey	2912 & 2913B, Namibia	2020
Total E&P South Africa	Seismic Survey	Block 11B/12B, SA	2019
Total E&P South Africa	Well Drilling	Southeast Coast, SA	2019
Petroleum Geo-Services	Seismic Survey	West & Southwest Coasts, SA	2018
ENI	Well Drilling	East Coast, SA	2018
Petroleum Geo-Services	Seismic Survey	East & South Coasts, SA	2018
Impact Africa Ltd	Seismic Survey	Orange Basin, SA	2017
Sungu Sungu Oil (Pty) Ltd	Seismic Survey	Pletmos Basin, SA	2017
Windhoek PEL 23 & 28 B.V.	Well Drilling	PEL82 & PEL83, Namibia	2019
Shell Namibia B.V.	Seismic Survey	PEL39, Namibia	2018
Shell Namibia B.V.	Well Drilling	PEL39, Namibia	2019
Spectrum Geo Ltd	Seismic Survey	Regional, Namibia	2017
GALP	Seismic Survey	PEL82 & PEL83, Namibia	2017

Other Experience:

- Management of Marine Mammal Observer (MMO), Passive Acoustic Monitoring (PAM) and Fisheries Liaison Services for seismic survey vessels in the offshore sub-Saharan region (a full list of over 100 deployments is available on request).
- Management of the ship-based scientific observer programmes for the South African Pelagic Fishing Industry Association and South African Deepsea Trawling Industry Association.
- GIS support and analysis of the South African fishery catch and effort for use in the Offshore Marine Protected Area Project - contracted by the South African National Biodiversity Institute (SANBI).
- A review on the effects of trawling on benthic habitat in part fulfilment of the Marine Stewardship Council certification of the South African hake trawl fishery (Client: South African Deepsea Trawling Industry Association (SADSTIA).

- Spatial mapping of the proposed expanded Saldanha Bay Aquaculture Development Zone (ADZ) in line with the goals of operation Phakisa.
- Offshore Marine Protected Areas Project: spatial distribution/ mapping of South Africa's commercial fisheries for the South African National Biodiversity Institute.
- Hake longline sector footprint: Spatial distribution of fishing effort and overlap with benthic habitats of the South African Exclusive Economic Zone (2002 – 2012; WWF South Africa).
- Ringfencing the trawl footprint (South African Deepsea Trawling Industry Association).
- Mapping of benthic habitat types, Southern Namibia inshore and nearshore region for Namdeb.

Courses and Symposia:

- 7th and 5th International Symposia on GIS/Spatial Analyses in Fishery and Aquatic Sciences, Hakodate, Japan & Wellington, New Zealand. International Fishery GIS Society
- Joint Nature Conservation Committee-certified Marine Mammal Observer Training (Intelligent Ocean Training Services)
- Passive Acoustic Monitoring Training (Intelligent Ocean Training and Consultancy Services and Seiche Measurements Ltd)
- Bureau of Ocean Energy Management, Regulation and Enforcement Gulf of Mexico: Protected Species Observer Training
- ArcGIS I, II and Spatial Analyst (GIMS: ESRI South Africa)
- Maxsea Navigational Software (TimeZero)
- Marine Stewardship Council Chain of Custody Training Course (Moody Marine Ltd)
- SAQA-approved learning facilitator

Publications:

Massie, P, Wilkinson S & D Japp 2015. Hake longline sector footprint: Spatial distribution of fishing effort and overlap with benthic habitats of the South African Exclusive Economic Zone (2002 – 2012). Capricorn Marine Environmental, Cape Town 15 pages.

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Contact References:

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South African National Biodiversity Institute (SANBI)	Dr Kerry Sink	K.Sink@sanbi.org.za
SLR Consulting (Pty) Ltd	Jeremy Blood	jblood@slrconsulting.com
SRK Consulting South Africa Pty Ltd	Dr Sue Reuther	sreuther@srk.co.za
ERM South Africa	Vicky Stevens	vicky.stevens@erm.com
ERM Iberia	Giulio Marin	giulio.marin@erm.com
Pisces Environmental Services Pty Ltd	Dr Andrea Pulfrich	apulfrich@pisces.co.za
South African Deepsea Trawling Industry Association (SADSTIA)	Dr Johann Augustyn	johann@sadstia.co.za
Environmental Impact Management Services (EIMS)	GP Kriel	gp@eims.co.za/ +27823233499

Appendix B: Declaration of Independence

SPECIALIST DECLARATION OF INDEPENDENCE

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

SPECIALIST INFORMATION

Specialist Company Name:	Capricorn Marine Environmental Pty Ltd		
Specialist name:	Sarah Wilkinson		
Specialist Qualifications:	BSc Hons Pri.Nat.Sci		
Professional affiliation/registration:	SACNASP		
Physical address:	Unit 15 Foregate Square FW de Klerk Blvd, Foreshore 8001		
Postal address:	P.O. Box 50035 Waterfront		
Postal code:	8001	**Cell:**	0827289673
Telephone:	0214252161	**Fax:**	
E-mail:	sarah@capfish.co.za		

DECLARATION BY THE SPECIALIST

I, Sarah Wilkinson, declare that –

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

Signature of the Specialist

CAPRICORN MARINE ENVIRONMENTAL PTY LTD.

Name of Company:

12/05/2023

Date

SPECIALIST DECLARATION OF INDEPENDENCE

UNDERTAKING UNDER OATH/ AFFIRMATION

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

Signature of the Specialist

CAPRICORN MARINE ENVIRONMENTAL PTY LTD.

Name of Company

12/05/2023

Date

Signature of the Commissioner of Oaths

2023-05-12

Date

SOUTH AFRICAN POLICE SERVICE
Community Service Centre
12 MAY 2023
TABLE BAY HARBOUR
SOUTH AFRICAN POLICE SERVICE