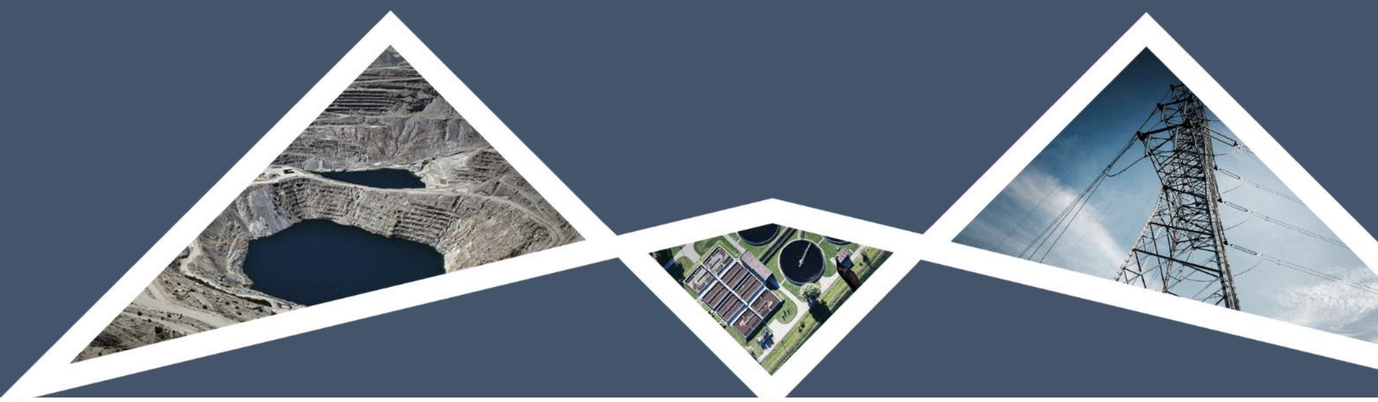
EIMS | ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

T 011 789 7170 E info@eims.co.za W www.eims.co.za

SCOPING REPORT

PROPOSED AFRICA OIL SOUTH AFRICA CORP (AOSAC) BLOCK 3B/4B EXPLORATION RIGHT



DOCUMENT DETAILS

EIMS REFERENCE:	1570
DOCUMENT TITLE:	Scoping Report – AOSAC Block 3B/4B Offshore Exploration Right

DOCUMENT CONTROL

	NAME	SIGNATURE	DATE
COMPILED:	Sinalo Matshona		2023/07/17
CHECKED:	GP Kriel		2023/07/17
AUTHORIZED:	Liam Whitlow		2023/07/17

REVISION AND AMENDMENTS

REVISION DATE:	REV #	DESCRIPTION
2023/07/17	ORIGINAL DOCUMENT	Scoping Report for public review

Table of Contents

Executive Summary xvii
1 Introduction 1
1.1 Report Structure 2
1.2 Details of the EAP 5
2 Description of the Project Area 7
3 Description and Scope of the Proposed Activity 9
3.1 Description of previous activities undertaken 9
3.1.1 Regional Setting of the Orange Basin 10
3.1.2 Regional Setting and Geology Associated with Block 3B/4B 13
3.1.3 Source Rocks 16
3.1.4 Reservoirs 18
3.1.5 Play Types 20
3.2 Description of Activities to be Undertaken 22
3.2.1 Pre-Drilling Surveys 22
3.2.2 Well Location and Drilling Programme 23
3.2.3 Drilling Unit Options 24
3.2.4 Support Vessels 24
3.2.5 Helicopters 24
3.2.6 Onshore Logistics Base 24
4 Policy and Legislative Context 26
4.1 Constitution of the Republic of South Africa 26
4.2 The Mineral and Petroleum Resources Development Act 26
4.3 The National Environmental Management Act 26
4.4 The National Heritage Resources Act 28
4.5 National Environmental Management: Protected Areas Act 29
4.6 National Environmental Management Air Quality Act 29
4.7 Additional South African Legislation 30
4.8 National Policy And Planning Context 33
4.8.1 Integrated Resource Plan 2019 33
4.8.2 National Development Plan 2030 34
4.8.3 White Paper on the Energy Policy of the Republic of South Africa (1998) 34
4.8.4 National Gas Infrastructure Plan (2005) 34
4.8.5 Paris Agreement – United Nations Framework Convention on Climate Change 34
4.8.6 National Climate Change Response White Paper 34
4.9 Provincial Policy and Planning Context 35
4.9.1 Northern Cape Strategic Plan 2020-2035 35

4.10 Municipal Policy and Planning Context ... 36
4.10.1 Namakwa District Municipality ... 36
4.10.2 Richtersveld Local Municipality ... 36
4.10.3 Nama Khoi Local Municipality ... 37
4.10.4 Kamiesberg Local Municipality ... 37
4.10.5 West Coast District Municipality ... 37
4.10.6 Matzikama Local Municipality ... 37
4.10.7 Cederberg Local Municipality ... 38
4.10.8 Bergrivier Local Municipality ... 38
4.10.9 Saldanha Bay Local Municipality ... 38
4.10.10 Swartland Local Municipality ... 38
4.10.11 City of Cape Town Metropolitan Municipality ... 39
4.11 International Legislation ... 39
4.11.1 United Nations Convention on the Law of the Sea ... 39
4.11.2 International Regulations for Preventing Collisions at Sea ... 40
4.11.3 International Marine Conventions ... 40
5 Need and Desirability of the Proposed Activity ... 41
6 Project Alternatives ... 53
6.1 Location Alternatives ... 53
6.2 Layout Alternatives ... 53
6.3 Technology Alternatives ... 53
6.4 Scheduling Alternatives ... 54
6.5 No Go Alternative ... 54
7 Stakeholder Engagement ... 56
7.1 General Approach to Scoping and Public Participation ... 56
7.2 Public Participation Progress ... 56
8 Environmental Attributes and Baseline Environment ... 58
8.1 Geophysical Characteristics ... 58
8.1.1 Bathymetry ... 58
8.1.2 Coastal and Inner-shelf Geology and Seabed GeomorphologY ... 59
8.1.3 Sedimentary Phosphates ... 62
8.2 Biophysical Characteristics ... 63
8.2.1 Wind Patterns ... 63
8.2.2 Large-Scale Circulation and Coastal Currents ... 65
8.2.3 Waves and Tides ... 67
8.2.4 Water ... 67
8.2.5 Upwelling & Plankton Production ... 68
8.2.6 Organic Inputs ... 68

8.2.7 Low Oxygen Events 69
8.2.8 Turbidity 69
8.2.9 Natural Hydrocarbon Seeps 70
8.3 Biological Environment 70
8.3.1 Demersal Communities 71
8.3.2 Pelagic Communities 87
8.4 Fisheries 138
8.4.1 Overview of Fisheries Sectors 138
8.4.2 Spawning and Recruitment of Fish Stocks 142
8.4.3 Research Surveys 153
8.4.4 Commercial Fisheries Sectors 155
8.4.5 Small-Scale Fishery Sector 204
8.4.6 Recreational Fishing 209
8.4.7 Illegal, Unreported and Unregulated Fishing 210
8.4.8 Namibian Commercial Fisheries 211
8.4.9 Summary Table of Seasonality of Catches 213
8.5 Other Uses of the Area 214
8.5.1 Beneficial Uses 214
8.5.2 Sanctuaries, Marine Protected Areas and other Sensitive Areas 215
8.6 Socio-Economic 228
8.6.1 Northern Cape Province 229
8.6.2 Western Cape Province 230
8.6.3 Description of the population 233
8.6.4 Population and household sizes 234
8.6.5 Population composition, age, gender and home language 241
8.6.6 Education 242
8.6.7 Employment 243
8.6.8 Household income 244
8.6.9 Housing 245
8.6.10 Household size 247
8.6.11 Access to water and sanitation 247
8.6.12 Energy 250
8.7 Cultural and Heritage Resources 252
8.7.1 Shell Middens 252
8.7.2 Stone Fish Traps 253
8.7.3 Indigenous Peoples 253
8.7.4 Intangible Heritage 257
8.8 Shipping density 263

9 Environmental Impact Assessment 265
9.1 Impact Assessment Methodology 265
9.1.1 Determination of environmental risk 265
9.1.2 Impact Prioritisation 268
9.2 Preliminary Impacts Identified 270
9.3 Description and Preliminary Assessment of Impacts 278
9.4 Cumulative Impacts 293
9.4.1 Cuttings discharge and Sediment plume 294
9.4.2 Underwater Noise 295
9.4.3 Vessel lighting and Operational Discharges 295
10 Plan of Study for Environmental Impact Assessment 296
10.1 Description of Alternatives to be Considered in EIA Phase 296
10.2 Description of the Aspects to be Assessed as part of the EIA process 296
10.3 Aspects to be Assessed by Specialists 296
10.4 Proposed Method of Assessing Environmental Aspects 303
10.5 Proposed Method for Assessing Duration and Significance 303
10.6 Stages at Which Competent Authorities will be Consulted 303
10.7 Proposed Method of EIA Phase Public Participation 303
10.8 Description of Tasks that will be Undertaken During the EIA Process 303
10.9 Measures to Avoid, Reverse, Mitigate, or Manage Impacts 304
11 Assumptions and Limitations 305
12 References 306
13 Appendices 307

List of Figures

Figure 1: Locality map. 8
Figure 2: Regional setting highlighting a subset of the wells, seismic surveys, exploration wells and discoveries in the Orange Basin. 11
Figure 3: Generalised chronostratigraphic Geological Column of the Orange Basin. 12
Figure 4: Main and postulated petroleum systems in the southern Orange Basin. 13
Figure 5: Schematic seismic profile showing location of Block 3B/4B within continental slope deposits. 15
Figure 6: Blockwide structure maps from Early Cretaceous through Eocene time for Block 3B/4B. 16
Figure 7: Summary log from the shelfal well K-D1, used as a key well for well-tie into Block 3B/4B seismicdata. 17
Figure 8: Source Rock maturity map for Aptian-Albian source rocks in the Southern Orange Basin 18
Figure 9: Examples of Near- and Far offset seismic data showing prospective reservoir targets in the Northern Area. 20
Figure 10: Examples of the 4 primary play types in Block 3B/4B. 22

Figure 11: Examples of the four primary play types in Block 3B/4B, showing tie to well K-D1. 22

Figure 12: Examples of drilling equipment. 24

Figure 13: EIA process diagram. 28

Figure 14: Biodiversity Priority and Marine Protected Areas in relation to the application area. 55

Figure 15: Map indicating submarine canyon domains of the southwestern Cape continental margin identified by Palan (2017). Insert shows the locality of the study area in relation to Block 3B/4B (red polygon).......59

Figure 16: Block 3B/4B (red polygon) in relation to sediment distribution on the continental shelf of the South African West Coast (Adapted from Rogers 1977). Based on information in Holness *et al*. (2014) and Sink *et al*. (2019), the mud/sandy mud sediments have been extended to the edge of the EEZ beyond that shown in Rogers (1977). 61

Figure 17: Block 3B/4B (red polygon) in relation to the distribution of seabed substratum types along the West Coast (adapted from Sink *et al*. 2019). The adjacent Namibian substratum types (adapted from Holness *et al*. 2019) are also shown. 62

Figure 18: Phosphorite hard ground (left) and its distribution (cyan) on the South African continental shelf (right) in relation to Block 3B/4B (red polygon) (adapted from Morant 2013). 63

Figure 19: Wind Speed vs. Wind Direction for NCEP hind cast data at location 16.5°E, 29°S (From PRDW, 2013). 64

Figure 20: Block 3B/4B (red polygon) in relation to aerosol plumes of sand and dust due to a 'berg' wind event on the southern African west coast in October 2019 (Image Source: LandWaterSA). 65

Figure 21: (a) Satellite sea-surface temperature image showing the predominance of the warm Agulhas Current along the South African south coast and the colder upwelled water on the west coast (adapted from Roberts *et al*. 2010), and (b) physical processes and features associated with the Southwest Coast in relation to Block 3B/4B (red polygon) (adapted from Roberts 2005). 66

Figure 22: Annual roseplots of significant wave height partitions of swell (left) and wind-sea (right) for GROW1012 hind cast data at location 15°E, 31°S (Pisces, 2023). 67

Figure 23: Red tides can reach very large proportions (Left, Photo: www.e-education.psu.edu) and can lead to mass stranding, or 'walk-out' of rock lobsters, such as occurred at Elands Bay in March 2022 (Right, Photo: Henk Kruger/African News Agency)..69

Figure 24: Block 3B/4B (red polygon) in relation to the inshore and offshore ecoregions of the South African coast (adapted from Sink *et al*. 2019). 71

Figure 25: Block 3B/4B (red polygon) in relation to the distribution of ecosystem types along the West Coast (adapted from Sink *et al*. 2019). 72

Figure 26: Block 3B/4B (red polygon) in relation to the ecosystem threat status for coastal and offshore benthic and pelagic habitat types on the South African West Coast (adapted from Sink *et al*. 2019). The adjacent Namibian threat status is also shown (adapted from Holness *et al*. 2019). 74

Figure 27: Examples of macroinvertebrates recorded in Block 2913B to the west-northwest of Block 3B/4B (Source Benthic Solutions Ltd 2019). 76

Figure 28: The summer (top) and winter (bottom) distribution of biscuit skate, triangular legskate,slime skate and soupfin shark in relation to Block 3B/4B (red polygon) (adapted from Harris *et al*. 2022). The IUCN conservation status is provided. 81

Figure 29: The distribution of various cartilaginous species mentioned in Table 6 in relation to Block 3B/4B (red polygon) (adapted from Harris *et al*. 2022). The IUCN conservation status is provided.............................82

Figure 30: Deep water benthic macrofauna from various depths in the Cape Canyon (Source: www.environment.gov.za/dearesearchteamreturnfromdeepseaexpedition). 85

Figure 31: Gorgonians and bryozoans communities recorded on deep-water reefs (100-120 m) off the southern African West Coast (Photos: De Beers Marine)..........86

Figure 32: Block 3B/4B (red polygon) in relation to the distribution of known and potential Vulnerable Marine Ecosystem habitat (adapted from Harris *et al*. 2022)..........87

Figure 33: Phytoplankton (left, photo: hymagazine.com) and zooplankton (right, photo: mysciencebox.org) is associated with upwelling cells. 88

Figure 34: Block 3B/4B (red polygon) in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford *et al*. 1987; Hutchings 1994; Hutchings *et al*. 2002)..90

Figure 35: Block 3B/4B (red polygon) in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford *et al.* 1987; Hutchings 1994; Hutchings *et al.* 2002)..91

Figure 36: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between September and October 2005 (adapted from Stenevik *et al*. 2008) in relation to Block 3B/4B (red polygon). 92

Figure 37: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between March and April 2007 (adapted from Stenevik *et al*. 2008) in relation to Block 3B/4B (red polygon). 92

Figure 38: Distribution of sardine (left) and anchovy (right) spawning areas, as measured by egg densities, in relation to Block 3B/4B (red polygon) (adapted from Harris *et al.* 2022). 93

Figure 39: Distribution of the colossal squid (top) and the giant squid (bottom). Blue squares <5 records, green squares 5-10 records (Source: http://iobis.org). 94

Figure 40: Cape fur seal preying on a shoal of pilchards (left). School of horse mackerel (right) (photos: www.underwatervideo.co.za; www.delivery.superstock.com). 95

Figure 41: Mean number of snoek per demersal trawl per grid block (5 × 5 Nm) by season for (A) the west coast (July 1985–Jan 1991) and (B) the south coast in relation to Block 3B/4B (red polygon) (Pisces, 2023). 96

Figure 42: Large migratory pelagic fish such as blue marlin (left) and longfin tuna (right) occur in offshore waters (photos: www.samathatours.com; www.osfimages.com). 98

Figure 43: The summer (top) and winter (bottom) distribution of white shark, whale shark, shortfin mako and bronze whaler shark in relation to Block 3B/4B (red polygon) (adapted from Harris *et al.* 2022). 99

Figure 44: Leatherback (left) and loggerhead turtles (right) occur along the West Coast of Southern Africa (Photos: Ketos Ecology 2009; www.aquaworld-crete.com). 100

Figure 45: Block 3B/4B (red polygon) in relation to the migration corridors of leatherback turtles in the south-western Indian Ocean. Relative use (CUD, cumulative utilization distribution) of corridors is shown through intensity of shading: light, low use; dark, high use (adapted from Harris *et al.* 2018). 101

Figure 46: Cape Gannets *Morus capensis* (left) (Photo: NACOMA) and African Penguins *Spheniscus demersus* (right) (Photo: Klaus Jost) breed primarily on the offshore Islands. 103

Figure 47: Block 3B/4B (red polygon) in relation to aggregate core home ranges of Cape Gannet (top left), African Penguin (top right) for different colonies and life-history stages, and foraging areas of Wandering Albatross (bottom left) and Atlantic, Yellow-nosed Albatross (bottom right). For foraging areas, darker shades are areas of higher use and where foraging areas from different colonies overlap (adapted from Harris *et al*. 2022). 105

Figure 48: Block 3B/4B (cyan polygon) in relation to projections of predicted distributions for nine odontocete species off the coast of South Africa (adapted from: Purdon *et al.* 2020a). 112

Figure 49: Block 3B/4B (red polygon) in relation to the distribution and movement of cetaceans along the West and South Coasts collated between 2001 and 2020 (SLR MMO database). Note: Figure depicts MMO sightings from seismic surveys undertaken between 2001 and 2020..........113

Figure 50: Block 3B/4B (red polygon) in relation to the distribution and movement of Humpback whales and Sperm whales along the southern African coast collated between 2001 and 2020 (SLR MMO database). 114

Figure 51: Block 3B/4B (red polygon) in relation to the predicted distribution of sperm whales (winter distribution)(top left), humpback whale (top middle), Bryde's whale (top right), Risso's dolphin (bottom left), common dolphin (bottom middle) and southern right whale (bottom right) with darker shades of blue indicating highest likelihood of occurrence (adapted from Harris *et al*. 2022). 116

Figure 52: The Bryde's whale *Balaenoptera brydei* (left) and the Minke whale *Balaenoptera bonaerensis* (right) (Photos: www.dailymail.co.uk; www.marinebio.org). 116

Figure 53: The Humpback whale *Megaptera novaeangliae* (left) and the Southern Right whale *Eubalaena australis* (right) are the most abundant large cetaceans occurring along the southern African West Coast (Photos: www.divephotoguide.com; www.aad.gov.au)........118

Figure 54: Block 3B/4B (red polygon) in relation to 'blue corridors' or 'whale superhighways' showing tracks of Humpback whales (orange) and Southern Right whales (green) between southern Africa and the Southern Ocean feeding grounds (adapted from Johnson *et al*. 2022)........119

Figure 55: Sperm whales *Physeter macrocephalus* (left) and killer whales *Orcinus orca* (right) are toothed whales likely to be encountered in offshore waters (Photos: www.onpoint.wbur.org; www.wikipedia.org). 121

Figure 56: The dusky dolphin Lagenorhynchus obscurus (left) and endemic Heaviside's Dolphin Cephalorhynchus heavisidii (left) (Photos: Simon Elwen, Sea Search Research and Conservation). 123

Figure 57: Colony of Cape fur seals *Arctocephalus pusillus pusillus* (Photo: Dirk Heinrich). 124

Figure 58: Block 3B/4B (red polygon) in relation to seal foraging areas on the West and South Coasts. Brown areas are generalised foraging areas around colonies, and areas in shades of red are foraging areas based on tracking data. Darker shades of red indicate areas of higher use (Adapted from Harris *et al*. 2022). .126

Figure 59: Schematic representation of the West Coast intertidal beach zonation (adapted from Branch & Branch 2018). 130

Figure 60: Common beach macrofaunal species occurring on exposed West Coast beaches. 131

Figure 61: Schematic representation of the West Coast intertidal rocky shore zonation (adapted from Branch & Branch 2018)........133

Figure 62: Typical rocky intertidal zonation on the southern African west coast. 134

Figure 63: The canopy-forming kelp *Ecklonia maxima* provides an important habitat for a diversity of marine biota (Photo: Geoff Spiby). 135

Figure 64: 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. 140

Figure 65: Block 3B/4B (red polygon) in relation to major spawning areas in the southern Benguela region (Source: Pulfrich, 2023 adapted from Cruikshank, 1990). 144

Figure 66: Block 3B/4B (Green polygon) and the AOI for drilling (Red polygon) in relation to the distribution of anchovy spawning areas, as measured by egg densities (DFFE). 145

Figure 67: Distribution and relative abundance of anchovy recruits (< 9 cm) (Source: DFFE Small Pelagic Scientific Working Group FISHERIES/2021/JUL/SWG-PEL/51draft 145

Figure 68: 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)........146

Figure 69: Block 3B/4B (Green polygon) and the AOI for drilling (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). 147

Figure 70: Distribution and relative abundance of sardine recruits (< 12 cm) (Source: DFFE Small Pelagic Scientific Working Group FISHERIES/2021/JUL/SWG-PEL/51draft 147

Figure 71: 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). 148

Figure 72: 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 m2 (Stenevik *et al*., 2008). 149

Figure 73: Conceptual model depicting the life history of snoek (left; Source: Griffiths, 2002) in the southern Benguela ecosystem, including spawning grounds, distribution and transport of eggs and larvae, and the nursery areas. 150

Figure 74: Main spawning grounds of Squid (Loligo spp.) on the eastern Agulhas Bank, east of the 'cold ridge'. Positions where paralarvae have been found are indicated (data from Augustyn *et al*. 1994). 151

Figure 75: Central Namibian spawning/nursery ground, between the Lüderitz upwelling cell and the Angola-Benguela Front (Hutchings *et al*. 2002). 152

Figure 76: Spatial distribution of trawling effort expended by DFFE over the period 2013 to 2021 in assessing the biomass of demersal fish species. 154

Figure 77: 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. 155

Figure 78: Commercially important target and bycatch species in the South African Demersal Trawl Fishery. Reference images courtesy of SAIAB. 156

Figure 79: (Top panel) Total catches ('000 tonnes) of Cape hakes split by species over the period 1917–2020 and the TAC set each year since the 1991. (Bottom panel) 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. Note that the vertical axis commences at 100 000 tonnes to better clarify the contributions by each sector (Source DFFE, 2022). 158

Figure 80: Photograph of MFV Harvest Mzansi, a wetfish vessel operating in the South African offshore demersal trawl sector source: www.sadstia.co.za). 159

Figure 81: Additional management protocols for offshore demersal trawlers in South Africa (SADSTIA 2017). 160

Figure 82: Gear configuration similar to that used by the offshore demersal trawlers targeting hake (Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling). 161

Figure 83: Overview of the spatial distribution of demersal trawl effort (2017 - 2021) in relation the licence block and AOI for proposed drilling. 162

Figure 84: Cape horse mackerel (Trachurus capensis), primary target species of the Midwater Trawl Fishery in South Africa. Images courtesy of SAIAB (left) and Oceana (Right). 163

Figure 85: Schematic diagram showing the typical gear configuration of a midwater trawler. Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling. 164

Figure 86: Overview of the spatial distribution of fishing effort expended by the midwater trawl sector (2017-2019) targeting horse mackerel in relation to the AOI for proposed drilling (red polygon) and block 3B/4B (green polygon). 165

Figure 87: An overview of the spatial distribution of fishing effort expended by the hake demersal longline sector in relation to the licence block 3B/4B (green polygon) and AOI for proposed drilling (red polygon). 167

Figure 88: Primary target species of the Shark Demersal Longline fishery in South Africa, the Smoothhound and Soupfin shark. Images courtesy of Shark Research Institute and SAIAB. 168

Figure 89: Time-series of estimated catch in metric tons (t) for soupfin sharks *Galeorhinus galeus* (1952-2018) showing the linefish historical data (green), commercial linefish data (yellow), trawl catch data (blue) and demersal shark longline catch data (orange; A century of shark fishing in SA, DFFE). 169

Figure 90: Spatial distribution of catch taken by the demersal shark longline fishery (2017 – 2019) in relation to the licence block 3B/4B (green polygon) and the AOI for proposed drilling (red polygon). 170

Figure 91: Small pelagic anchovy and sardine TACs, PUCL's, and Pools for the 2023 season (DFFE notice, 20 Dec 2022) 171

Figure 92: 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..........172

Figure 93: (Above) Photograph of a purse-seine vessel registered to fish for small pelagic species (credit C. Heinecken, CapMarine). (Below) Typical configuration and deployment of a small pelagic purse seine for targeting anchovy, sardine and round herring as used in South African waters. Source: http://www.afma.gov.au/portfolio-item/purse-seine. 173

Figure 94: Graph showing monthly catch (tons) and effort (number of sets) reported for the small pelagic purse-seine fleet over the period 2000 to 2016 (cumulative). Source: DFFE. 174

Figure 95: An overview of the spatial distribution of effort expended by the purse-seine sector targeting small pelagic species in in relation to the licence block 3B/4B (Green polygon) and the proposed AOI for drilling (Red Polygon)..........175

Figure 96: Primary species targets for the Large Pelagic Longline Fishery (LPL) and Tuna Pole Fishery in South Africa. Images courtesy of WWF-SASSI and SAIAB. 176

Figure 97: 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; Source: DEFF, 2019)..........177

Figure 98: 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). 178

Figure 99: Typical large pelagic longline gear (Source: http://www.afma.gov.au/portfolio-item/longlining)...179

Figure 100: Photographs showing marker buoys (left), radio buoys (centre) and monofilament branch lines (right) (Source: CapMarine, 2015)..........179

Figure 101: Numbers of hooks set per (A) year (2000–2015) and (B) per calendar month, as reported by local and foreign pelagic longliners (Jordaan *et al*., 2018). 180

Figure 102: Geographical distribution of fishing effort by (A) local and (B) foreign pelagic longliners between 2000 and 2015, based on logbook data provided by vessel skippers (Jordaan *et al*., 2018). 181

Figure 103: An overview of the spatial distribution of fishing effort expended by the longline sector targeting large pelagic fish species in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon)..........182

Figure 104: Catches (tons) of pelagic species by the South Africa pole-line ("Baitboat") fleet between 1980 and 2020 (ICCAT, 2022)..........184

Figure 105: Schematic diagram of pole and line operation (Source: http://www.afma.gov.au/portfolio-item/minor-lines)..........184

Figure 106: An overview of the spatial distribution of fishing effort expended by the pole- line sector targeting pelagic tuna (offshore areas) and snoek (inshore areas) in relation to the licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon). 185

Figure 107: Annual catch (t) of the eight most important linefish species for the period 1985-2021 (DFFE, 2022). 186

Figure 108: Fishermen landing snoek on board a vessel operating in the traditional linefishery (photo credit Jaco Barendse)........ 188

Figure 109: An overview of the spatial distribution of catch taken by the line fish sector in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon). 189

Figure 110: Graph showing the average monthly catch (tonnes) and effort (number of traps hauled) reported by the offshore (trap boat) and inshore (bakkie) rock lobster sectors over the period 2006 to 2020. 190

Figure 111: 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. 191

Figure 112: An overview of the spatial distribution of fishing effort expended by the west coast rock lobster nearshore (above) and offshore (below) sub-sectors within demarcated lobster management zones.... 192

Figure 113: Spatial distribution of lobster catch by management sub-area over the period 2006 to 2020 (offshore/trap boat sub-sector) in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon). Depth contours range from 100 m to 1000 m. 193

Figure 114: Oyster fishery in Gqeberha and the Southern Cape. Colour areas denote dedicated oyster collection zones (DEFF, 2020) 195

Figure 115: Abalone fishing Zones A to G, including sub-zones, and distribution of abalone (insert). The experimental fisheries (2010/11-2013/14) on the western and eastern sides of False Bay and in the Eastern Cape are also shown. These areas within False Bay, included in the commercial fishery recommendations for 2017/18, are referred to as Sub-zone E3 and Sub-zone D3 (DEFF, 2020) 196

Figure 116: An overview of the spatial distribution of abalone ranching concession areas 1 – 4 in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon). 197

Figure 117: Beach-seine and gillnet fishing management areas and TAE (DAFF, 2014)........ 198

Figure 118: Netfish (gillnet and beach-seine) management areas (DAFF, 2016/17) in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon). 199

Figure 119:Map of seaweed rights areas in South Africa (DEFF, 2020). 200

Figure 120: Location of seaweed rights areas (numbered) and kelp collection areas in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon). 201

Figure 121: Proposed Marine Aquaculture Development Zones and existing mariculture operations. 202

Figure 122: Schematic diagrams of the types of aquaculture systems a) cage, b) flow-through, c) raft and d) longline. 203

Figure 123: Distribution of aquaculture farms along the South African coast. 204

Figure 124: The University of Western Cape's PLAAS and Masifundise Development Trust organized a round table discussion on the status of small-scale fisheries in South Africa on 19 April 2018. More than 60 people, including civil society members, academics, community representatives, students, and legal practitioners, attended the event and presented their views. Image: Fishing Industry News SA 205

Figure 125: Fishing boats outside the Hondeklipbaai small-scale community co-operative (photo credit Carika van Zyl). 207

Figure 126: Block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon) in relation to the spatial distribution of small-scale fishing communities and number of participants per community along the west coast of South Africa. 209

Figure 127: Typical crawler-vessel (left) and drillship (right) operating in the Atlantic 1 Mining Licence Area (Photos: De Beers Marine). 214

Figure 128: Block 3B/4B (red polygon) in relation to other marine infrastructure on the West Coast, illustrating the location of well heads, diamond mining concessions, submarine telecommunications cables and ammunition dumps. 215

Figure 129: Block 3B/4B (red polygon) in relation to project - environment interaction points on the West Coast, illustrating the location of seabird and seal colonies and resident whale populations, Marine Protected Areas (MPAs) and Ecologically and Biologically Significant Areas (EBSAs) (Adapted from MARISMA Project 2020). 219

Figure 130: Block 3B/4B (red polygon) in relation to protection levels of 150 marine ecosystem types as assessed by Sink *et al.* (2019). The adjacent Namibian protection levels (adapted fom Holness *et al.* 2019) are also shown. 220

Figure 131: Block 3B/4B (red polygon) and the AOI for exploration drilling (orange dashed polygons) in relation to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Version 1.2) (Harris *et al.* 2022). 223

Figure 132: Block 3B/4B (red polygon) in relation to coastal and marine IBAs (Source: https://maps.birdlife.org/marineIBAs). 225

Figure 133: Block 3B/4B (red polygon) in relation to coastal and marine IMMAs (Source: www.marinemammalhabitat.org/imma-eatlas/). 228

Figure 134: Population density (source: Community Survey 2016) 235

Figure 135: People per ward (source: Census 2011). 236

Figure 136: Households per ward (source: Census 2011) 237

Figure 137: Total dependency ratios (source: Census 2011) 240

Figure 138: Employed dependency ratio (source: Census 2011). 240

Figure 139: Classified as Coloured (shown in percentage, source: Census 2011) 241

Figure 140: Home language Afrikaans (shown in percentage, source; Census 2011) 242

Figure 141: Proportion of people that did not complete secondary school (shown in percentage, source: Census 2011). 243

Figure 142: Proportion of adults that are unemployed (shown in percentage, source: Census 2011). 244

Figure 143: Proportion of households with an annual income of R19 600 or less in 2011 (shown in percentage, source: Census 2011). 245

Figure 144: Proportion of households that live in urban areas (shown in percentage, source: Census 2011). 246

Figure 145: Proportion of households that live in informal dwellings (shown in percentage, source: Census 2011). 246

Figure 146: Average household sizes (source: Census 2011). 247

Figure 147: Proportion of households that does not get water from a regional or local water scheme (shown in percentage, source: Census 2011). 248

Figure 148: Proportion of households that does not have piped water in the dwelling (shown in percentage, source: Census 2011). 249

Figure 149: Proportion of households that does not have a flush toilet (shown in percentage, source: Census 2011). 250

Figure 150: Proportion of households that use paraffin, candles, wood or nothing for lighting purposes (shown in percentage, source: Census 2011). 251

Figure 151: Proportion of households that use paraffin, wood, coal, dung or something else for heating purposes (shown in percentage, source: Census 2011). 251

Figure 152: Proportion of households that use paraffin, wood, coal, dung or something else for cooking purposes (shown in percentage, source: Census 2011). 252

Figure 153: A portion of the ships wrecked off South Africa and in the southern Atlantic. 257

Figure 154: Report in The Auckland Star 26-07-1895, by the Walmate on the drifting hulk of the Salsette. 257

Figure 155: Shipping density along the South African Coast. 264

List of Tables

Table 1: Preliminary Impacts Identified. xviii

Table 2: Report structure 2

Table 3: Locality details 7

Table 4: NEMA listed activities to be authorised 27

Table 5: Applicable legislation and guidelines overview 30

Table 6: Needs and desirability analysis for the proposed co-disposal facility. 42

Table 7: Demersal cartilaginous species found on the continental shelf along the West Coast, with approximate depth range at which the species occurs (Pisces, 2023). 78

Table 8: Potential VME species from the continental shelf and shelf edge on the West Coast (Atkinson & Sink 2018) 86

Table 9: Some of the more important large migratory pelagic fish likely to occur in the offshore regions of the West Coast (TOPS list under NEMBA, Act 10 of 2004; Sink *et al*. 2019; www.iucnredlist.org;). The National and Global IUCN Conservation Status are also provided. Species reported from Deep Water Orange Basin Area by MMOs are highlighted (CapFish 2013a). 96

Table 10: Global and Regional Conservation Status of the turtles occurring off the West Coast showing variation depending on the listing used. 100

Table 11: Pelagic seabirds common in the southern Benguela region (Crawford *et al*. 1991; BirdLife 2021). IUCN Red List and Regional Assessment status are provided (Sink *et al*. 2019). Species reported from the adjacent Deep Water Orange Basin Area by MMOs are highlighted (CapFish 2013a, 2013b). 103

Table 12: Breeding resident seabirds present along the South-West Coast (adapted from CCA & CMS 2001). IUCN Red List and National Assessment status are provided (Sink *et al*. 2019). Species reported from the adjacent Deep Water Orange Basin Area by MMOs are highlighted (CapFish 2013a, 2013b). * denotes endemicity. 106

Table 13: Cetaceans occurrence off the West Coast of South Africa, their seasonality, likely encounter frequency with proposed exploration activities and South African (Child *et al*. 2016) and Global IUCN Red List conservation status. 108

Table 14: Seasonality of baleen whales in the broader project area based on data from multiple sources, predominantly commercial catches (Best 2007 and other sources) and data from stranding events (NDP unpublished data). Values of high (H), Medium (M) and Low (L) are relative within each row (species) and

not comparable between species. For abundance / likely encounter rate within the broader project area. 111

Table 15: Threat status of the intertidal and shallow subtidal ecosystem types in the broader project area (Sink *et al*. 2019). 128

Table 16: Threat status of the estuaries in the broader project area from the Namibian Border to Cape Agulhas (Van Niekerk *et al*. 2019). Only true estuaries, not micro-systems are listed. 137

Table 17: South African offshore commercial fishing sectors: wholesale value of production in 2017 (adapted from DEFF, 2019). 140

Table 18: South African offshore fishing sectors, areas of operation and target species (DEFF, 2019). 141

Table 19: Summary breeding season and locality for important linefish species in Western Cape. Information adapted from Marine Linefish Species Profiles (Mann *et al*. 2013). 153

Table 20: Summary table of known spawning periods for key commercial species off the West Coast of South Africa. 153

Table 21: Estimates for the inshore and offshore demersal hake trawl fisheries. This includes financially value of the fishery (as of 2021) and TAC as of 2022. 157

Table 22: 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). 157

Table 23: Total catches per FAO area of demersal shark (2018). 169

Table 24: Total catch (t) and number of active domestic and foreign-flagged vessels targeting large pelagic species for the period 2005-2018 (Source: DEFF, 2019). 177

Table 25: 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 190

Table 26: Summary table showing seasonal variation in fishing effort expended by each of the main commercial fisheries sectors operating in West Coast South African waters. 213

Table 27: List of confirmed coastal Important Bird Areas (IBAs) and their criteria listings. (www.BirdLife.org.za). Those incorporating or listed as RAMSAR sites are shaded 224

Table 28: List of coastal RAMSAR sites in the area of influence of Block 3B/4B. 225

Table 29: Population density and growth estimates (sources: Census 2011, Community Survey 2016) 234

Table 30: Household sizes and growth estimates (sources: Census 2011, Community Survey 2016) 236

Table 31: Total dependency ratios (source: Census 2011). 238

Table 32: Criteria for Determining Impact Consequence. 265

Table 33: Probability Scoring. 267

Table 34: Determination of Environmental Risk. 267

Table 35: Significance Classes. 268

Table 36: Criteria for Determining Prioritisation. 268

Table 37: Determination of Prioritisation Factor. 269

Table 38: Environmental Significance Rating 269

Table 39: Identified preliminary environmental impacts. 271

Table 40: Preliminary impact assessment. 279

Table 41: Details of specialist input during the EIA phase. 297

Appendices

Appendix 1: EAP CV

Appendix 2: Public Participation Report

Appendix 3: Impact Assessment Matrix

Appendix 4: DFFE Screening Tool Report

Appendix 5: Environmental Authorisation Application

Acronyms and Abbreviations

2D	two-dimensional
3D	three-dimensional
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species
CPUE	Catch per unit effort
CUD	cumulative utilization distribution
DEFF	Department of Agriculture, Forestry and Fisheries
DFA	Development Facilitation Act (Act No. 67 of 1995)
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EAP	economically active population
EAP	Environmental Assessment Practitioner
EBSA	Ecologically and Biologically Significant Area
ECA	Environment Conservation Act (Act No. 73 of 1989)
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd
EMPr	Environmental Management Programme
ER	Exploration Right
ESAs	Ecological Support Areas
EWP	Exploration Works Programme
FAMDA	Fishing and Mariculture Development Association
FRAP	Fishery Rights Allocation Process
GN	Government Notice
GPS	Global Positioning System
GRT	Gross Registered Tonnage
HABs	Harmful Algal Blooms
I&APs	Interested and Affected Parties
IBA	Important Bird Area
ICCAT	International Commission for the Conservation of Atlantic Tunas
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IOTC	Indian Ocean Tuna Commission
IUCN	International Union for the Conservation of Nature
kts	knots
LFPR	labour force participation rate
MLRA	Marine Living Resources Act (Act No. 18 of 1998)

MPA	Marine Protected Area
MPRDA	Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)
NBA	National Biodiversity Assessment
NDM	Namakwa District Municipality
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMPAA	National Environmental Management Protected Areas Act (Act No. 57 of 2003)
NGOs	Non-Governmental Organisations
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
PAM	Passive Acoustic Monitoring
PASA	Petroleum Agency of South Africa
PIM	Particulate Inorganic Matter
PNSF	Port Nolloth Sea Farms
POM	Particulate Organic Matter
PPP	Public Participation Process
ROVs	Remote Operated Vehicles
S&EIA	Scoping and Environmental Impact Assessment
S&EIA	Scoping and Environmental Impact Assessment
SACW	South Atlantic Central Water
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
TCP	Technical Co-operation Permit
TOPS	Threatened and Endangered Species
TSPM	Total Suspended Particulate Matter
VMEs	Vulnerable Marine Ecosystems
WESSA	Wildlife and Environment Society of South Africa

EXECUTIVE SUMMARY

Africa Oil SA Corp, Ricocure (Pty) Ltd and Azinam Limited (a wholly owned subsidiary of Eco Atlantic) (the Joint Venture (JV) Partners – hereafter jointly referred to as the Applicant) are the holders of the Block 3B/4B Exploration Right (ER) in terms of the Mineral and Petroleum Resources Development Act (No. 28 of 2002 – MPRDA), as amended. The licence block covers an area of approximately 17 851 km^2, and is situated between latitudes 31°S and 33°S on the continental shelf in water depths ranging from 200 m to 2 000 m.

The area of primary interest in the north of this block, but this could also cover the central part of the block. As part of the process of applying for the Exploration Right, the JV Partners undertook and completed the reprocessing project covering 2 000 km^2, which is a subset of the 10 000 km^2 BHP/Shell 3D seismic datasets, focussed primarily on the most northern portion of Block 3B/4B.

Based on analysis of the reprocessed 3D dataset, the JV Partners are now proposing to drill an exploration well in the area of primary interest in order to fully appraise the hydrocarbon potential of the geological structure or "prospect", with the option to drill up to four additional wells.

A full Scoping and Environmental Impact Assessment (S&EIA) process is being undertaken to accompany the ER application for the EIA Listing Notices listed activities applicable to the project namely: Listing Notice 2: Activity 18.

PUBLIC PARTICIPATION PROCESS

The PPP for the proposed project has been undertaken in accordance with the requirements of the NEMA EIA Regulations (2014), and in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project and have their views considered and included as part of project planning.

The comments received from I&APs during the initial call to register and commenting period so far have been captured in the Public Participation Report (PPR) in Appendix 2. A high-level summary of the key comments and concerns raised to date are presented below:

- I&AP registrations and deregistration;
- Request for clarity regarding terminology such as the reprocessing of data;
- Request for clarity on the nature of the project;
- Request to be informed about updates of the project;
- Request for files related to the location and situation of the project site; and
- Provision of information related to SAHRIS application procedure for the project

PURPOSE OF THE SCOPING PHASE

The Scoping Phase aims to achieve the following:

- Provide a description of the proposed project and the location.
- Review the relevant legislation and its' applicability to the proposed project.
- Discuss the needs and desirability of the proposed project.
- Investigate potential alternatives to be further assessed in the Environmental Impact Assessment phase of the project.
- Describe the receiving biophysical, social and cultural receiving environment.
- Provide preliminary impact assessment of the social, cultural and biophysical environments affected by the proposed project.
- Discuss the plan of study for the EIA Phase.

- Undertake a fully inclusive public involvement process to ensure that Interested and Affected Parties (I&APs) are afforded the opportunity to participate, and that their issues and concerns are recorded.

PRELIMINARY IMPACT ASSESSMENT

Potential environmental impacts were identified during the scoping process. These impacts were identified by the EAP, the appointed specialists, as well as the preliminary input from the public. Table 1 provides a summary list of potential impacts identified in the different phases.

Potential cumulative impacts have been identified, evaluated, and mitigation measures suggested which will be updated during the detailed EIA level investigation. When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the activity. The main impacts which have a cumulative effect on a regional scale are related to the transportation vectors that they act upon. For example, air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly, water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

Table 1: Preliminary Impacts Identified

#	Preliminary Impact	Phase	Further Assessment
1	Routine Operational Discharges to Sea	Operation	Yes
2	Discharge of Ballast Water from Vessels	Operation	Yes
3	Noise from Helicopters	Operation	Yes
4	Lighting from Drill Unit and Vessels	Operation	Yes
5	Drilling and Placement of Infrastructure on the Seafloor	Operation and Demobilisation	Yes
6	Disturbance and/or Smothering of soft-sediment benthic communities due to drilling solids discharge	Operation	Yes
7	Disturbance and/or Smothering of hardgrounds / deep-water reef communities due to drilling solids discharge	Operation	Yes
8	Biochemical Impacts of residual WBMs, NADFs and cements additives on marine organisms in unconsolidated sediments	Operation	Yes
9	Biochemical Impacts of residual WBMs, NADFs and cements additives on marine organisms on hard grounds	Operation	Yes
10	Biochemical Impacts of residual WBMs, NADFs and cements additives on marine organisms in the water column	Operation	Yes
11	Increased Water Turbidity and reduced Light Penetration on marine ecology	Operation	Yes
12	Reduced physiological functioning of marine organisms due to indirect biochemical effects in the sediments	Operation	Yes
13	Disturbance, behavioural changes and avoidance of feeding and/or breeding areas in seabirds, seals, turtles and cetaceans due to drilling and vessel noise (continuous noise)	Mobilisation, Operation and Decommissioning	Yes

#	Preliminary Impact	Phase	Further Assessment
14	Impacts of infrastructure and residual cement on marine biodiversity	Construction	Yes
15	Impacts of flare lighting on marine fauna	Operation	Yes
16	Impact on marine fauna from the discharge of treated produced water	Operation	Yes
17	Impact on marine fauna from hydrocarbon 'drop-out'	Operation	Yes
18	Unplanned Collision of Vessels with Marine Fauna	Operation	Yes
19	Unplanned Loss of Equipment	Operation	Yes
20	Unplanned Oil release to the sea due to vessel collisions, bunkering accident and line / pipe rupture	Operation	Yes
21	Unplanned Well Blow-out	Operation	Yes
22	Social unrest and community conflict	Planning and Operation	Yes
23	Negative perceptions	Planning and Operation	Yes
24	Uncertainty	Planning and Operation	Yes
25	Further marginalisation of vulnerable groups	Planning and Operation	Yes
26	Concerns about cumulative impacts on their livelihoods and sense and spirit of place	Planning and Operation	Yes
27	Concerns about industrial accidents	Planning and Operation	Yes
28	Impacts on sense and spirit of place	Planning and Operation	Yes
29	Impacts on social license to operate	Planning and Operation	Yes
30	Stakeholder fatigue and disillusionment	Planning and Operation	Yes
31	Community expectations regarding perceived benefits of projects	Planning and Operation	Yes
32	Potential influx of people	Planning and Operation	Yes
33	Gender impacts	Planning and Operation	Yes
34	Economic benefits	Planning and Operation	Yes

#	Preliminary Impact	Phase	Further Assessment
35	Diversification of economic activities	Planning and Operation	Yes
36	Impacts on mental health	Planning and Operation	Yes
37	Job Creation	Planning	No further impact assessment required in the EIA phase. Mitigation measures to be included in the EMPr.
		Operation	
38	Disturbance of Potential Heritage Features	Operation	No further impact assessment required in the EIA phase. Mitigation measures to be included in the EMPr.
39	Cultural heritage impact of drilling	Operation	Yes
40	Interference with Existing Uses	Planning	Yes
		Operation	
41	Impacts on the fishing sector catch rates (tuna pole and large pelagic longline.	Operation	Yes
42	Exclusion from Fishing Ground Due to Temporary Safety Zone around Vessels	Operation	Yes
43	Atmospheric Emissions	Operation	Yes

CUMULATIVE IMPACTS

Cumulative effects are the combined potential impacts from different actions that result in a significant change larger than the sum of all the impacts. Consideration of 'cumulative impact' should include "past, present and reasonably foreseeable future developments or impacts". This requires a holistic view, interpretation and analysis of the biophysical, social and economic systems (DEAT 2004).

Cumulative impact assessment is limited and constrained by the method used for identifying and analysing cumulative effects. As it is not practical to analyse the cumulative effects of an action on every environmental receptor, the list of environmental effects being considered to inform decision makes and stakeholders should focus on those that can be meaningfully (DEAT 2004).

The individual and population level consequences of other exploration activities or multiple smaller and more localised stressors (see for example Booth et al. 2020; Derous et al. 2020) are difficult to assess. A significant adverse residual environmental effect is considered one that affects marine biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. Natural recruitment may not re-establish the population(s) to its original level within several generations or avoidance of the area becomes permanent. For example, despite the density of exploration drilling coverage off the southern African West Coast over the past 17 years, the southern right whale population is reported to be increasing by 6.5% per year (Brandaõ et al. 2017), and the humpback whale by at least 5% per annum (IWC 2012;) over a time when seismic surveying frequency has increased, suggesting that, for these population at least, there is no evidence of long-term negative change to population size as a direct result of exploration activities.

Reactions to sound or other anthropogenic disturbances by marine fauna depend on a multitude of factors including species, state of maturity, experience, current activity, reproductive state, time of day (Wartzok et al. 2004; Southall et al. 2007). If a marine animal does react briefly to a disturbance by changing its behaviour or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the population as a whole (NRC 2005). However, if a disturbance displaces a species from an important feeding or breeding area for a prolonged period, impacts at the population level could be significant. The increasing numbers of southern right and humpback whales around the Southern African coast, and their lingering on West Coast feeding grounds long into the summer, suggest that acoustic surveys and exploration activities conducted over the past 17 years have not negatively influenced the distribution patterns of these two migratory species at least. Information on the population trends of resident species of baleen and toothed whales is unfortunately lacking, and the potential effects of seismic noise on such populations remains unknown.

While it is foreseeable that further exploration (seismic and well-drilling) and future production activities could arise if the current application is granted, there is not currently sufficient information available to make reasonable assertions as to nature of such future activities. This is primarily due to the current lack of relevant geological and resource potential information, which the proposed exploration process aims to address. While there are many other rights holders in the offshore environment (e.g. marine diamonds and gemstones, heavy minerals, precious metals and ferrous and base metals), most of these are located well inshore of Block 3B/4B and are not undertaking any exploration activities at present or would be concurrently with the proposed AOSAC exploration drilling campaign. A possible exception is further proposed exploration well drilling in PEL39, in Namibia.

Thus, the possible range of the future prospecting, mining, exploration and production activities that could arise will vary significantly in scope, location, extent, and duration depending on whether a resource(s) is discovered, its size, properties and location, etc. As these cannot at this stage be reasonably defined, it is not possible to undertake a reliable assessment of the potential cumulative environmental impacts. It is also possible that the proposed, or future, exploration fails to identify an economic petroleum resource, in which case the potential impacts associated with the production phase would not be realised.

Furthermore, the assessment methodology used in the ESIA by its nature already considers past and current activities and impacts. In particular, when rating the sensitivity of the receptors, the status of the receiving environment (benthic ecosystem threat status, protection level, protected areas, etc.) or threat status of individual species is taken into consideration, which is based to some degree on past and current actions and impacts (e.g. the IUCN conservation rating is determined based on criteria such as population size and rate of decline, area of geographic range / distribution, and degree of population and distribution fragmentation. Thus, past and existing offshore activities (including shipping, prospecting, mining, exploration, production, commercial fishing, etc.) have been taken into account in the assessment of potential impacts related to the proposed project.

The primary impacts associated with the drilling of exploration wells (normal drilling operations) in the Southeast Atlantic Deep Ocean Biozone, relate to physical disturbance of the seabed, discharges of drilling solids to the benthic environment, the presence of infrastructure remaining on the seabed and associated vessels and drill unit. Other marine exploration and mining activities off the West Coast are all located well inshore of the AOI, but various existing and proposed subsea fibreoptics cables pass through the block. Cumulative impacts on benthic ecosystems in Block 3B/4B are therefore expected to be minimal.

PLAN OF STUDY FOR EIA

The section below outlines the proposed plan of study which will be conducted for the various environmental aspects during the EIA Phase. It is also important to note that the plan of study will also be guided by comment obtained from I&AP's and other stakeholders during the initial and scoping phase PPP.

DESCRIPTION OF ALTERNATIVES TO BE CONSIDERED IN EIA PHASE

As per the description in Section 6, no location alternatives are applicable to the project, the layout alternative of avoiding the CBAs identified within the AOI will be further assessed in the EIA phase. The activities proposed in this application require specialised technology and skills. The most suitable technology for use will be further assessed in the EIA phase once the final rig selection has been decided upon depending on availability and final design selection. Various scheduling alternatives have also been investigated and these will be further assessed in the EIA phase.

The no go alternative would imply that no exploration activities are undertaken. As a result, the opportunity to identify potential oil and gas resources within the Block 3B/4B and proposed AOI would not exist. This will negate the potential negative and positive impacts associated with the proposed exploration activities.

DESCRIPTION OF THE ASPECTS TO BE ASSESSED AS PART OF THE EIA PROCESS

The following aspects will be assessed further during the EIA phase investigation to be undertaken:

- Impacts on existing uses;
- Marine Ecology;
- Fisheries;
- Acoustic Impacts;
- Cultural Heritage;
- Social Impacts;
- Air Quality and Climate Change;
- Drill Cutting and Oil Spill; and
- Economic Impacts.

PROPOSED METHOD OF ASSESSING ENVIRONMENTAL ASPECTS

The same method of assessing impact significance as was used during the Scoping phase will be applied during the EIA phase.

PROPOSED METHOD FOR ASSESSING DURATION AND SIGNIFICANCE

The significance of environmental impacts will be rated before and after the implementation of mitigation measures. These mitigation measures may be existing measures or additional measures that may arise from the impact assessment and specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of the mitigation. The proposed method for the assessment of environmental issues. This assessment methodology enables the assessment of environmental issues including: the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

The specialist studies will recommend practicable mitigation measures or management actions that effectively minimise or eliminate negative impacts, enhance beneficial impacts, and assist project design. If appropriate, the studies will differentiate between essential mitigation measures, which must be implemented and optional mitigation measures, which are recommended.

STAGES AT WHICH COMPETENT AUTHORITIES WILL BE CONSULTED

Competent authorities have been and will be consulted during the initial notification period, the scoping phase as well as during the EIA phase.

PROPOSED METHOD OF EIA PHASE PUBLIC PARTICIPATION

The proposed public participation process to be followed for the EIA phase is provided below.

- The commenting periods that will be provided to the I&AP's (and the competent authorities) will be 30 days as per the relevant legislative requirements.
- The dates of the review and commenting period for the draft EIA/EMPr will be determined at a later date and communicated to all registered I&AP's through faxes, emails, SMS's and/or registered letters.
- The location at which the hard copy of the EIA report will be made available is at the same public places in the project area that the Scoping Report was made available (refer Appendix 2), sent electronically to stakeholders who request a copy, and placed on the EIMS website: www.eims.co.za.
- The public participation will be undertaken in compliance with NEMA GNR 982 (Chapter 6).
- Public meetings will be held during the review period for the EIA report.
- All comments and issues raised during the comment periods will be incorporated into the final EIA Report.

DESCRIPTION OF TASKS THAT WILL BE UNDERTAKEN DURING THE EIA PROCESS

The plan of study detailed in the above sections and is summarised below. The following tasks will be undertaken as part of the EIA phase of the project:

- EIA-phase specialist studies.
- Public consultation:
  - Notification of the availability of the EIAR for review and comment to all registered I&AP's;
  - Public and focus group meetings if required.
- Authority consultation:
  - Consultation with DMR and the commenting authorities; and
  - Authorities consultation (including meetings where necessary) to provide authorities with project related information and obtain their feedback.
- Document compilation:
  - The EIA and EMPr will be compiled in line with the requirements of Appendix 3 and 4 of the NEMA EIA Regulations.
  - The EIA and EMPr will be made available for public comment for a period of 30 days.
  - The EIA and EMPr will be finalised and submitted to the PASA/DMRE for adjudication and decision making.

MEASURES TO AVOID, REVERSE, MITIGATE, OR MANAGE IMPACTS

All comments received from I&APs during the Scoping Report review will be taken into consideration and where applicable inform the high-level mitigation measures. Detailed mitigation measures will be further developed as part of the EIA phase. The potential impacts will further be assessed in terms of the mitigation potential, taking into consideration the following:

- Reversibility of impact:
  - Reversible.
  - Partially reversible.
  - Irreversible.
- Irreplaceable loss of resources:
  - Replaceable.

- Partially replaceable.
- Irreplaceable.

- Potential of impacts to be mitigated:
  - High.
  - Medium.
  - Low.

This information for each identified impact will be provided in the EIA and EMPr.

1 INTRODUCTION

Africa Oil SA Corp, Ricocure (Pty) Ltd and Azinam Limited (a wholly owned subsidiary of Eco Atlantic) (the Joint Venture (JV) Partners – hereafter jointly referred to as the Applicant) are the holders of the Block 3B/4B Exploration Right (ER) in terms of the Mineral and Petroleum Resources Development Act (No. 28 of 2002 – MPRDA), as amended. The licence block covers an area of approximately 17 581 km^2, and is situated between latitudes 31°S and 33°S on the continental shelf in water depths ranging from 200 m to 2 000 m.

The area of primary interest in the north of this block, but this could also cover the central part of the block. As part of the process of applying for the Exploration Right, the JV Partners undertook and completed the reprocessing project covering 2 000 km^2, which is a subset of the 10 000 km^2 BHP/Shell 3D seismic datasets, focussed primarily on the most northern portion of Block 3B/4B.

Based on analysis of the reprocessed 3D dataset, the JV Partners are now proposing to drill an exploration well in the area of primary interest in order to fully appraise the hydrocarbon potential of the geological structure or "prospect", with the option to drill up to four additional wells.

A full Scoping and Environmental Impact Assessment (S&EIA) process is being undertaken to accompany the ER application for the EIA Listing Notices listed activities applicable to the project namely: **Listing Notice 2: Activity 18**

1.1 REPORT STRUCTURE

This report has been compiled in accordance with the NEMA EIA Regulations, 2014, as amended. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 2 below.

Table 2: Report structure

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 2(2)(a):	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	1.2
Appendix 2(2)(b):	The location of the activity. Including – i. The 21-digit Surveyor General code of each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	2
Appendix 2(2)(c):	A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On a land where the property has not been defined, the coordinates within which the activity is to be undertaken;	2
Appendix 2(2)(d):	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered; ii. A description of the activities to be undertaken, including associated structures and infrastructure;	3
Appendix 2(2)(e):	A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process;	4

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 2(2)(f):	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	5
Appendix 2(2)(h):	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including – i. Details of all alternatives considered; ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; iv. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – a. Can be reversed; b. May cause irreplaceable loss or resources; and c. Can be avoided, managed or mitigated; vi. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives; vii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; viii. The possible mitigation measures that could be applied and level of residual risk; ix. The outcome of the site selection matrix; x. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and xi. A concluding statement indicating the preferred alternatives, including preferred location of the activity;	6, 7, 8 and 9
Appendix 2(2)(i):	A plan of study for undertaking the environmental impact assessment process to be undertaken, including –	10

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	i. A description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity; ii. A description of the aspects to be assessed as part of the environmental impact assessment process; iii. Aspects to be assessed by specialists; iv. A description of the proposed method of assessing the environmental aspects, including a description of the proposed method assessing the environmental aspects to be assessed by specialists; v. A description of the proposed method of assessing duration and significance; vi. An indication of the stages at which the competent authority will be consulted; vii. Particulars of the public participation process that will be conducted during the environmental impact assessment process; and viii. A description of the tasks that will be undertaken as part of the environmental impact assessment process; ix. Identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored;	
Appendix 2(2)(j)	An undertaking under oath or affirmation by the EAP in relation to – i. The correctness of the information provided in the report; ii. The inclusion of comments and inputs from stakeholders and interested and affected parties; and iii. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Appendix 1
Appendix 2(2)(k):	An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	Appendix 1
Appendix 2(2)(l):	Where applicable, any specific information required by the competent authority; and	None
Appendix 2(2)(m):	Any other matter required in terms of section 24(4)(a) and (b) of the Act.	None

1.2 DETAILS OF THE EAP

EIMS has been appointed by the Applicant as the independent Environmental Assessment Practitioner (EAP) to prepare and submit the EA application, Scoping and EIA Reports, and undertaking a Public Participation Process (PPP) to accompany the ER Application. The contact details of the EIMS consultant and EAP who compiled this Report are as follows:

Name of Practitioner	Mr G.P. Kriel (EAP and Quality Reviewer)	Ms Sinalo Matshona (Report Compilation)
Tel No.:	011 789 7170	011 789 7170
E-mail:	block3b4b@eims.co.za	

In terms of Regulation 13 of the EIA Regulations, 2014, as amended, an independent EAP, must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 29 years' experience in conducting EIA's. Please refer to the EIMS website (www.eims.co.za) for further details of expertise and experience.

Mr Gideon Petrus Kriel (GP) holds an M.Env.Sci (Water Sciences) Cum Laude from the North-West University (Potchefstroom Campus) and has been employed as an Environmental Consultant since 2007. GP is a Registered Professional Natural Scientist (South African Council for Natural and Scientific Professions) and a Registered Environmental Assessment Practitioner (Environmental Assessment Practitioner). He has delivered presentations locally and internationally concerning the use of bio-indicators for the determination of water quality, and has experience in a wide variety of environmental management projects including: Environmental Impact Assessments, Basic Assessments, Geographic Information Systems (GIS), Environmental Compliance Monitoring, Environmental Awareness Training, Aquatic Ecological Assessments, Drinking and Waste Water Treatment Process Audits, Wetland Delineation and Assessments, ISO 14001 Aspect Registers, Water Use Licence Applications, Waste Management Licence Applications and Integrated Waste and Water Management Plans (IWWMP).

Ms Sinalo Matshona is a registered Candidate Natural Scientists who holds a BSc (Life and Environmental Science) majoring in Geography and Environmental Management from the University of Johannesburg. Sinalo is registered with SACNASP as a Candidate Natural Scientist (#147072) and is also registered with EAPASA as a Candidate Environmental Assessment Practitioner (EAP), 2021/4082. She has been employed as a full time Environmental Officer since 24 February 2020, her duties involved daily environmental compliance monitoring onsite, preparing and updating of environmental file, construction site rehabilitation planning, Environmental Awareness Training, liaising with the Contractor, external auditors and other involved parties and providing verbal and written reports. She is currently working as a full time Environmental Consultant; her key roles include but are not limited to undertaking and managing the public participation process for various ongoing Environmental Impact Assessment (EIA) projects, compiling of Basic Assessment and Environmental Impact Assessment Reports, Water Use License Applications (WULA), undertaking environmental compliance monitoring and project management.

The Curriculum Vitae of the EAP and the candidate EAP that were responsible for the compilation of this Report is included in Appendix 1.

2 DESCRIPTION OF THE PROJECT AREA

Table 3 indicates the details of the project area for the proposed project including details on the project location as well as the distance from the proposed project area to the nearest towns.

Table 3: Locality details

Project Area	Block 3B/4B is situated between latitudes 31°S and 33°S on the continental shelf in water depths ranging from 200 m to 2 000 m. The area of primary interest in the north of this block, but this could also cover the central part of the block. As part of the process of applying for the Exploration Right, the JV Partners undertook and completed the reprocessing project covering 2 000 km^2, which is a subset of the 10 000 km^2 BHP/Shell 3D seismic datasets, focussed primarily on the most northern portion of Block 3B/4B.
Application Area	Block 3B/4B Approximately 1 758 100 ha covers an area of approximately 17 581 km^2, and
Magisterial District	Adjacent to the Namaqualand and West Coast District Municipalities
District Municipality	Adjacent to the Namaqualand and West Coast District Municipalities
Local Municipalities	Adjacent to the Kamiesberg; Richtersveld; Nama Khoi; Matzikama; Cederberg; Bergrivier; Saldanha Bay; Swartland; and City of Cape Town Local Municipalities.
Application area coordinates	The application area corner coordinate points are as follows:

Point	Latitude	Longitude	Point	Latitude	Longitude
1	-31.00030518	14.74908447	**12**	-32.70800781	16.60467529
2	-31.00030518	15.94488525	**13**	-33.00018311	16.60467529
3	-31.45031738	15.94488525	**14**	-33.00030518	16.24932861
4	-31.45031738	15.96588135	**15**	-32.75030518	16.24932861
5	-31.88360596	15.96588135	**16**	-32.75030518	15.74908447
6	-31.88360596	16.2824707	**17**	-32.25030518	15.74908447
7	-32.41699219	16.2824707	**18**	-32.25030518	15.49908447
8	-32.41699219	16.41589356	**19**	-32.00030518	15.49908447
9	-32.60028076	16.41589356	**20**	-32.00030518	14.99908447
10	-32.60028076	16.54931641	**21**	-31.25030518	14.99908447
11	-32.70800781	16.54931641	**22**	-31.25030518	14.74908447

The locality of the proposed exploration area is shown in Figure 1.

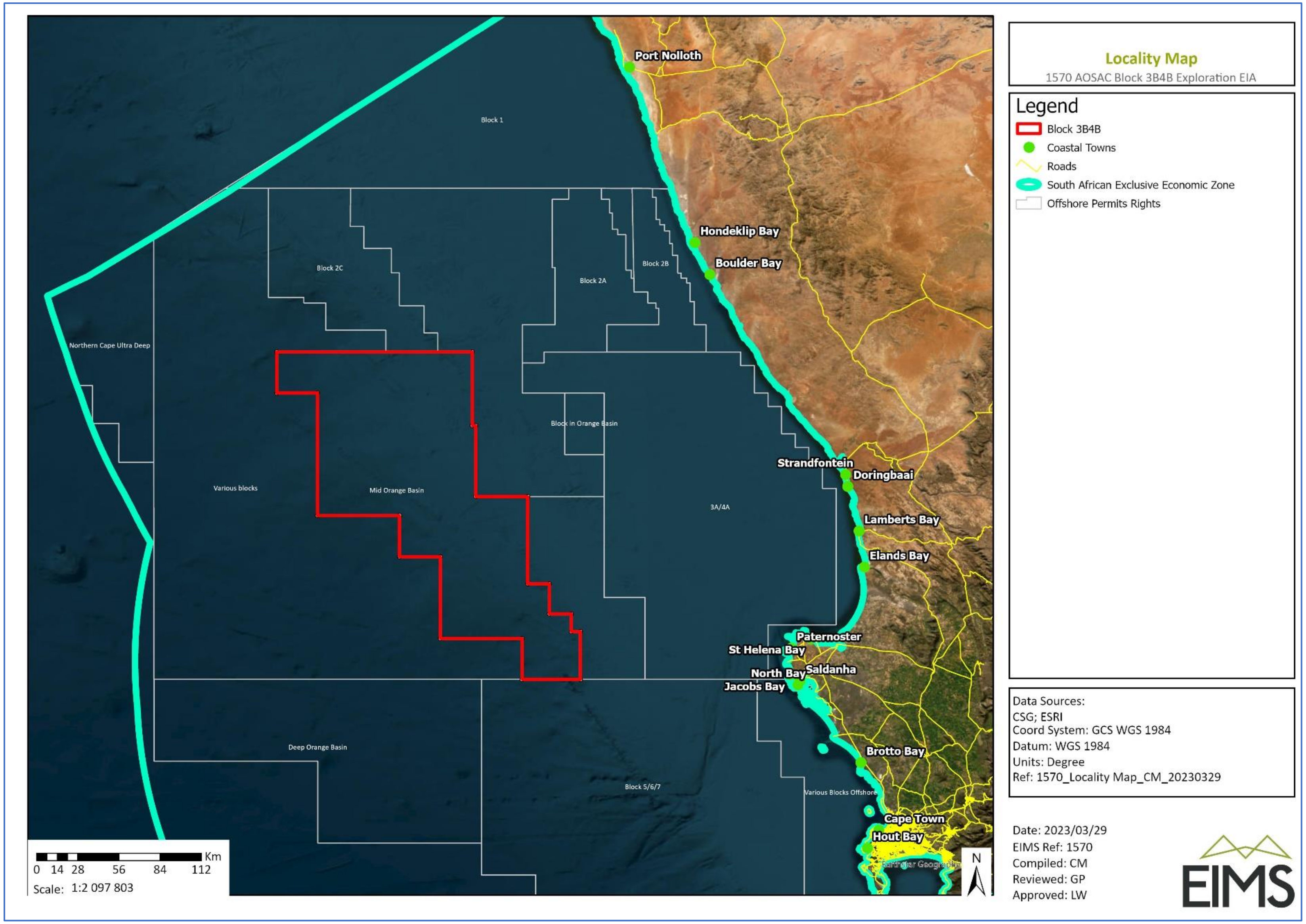


Figure 1: Locality map.

3 DESCRIPTION AND SCOPE OF THE PROPOSED ACTIVITY

This section provides an overview of the proposed activity. A brief history of the applicant's involvement in Block 3B/4B is provided followed by the proposed activities to be undertaken as part of this application.

3.1 DESCRIPTION OF PREVIOUS ACTIVITIES UNDERTAKEN

A number of previous investigations and exploration activities have been undertaken within Block 3B/4B in the past. Approximately 14 000 linear km's of 2D seismic and 10 800 km^2 of 3D seismic data exists over Block 3B/4B. While a number of key 2D seismic lines have been acquired, the subsurface evaluation has largely utilized the extensive 3D seismic data that was acquired by PGS in 2013 for BHP Petroleum. This single 3D survey covers approximately 65% of the block and is joined in the northern part of the block by an overlapping 3D seismic survey acquired by Dolphin in 2013 for Shell. In 2022, a subset of the BHP survey was reprocessed by Down Under Geophysical (DUG) through Pre-Stack Depth Migration on behalf of the JV Partners.

An ER for Block 3B/4B was granted to Ricocure (a company that is part of the JV Partners) by the Director-General of the Department of Mineral Resources and Energy (DMRE) duly delegated to act on behalf of the Minister of DMRE in terms of Section 80 of the Mineral and Petroleum Resources Development Act, 2002. The ER was signed on 9 May 2019 with an effective start date of the Initial Period of 27 March 2019 and recorded as file reference number 12/3/339. The ER allows for two additional renewal periods, each with a two-year duration. The work programme for each renewal period is negotiable. Clause 10 of the Block 3B/4B ER requires a 20% relinquishment upon completion of the Initial Exploration Period which equates to approximately 3,516 km^2. The Applicant applied for a deferment of this relinquishment obligation until such time as the Marine Protected Areas within Block 3B/4B has been finalised. The application for deferment of the relinquishment obligation was granted by the Director-General of the Department of Mineral Resources and Energy (DMRE) duly delegated to act on behalf of the Minister of DMRE and accordingly the Applicant did not relinquish at the end of the Initial Exploration Period.

The Initial three-year exploration period expired on 26 March 2022. The Initial work programme included the following:

- Regional interpretation and mapping of key horizons and faults;
- Detailed petrophysical analysis tying to neighbouring wells;
- Quantitative interpretation work of the physical properties;
- Basin model update Integrating the regional studies;
- Prospect maturation; and
- Prospect ranking and final report compilation.

During the Initial Exploration Period, the JV Partners purchased and acquired digital copies of 2D and 3D seismic data, well data, and regional reports from the Petroleum Agency of South Africa (PASA). As part of the minimum work programme the JV Partners performed regional mapping, basin modelling studies, well log interpretation, and quantitative rock physics and AVO seismic attribute analysis on legacy 2D and 3D seismic data. In 2022, the JV Partners completed reprocessing 2,020 km^2 of legacy 3D seismic survey, exceeding the minimum work commitment for the exploration period.

The remaining work programme for that exploration period includes the interpretation of recently reprocessed 3D seismic, geologic studies to rank prospects, and recommendations for exploratory drilling candidates. The reprocessing effort was successful in terms of providing improved seismic imaging and further de-risking the existing prospect inventory and has helped the JV Partners identify new prospects.

On expiry of the Initial Exploration Period of the ER the JV applied to enter into the First Renewal Period. On 23 September 2022 the Director-General of DMRE, duly delegated to act on behalf of the Minister of DMRE, granted the entry into the First Renewal Period. The Petroleum Agency of South Africa (PASA) informed the JV of the aforementioned grant on 27 October 2022 and as such, the First Renewal Period commenced on 27 October 2022 and ends on 26 October 2024. The minimum work commitment includes the following:

- Reprocess 1,500 km^2 of 3D Seismic applying Pre-stack Depth Migration;
- Seismic Interpretation of the newly reprocessed seismic data in the Northern Area;
- Seismic Amplitude Versus Offset analysis of prospects identified on the newly re-processed seismic data;
- Update regional source rock and reservoir models developed during the Initial Exploration Phase with results from the recent wells in the Deepwater Orange Basin;
- Update Prospect Inventory (Volumes and Ranking); and
- Conduct commercial evaluation of high-graded prospects to determine the risked value, or the risk versus reward of the best prospects.

3.1.1 REGIONAL SETTING OF THE ORANGE BASIN

According to the literature and exploration activity associated with Block 3B/4B to date, it was reported that there is evidence and confirmation that several petroleum systems sourced from known source rocks are developed in the Orange Basin as shown in Figure 2 below. Evidence for Aptian source rocks has been reported by a number of authors and there is also evidence for the presence of an active Cenomanian/Turonian source rock. These oil and gas systems contain a number of exploration plays and several prospects and leads were identified, which have been evaluated and reviewed by a number of companies previously active in exploration in South Africa. The Albian stratigraphic structural play has been confirmed in several gas discoveries off South Africa, the best of which is the A-K1 (Ibhubesi gas field), as shown in Figure 3 below.

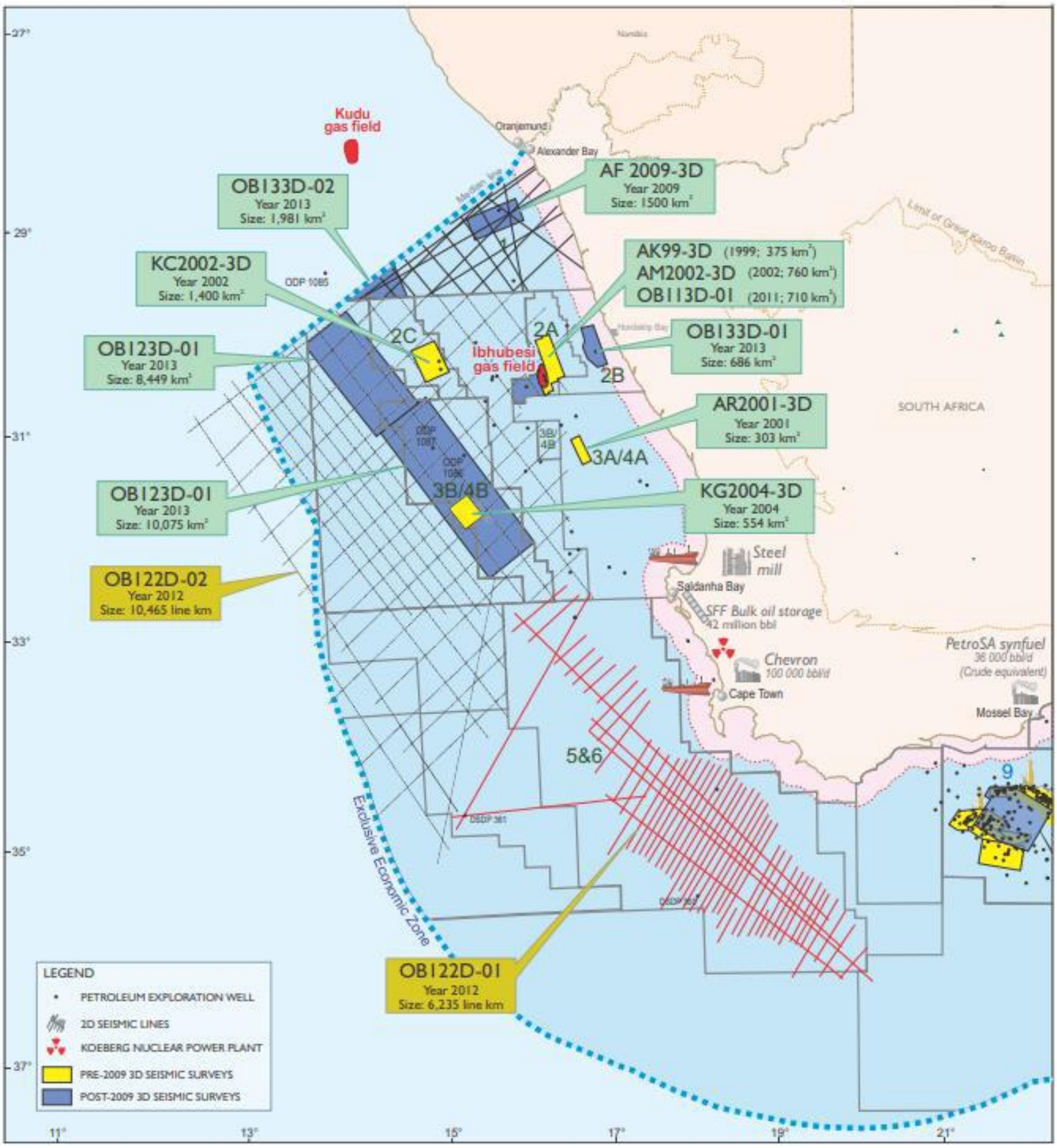


Figure 2: Regional setting highlighting a subset of the wells, seismic surveys, exploration wells and discoveries in the Orange Basin.

The A-F1 gas discovery confirmed the following key parameters:

- Tested approximately 32 MMscf/d;
- 17 m fluvial sandstone;
- Albian play;
- Porosities 20-26%; and
- Incised valley system.

Within the syn-rift succession, the only oil system confirmed to-date occurs in the isolated A-J half-graben (Figure 4 below). The oil is sourced from typically rich Hauterivian lacustrine shales within the half-graben and is trapped stratigraphically within lake shore-line sandstones interbedded with the source shales. The maximum flow rate reached whilst testing was approximately 200 barrels per day of oil.

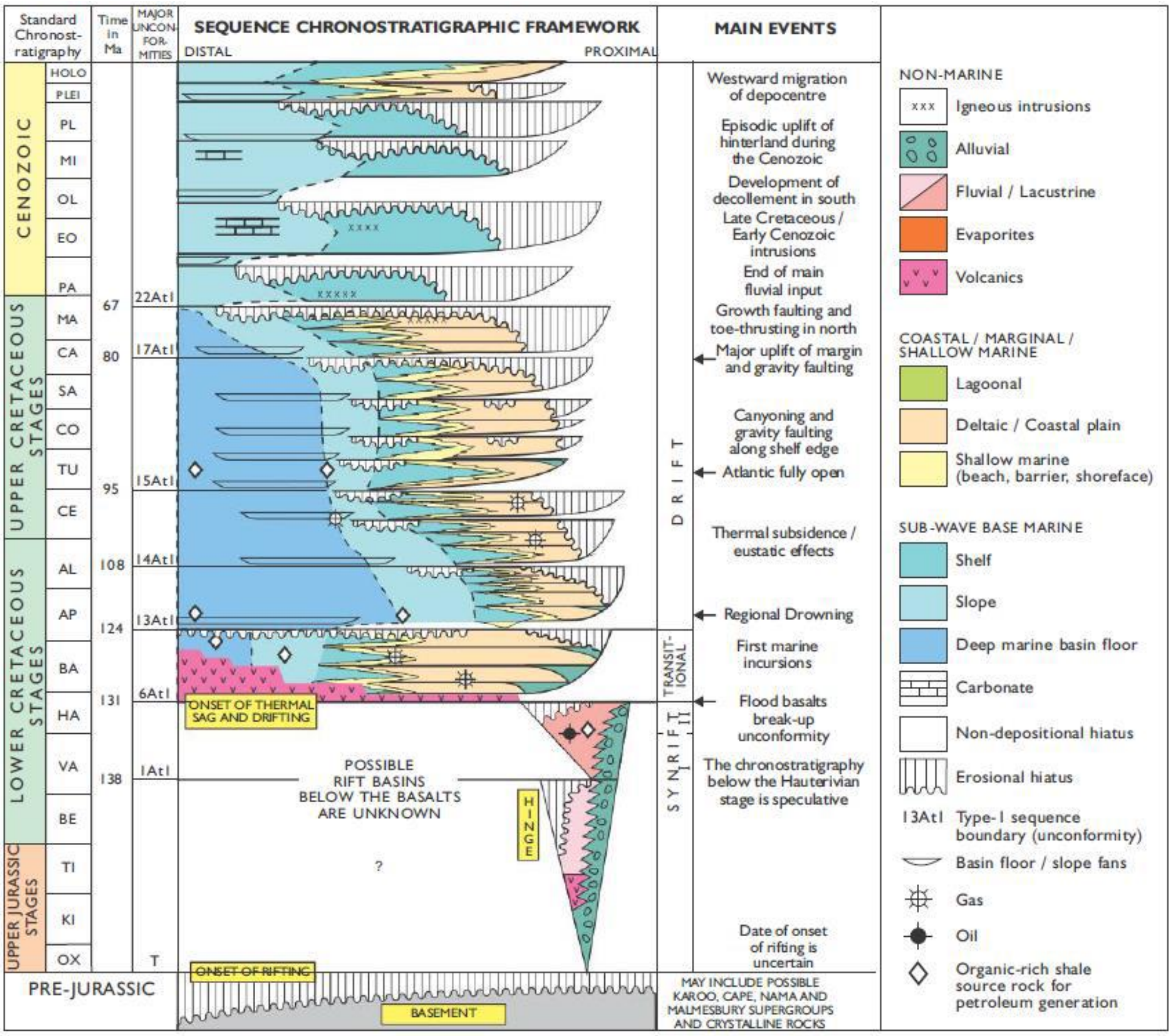


Figure 3: Generalised chronostratigraphic Geological Column of the Orange Basin.

It is anticipated that there is also significant potential in other syn-rift grabens to the north and south of the A-J Graben and there is potential for significant gas and light oil discoveries in the shallower sequences above the rift graben succession in the outboard areas of Block 3B/4B.

Two main source rock units are known to occur in the Orange Basin which includes:

- Late Hauterivian synrift source rock;
- Barremian-early Aptian source rock; and
- Indication of a regionally developed Cenomanian-Turonian source rock.

Each of these marine condensed sequences is associated with the three main phases of basin development in the Orange Basin, namely the rift, early drift, complete drift phases.

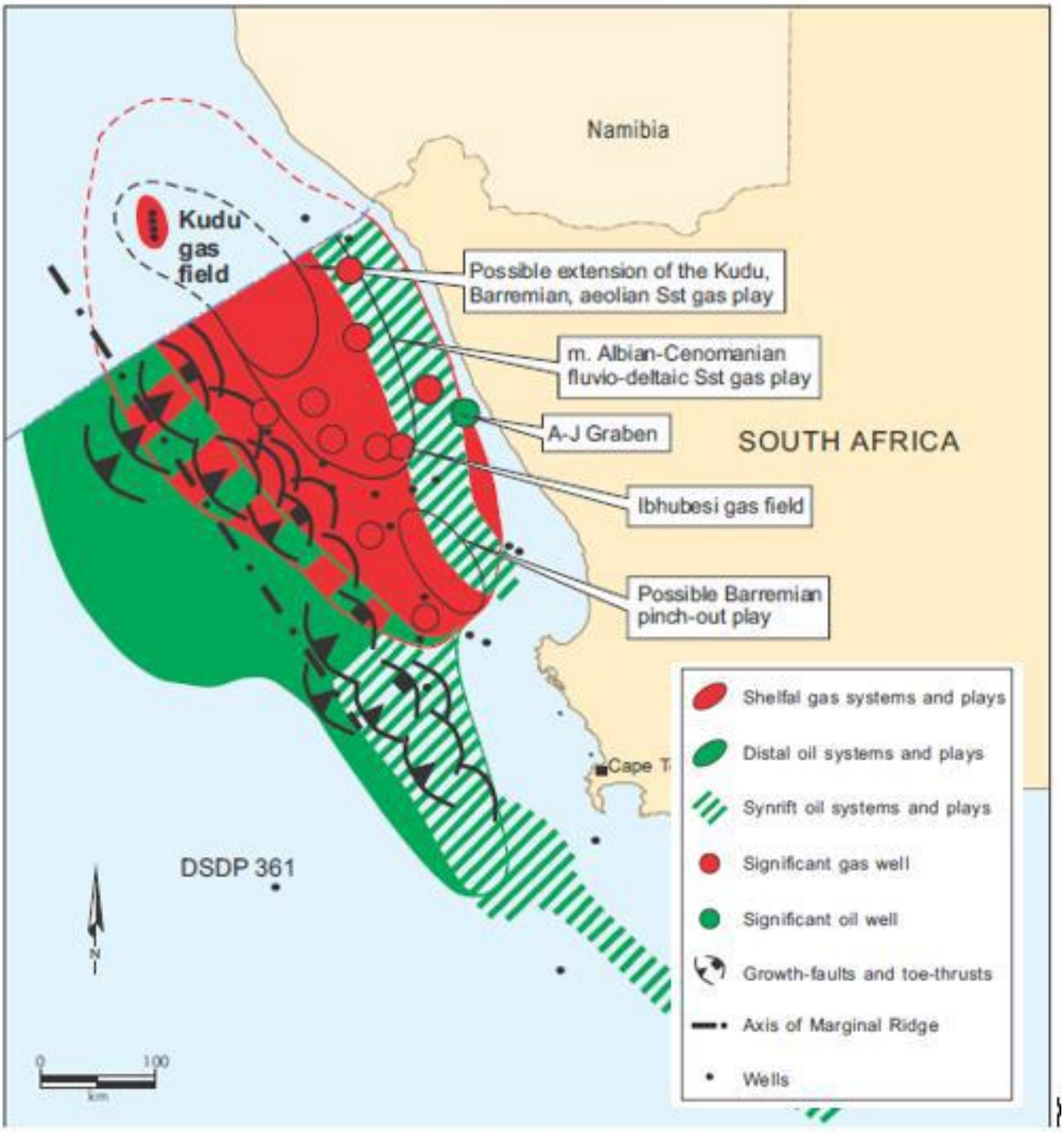


Figure 4: Main and postulated petroleum systems in the southern Orange Basin.

3.1.2 REGIONAL SETTING AND GEOLOGY ASSOCIATED WITH BLOCK 3B/4B

Exploration in the Orange Basin has historically targeted Cretaceous shelf sequences in shallow water areas, inboard of Block 3B/4B. Before the major Graff and Venus discoveries in 2022, very few discoveries had been made. Early exploration had focused mainly on targets in relatively shallow water, the most notable being the Kudu gas discovery in southern Namibia (in aeolian, shallow-marine Barremian reservoirs), the Ibhubesi gas discovery (in Aptian-Albian shallow-marine fluvio-deltaics) and the small A-J1 oil field (in Hauterivian syn-rift and lacustrine clastics).

In 2009, Shell were granted an Exploration Right to explore the deepwater area to the west in deep and ultra-deep water. Shell expanded their exploration activity into Namibia which has led to their recent light oil and gas discoveries in Cretaceous age turbidite reservoirs as encountered in the Graff-1, La Rana-1 and Jonkers-1 discovery wells in 2022 and 2023. Similarly TotalEnergies have joined this activity and maintain a large position in the deep water and ultra-deepwater licenses of the Orange Basin. In Namibia, TotalEnergies and partners announced a significant light oil discovery in Cretaceous turbidite fans. These along with Luiperd and Brulpadda discoveries reportedly benefit from strong seismic amplitude, or AVO seismic signatures.

Prospects in Block 3B/4B will target turbidite fan deposits of similar age and seismic response to the discoveries made by both TotalEnergies and Shell. Traps are generally combination structural-stratigraphic traps, with siliciclastic reservoirs confined within channels, or deposited as turbidite fans fully encased in shales.

Block 3B/4B lies within the Orange Basin which extends from South Africa as far north as the Lüderitz Arch in Namibia. The basin formed from the breakup of the African and South American continents starting in Jurassic time. The early syn-rift basin fill consists of both siliciclastics, and carbonates deposited during the Late Jurassic and Early Cretaceous eras (Figure 3: Note multiple unconformities occur through the Upper Cretaceous transporting sands into the deepwater basin. This was followed by deposition of Aptian-Albian aged organic-rich shales deposited in a marine restricted environment. These regionally extensive marine shales are the primary source rock for the Orange Basin.

Following deposition of the Aptian-Albian marine source rocks, separation of the continents continued during what is referred to the 'drift' stage, where sediments from major proto rivers deposited large quantities of clastic sediments as fluvial-deltaic deposits in the nearshore areas. Further offshore, where Block 3B/4B is located, Cretaceous clastic sediments were deposited at the paleo shelf edge and slope as turbidites. Two ancient river systems provided sediments to the nearshore and offshore areas of Block 3B/4B during the Upper Cretaceous, the Orange River to the north, and the Olifants River located immediately east of Block 3B/4B.

The shelf areas of the Orange Basin east of Block 3B/4B have been explored with more than 38 wells, most of which were drilled in water depths of 500 m or less. While these wells did not target the same depositional environments that are being targeted in Block 3B/4B, the wells do provide information about the stratigraphy of the Upper Cretaceous sediments east of Block 3B/4B. For example, wells located on the shelf confirm the presence of sandstone input into the area, and also confirm the presence of Cretaceous source rocks that are key to a working petroleum system.

Sediments of Albian age were deposited in the shelfal areas by distributary meandering channels on the lower to middle shoreface of a delta front. Proportions of sand up to 63% are noted and a general trend of decreasing sand proportions across the shelf is observed, with approximately 60% sand in proximal wells such as A-K1 and P-Fl, and very low proportions sand (4% to 5%) deposited in distal wells such as A-C3 and K-A2. Where tested, these Albian sandstones have good porosity and permeability and good flow rates.

In Ibhuhesi field, located east of Block 3B/4B, Albian deltaic sandstone reservoirs achieved rates greater than 30 MMscf/d from individual reservoir zones.

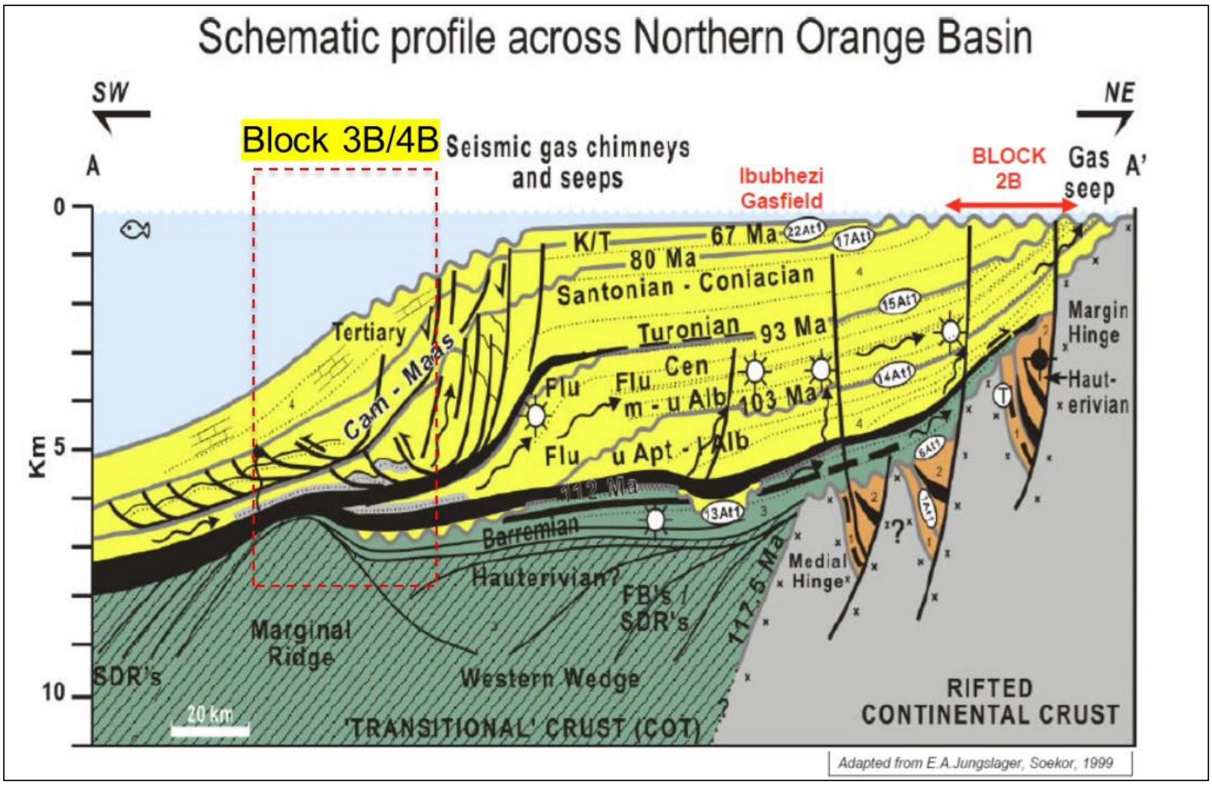


Figure 5: Schematic seismic profile showing location of Block 3B/4B within continental slope deposits.

Structural deformation, or faulting is not prominent in Cretaceous sediments of Block 3B/4B although some minor faulting and soft-sediment deformation has occurred in some rather limited intervals within the Cretaceous or Tertiary sections. However, a prominent topographic high referred to as the 'Outer Ridge' or 'Outer High' provides an important structural element for Block 3B/4B. This feature was a topographic high during deposition of the Aptian-Albian time and in some areas the key source rock interval is thin or absent over this Outer High7 (Figure 5 and Figure 6).

Similarly, the Outer High affected deposition of Albian turbidite fans which in some areas ponded, thinned, or pinched-out against this topographic feature. Lower areas or 'gaps' in the Outer High allowed turbidite sediments to more easily reach deepwater areas. The Venus and Graff discoveries in Namibia are located seaward of one these 'gaps' in the Outer Ridge where sediments could more easily funnel through to more distant slope and deepwater areas. In Block 3B/4B one of the larger prospects in the inventory, 'Fan-S', is a turbidite fan that thins and truncates against the Outer High, forming a combination structural-stratigraphic trap. Further offshore, and in the area of Block 3B/4B, these Albian sandstones were deposited as turbidite channels and fans and form one of the principal reservoir targets.

Following deposition of Cretaceous sediments, Tertiary deposition continued with the development of an aggrading shelf margin with little or no deformation. Later phases of deposition during the Tertiary are characterized in some areas by instability resulting in development of a coupled growth fault and toe thrust system but these are not prominent in Block 3B/4B and have not been a focus for developing the prospect inventory. The current prospect inventory does not include any prospects of Tertiary age, but this shallow section could contain thermogenic gas generated deeper in the Cretaceous section. Tertiary deposition is most significant from the prospective of source maturation in Block 3B/4B, as it is the timing and thickness of Tertiary deposition that drives the maturation of Cretaceous source rocks in Block 3B/4B.

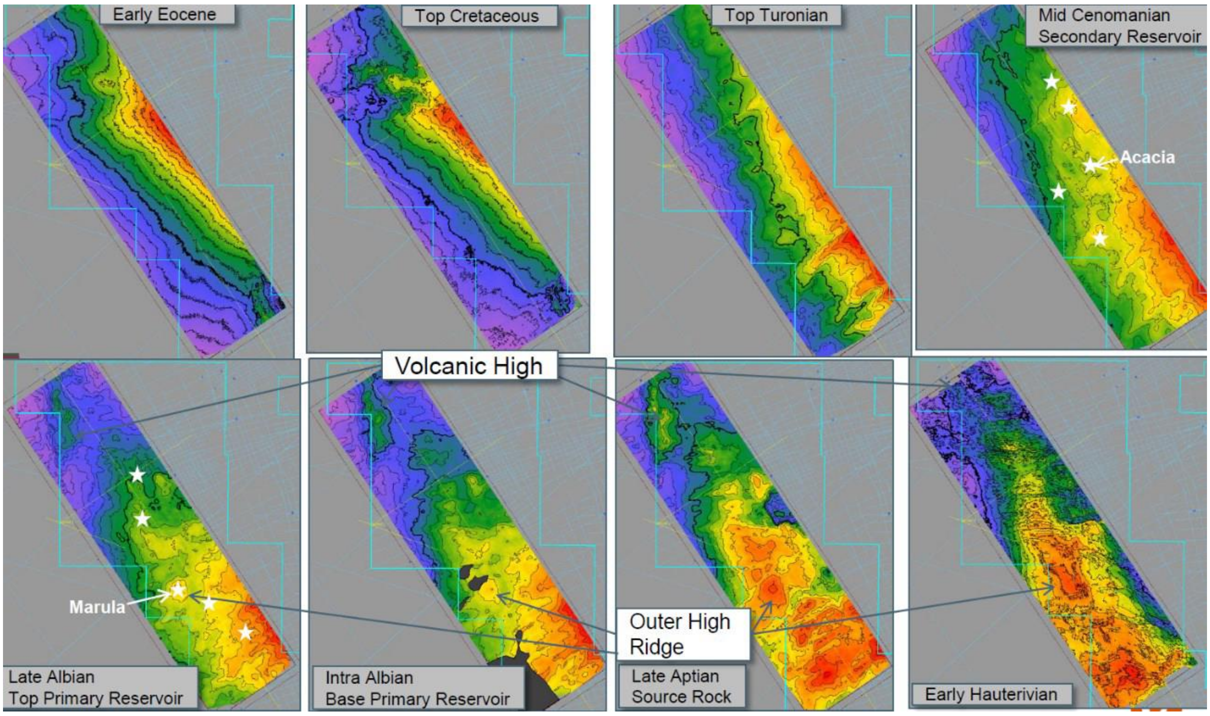


Figure 6: Blockwide structure maps from Early Cretaceous through Eocene time for Block 3B/4B.

Shelfal well K-D1, was used as a key well for well-ties into Block 3B/4B seismic because of the total depth of penetration (Figure 7). Unfortunately, well K-D1 did not penetrate the Late Cretaceous turbidite feeder channels that would have helped the correlation of sands in the deepwater section.

3.1.3 SOURCE ROCKS

Cretaceous Aptian-Albian and Barremian shales have been identified as the primary source rocks in the Orange basin. Wells located inboard and adjacent to Block 3B/4B provide key evidence for source rock quality and maturity. Potential source rocks of Aptian and or Albian age are penetrated in wells A-F1, A-E1, K-A2, A-C2, PA-1, 0-A1, and DSDP-360. These source rocks are generally characterized by modest TOC's (2% to 3%) with kerogen types that are indicative of mixed oil and gas-prone source rocks. To the west of the Outer High, source rocks are expected to be more oil prone due both to their lower maturity and less terrigenous clastic input. This interpretation is based not only on the recent light oil and west gas discoveries by Shell and TotalEnergies, but by data provided by DSDP8-361 located southwest of Block 3B/4B which encountered Aptian organic-rich black shales with TOC9 content up to 25% with a thermal maturity capable of oil and wet gas generation.

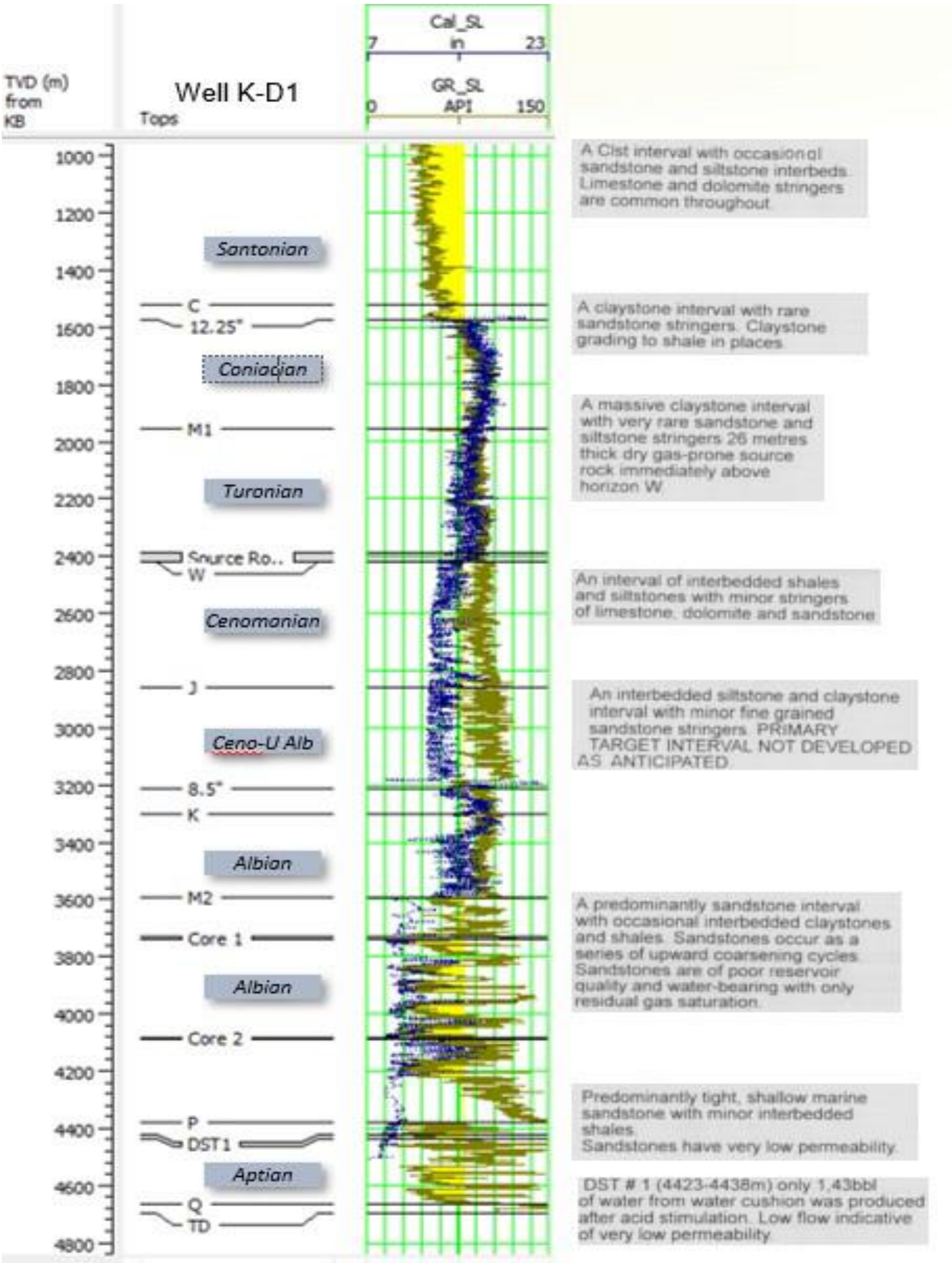


Figure 7: Summary log from the shelfal well K-D1, used as a key well for well-tie into Block 3B/4B seismicdata.

Inboard of Block 3B/4B basin these source rocks are in the gas window as evidenced by the discoveries to date. However, Tertiary and Late Cretaceous overburden thins westwards towards Block 3B/4B, and basin models suggest that source rocks are less mature and in the oil window (Figure 8: Note absence of source rocks on Outer High). This Modelling prediction is supported by the recent light oil and wet gas discoveries by Shell and TotalEnergies along trend in Namibia.

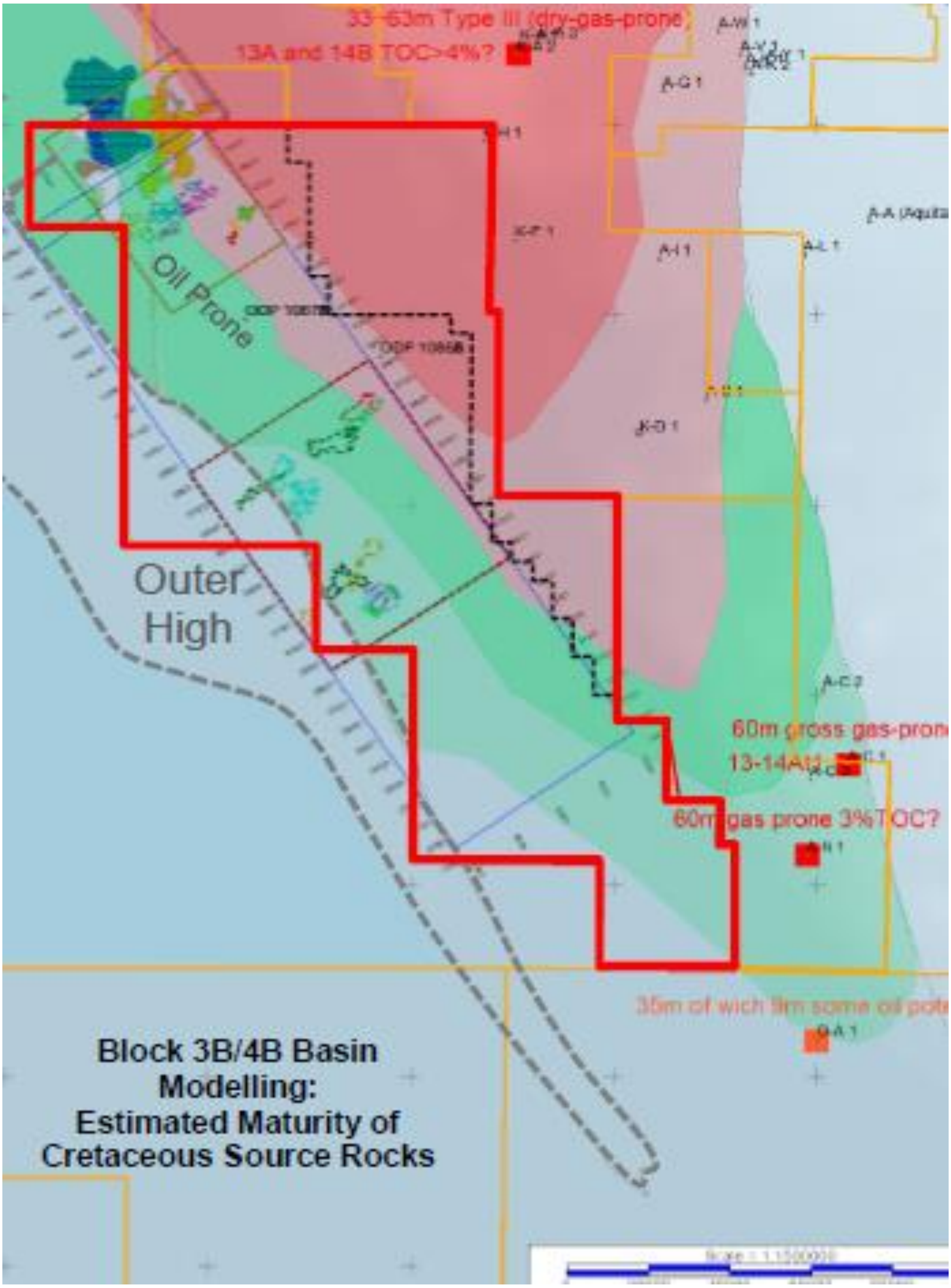


Figure 8: Source Rock maturity map for Aptian-Albian source rocks in the Southern Orange Basin .

3.1.4 RESERVOIRS

Expected porosity and permeability ranges for potential Cretaceous reservoirs in Block 3B/4B have been derived from depth versus porosity cross plots based on available well control, most of which are located to the east of Block 3B/4B. Since prospects in Block 3B/4B are targeting different facies (turbidite sandstones versus fluvialdeltaics), analog data from other deepwater discoveries has also been incorporated into estimates for reservoirs parameters. The work of Bjorkum *et al*. (1998) for example provides a useful reference for estimating porosity of Upper Cretaceous sandstones deposited in a turbidite setting and buried to depths of 3 km to 4 km with a temperature gradient of circa 30°C/ km.

Primary reservoir targets in Block 3B/4B are as follows:

- Santonian or 'Upper Cretaceous' age sandstones deposited in turbidite channel and fan systems at the slope margin.
- Cenomanian-Turonian age sandstones deposited in turbidite channel and fan systems at the slope margin and outer slope.
- Albian sandstones deposited as turbidites as basin floor fans.

Studies of analog reservoirs in the Orange Basin have shown that diagenetic alteration can reduce porosity and permeability by quartz overgrowth and authigenic chlorite precipitation. In some cases, the presence of chlorite has proven to inhibit quartz overgrowths, thereby preserving porosity. However, an abundance of chlorite can reduce permeability, which can also be improved or degraded by other factors such as sorting. For prospects in Block 3B/4B porosities are generally considered to have a P50 of 20%, increasing to 25% where reservoirs are shallower and thickest.

Permeabilities are expected to be in the 10's to 100's of millidarcies based on limited well penetrations and analog data. The expectation for low viscosity light oil is expected to offset lower permeabilities and flow rates above 10,000 bopd can be achieved based on analog data from similar reservoirs, pressures, and fluid characteristics.

Seismic attributes and particularly AVO analysis has been a particularly good tool for identifying potential reservoir targets in the upper Cretaceous sequences of the Orange Basin. While calibration to well control is required for porosity and fluid prediction, in the absence of nearby well control and as a qualitive indicator, AVO analysis forms the most robust exploration tool for identifying sandstone turbidites in Block 3B/4B. Although seismic amplitude responses are non-unique, when AVO anomalies conform to depth this may be indicative of fluid contacts, which greatly increases the chance of encountering hydrocarbons. Several prospects within the Block 3B/4B prospect inventory exhibit some conformance to depth contours.

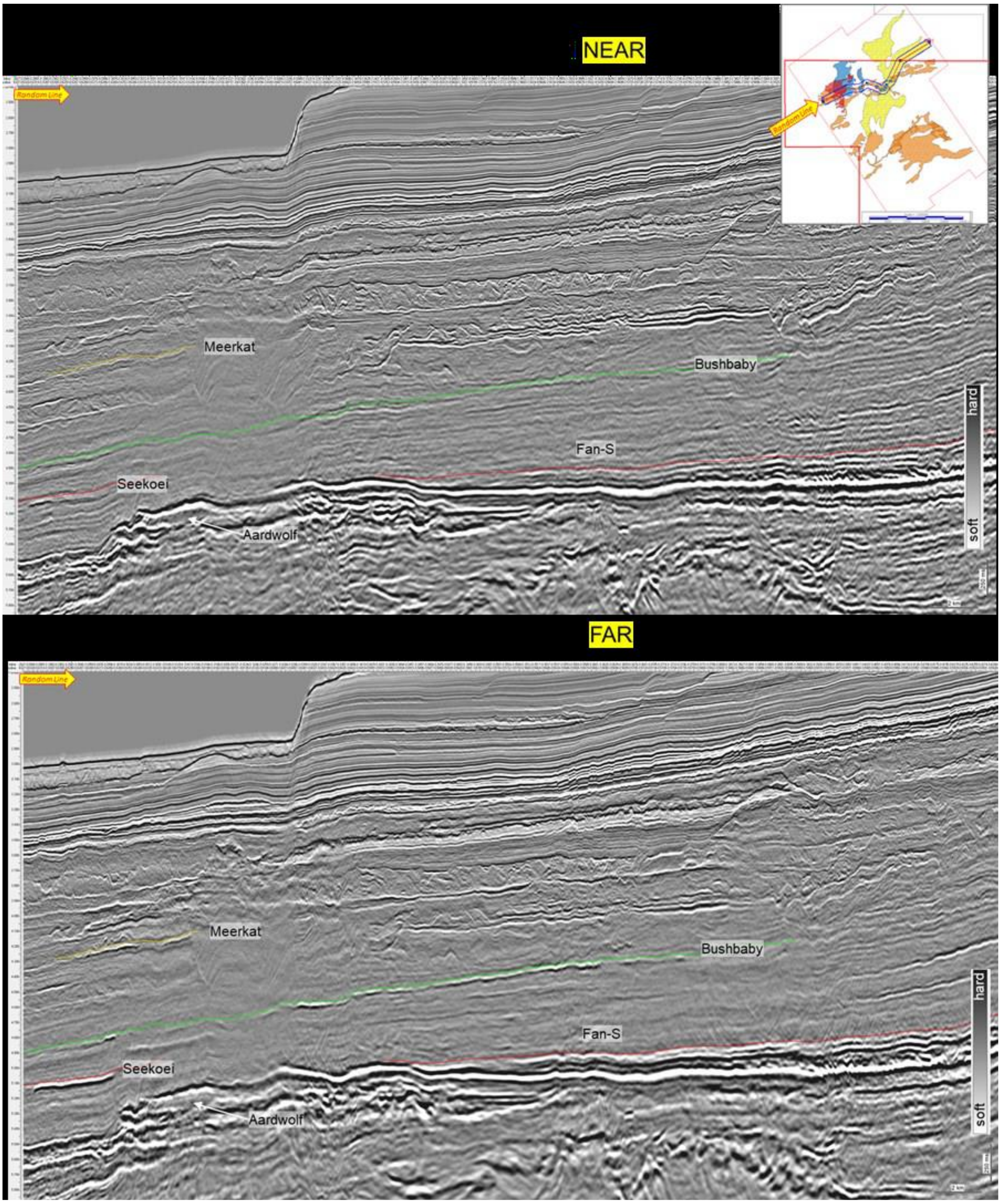


Figure 9: Examples of Near- and Far offset seismic data showing prospective reservoir targets in the Northern Area.

3.1.5 PLAY TYPES

Prospects within the Block 3B/4B inventory all target Cretaceous reservoirs that are expected to contain hydrocarbons sourced from Aptian-Albian source rocks below, and therefore all part of a single proven petroleum system. Inboard of Block 3B/4B, source rocks have more overburden and deeper burial has pushed source rocks into the gas window. Within Block 3B/4B and source rocks are generally in the oil, or wet gas window, becoming more oil prone to the west as overburden is thinner.

Within this proven petroleum system there are at least four general play types (Figure 10 and Figure 11). The first three are similar in that they all rely on stratigraphic trapping and the key tools for identifying prospects rely on seismic attributes. Sand bodies are identified based on amplitude, relative impedance, AVO characteristics, shear modulus, and cross plots of these various attributes to produce relationships such as 'Fluid Factor' that can provide insight to fluid composition within reservoir targets.

Prospects are high graded if they show evidence of an up-dip pinchout for trapping. AVO anomalies with strong increase in FAR angle gathers are ranked higher, and AVO anomalies that have conformance to depth, indicative of a possible fluid contact are ranked with the highest chance of success.

- Santonian or 'Upper Cretaceous' Turbidite Play - target reservoirs are turbidite sandstones deposited in an outer slope environment.
    - Reservoir: turbidite sandstones 10 m to 30 m thick, often stacked;
    - Reservoir Geometry: channelized, overbank, splays, and basin-floor fans;
    - Traps: stratigraphic or combination traps relying on up-dip truncation of feeder channels;
    - De-risking Elements: clear imaging of updip pinchout, strong AVO anomalies (Class II or III), conformance of AVO anomaly with depth contours.
    - Cenomanian-Turonian Turbidite Play - turbidite sandstones deposited in an outer slope environment; with the same prospecting characteristics as above.
    - Albian Basin Floor Fan - similar characteristics to Plays 1 and 2, except that sand bodies tend to be more widespread and fan-shaped due to their deposition on the basin floor. In these low gradient areas sand deposition is heavily influenced by subtle changes in topography, such as the Outer High.
    - Barremian-Aptian Carbonate Ramp Play - characterized by positive features of Albian age located in close association with the Outer High and interpreted as isolated carbonate platforms or ramps. Prospects often exhibit internal seismic reflections with clinoform geometry. Similar leads have been recognized along the Outer High and into Namibia. No carbonates have been encountered at this stratigraphic level in any of the inboard wells. The closest penetration of carbonates in the deepwater trend is Moosehead- 1 and reservoir risk is deemed high as a result.

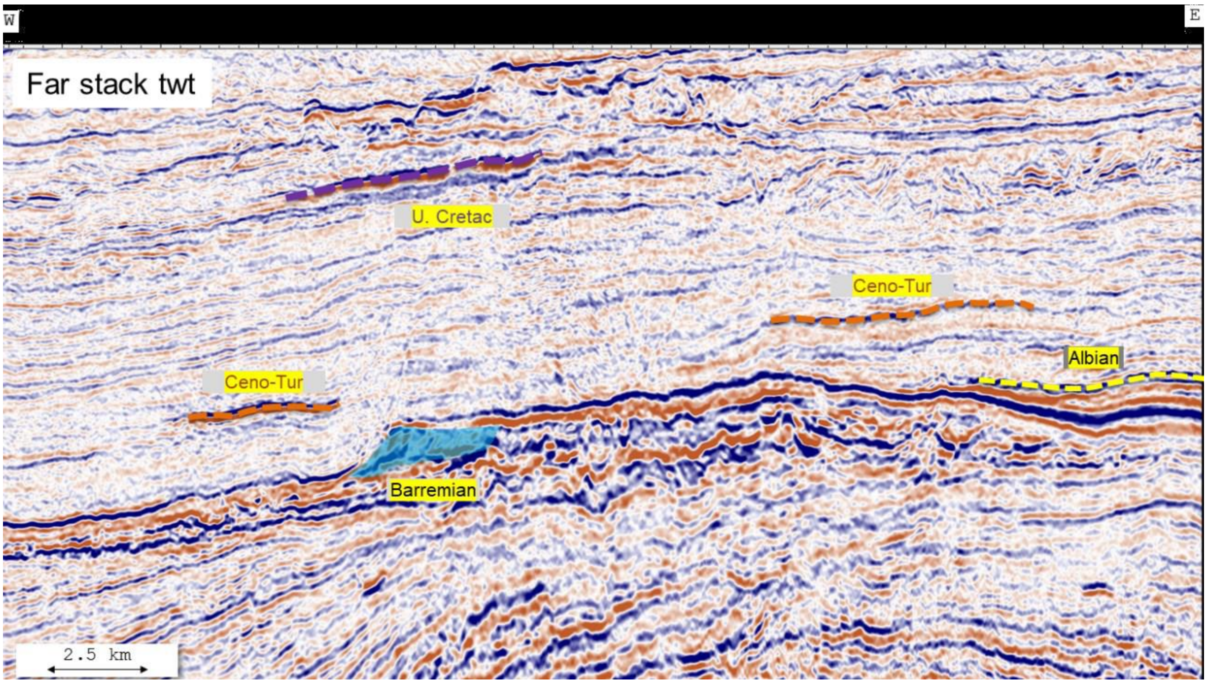


Figure 10: Examples of the 4 primary play types in Block 3B/4B.

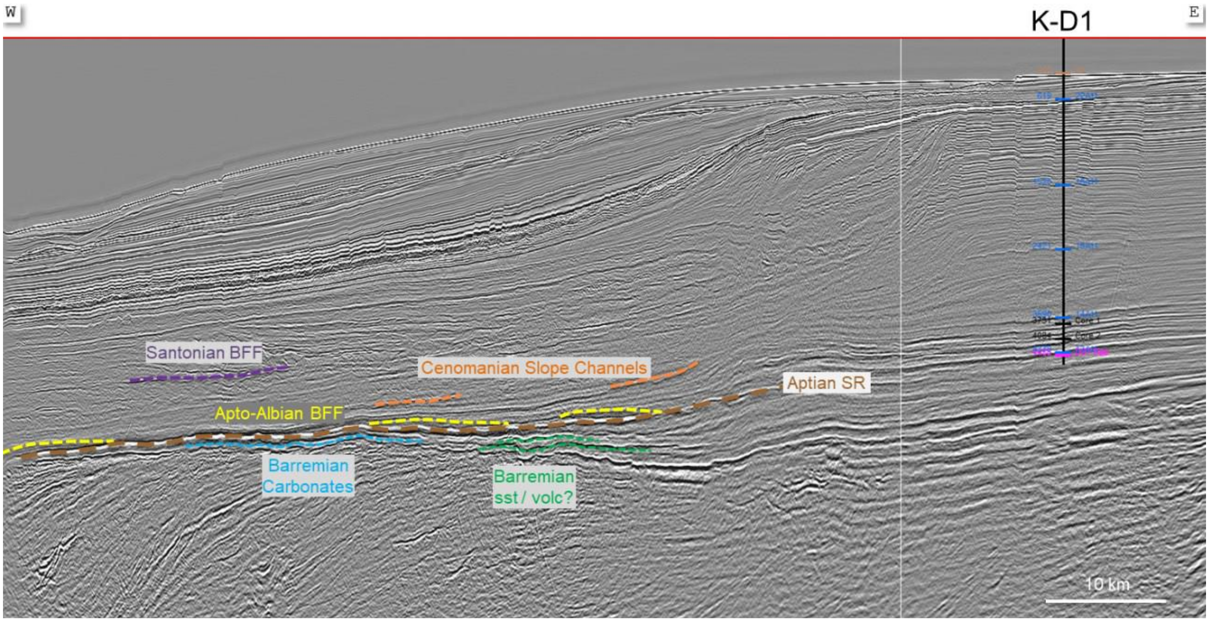


Figure 11: Examples of the four primary play types in Block 3B/4B, showing tie to well K-D1.

3.2 DESCRIPTION OF ACTIVITIES TO BE UNDERTAKEN

Hydrocarbon deposits occur in reservoirs in sedimentary rock layers. Being lighter than water they accumulate in traps where the sedimentary layers are arched or tilted by folding or faulting of the geological layers. Exploration drilling activities are one of the primary geophysical methods for locating such deposits. The below activities are expected to be undertaken as part of the proposed exploration for oil and gas.

3.2.1 PRE-DRILLING SURVEYS

Pre-drilling surveys may be undertaken prior to drilling in order to confirm baseline conditions at the drill site and to identify and delineate any seabed and sub-seabed geo-hazards that may impact the proposed exploration drilling operations. Pre-drilling surveys may involve sonar surveys, sediment sampling, water sampling and ROV activities.

3.2.1.1 SONAR SURVEYS

Pre-drilling sonar surveys may involve multi- and single beam echo sounding and sub-bottom profiling. These surveys would not be limited to a specific time of the year but would be of short duration (around 15 days or shorted per survey) and focused on selected areas of interest within the block. This survey and other anticipated success-based surveys and would take up to four weeks to complete.

3.2.1.2 ECHO SOUNDERS

The majority of hydrographic depth/echo sounders are dual frequency, transmitting a low frequency pulse at the same time as a high frequency pulse. Dual frequency depth/echo sounding has the ability to identify a vegetation layer or a layer of soft mud on top of a layer of rock. The JV Partners are proposing to utilise a single beam echo-sounder with a frequency range of 38 to 200 kHz. In addition, it is proposed to also utilise multibeam echo sounders (70 - 100 kHz range and 200 dB re 1µPa at 1m source level) that are capable of receiving many return "pings". This system produces a digital terrain model of the seafloor.

3.2.1.3 SUB-BOTTOM PROFILERS

Sub-bottom profilers are powerful low frequency echo-sounders that provide a profile of the upper layers of the ocean floor. Bottom profilers emit an acoustic pulse at frequencies ranging between 2 and 16 kHz, typically producing sound levels in the order of 200-230 db re 1µPa at 1m.

3.2.1.4 PISTON CORING

Piston coring (or drop coring) is one of the more common methods used to collect seabed geochemical samples. The piston coring rig is comprised of a trigger assembly, the coring weight assembly, core barrels, tip assembly and piston. The core barrels are 6 - 9 m in lengths with a diameter of 10 cm.

The recovered cores are visually examined at the surface for indications of hydrocarbons (gas hydrate, gas parting or oil staining) and sub-samples retained for further geochemical analysis in an onshore laboratory.

3.2.1.5 BOX CORING

Box corers are lowered vertically to the seabed from a survey vessel by. At the seabed the instrument is triggered to collect a sample of seabed sediment. The recovered sample is completely enclosed thereby reducing the loss of finer materials during recovery. On recovery, the sample can be processed directly through the large access doors or via complete removal of the box and its associated cutting blade. The JV Partners are proposing to take box core samples (50 cm x 50 cm) at a depth of less than 60 cm.

3.2.2 WELL LOCATION AND DRILLING PROGRAMME

The JV Partners are proposing to drill up to five exploration wells within the Area of Interest (AOI) within the Block 3B/4B licence block. The licence block covers an area of approximately 17 581 km^2 and is situated between latitudes 31°S and 33°S on the continental shelf in water depths ranging from 200 m to 2 000 m.

Block 3B/4B is located approximately 120 km west of St Helena Bay and approximately 145 km south-west of Hondeklip Bay off the West Coast of South Africa. The area of primary interest is in the north of this block, but this could also cover the central part of the block. Within Block 3B/4B the AOI for drilling is located offshore roughly between Port Nolloth and Hondeklip Bay, approximately 188 km from the coast at its closest point and 340 km at its furthest, in water depths between 1 000 m and 3 000 m. The expected target drilling depth is not confirmed yet and a notional well depth, below mudline, of 3 570 m is assumed at this stage.

The schedule for drilling the wells is not confirmed yet; however, the earliest anticipated date for commencement of drilling is between first quarter of 2024 (Q1 2024) and third quarter of 2024 (Q3 2024). The expected target drilling depth is not confirmed yet and a notional well depth of 3 570 m below sea floor is assumed at this stage. It is expected that it would take approximately three to four months to complete the physical drilling and testing of each well (excluding mobilisation and demobilisation).The Applicant's strategy for future drilling is that drilling could be undertaken throughout the year (i.e. not limited to a specific seasonal window period).

3.2.3 DRILLING UNIT OPTIONS

Various types of drilling technology can be used to drill an exploration well (e.g. barges, jack-up rigs, semi-submersible drilling units (rigs) and drill-ships) depending on, inter alia, the water depth and marine operating conditions experienced at the well site. Based on the anticipated sea conditions, the JV Partners are proposing to utilise a semi-submersible drilling unit or a drill-ship, both with dynamic positioning system suitable for the deep-water harsh marine environment. The final rig selection will be made depending upon availability and final design specifications.

A semi-submersible drilling unit (Figure 2, right) is essentially a drilling rig located on a floating structure of pontoons. When at the well location, the pontoons are partially flooded (or ballasted), with seawater, to submerge the pontoons to a pre-determined depth below the sea level where wave motion is minimised. This gives stability to the drilling vessel thereby facilitating drilling operations.

A drill-ship (Figure 12, left) is a fit for purpose built drilling vessel designed to operate in deep water conditions. The drilling “rig” is normally located towards the centre of the ship with support operations from both sides of the ship using fixed cranes. The advantages of a drill-ship over the majority of semi-submersible units are that a drill-ship has much greater storage capacity and is independently mobile, not requiring any towing and reduced requirement of supply vessels.

Figure 12: Examples of drilling equipment.

3.2.4 SUPPORT VESSELS

The drilling unit would be supported / serviced by up to two support vessels, which would facilitate equipment, material and waste transfer between the drilling unit and onshore logistics base. A supply vessel will always be on standby near the drilling unit to provide support for firefighting, oil containment / recovery, rescue in the unlikely event of an emergency and supply any additional equipment that may be required. Support vessels can also be used for medical evacuations or transfer of crew if needed.

3.2.5 HELICOPTERS

Transportation of personnel to and from the drilling unit would be provided by helicopter from Cape Town airport. It is estimated that there may be at least two flights per week between the drilling unit and the helicopter support base at Cape Town. The helicopters can also be used for medical evacuations from the drilling unit to shore (at day- or night-time), if required.

3.2.6 ONSHORE LOGISTICS BASE

The primary onshore logistics base will most likely be located at the Port of Cape Town (preferred option), but alternatively at the Port of Saldanha.

The shore base would provide for the storage of materials and equipment that would be shipped to the drilling unit and back to storage for onward international freight forwarding. The shore base would also be used for offices, waste management services, bunkering vessels, and stevedoring / customs clearance services.

4 POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the governing legislation identified which relates to the proposed project. Additional legislation and other guidelines and policies are discussed in Table 5 below.

4.1 CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The constitution of any country is the supreme law of that country. The Bill of Rights in chapter 2 section 24 of the Constitution of South Africa Act (Act No. 108 of 1996) makes provisions for environmental issues and declares that: *"Everyone has the right -*

a) to an environment that is not harmful to their health or well-being; and

b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

- ***i.*** *prevent pollution and ecological degradation;*
- ***ii.*** *promote conservation; and*
- *iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development"*

The Scoping and EIA process as well as associated impact mitigation actions are conducted to fulfil the requirement of the Bill of Rights.

4.2 THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT

The aim of the MPRDA is to *"make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources"*. The MPRDA outlines the procedural requirements that need to be met to acquire mining rights in South Africa. In this regard, The JV Partners have compiled and submitted an Exploration Right Renewal application to PASA, a subsidiary of the Department of Mineral Resources and Energy (DMRE), which was approved as the First Renewal Period for an additional two year term from 27 October 2022 to 26 October 2024 . An application for EA, in term of Section 16 of the NEMA EIA Regulations, 2014 was submitted to PASA on for the proposed exploratory drilling activities.

As per Section 79 of the MPRDA, the Applicant is required to conduct an EIA and submit an EMPR for approval as well as to notify in writing and consult with interested and affected parties (I&APs) within 180 days of acceptance. The MPRDA also requires adherence with related legislation, chief amongst them is NEMA.

Several amendments have been made to the MPRDA. These include, but are not limited to, the amendment of Section 102, concerning amendment of rights, permits, programmes and plans, to requiring the written permission of the Minister for any amendment or alteration; and the section 5A(c) requirement that landowners or land occupiers receive twenty-one (21) days' written notice prior to any activities taking place on their properties. One of the most recent amendments requires all mining related activities to follow the full NEMA process as per the EIA Regulations, 2014, which came into effect on 4 December 2014.

On 3 June 2015, GNR 466 was published. The notice details amendments made to petroleum exploration and production relating, in particular, to the EIA process required, well design and construction, management and operations, water, waste, pollution incidents and air quality.

4.3 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA Regulations, the applicant is required to appoint an EAP to undertake the EIA process, as well as conduct the public participation process towards an application for EA. In South Africa, EIA's became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant EA. On 21 April 2006, the Minister of Environmental Affairs and Tourism (now Department of Forestry, Fisheries and Environment – DFFE) promulgated regulations in terms of Chapter 5 of the NEMA. These regulations, in terms of the NEMA, were amended in June 2010 and again in December 2014 as well as April 2017. The NEMA EIA Regulations, 2014, as amended, are applicable to this project. Exploration activities officially became governable under the NEMA EIA Regulations in December 2014 with the competent authority identified as the Department of Mineral Resources and Energy (DMRE).

The objective of the EIA Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the listed activities that are triggered by the proposed project. The purpose of these procedures is to provide the competent authority with adequate information to make informed decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorised, and that activities which are authorised are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIA's in order to apply for, and be considered for, the issuing of an EA. These EIA Regulations provide a detailed description of the EIA process to be followed when applying for EA for any listed activity.

A Scoping and EIA process is reserved for activities which have the potential to result in significant impacts which are complex to assess. Scoping and EIA studies accordingly provide a mechanism for the comprehensive assessment of activities that are likely to have more significant environmental impacts. Figure 13 below provides a graphic representation of all the components of a full EIA process. The Table 4 below identifies the listed activities the proposed project triggers and consequently requires authorisation prior to commencement.

Table 4: NEMA listed activities to be authorised

Activity	Activity Description	Applicability
Listing Notice 2 Activity 18	Any activity including the operation of that activity which requires an exploration right in terms of section 79 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice, in Listing Notice 1 of 2014 or in Listing Notice 3 of 2014, required to exercise the exploration right, excluding (a) any desktop study; (b) any arial survey; (c) any onshore seismic survey which is included in activity 21C in Listing Notice 1 of 2014, in which case that activity applies; (d) a hydraulic fracturing activity which is included in activity 20A, in which case activity 20A of this Notice applies; and (e) the processing of a petroleum resource, including the beneficiation or refining of gas, oil or petroleum products, in which case activity 5 of this Notice applies.	The undertaking of exploration activities within the Block 3B/4B offshore area, requires an Exploration Right in terms of the MPRDA.

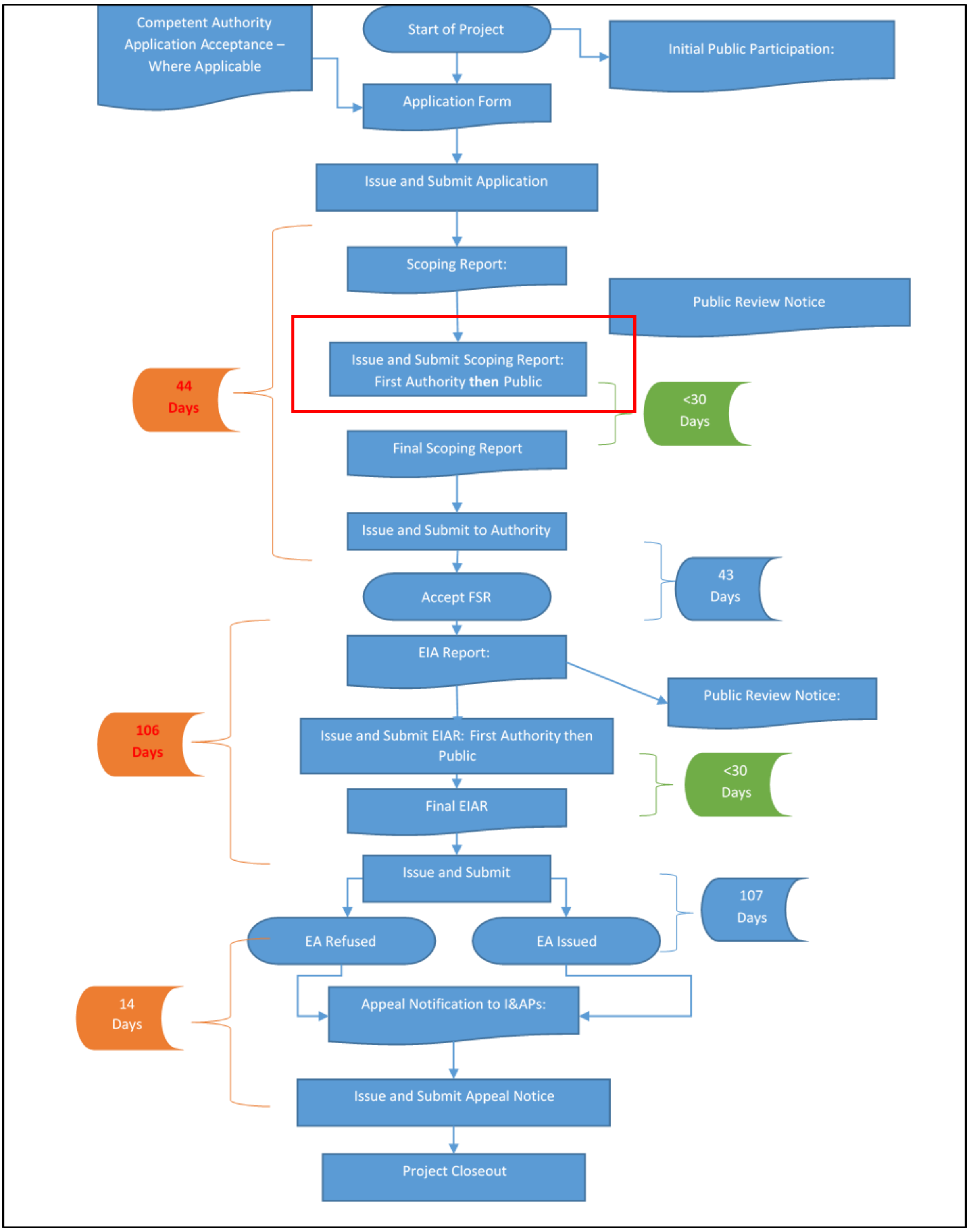


Figure 13: EIA process diagram.

4.4 THE NATIONAL HERITAGE RESOURCES ACT

The National Heritage Resources Act (Act 25 of 1999 – NHRA) stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 34(1) of the NHRA states that, "*no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…*" The NHRA is utilised as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of

NHRA, and those developments administered through the NEMA, MPRDA and the Development Facilitation Act (DFA) legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorisations are granted for a development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impact Processes required by the NEMA and MPRDA. This change requires an evaluation of the Section of these Acts relevant to heritage (Fourie, 2008).

The NHRA provides for the protection of South Africa's natural heritage, including wrecks or associated debris or artefacts that may be found or disturbed on the seabed. Section 2.1.4 states that the South African Heritage Resources Agency (SAHRA) is the statutory organisation responsible for the protection of South Africa's cultural heritage. SAHRA thus has jurisdiction over any shipwrecks that may occur within the territorial waters and the maritime cultural zone fall. According to Section 35 of the NHRA, any person who discovers archaeological objects or material (including wrecks) in the course of a development must immediately report the find to SAHRA. No person may, without a permit issued by SAHRA, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological site.

Furthermore, Section 38 deals with matters of Heritage Resource Management. Section 38(8) states that *"(8) The provisions of this section do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No. 50 of 1991), or any other legislation: Provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent."*

In terms of the above, in terms of this section, the South African Heritage Resources Agency (SAHRA) have been notified regarding the proposed development and would act as a key commenting authority.

4.5 NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT

The National Environmental Management Protected Areas Act (Act No. 57 of 2003 – NEMPAA) is intended to *"provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes"* and creating a *"national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity".*

The NEMPAA defines various kinds of protected areas, namely: *"special nature reserves, national parks, nature reserves (including wilderness areas) and protected environments; world heritage sites; marine protected areas; specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act 84 of 1998); and mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act 63 of 1970)".*

Although Block 3B/4B is in close proximity to the Child's Bank and Benguela Muds MPAs, no marine protected areas (MPA) are located within Block 3B/4B. For oil and gas exploration activities, although vessels are permitted to sail through these areas, no invasive exploration activities are permitted in any proclaimed MPA. As such, under the proposed exploration right, no invasive exploration activities such as the proposed exploration drilling will take place in any proclaimed MPAs.

4.6 NATIONAL ENVIRONMENTAL MANAGEMENT AIR QUALITY ACT

The National Environmental Management: Air Quality Act (Act No. 39 of 2004 as amended – NEMAQA) is the main legislative tool for the management of air pollution and related activities. The Object of the Act is:

- To protect the environment by providing reasonable measures for –
  - the protection and enhancement of the quality of air in the Republic;
  - the prevention of air pollution and ecological degradation; and

- securing ecologically sustainable development while promoting justifiable economic and social development; and
    - Generally, to give effect to Section 24(b) of the constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

The NEMAQA mandates the Minister of Environment to publish a list of activities which result in atmospheric emissions and consequently cause significant detrimental effects on the environment, human health and social welfare. All scheduled processes as previously stipulated under the Air Pollution Prevention Act (APPA) are included as listed activities with additional activities being added to the list. The updated Listed Activities and Minimum National Emission Standards were published on the 22nd November 2013 (Government Gazette No. 37054).

According to the NEMAQA, air quality management control and enforcement is in the hands of local government with District and Metropolitan Municipalities as the licensing authorities. Provincial government is primarily responsible for ambient monitoring and ensuring municipalities fulfil their legal obligations, with national government primarily as policy maker and co-ordinator. Each sphere of government must appoint an Air Quality Officer responsible for co-ordinating matters pertaining to air quality management. Given that air quality management under the old Act was the sole responsibility of national government, local authorities have in the past only been responsible for smoke and vehicle tailpipe emission control.

The National Pollution Prevention Plans Regulations were published in March 2014 (Government Gazette 37421) and tie in with the National Greenhouse Gas (GHG) Emission Reporting Regulations which took effect on 3 April 2017. In summary, the Regulations aim to prescribe the requirements that pollution prevention plans of greenhouse gases declared as priority air pollutants, need to comply with in terms of the NEMAQA. The Regulations specify who needs to comply, and by when, as well as prescribing the content requirements. Tetra4 has an obligation to report on the GHG emissions under these Regulations. There is also a requirement to account for the amount of pollutants discharged into the atmosphere (total emissions for one or more specific GHG pollutants) by 31 March each year.

An Air Quality and Climate Change Impact Assessment will be undertaken during the EIA phase to assess the impact of the proposed project on air quality.

4.7 ADDITIONAL SOUTH AFRICAN LEGISLATION

Additional legislation may be applicable to the exploration activities proposed for this project. These are presented in Table 5 below.

Table 5: Applicable legislation and guidelines overview

Legislation / Guidelines	Description
Potentially Applicable Legislation	
Dumping at Sea Control Act (Act No. 73 of 1980)	This Act controls the dumping of substances at sea. The Act lists substances that are prohibited to be dumped at sea (Schedule 1) and substances that are restricted when dumping at sea (Schedule 2). The Director-General may on application grant a special permit authorising the dumping of substances listed in Schedule 1 or 2.
Environment Conservation Act (Act No. 73 of 1989)	The Environment Conservation Act (Act No. 73 of 1989 – ECA) was, prior to the promulgation of the NEMA, the backbone of environmental legislation in South Africa. To date the majority of the ECA has been repealed by various other Acts, however Section 25 of the Act and the Noise Regulations (GN R. 154 of 1992) promulgated under this section are still in effect. These Regulations serve to control noise and general prohibitions relating to noise impact and nuisance.
Hazardous Substances Act (Act No. 85 of 1983)	This Act provides for the control of substances which may cause injury or ill-health to or death of human. No person may, without a licence: (1) sell any Group I Hazardous Substance; (2) use, operate or apply any Group III Hazardous Substance

Legislation / Guidelines	Description
	(listed electronic products); and (3) install or keep any Group Ill Hazardous Substance.
Marine Living Resources Act (Act No. 18 of 1998)	This Act provides for the conservation of marine ecosystems, the long-term sustainable utilisation of marine living resources and the orderly access to exploitation, utilisation and protection of certain marine living resources.
Marine Traffic Act (Act No. 2 of 1981)	This Act regulates marine traffic in South Africa's territorial waters. It regulates the entry and dropping of anchor within 500 m safety zone of installations.
Marine Pollution (Control and Civil Liability) Act (Act No. 6 of 1981)	The purpose of this Act is to provide protection of the marine environment from pollution by oil and other harmful substances, by giving power to South African Maritime Safety Authority (SAMSA) to take steps to prevent harmful substances being discharged from vessels. The applicant would have to disclose to SAMSA before the commencement of proposed activities the amounts and types of chemicals that would be used and disposed of during operations. No disposal of waste at sea is proposed.
Marine Pollution (Prevention of Pollution from Ships) Act (Act No. 2 of 1986)	This Act regulates pollution from ships, tankers and offshore installations, and for that purpose gives effect to MARPOL 73/78. In terms of the Act, it is an offence to discharge any oil from a ship, tanker or offshore installation within 12 miles (19 km) off the South African coast. The discharge of oily water or oil and any other substance which contains more than a hundred parts per million of oil is prohibited between 19 – 80 km offshore. No dumping at sea is proposed as part of this application.
Marine Pollution (Intervention) Act (Act No. 65 of 1987)	This Act gives effect to the international convention relating to the Intervention of the High Seas in cases of oil pollution casualties, and to the Protocol relating to Intervention of the High Seas in cases of Marine Pollution by substances other than Oil in South African Waters.
Maritime Safety Authority Act (Act No. 5 of 1998)	This Act provides for the establishment and functions of SAMSA. The objectives of the Act are to, inter alia: (1) ensure safety of life and property at sea; (2) prevent and combat pollution of the marine environment by ship; and (3) promote South Africa's maritime interests.
Maritime Safety Authority Levies Act (Act No. 6 of 1998)	This Act provides for the imposition of levies by SAMSA. SAMSA is permitted to raise and collect a levy on all vessels calling at South African ports and operating in South African waters.
Maritime Zones Act (Act No. 15 of 1994)	The Act defines the maritime zones, including territorial waters, contiguous zone, exclusive economic zone and continental shelf. Section 9(1) states that any law in force in South Africa shall also apply on and in respect of an installation.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	This Act regulates the carrying out of restricted activities that may harm listed threatened or protected species or activities that encourage the spread of alien or invasive species subject to a permit.
Maritime Safety Authority Levies Act (Act No. 6 of 1998)	This Act provides for the imposition of levies by SAMSA. SAMSA is permitted to raise and collect a levy on all vessels calling at South African ports and operating in South African waters.
National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)	This Act supports the authorisation requirements of NEMA but specifies additional criteria for regulating activities or developments (Section 63) and provides for pollution control within the coastal zone (Sections 69 to 73), where the coastal zone includes the Exclusive Economic Zone defined in the Maritime Zone Act.
National Ports Act (Act No. 12 of 2005)	This Act regulates and controls navigation within port limits and the approaches to ports, cargo handling, and the pollution and the protection of the environment within the port limits. The Act specifies a requirement for an agreement with or a licence from the National Ports Authority to operate a port facility or service.

Legislation / Guidelines	Description
Sea-Shore Act (Act No. 21 of 1935)	This Act declares the State President the owner of the seashore and the sea within the territorial waters of South Africa and provides for the grant of rights in respect of the seashore and the sea and for the alienation of portions of the seashore and the sea.
Promotion of Administrative Justice Act (Act No. 3 of 2000)	The Bill of Rights in the Constitution of the Republic of South Africa 1996 states that everyone has the right to administrative action that is legally recognised, reasonable, and procedurally just. The Promotion of Administrative Justice Act (PAJA) 3 of 2000 gives effect to this right. The PAJA applies to all decisions of all State organisations exercising public power or performing a public function in terms of any legislation that negatively affects the rights of any person. The Act prescribes what procedures an organ of State must follow when it takes decisions. If an organ of State implements a decision that impacts on an individual or community without giving them an opportunity to comment, the final decision will be illegal and may be set aside. The Promotion of Administrative Justice Act 3 of 2000 also forces State organisations to explain and give reasons for the manner in which they have arrived at their decisions and, if social issues were involved, and how these issues were considered in the decision-making process. The Promotion of Administrative Justice Act 3 of 2000 therefore protects the rights of communities and individuals to participate in decision-making processes, especially if these processes affect their daily lives.
Traditional and Khoi-San Leadership Act (Act No. 3 of 2019)	The Traditional and Khoi-San Leadership Act 3 of 2019 aims: • to provide for the recognition of traditional and Khoi-San communities, leadership positions and for the withdrawal of such recognition; • to provide for the functions and roles of traditional and Khoi-San leaders; • to provide for the recognition, establishment, functions, roles and administration of kingship or queenship councils, principal traditional councils, traditional councils, Khoi-San councils and traditional sub-councils, as well as the support to such councils; • to provide for the establishment, composition and functioning of the National House of Traditional and Khoi-San Leaders; • to provide for the establishment of provincial houses of traditional and Khoi-San leaders; • to provide for the establishment and composition of local houses of traditional and Khoi-San leaders; • to provide for the establishment and operation of the Commission on Khoi-San Matters; • to provide for a code of conduct for members of the National House, provincial houses, local houses and all traditional and Khoi-San councils; • to provide for regulatory powers of the Minister and Premiers; • to provide for transitional arrangements; • to amend certain Acts; • to provide for the repeal of legislation; and • to provide for matters connected therewith.

Legislation / Guidelines	Description
Protection, Promotion, Development and Management of Indigenous Knowledge Act (Act No. 6 of 2019)	The Protection, Promotion, Development and Management of Indigenous Knowledge Act 6 of 2019 intends: • to provide for the protection, promotion, development and management of indigenous knowledge; • to provide for the establishment and functions of the National Indigenous Knowledge Systems Office; • to provide for the management of rights of indigenous knowledge communities; • to provide for the establishment and functions of the Advisory Panel on indigenous knowledge; • to provide for access and conditions of access to knowledge of indigenous communities; • to provide for the recognition of prior learning; • to provide for the facilitation and coordination of indigenous knowledge-based innovation; and • to provide for matters incidental thereto.
Applicable Guidelines	
Integrated Environmental Management Information Guidelines Series	The various guidelines will be considered throughout this environmental Scoping and EIA process. This series of guidelines was published by the Department of Environmental Affairs (DEA – now DFFE) and refers to various environmental aspects. Applicable guidelines in the series for the project include: Guideline 5: Companion to NEMA EIA Regulations (October 2012); Guideline 7: Public participation (October 2012); and Guideline 9: Need and desirability (October 2014). Additional guidelines published in terms of the NEMA EIA Regulations, 2014 (as amended), in particular: Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006; Guideline 4: Public Participation in support of the EIA Regulations, 2006; and Guideline 5: Assessment of alternatives and impacts in support of the EIA Regulations, 2006.

4.8 NATIONAL POLICY AND PLANNING CONTEXT

Various other national policy and planning may be of specific relevance to the needs and desirability of the project with respect to overarching energy and climate change policy and planning in South Africa. These are described below:

4.8.1 INTEGRATED RESOURCE PLAN 2019

The Minister of Mineral Resources and Energy (Minister) published the current Integrated Resource Plan (IRP 2019) as GN 1360 of 18 October 2019 in Government Gazette No. 4278. The Determination provides for various energy sources to be procured from Independent Power Producers (IPPs) through one or more IPP Procurement Programmes as contemplated in the Electricity Regulations on New Generation Capacity, 2011. The plan aimed to balance a number of objectives namely, to ensure security of supply, to minimize cost of electricity, to minimize negative environmental impact (emissions) and to minimize water usage. The IRP 2019 makes provision for gas from year 2024.

4.8.2 NATIONAL DEVELOPMENT PLAN 2030

The NDP aims to eliminate poverty and reduce inequality by 2030. According to the plan, South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society. One of the key priorities is "faster and more inclusive economic growth". To transform the economy and create sustainable expansion for job creation, an average economic growth exceeding 5% per annum is required. The NDP makes numerous mentions of the need to act responsibly to mitigate the effects of climate change. Diversification of the energy mix away from fossil fuels will be key as energy generation makes up 48 percent of South Africa's GHG emissions. The NDP indicates that "the country will explore the use of natural gas as a less carbon intensive transitional fuel".

4.8.3 WHITE PAPER ON THE ENERGY POLICY OF THE REPUBLIC OF SOUTH AFRICA (1998)

The White Paper on the Energy Policy (1998) is the overarching policy document which guides future policy and planning in the energy sector. The policy objectives include the stimulation of economic development, management of energy related environmental and health impacts and diversification of the country's energy supply to ensure energy security. The paper states that the government will, inter alia, "promote the development of South Africa's oil and gas resources…" and "ensure private sector investment and expertise in the exploitation and development of the country's oil and gas resources". The successful exploitation of these natural resources would contribute to the growth of the economy and relieve pressure on the balance of payments.

4.8.4 NATIONAL GAS INFRASTRUCTURE PLAN (2005)

The gas infrastructure plan is intended to be a strategy for the development of the natural gas industry in South Africa. Government wishes to promote the gas industry based on its energy policy objectives as set out in the White Paper on Energy (1998). These include:

- Increasing access to affordable energy services;
- Improving energy governance;
- Stimulating economic activity;
- Managing energy-related environmental impacts;
- Securing security of supply through diversity of supply;
- Competition within and between energy carriers; and
- Promoting New Partnership for African Development (NEPAD) cross-border type projects.

4.8.5 PARIS AGREEMENT – UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. The Paris Agreement aims to limit the global temperature increase to below 2 °C. Each individual country is responsible for determining their contribution (referred to as the "nationally determined contribution") in reaching this goal. As a signatory to the Agreement, South Africa will be required to adopt the agreement within its own legal systems, through ratification, acceptance, approval or accession. "As a signatory to the Paris Agreement, South Africa is required to investigate alternatives to existing industries which have high carbon-emissions. A shift away from coal-based energy production within the energy sector and increased reliance on alternative energy sources is therefore anticipated."

4.8.6 NATIONAL CLIMATE CHANGE RESPONSE WHITE PAPER

The majority of South Africa's energy emissions arise from electricity generation. The Paper sets out South Africa's overall response strategy though strategic priorities, leading to a series of adaption, mitigation, response measures and priority flagship programmes. Policy decisions on new infrastructure investments must consider climate change impacts to avoid the lock-in of emissions intensive technologies into the future. In the medium-term, the Paper indicates that a mitigation option with the biggest potential includes a shift to lower-carbon electricity generation options.

4.9 PROVINCIAL POLICY AND PLANNING CONTEXT

The Provincial Growth and Development Strategies of the Northern Cape and Western Cape Provinces which need to be considered for the project are outlined below.

4.9.1 NORTHERN CAPE STRATEGIC PLAN 2020-2035

The four drivers of the Northern Cape Provincial Growth and Development Plan:

4.9.1.1 ECONOMIC TRANSFORMATION, GROWTH AND DEVELOPMENT

To ensure economic growth and development that will lead to job creation and radical economic transformation for the people of the Northern Cape Province, ten economic drivers or development paths have been identified:

- Agriculture and agro processing;
- Mining and mineral beneficiation;
- Tourism market development;
- Rural development and land reform;
- Development of energy sector;
- Manufacturing and trade;
- Competitive infrastructure development;
- Employment and skills development;
- Innovation and knowledge economy;
- Marine economy; and
- Social transformation and human welfare.

To sustainably address the social injustices and inequalities in the province, social transformation must be accelerated and deepened towards human development and welfare. The following six drivers have been identified:

- Quality basic education;
- Quality health care;
- Social cohesion and community participation;
- Social protection and safety;
- Sustainable human developments;
- Employment and skills development; and
- Environmental sustainability and resilience.

The Northern Cape Province has an abundance of natural resources and environmental assets. While these present a wide range of economic opportunities, a concerted effort must be made to ensure that these are protected and enhance to support the developmental objectives of the province. As the province is an arid region, it must be ensured that enough is done to mitigate the real threat of climate change.

4.9.1.2 **EFFECTIVE, EFFICIENT, AND ACCOUNTABLE GOVERNANCE**

A capable and accountable government based on strong inter-governmental cooperation and participatory governance with civil society will be better positioned and capable to perform seamless services based on the needs of those on whose behalf they govern. Three drivers have been identified to facilitate effective, efficient, and accountable governance:

- Developmental and democratic state;
- Effective local government; and
- International relations.

4.9.1.3 **WESTERN CAPE PROVINCIAL STRATEGIC PLAN 2019-2024**

Vision has five strategic priorities with the following problem areas and focus areas:

- Safe and cohesive communities – a place where residents and visitors feel safe;
- Growth and jobs – an enabling environment for the private sector and markets to drive growth and create jobs;
- Empowering people -residents have opportunities to shape their lives and the lives of others, to ensure a meaningful and dignified live;
- Mobility and spatial transformation – residents live in well-connected, vibrant, and sustainable communities and move around efficiently on safe, affordable, low-carbon public transport
- Innovation and culture – government services are delivered to the people in an accessible, innovative, and citizen-centric way.

4.10 MUNICIPAL POLICY AND PLANNING CONTEXT

For the purpose of this project, Integrated Development Plan (IDP) documents of the below listed municipalities need to be considered.

4.10.1 NAMAKWA DISTRICT MUNICIPALITY

In its IDP the Namakwa District Municipality states that its strategic objectives are:

- Monitoring and support local municipalities to deliver basic services which include water, sanitation, housing, electricity and waste management;
- Support vulnerable groups in the district;
- Improve administrative and financial viability and capability;
- Promote and facilitate Local Economic Development (include tourism);
- Enhance good governance (include IGR) (IGR - intergovernmental relations);
- Promote and facilitate spatial transformation and sustainable urban development;
- To render municipal health services;
- To coordinate the disaster management and fire management services in the district; and
- Caring for the environment.

4.10.2 RICHTERSVELD LOCAL MUNICIPALITY

- The Richtersveld Local Municipality indicated in its IDP that its strategic goals/objectives are:
- For every household to have access to clean water, electricity, and sanitation;
- To treat all their residents with pride and dignity;

- To be an effective and efficient local government;
- To be an effective instrument of change within its community;
- To be a local government that is accountable with community driven development; and
- To be the gateway for local economic development and tourism in the north-western coast of the Northern Cape.

4.10.3 NAMA KHOI LOCAL MUNICIPALITY

The key performance areas of the Nama-Khoi Local Municipality are:

- Basic services delivery;
- Municipal financial viability and management;
- Local economic development;
- Municipal transformation and institutional development; and
- Good governance and community participation.

4.10.4 KAMIESBERG LOCAL MUNICIPALITY

The Kamiesberg Local Municipality identified its key performance areas in its IDP as:

- Service delivery – to provide and maintain superior decentralised customer services (water, sanitation, roads, storm water, waste management and electricity);
- Local economic development;
- Financial viability;
- Municipal transformation; and
- Good governance.

4.10.5 WEST COAST DISTRICT MUNICIPALITY

The West Coast District Municipality stated in its IDP that its objectives are to:

- Care for the social well-being, safety and health of all our communities;
- Promote regional economic growth and tourism.;
- Coordinate and promote the development of bulk and essential services and transport infrastructure;
- Foster sound relationships with all stakeholders, especially local municipalities; and
- Maintain financial viability and good governance.

4.10.6 MATZIKAMA LOCAL MUNICIPALITY

The Matzikama Local Municipality identified the following strategic objectives in its IDP:

- Provide municipal basic services to meet demands of growing population and development challenges;
- Maintain sufficient revenue resources to enable the municipality to meet its constitutional obligations;
- Coordinate, facilitate and stimulate sustainable economic development through strategy, policy and programme development;
- Reduce poverty levels as measured by SAMPI;

- Maintain sufficient organisation resources, enhance the involvement of the public in the development and decision making processes and provide ethical and professional services to support the needs of the communities;
- Provide opportunities to officials and councillors for the development of professional and leadership skills and enhance employment equity in the organisation; and
- Develop and sustain our spatial, natural and built environment.

4.10.7 CEDERBERG LOCAL MUNICIPALITY

The Cederberg Local Municipality identified the following strategic goals:

- Strengthen financial sustainability and further enhancing good governance;
- Sustainable service delivery;
- Facilitate an enabling environment for economic growth to alleviate poverty;
- Promote safe, healthy, educated and integrated communities; and
- A sustainable, inclusive and integrated living environment.

4.10.8 BERGRIVIER LOCAL MUNICIPALITY

The Bergrivier Local Municipality identified the following strategic objectives:

- Improve and sustain basic service delivery and infrastructure development;
- Financial viability and economically sustainability;
- Good governance, community development and public participation;
- Facilitate, expand and nurture sustainable economic growth and eradicate poverty;
- Enable a resilient, sustainable, quality and inclusive living environment and human settlements i.e. housing development and informal settlement upgrade;
- To facilitate social cohesion, safe and healthy communities; and
- Development and transformation of the institution to provide a people-centred human resources and administrative services to citizens, staff and council.

4.10.9 SALDANHA BAY LOCAL MUNICIPALITY

The Saldanha Bay Local Municipality identified the following strategic actions to create additional growth:

- Retaining large existing exporting businesses;
- Promote Aquaculture-, Fishing-, and Food processing sectors;
- Tourism growth;
- Attract new industrial investors by creating a more enabling environment;
- Maximise the competitive advantages for ports;
- Support local SME to access more opportunities; and
- Availability of credible vocational skills development and tertiary education.

4.10.10 SWARTLAND LOCAL MUNICIPALITY

The strategic goals of the Swartland Local Municipality are:

- Improved quality of life for citizens;

- Inclusive economic growth;
- Quality and sustainable living environment;
- Caring, competent and responsive institutions, organisations, and business; and
- Sufficient, affordable and well-run services.

4.10.11 CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY

The City of Cape Town has sixteen objectives linked to its priorities and foundations:

- Economic growth
  - Increased jobs and investment in the Cape Town economy.
- Basic services
  - Improved access to quality and reliable basic services.
  - End load-shedding in Cape Town over time.
  - Well-managed and modernised infrastructure to support economic growth.
- Safety
  - Effective law enforcement to make communities safer.
  - Strengthen partnerships for safer communities.
- Housing
  - Increased supply of affordable, well-located homes.
  - Safer, better-quality homes in informal settlements and backyards over time.
  - Public space, environment and amenities.
  - Healthy and sustainable environment.
  - Clean and healthy waterways and beaches.
  - Quality and safe parks and recreational facilities supported by community partnerships.
- Transport
  - A sustainable transport system that is integrated, efficient and provides safe and affordable options for all.
  - Safe and quality roads for pedestrians, cyclists and vehicles.
- A resilient city
- A more spatial integrate and inclusive city.
- A capable and collaborative city government.

4.11 INTERNATIONAL LEGISLATION

Various other international legislation may be of specific relevance to the proposed project and is outlined in the sections below.

4.11.1 UNITED NATIONS CONVENTION ON THE LAW OF THE SEA

The United Nations Convention on the Law of the Sea 1982 sets out the roles and responsibilities of the signatory nations in the use of the oceans. The convention establishes guidelines for governments, businesses, and other organisations for the management of marine natural resources. The fundamental principle established in the Convention is that States should cooperate to ensure conservation and promote the objective of the optimum utilization of fisheries resources both within and beyond the exclusive economic zone.

The Agreement attempts to achieve this objective by providing a framework for cooperation in the conservation and management of those resources. It promotes the effective management and conservation of international marine resources by establishing, among other things, detailed minimum international standards for the conservation and management of straddling fish stocks and highly migratory fish stocks; ensuring that measures taken for the conservation and management of those stocks in areas under national jurisdiction and in the adjacent international waters are compatible and coherent; ensuring that there are effective mechanisms for compliance and enforcement of those measures in international waters; and recognizing the special requirements of developing states in relation to conservation and management as well as the development and participation in fisheries of straddling and highly migratory fish stocks.

4.11.2 INTERNATIONAL REGULATIONS FOR PREVENTING COLLISIONS AT SEA

Under the convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972), an exploration vessel that is engaged in surveying is defined as a “vessel restricted in its ability to manoeuvre” and power-driven and sailing vessels are therefore required to give way to it. Vessels engaged in fishing shall, in so far as possible, keep out of the way of the exploration operation. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), an exploration vessel falls under the definition of an “offshore installation” and as such it is protected by a 500 m horizontal safety zone. It is an offence for an unauthorised vessel to enter the safety zone. In addition to a statutory 500 m safety zone, contractors generally request a safe operational limit (that is greater than the 500 m safety zone) that they would like other vessels to stay beyond. Support vehicles are usually commissioned as ‘chase’ boats to ensure that other vessels adhere to the safe operational limits.

4.11.3 INTERNATIONAL MARINE CONVENTIONS

The following international marine conventions may be applicable to the proposed exploration activities:

- 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);
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the London Convention) and the 1996 Protocol (the Protocol);
- International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties (1969) and Protocol on the Intervention on the High Seas in Cases of Marine Pollution by substances other than oil (1973);
- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1989);
- Convention on Biological Diversity (1992); and
- Benguela Current Convention (2013).

5 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITY

South Africa's crude oil demand has increased steadily to over 600 000 barrels / day. Most of the crude oil consumed in South Africa is imported, as local oil and gas production is low, contributing towards a current account deficit. Producing more oil and gas within South Africa is expected to contribute towards a lower current account deficit, more stable prices, create new jobs and industries in the upstream and downstream oil and gas industry supply chain and sectors, and counter volatility related to instabilities in major oil producing regions. The services sector in the oil and gas industry is not mature in the upstream side and this could provide opportunities to invest in the sector.

The proposed project aims to identify oil and gas resources to be used in the energy production and/ or processing or manufacturing of materials and does not include any production activities. The identification and assessment of impacts would therefore be limited to the activities associated with the exploration for oil and gas as outlined in Section 3 above.

The needs and desirability analysis component of the “Guideline on need and desirability in terms of the EIA Regulations (Notice 819 of 2014)” includes, but is not limited to, describing the linkages and dependencies between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development’s ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.). Table 6 below presents the needs and desirability analysis undertaken for the project.

Table 6: Needs and desirability analysis for the proposed co-disposal facility.

Ref No.	Question	Answer
1	Securing ecological sustainable development and use of natural resources	
1.1	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management Framework, Spatial Development Framework (SDF) and global and international responsibilities.	A number of specialist studies will inform the EIA Phase of this application and include: • Marine Ecological Impact Assessment; • Fisheries Impact Assessment; • Acoustic Modelling; • Cultural Heritage Assessment; • Social Impact Assessment; • Air Quality and Climate Change; • Oil Spill and Drill Cuttings Modelling; and • Economic Impact Assessment.
1.2	How will this project disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to baseline marine ecological statement in Section 8, and the preliminary impact assessment in Section 9.2 of this report.
1.3	How will this development pollute and / or degrade the biophysical environment? What measures were explored to either avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	
1.4	What waste will be generated by this development? What measures were explored to avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	Waste will be generated during the operational phase. The types of waste generated include sewage waste, biodegradable galley wastes, and non-biodegradable solid waste. Waste has been identified as an impact and assessed in Section 9.2. However, it is anticipated that the following measures can be utilised to reduce the impact of the waste on the receiving environment:

Ref No.	Question	Answer
		• Visual inspection that waste does not leave the vessel. • Waste must be securely stored. • All hazardous waste such as oil must be stored separately and disposed of at a registered facility. • Proof of disposal must be kept by the Applicant.
1.5	How will this project disturb or enhance landscapes and / or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Although Block 3B/4B is in close proximity to the Child's Bank and Benguela Muds MPAs, no marine protected areas (MPA) are located within Block 3B/4B. For oil and gas exploration activities, although vessels are permitted to sail through these areas, no invasive exploration activities are permitted in any proclaimed MPA. As such, under the proposed exploration right, no invasive exploration activities such as the proposed exploration drilling will take place in any proclaimed MPAs.
1.6	How will this project use and / or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the preliminary impact assessment in Section 9.2 of this report. As a result of the fact that this project entails the exploration for oil and gas, it is anticipated that this project will not lead to a significant impact or depletion of non-renewable resources.
1.7	How will this project use and / or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and / or impacts on the ecosystem jeopardise the integrity of the resource and / or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	Refer to the preliminary impact assessment in Section 9.2 of this report.
1.7.1	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)?	The proposed project aims to identify oil and gas resources to be used in the energy production and/ or processing or manufacturing of materials.

Ref No.	Question	Answer
1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used?	The proposed project aims to identify oil and gas resources and will not, at this stage, involve the use of the natural resources identified as part of the proposed exploration project.
1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The proposed project aims to identify oil and gas resources and will not, at this stage, involve the use of the natural resources identified as part of the proposed exploration project.
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts:	
1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	The limitations and/or gaps in knowledge are presented in Section 11.
1.8.2	What is the level of risk associated with the limits of current knowledge?	The level of risk is considered low at this stage and will be further interrogated during the EIA phase (where applicable).
1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	As a result of the fact that this project entails the exploration for oil and gas (including drilling). Since the exploration activities will include drilling, a risk averse and cautious approach has been implemented through the proposed specialist mitigation measures to limit the impact on the surrounding environment. The highest predicted impact to the surrounding environment would be a blow-out event which is very unlikely and can also be prevented by following the specialist mitigation measures.
1.9	How will the ecological impacts resulting from this development impact on people's environmental right in terms following?	
1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	As a result of the fact that this project entails the exploration for oil and gas. Since the exploration activities will include drilling, a risk averse and cautious approach has been implemented through the proposed specialist mitigation measures to limit the impact on the surrounding environment. The highest predicted impact to the surrounding environment would be a blow-out event which is very unlikely and can also be prevented by following the specialist mitigation measures. The impact of the exploration activities will be assessed during the EIA Phase.
1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the	A low impact on third party wellbeing, livelihoods and ecosystem services is foreseen at this stage of this application. Refer to the preliminary impact assessment in Section 9 of this report.

Ref No.	Question	Answer
	development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	The highest predicted impact to the surrounding environment would be a blow-out event which is very unlikely and can also be prevented by following the specialist mitigation measures. Refer to the preliminary impact assessment in Section 9 in this report.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Refer to Section 6, details of the alternatives considered.
1.13	Describe the positive and negative cumulative ecological / biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to Section 9.4 of this report.
2	Promoting justifiable economic and social development	
2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following:	
2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks or policies applicable to the area,	The offshore area of activity, as well as the Exclusive Economic Zone (EEZ) as a whole, do not fall within the borders of any municipality or province of South Africa. Thus, the related planning documentation, especially at the District and Local Municipality level, typically do not directly address offshore areas and activities in a significant level of detail. The Application Area is located adjacent to the district municipalities indicated in Table 3 above. Refer to Section 8.6 of this report for a breakdown of the demographics and social environment in these areas. The Namakwa IDP (2022 – 2027) aligns with the Nine Point Plan Identified by the National Government and identifies the Growing the Oceans Economy and Tourism – Small Harbour Development & Coastal and Marine Tourism. The IDP does not specifically mention offshore activities or exploration. The impact of the actual exploration activities on the local economy will be assessed during the EIA Phase. Spatial Development Goal 4 of the West Coast District Municipality IDP (2022 – 2027) states that the district should promote sustainable utilisation of the District's natural resource base

Ref No.	Question	Answer
		to extract economic development opportunities. The impact of the actual exploration activities on the local economy will be assessed during the EIA Phase.
2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	Exploration activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised.
2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	Refer to the baseline environment in Section 8 of this report.
2.1.4	Municipal Economic Development Strategy ("LED Strategy").	Considering the limited scope and extent of the proposed exploration activities, it is not anticipated to significantly promote or facilitate spatial transformation and sustainable urban development.
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	Refer to the preliminary impact assessment in Section 9.2 in this report.
2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	Considering the limited scope and extent of the proposed exploration activities, it is not anticipated to significantly promote or facilitate spatial transformation and sustainable urban development.
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Refer to the public participation process and feedback contained Appendix 2.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	Refer to the preliminary impact assessment and mitigation measures in Section 9.2 of this report.
2.5	In terms of location, describe how the placement of the proposed development will:	
2.5.1	Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.	Exploration activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised. The impact of the actual exploration activities on employment opportunities will be assessed during the EIA Phase.

Ref No.	Question	Answer
2.5.2	Reduce the need for transport of people and goods.	The exploration activities are not anticipated to have an impact on the transportation of goods and people.
2.5.3	Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms of public transport),	The exploration activities are not anticipated to have an impact on the public transport.
2.5.4	Compliment other uses in the area,	Block 3B/4B offshore area has been subjected to a number of previous exploration activities and some wells have been drilled in the past. The proposed exploratory drilling complements previous activities undertaken in the block aimed at discovering potential oil and gas resources. These activities include a number of seismic surveys which have previously been undertaken.
2.5.5	Be in line with the planning for the area.	Refer to item 2.1.1 of this table (above).
2.5.6	For urban related development, make use of underutilised land available with the urban edge.	Not applicable. The proposed project is not located in an urban area.
2.5.7	Optimise the use of existing resources and infrastructure,	Refer to Section 3 of this report.
2.5.8	Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	
2.5.9	Discourage "urban sprawl" and contribute to compaction / densification.	Not applicable. The proposed project is not located in an urban area.
2.5.10	Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	Refer to items 2.5.7 – 2.5.9 of this table (above).
2.5.11	Encourage environmentally sustainable land development practices and processes	As a result of the fact that this project entails the exploration for oil and gas. Since the exploration activities will include drilling, a risk averse and cautious approach has been implemented through the proposed specialist mitigation measures to limit the impact on the surrounding environment. The highest predicted impact to the surrounding environment would be a blow-out event which is very unlikely and can also be prevented

Ref No.	Question	Answer
		by following the specialist mitigation measures. The impact of the exploration activities will be assessed during the EIA Phase.
2.5.12	Take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	The proposed project aims to identify potentially strategic oil and gas resources.
2.5.13	The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential).	The proposed project aims to identify oil and gas resources. Given the location offshore, it is not anticipated that the exploration activities will contribute to the significantly to settlements or areas in terms of socio-economic returns.
2.5.14	Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	Refer to preliminary impact assessment in Section 9.2 of this report.
2.5.15	In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	Given the location offshore, it is not anticipated that the exploration activities will contribute to the significantly to settlements or areas in terms of socio-economic returns.
2.6	How was a risk-averse and cautious approach applied in terms of socio-economic impacts:	
2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Refer to Section 11of this report.
2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The level of risk is low as the project is not expected to have far reaching negative impacts on socio-economic conditions.
2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The level of risk is low as the project is not expected to have far reaching negative impacts on socio-economic conditions. Since the exploration activities will include drilling, a risk averse and cautious approach will be implemented through the proposed specialist mitigation measures to limit the impact on the surrounding environment. The highest predicted impact to the surrounding environment would be a blow-out event which will be assessed in greater detail during the EIA Phase.
2.7	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	

Ref No.	Question	Answer
2.7.1	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the preliminary impact assessment in Section 9.2 of this report.
2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	Refer to the preliminary impact assessment in Section 9.2 of this report.
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to the preliminary impact assessment in Section 9.2 of this report.
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	Refer to the preliminary impact assessment in Section 9.2 of this report.
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Refer to the preliminary impact assessment in Section 9.2 of this report. Exploration activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised, but it is anticipated that this will be extremely limited, it at all.
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	By conducting a Scoping and EIA Process, the applicant ensures that equitable access has been considered. Refer to the preliminary impact assessment in Section 9.2 of this report.
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	Refer to the preliminary impact assessment in Section 9.2 of this report. The EIA and EMPr will specify timeframes within which mitigation measures must be implemented.
2.13	What measures were taken to:	
2.13.1	Ensure the participation of all interested and affected parties.	Refer to Section 7 of this report, describing the public participation process undertaken for the proposed project.

Ref No.	Question	Answer
2.13.2	Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Refer to Section 7 of this report, describing the public participation process undertaken for the proposed project. The advertisement and site notice have been made available in English, Afrikaans and IsiXhosa to assist in understanding of the project. Further public consultation will be held during the remainder of the Scoping and EIA phases of the project.
2.13.3	Ensure participation by vulnerable and disadvantaged persons,	
2.13.4	Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	
2.13.5	Ensure openness and transparency, and access to information in terms of the process,	
2.13.6	Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	
2.13.7	Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein will be promoted?	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	Refer to Section 7 of this report, describing the public participation process undertaken for the proposed project. Further public consultation will be held during the remainder of the Scoping and EIA phases of the project.
2.15	What measures have been taken to ensure that current and / or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Potential future workers will have to be educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Furthermore, adequate measures will have to be taken to ensure that the appropriate personal protective equipment is issued to workers based on the conditions that they work in and the requirements of their job.
2.16	Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1	The number of temporary versus permanent jobs that will be created.	

Ref No.	Question	Answer
2.16.2	Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area).	Exploration activities typically require highly skilled employment. However, where feasible, it is anticipated that the use of local labour could be utilised, but it is anticipated that this will be extremely limited, it at all. However, should local labour be required during the exploration activities, then travel will be from suitable ports.
2.16.3	The distance from where labourers will have to travel.	
2.16.4	The location of jobs opportunities versus the location of impacts.	
2.16.5	The opportunity costs in terms of job creation.	
2.17	What measures were taken to ensure:	
2.17.1	That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment.	The Scoping and EIA Process requires governmental departments to communicate regarding any application. In addition, all relevant departments are notified at various phases of the project by the EAP.
2.17.2	That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures.	
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Refer to Section 7 of this report, describing the public participation process implemented for the application, as well Section 7, the impact on any national estate.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Refer to the preliminary impact assessment and mitigation measures in Section 9.2 of this report.
2.20	What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	The proposed exploration activities are not anticipated to produce significant pollution, environmental damage or adverse health effects in the long term, with the exception of a well-blow out event, which will be assessed in greater detail in the EIA Phase.
2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Refer to Section 6, description of the process followed to reach the proposed preferred site.

Ref No.	Question	Answer
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	This will be further assessed in the EIA Report.

6 PROJECT ALTERNATIVES

This section provides a description of the alternatives considered as part of this Scoping and EIA process. It should be noted that the exploration for oil and gas within the Block 3B/4B offshore area will be undertaken by the drilling of exploration wells focused mostly on north and central of the exploration area.

6.1 LOCATION ALTERNATIVES

It should be noted that the exploration for oil and gas within the Block 3B/4B offshore area will be undertaken by the drilling of exploration wells focused mostly on north and central of the exploration area as described in Section 3.2 above. The sites which have been identified as AOI are located north where four (4) exploration wells are proposed and at the centre where one (1) well is proposed within the 3B/4B exploration area. It is understood that prospects and leads outlines were depicted for the areas where drilling of exploration wells is proposed. Further to this more mature prospects were depicted in the northern section of the block which need to be further explored. As such no further location alternatives will be assessed in the study.

6.2 LAYOUT ALTERNATIVES

Though Block 3B/4B is in close proximity to the Child's Bank and Benguela Muds MPAs, the proposed exploration drilling areas which should they be authorised can only occur within Block 3B/4B do not overlap with any proclaimed MPAs as the AOI already avoids these areas. Block 3B/4B overlaps to some extent with the Child's Bank Ecologically and Biologically Significant Area (EBSA). However, the AOI for exploration drilling avoids all EBSAs. For oil and gas exploration activities, although vessels are permitted to sail through these areas, no invasive exploration activities are permitted in any proclaimed MPA. Under the currently issued exploration permit, no invasive exploration activities such as the proposed exploration drilling will take place in any proclaimed MPAs.

The AOIs do, however, overlap with some Critical Biodiversity Areas (CBA), and as such, it is anticipated that the option of avoiding these CBAs withing the AIO will be assessed as a layout alternative during the EIA Phase. No other environmental sensitivities which require further avoidance have been identified in the proposed AOI, and as such no additional layout alternatives are considered feasible for further consideration.

6.3 TECHNOLOGY ALTERNATIVES

Various types of drilling technology can be used to drill an exploration well (e.g. barges, jack-up rigs, semi-submersible drilling units (rigs) and drill-ships) depending on, inter alia, the water depth and marine operating conditions experienced at the well site. Based on the anticipated sea conditions, the Applicants are proposing to utilise a semi-submersible drilling unit or a drillship, both with dynamic positioning system suitable for the deep-water harsh marine environment. The final rig selection will be made depending upon availability and final design specifications.

- A semi-submersible drilling unit is essentially a drilling rig located on a floating structure of pontoons. When at the well location, the pontoons are partially flooded (or ballasted), with seawater, to submerge the pontoons to a pre-determined depth below the sea level where wave motion is minimised. This gives stability to the drilling vessel thereby facilitating drilling operations.
- A drillship is a fit for purpose built drilling vessel designed to operate in deep water conditions. The drilling "derrick" is normally located towards the centre of the ship with support operations from both sides of the ship using fixed cranes. The advantages of a drillship over the majority of semi-submersible units are that a drillship has much greater storage capacity and is independently mobile, not requiring any towing and reduced requirement of supply vessels.

The activities proposed in this application require specialised technology and skills. The most suitable technology which to be used will be further assessed in the EIA phase once the final technology selection has been decided upon depending on availability and final design selection.

6.4 SCHEDULING ALTERNATIVES

Based on the findings of the Drill Cutting and Oil Spill Modelling, Acoustics, Marine Ecology and Fisheries recommendations, alternatives scheduling alternatives will be considered in order to avoid/ minimise the impacts associated with exploration activities. These will include considerations on:

- Avoid/ minimise impacts/ likelihood of well-blowout or other pollution events;
- Avoid sensitive areas and periods for some marine fauna: e.g. movement of migratory animals and feeding grounds; and
- Avoid periods of peak fishing activity.

6.5 NO GO ALTERNATIVE

The no go alternative would imply that no exploration activities are undertaken. As a result, the opportunity to identify potential oil and gas resources within the Block 3B/4B and proposed AOI would not exist. This will negate the potential negative and positive impacts associated with the proposed exploration activities.

A detailed no-go alternative assessment will be undertaken during the EIA Phase.

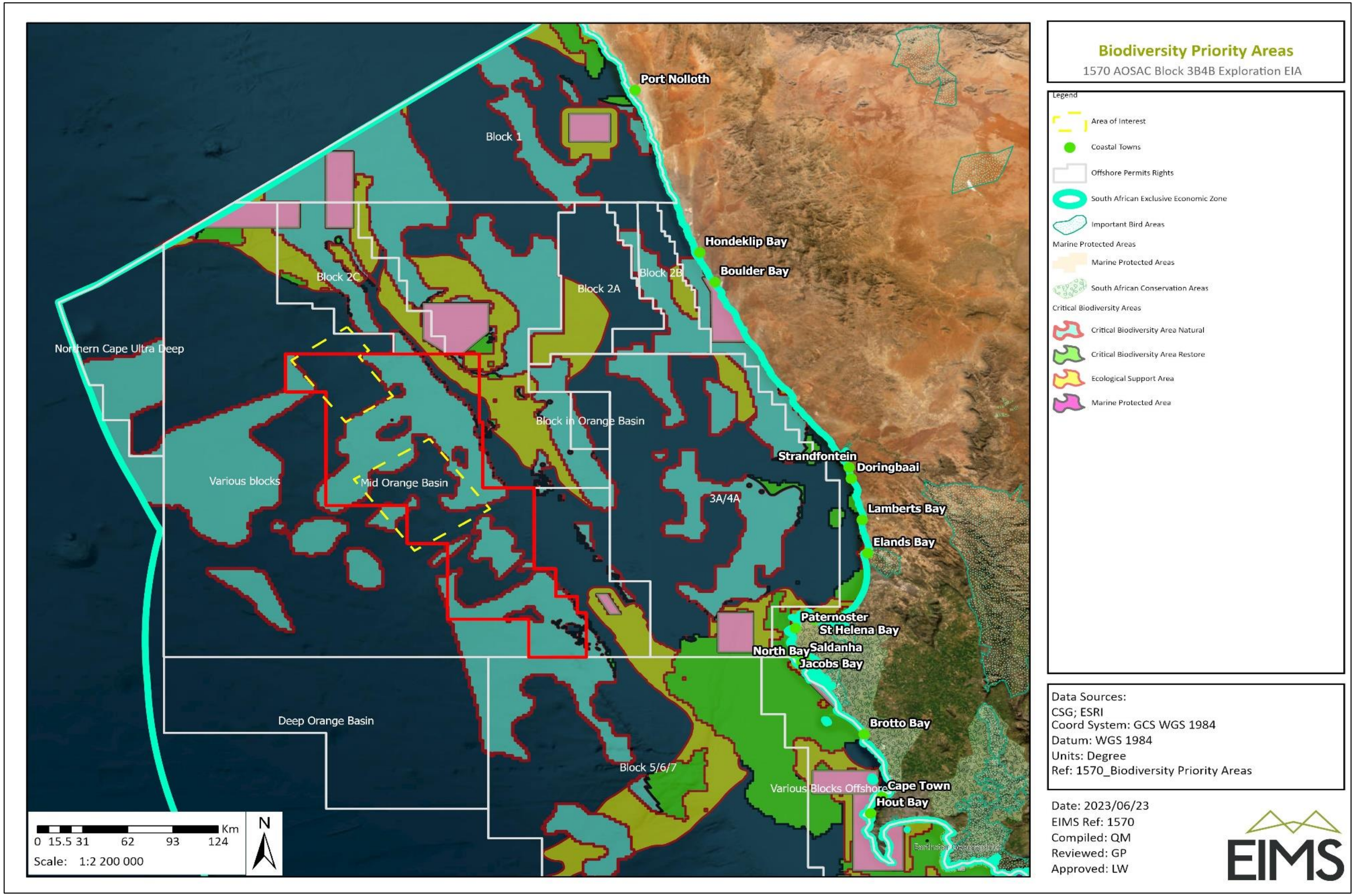


Figure 14: Biodiversity Priority and Marine Protected Areas in relation to the application area.

7 STAKEHOLDER ENGAGEMENT

The Public Participation Process (PPP) is a requirement of several pieces of South African legislation and aims to ensure that all relevant Interested and Affected Parties (I&APs) are consulted, involved and their comments are considered, and a record included in the reports submitted to the Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed project needs to be managed sensitively and according to best practises to ensure and promote:

- Compliance with international best practice options;
- Compliance with national legislation;
- Establishment and management of relationships with key stakeholder groups; and
- Involvement and participation in the environmental study and authorisation/approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Introduce the proposed project;
- Explain the authorisations required;
- Explain the environmental studies already completed and yet to be undertaken (where applicable);
- Solicit and record any issues, concerns, suggestions, and objections to the project;
- Provide opportunity for input and gathering of local knowledge;
- Establish and formalise lines of communication between the I&APs and the project team;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximize and/or promote positive environmental impacts associated with the project.

7.1 GENERAL APPROACH TO SCOPING AND PUBLIC PARTICIPATION

The PPP for the proposed project has been undertaken in accordance with the requirements of the NEMA EIA Regulations (2014), and in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project and have their views considered and included as part of project planning. The details of the approach and processes undertaken for public participation are outlined in the Public Participation Report (PPR), refer to Appendix 2.

7.2 PUBLIC PARTICIPATION PROGRESS

Comments raised to date have been addressed in a transparent manner and included in the Public Participation Report (Appendix 2). A high-level summary of the key comments and concerns raised to date are presented below.

A summary of the comments received since the start of the PPP period to date has been provided below:

- I&AP registrations and deregistration;
- Request for clarity regarding terminology such as the reprocessing of data;
- Request for clarity on the nature of the project;
- Request to be informed about updates of the project;
- Request for files related to the location and situation of the project site; and

- Provision of information related to SAHRIS application procedure for the project.

8 ENVIRONMENTAL ATTRIBUTES AND BASELINE ENVIRONMENT

This section of the Scoping Report provides a description of the environment that may be affected by the proposed project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area, specialist baseline assessments, as well as previous reports undertaken for Block 3B/4B. The DFFE screening tool was also used to inform this section and a copy of the screening report is included in Appendix 4.

8.1 GEOPHYSICAL CHARACTERISTICS

This section provides a description of the geophysical characteristics of the application area. The information has been sourced from the Marine Ecological Baseline Study undertaken by Pisces Environmental Services (Pty) Ltd.

8.1.1 BATHYMETRY

The continental shelf along the West Coast is generally wide and deep, although large variations in both depth and width occur. The shelf maintains a general NNW trend, widening north of Cape Columbine and reaching its widest off the Orange River (180 km). The nature of the shelf break varies off the South African West Coast. Between Cape Columbine and the Orange River, there is usually a double shelf break, with the distinct inner and outer slopes, separated by a gently sloping ledge. The immediate inshore area consists mainly of a narrow (about 8 km wide) rugged rocky zone and slopes steeply seawards to a depth of around 80 m. The middle (-50 to 150 m) and outer shelf (-150 to -350 m) normally lacks relief and slopes gently seawards reaching the shelf edge at a depth of between -350 to -500 m (Sink *et al*. 2019). The three shelf zones characterising the West Coast are recognised following both abiotic (de Wet 2013) and biotic (Karenyi *et al*. 2016) patterns.

Banks on the continental shelf include the Orange Bank (Shelf or Cone), a shallow (160 - 190 m) zone that reaches maximal widths (180 km) offshore of the Orange River, and Child's Bank, situated ~150 km offshore at about 31°S, and adjacent to the northeastern corner of the licence block. Child's Bank is a major feature on the West Coast margin and is the only known submarine bank within South Africa's Exclusive Economic Zone (EEZ), rising from a depth of 350 - 400 m water to less than -200 m at its shallowest point. It is a rounded, flat topped, sandy plateau, which lies at the edge of the continental shelf. The bank has a gentle northern, eastern and southern margin but a steep, slump-generated outer face (Birch & Rogers 1973; Dingle *et al*. 1983; de Wet 2013). At its southwestern edge, the continental slope drops down steeply from -350 to -1 500 m over a distance of less than 60 km (de Wet 2013) creating precipitous cliffs at least 150 m high (Birch & Rogers 1973). The bank consists of resistant, horizontal beds of Pliocene sediments, similar to that of the Orange Banks, and represents another perched erosional outlier formed by Post-Pliocene erosion (Dingle 1973; Siesser *et al*. 1974). The top of this feature has been estimated to cover some 1 450 km^2 (Sink *et al*. 2012).

Tripp Seamount, a geological feature ~130 km to the north-northwest of the licence block, rises from the seabed at ~1 000 m to a depth of 150 m. It is a roughly circular feature with a flat apex that drops steeply on all sides.

A further two unnamed seamounts are situated ~110 km and ~140 km to the west of the western boundary of the licence block rising from depths of 3 000 m and 3 500 m.

Further underwater features in the vicinity of the licence block include the Cape Canyon and Cape Point Valley, which lie ~100 km and ~245 km to the southeast of the southern boundary of the licence block (Simpson & Forder 1968; Dingle 1986; Wigley 2004; Wigley & Compton 2006). The Cape Canyon was discovered in the 1960s. The canyon head forms a well-developed trench on the continental shelf, 100 m deep and 4 km wide (Wigley 2004; Wigley & Compton 2006). South of Cape Columbine the canyon becomes progressively narrower and deeper. Adjacent to Cape Town in a water depth of 1 500 m, the canyon has a local relief in the order of 500–800 m (Simpson & Forder 1968; Dingle *et al*. 1987). The Cape Canyon has a longitudinal extent of at least 200 km and can be traced to a water depth of at least 3 600 m (Dingle 1970), where the topography of the distal end is rugged and complex (Dingle *et al*. 1987). Sediments in the canyon are predominately unconsolidated sands and muds. The canyon serves as an upwelling feature funnelling cold, nutrient-rich South Atlantic Central Water up the canyon slope providing highly productive surface waters which in turn power feeding grounds for cetaceans and seabirds (Filander *et al*. 2018; www.environment.gov.za/ dearesearchteamreturnfromdeepseaexpedition).

The Cape Point Valley, which lies about 70 km south of the Cape Peninsula, is another large canyon breaching the shelf. This canyon has sustained the highest fishing effort and catches in the South African demersal trawl fishery for almost a century (www.marineprotectedareas.org.za/canyons).

Using high-resolution bathymetry collected between 315 – 3 125 m depth, Palan (2017) identified numerous new and previously undocumented submarine canyon systems, most of which are less extensive than the Cape Canyon and Cape Point Valley and do not incise the shelf (Figure 15). Canyon morphology was highly variable and included linear, sinuous, hooked and shelf-indenting types. Large fluid seep/pockmark fields of varying morphologies were similarly revealed situated in close proximity to the sinuous, hooked and shelf-indenting canyon types thereby providing the first evidence of seafloor fluid venting and escape features from the South African margin. These pockmarks represent the terminus of stratigraphic fluid migration from an Aptian gas reservoir, evidenced in the form of blowout pipes and brightened reflectors. This area lies well to the southeast of the licence block.

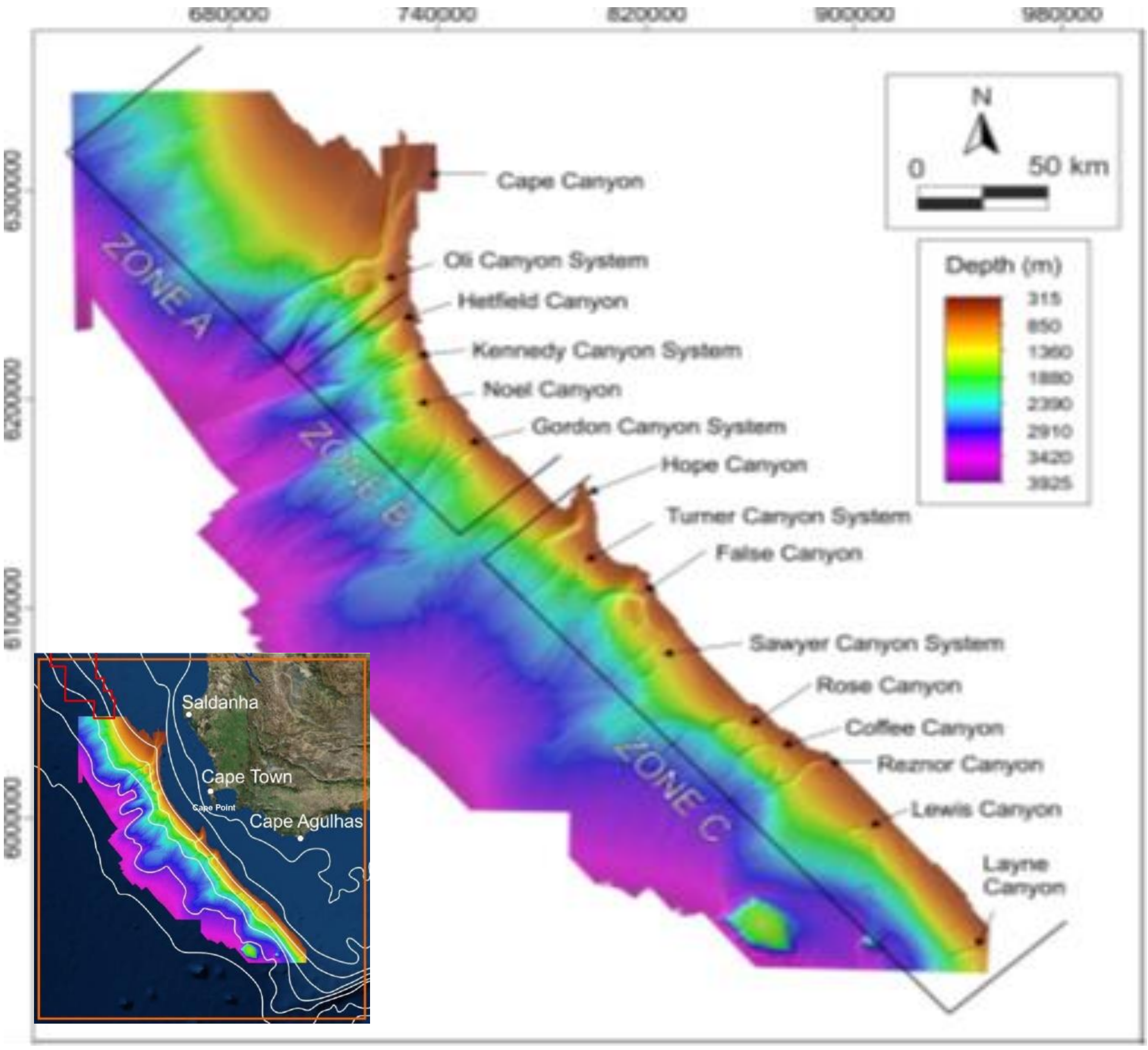


Figure 15: Map indicating submarine canyon domains of the southwestern Cape continental margin identified by Palan (2017). Insert shows the locality of the study area in relation to Block 3B/4B (red polygon).

8.1.2 COASTAL AND INNER-SHELF GEOLOGY AND SEABED GEOMORPHOLOGY

Figure 16 and Figure 17 below illustrates the distribution of seabed surface sediment types off the South African north-western coast. The inner shelf is underlain by Precambrian bedrock (Pre-Mesozoic basement), whilst the middle and outer shelf areas are composed of Cretaceous and Tertiary sediments (Dingle 1973; Dingle *et al*. 1987; Birch *et al*. 1976; Rogers 1977; Rogers & Bremner 1991). As a result of erosion on the continental shelf, the unconsolidated sediment cover is generally thin, often less than 1 m. Sediments are finer seawards, changing from sand on the inner and outer shelves to muddy sand and sandy mud in deeper water. However, this general pattern has been modified considerably by biological deposition (large areas of shelf sediments contain high levels of calcium carbonate) and localised river input. An approximately 500 km long mud belt (up to 40 km wide, and of 15 m average thickness) is situated over the innershelf shelf between the Orange River and St Helena Bay (Birch *et al*. 1976). Further offshore and within the licence block, sediment is dominated by muds and sandy muds, with the eastern portion of the licence block having muddy sands and sands being present in the northeastern corner of the block. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous ooze.

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

The benthic habitat types of the West Coast were classified and mapped in detail through the 2011 National Biodiversity Assessment (NBA) (Sink *et al*. 2012a). These were refined in the 2018 NBA (Sink *et al*. 2019) to provide substratum types (Figure 16).

In the licence block the water depth ranges from ~300 m to 2 600 m. The Southeast Atlantic Unclassified Slopes substratum dominates across the area. The shelf inshore of the licence block boasts a diversity of substrata (Sink *et al*. 2019).

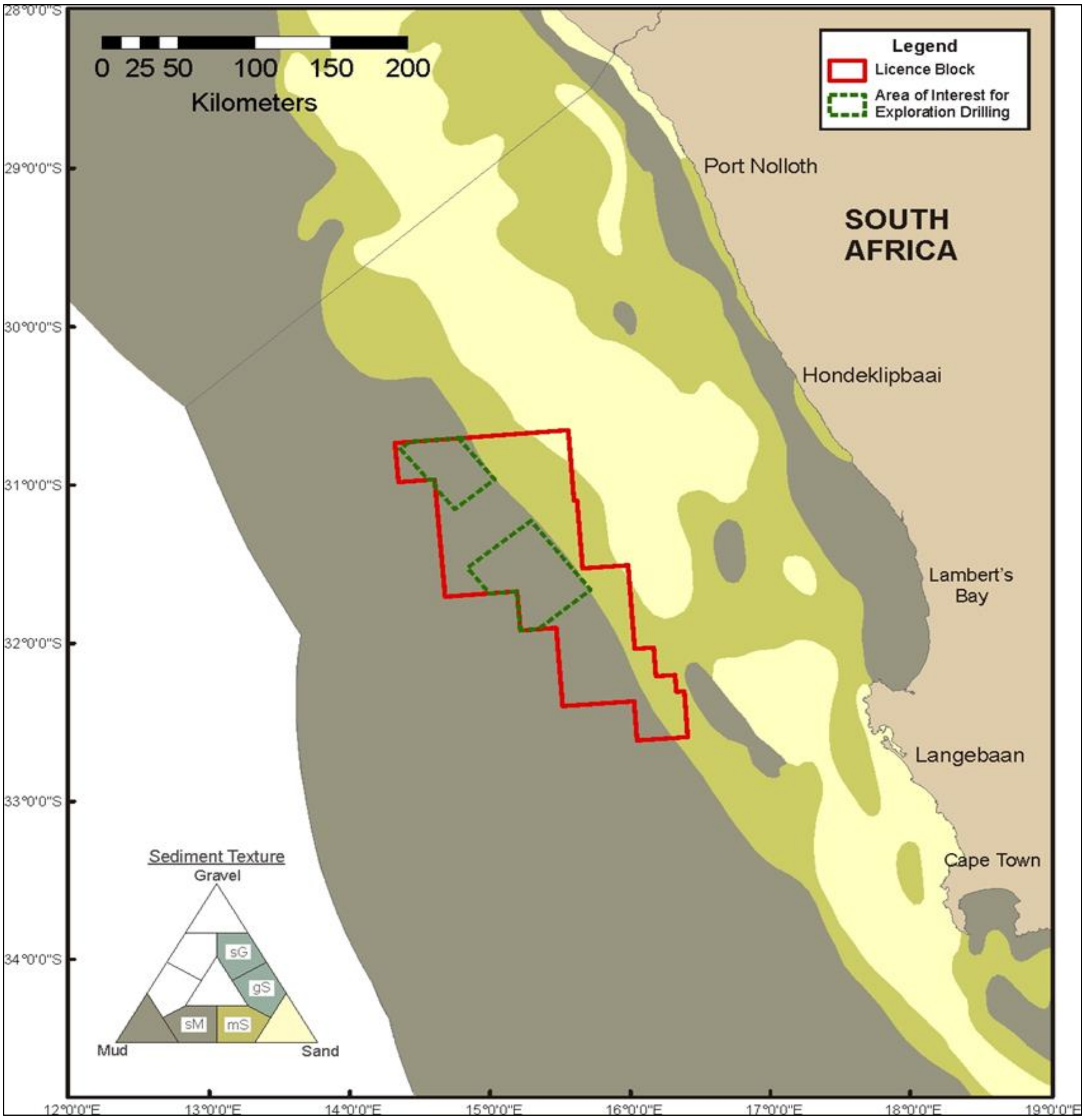


Figure 16: Block 3B/4B (red polygon) in relation to sediment distribution on the continental shelf of the South African West Coast (Adapted from Rogers 1977). Based on information in Holness *et al*. (2014) and Sink *et al*. (2019), the mud/sandy mud sediments have been extended to the edge of the EEZ beyond that shown in Rogers (1977).

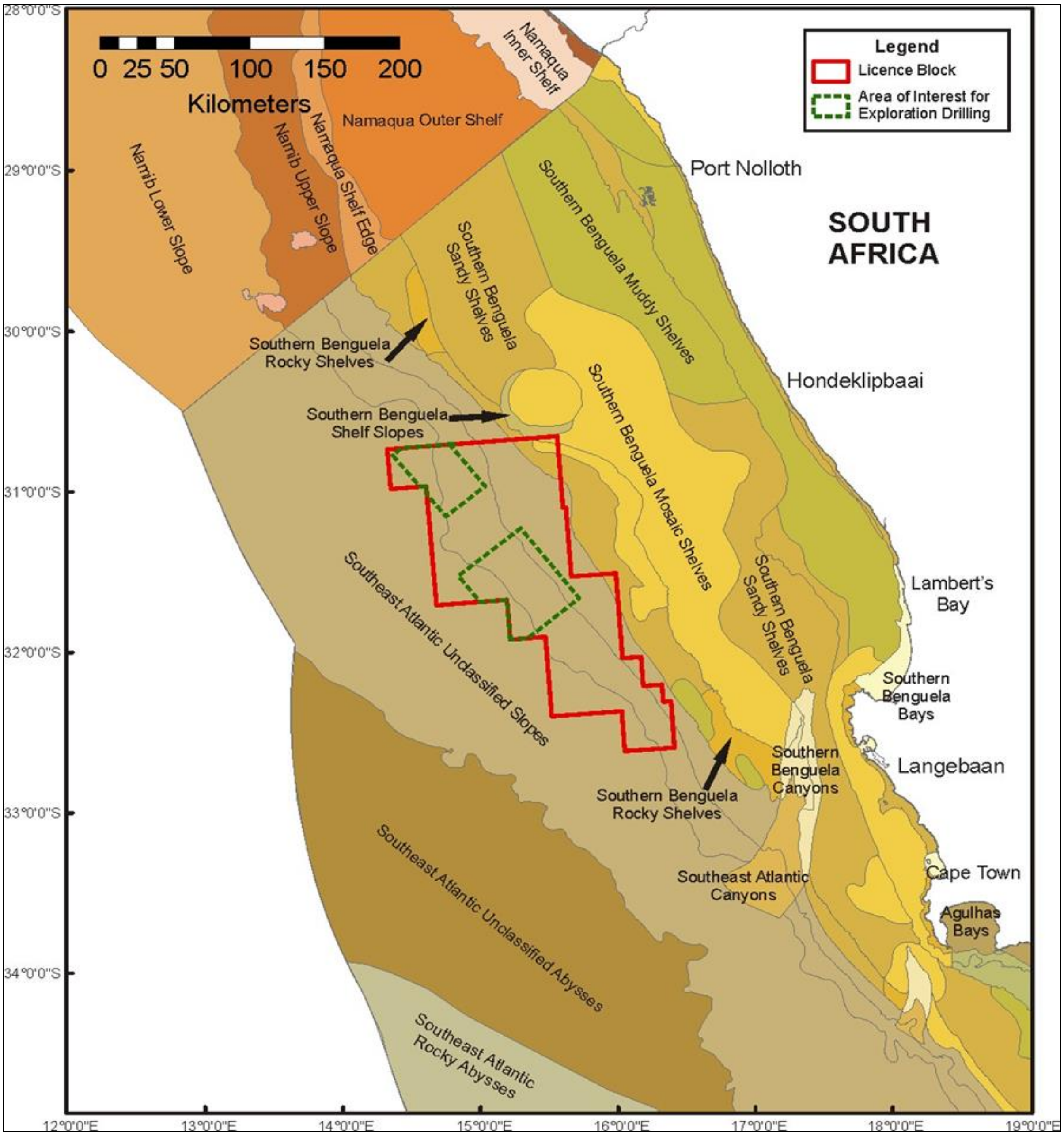


Figure 17: Block 3B/4B (red polygon) in relation to the distribution of seabed substratum types along the West Coast (adapted from Sink *et al*. 2019). The adjacent Namibian substratum types (adapted from Holness *et al*. 2019) are also shown.

8.1.3 SEDIMENTARY PHOSPHATES

Phosphorite, or phosphate-rich rock, is defined as sedimentary rock typically containing between 5%-20% phosphate. In the marine environment, it occurs either as a nodular hard ground capping of a few metres thick (Figure 18, left) or as series of unconsolidated sediments (Morant 2013). Several types of sedimentary phosphates occur offshore and onshore in South Africa, the largest of which is the diagenetic replacement resource on the Agulhas Bank. These replacement phosphate resources occur as near-continuous ‘pavements’ or cappings of limestones at depths between 200 m and 500 m on the continental shelf between Cape Agulhas and Cape Recife, covering an approximate area of 21 500 km^2. Further sporadic phosphate mantles over the continental shelf are known to occur from Lamberts Bay, north to the mouth of the Orange River (Figure 18, right). Block 3B/4B lies offshore of the phosphorite hard grounds.

The “open shelf” phosphorite deposits were formed during several episodes over the last 1.7 – 65 million years. They originated from the precipitation of phosphate in the form of calcium phosphate in an environment of intense upwelling and high biological activity along the continental margin of South Africa. The upwelling resulted in a change in temperature and pressure of the phosphate-laden oceanic waters, thus lowering the solubility of the phosphate salts they contained, and consequently precipitating the phosphates (in the form of apatite) over the continental shelf to form phosphatic packstones and colitic pellets at the sediment-water interface. The precipitation is facilitated by the decay of siliceous phytoplankton. The precipitated phosphates subsequently combined with calcium, derived from the disaggregation of calcareous foraminiferal and coccolithophorid debris on the outer continental shelf, to form phosphatised lime-rich muds. These muds subsequently lithified or consolidated through their replacement by secondary calcium phosphate (francolite), to form a near continuous hard capping of phosphate rock over the seafloor sediments (Birch 1990; Morant 2013).

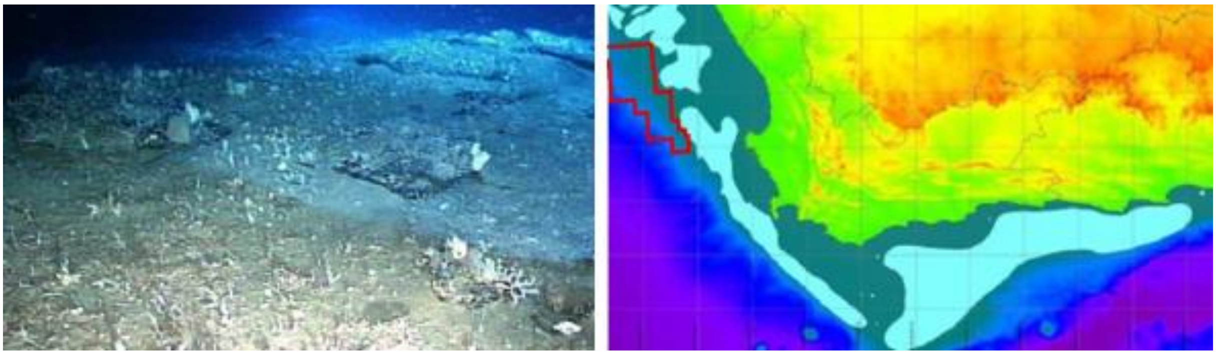


Figure 18: Phosphorite hard ground (left) and its distribution (cyan) on the South African continental shelf (right) in relation to Block 3B/4B (red polygon) (adapted from Morant 2013).

During repeated sea level changes, the phosphate-rich rocks were extensively re-worked, eroding the hard capping pavements thereby liberating the heavy phosphate-bearing minerals (mainly glauconite and apatite) and concentrating them in the overlying unconsolidated sediments. Migrating zones of deposition and erosion occurred during repeated transgressive/regressive cycles. Renewed carbonate deposition and a further period of phosphatization occurred when the deposition zones migrated back across the shelf in response to a rising sea level, thereby incorporating boulders and cobbles of phosphatized limestone and glauconite left behind after the previous regressive cycle into the second-generation phosphatic deposits, forming conglomeratic rock types. Two main periods of phosphatization have been identified, namely the Middle Miocene (ca 15 million years ago), and possibly the Upper Eocene (ca 37 million years ago) (Birch 1990; Morant 2013).

The phosphate-bearing lithologies comprise three non-conglomeratic and two conglomeratic rock types. The non-conglomeratic types are phosphatized foraminiferal lime packstones (a type of limestone), which are either poor in glauconite and quartz, rich in goethite, or highly glauconitic. The first conglomeratic type is also rich in glauconite but contains pebble inclusions of phosphatized foraminiferal limestone. The second conglomeratic type is distinguished by its low glauconite content and high macrofossil and goethite abundance. The depth of mineralization within the conglomeratic ores is typically restricted to the upper few metres of sediment. The phosphate-rich rocks on the Agulhas Bank are estimated to have an average P2O5 content of 16.2%. With an area of 35 000 million m2, an average thickness of 0.5 m, the Agulhas Bank offshore phosphate deposits are estimated to contain in the order of 5 000 million tons of P2O5 (Birch 1990).

8.2 BIOPHYSICAL CHARACTERISTICS

This section provides a description of the biophysical characteristics of the application area. The information has been sourced from the Marine Ecological Baseline Study undertaken by Pisces Environmental Services (Pty) Ltd.

8.2.1 WIND PATTERNS

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

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

These seasonal changes result in substantial differences between the typical summer and winter wind patterns in the region, as the southern hemisphere anti-cyclonic high-pressures system, and the associated series of cold fronts, moves northwards in winter, and southwards in summer. The strongest winds occur in summer (October to March), during which winds blow 98% of the time, with a total of 226 gales (winds exceeding 18 m/s or 35 knots (kts)) being recorded over the period. Virtually all winds in summer come from the south to south-southeast (Figure 19 below). These southerlies occur over 40% of the time, averaging 20 – 30 kts and reaching speeds in excess of 60 kts, bringing cool, moist air into the coastal region and driving the massive offshore movements of surface water, and the resultant strong upwelling of nutrient-rich bottom waters, which characterise this region in summer. The winds also play an important role in the loss of sediment from beaches. These strong equator-wards winds are interrupted by the passing of coastal lows with which are associated periods of calm or north or northwest wind conditions. These northerlies occur throughout the year but are more frequent in winter.

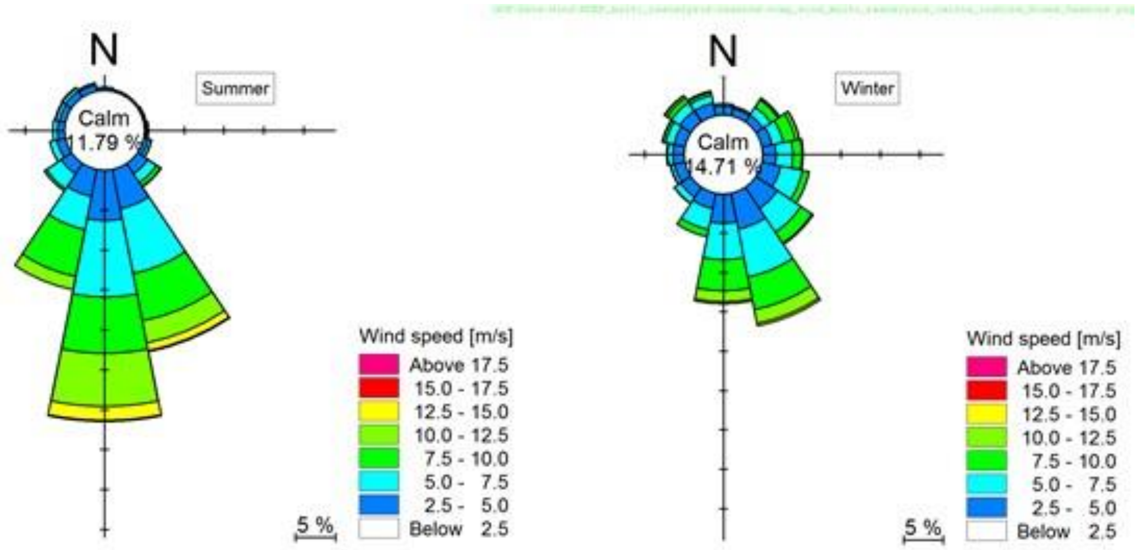


Figure 19: Wind Speed vs. Wind Direction for NCEP hind cast data at location 16.5°E, 29°S (From PRDW, 2013).

Winter remains dominated by southerly to south-easterly winds, but the closer proximity of the winter cold-front systems results in a significant south-westerly to north-westerly component (Figure 19 above). This 'reversal' from the summer condition results in cessation of upwelling, movement of warmer mid-Atlantic water shore-wards and breakdown of the strong thermoclines which typically develop in summer. There are also more calms in winter, occurring about 3% of the time, and wind speeds generally do not reach the maximum speeds of summer. However, the westerly winds blow in synchrony with the prevailing south-westerly swell direction, resulting in heavier swell conditions in winter.

During autumn and winter, catabatic, or easterly 'berg' winds can also occur. These powerful offshore winds can exceed 50 km/h, producing sandstorms that considerably reduce visibility at sea and on land. Although they occur intermittently for about a week at a time, they have a strong effect on the coastal temperatures, which often exceed 30°C during 'berg' wind periods. The winds also play a significant role in sediment input into the coastal marine environment with transport of the sediments up to 150 km offshore (Figure 20 below).

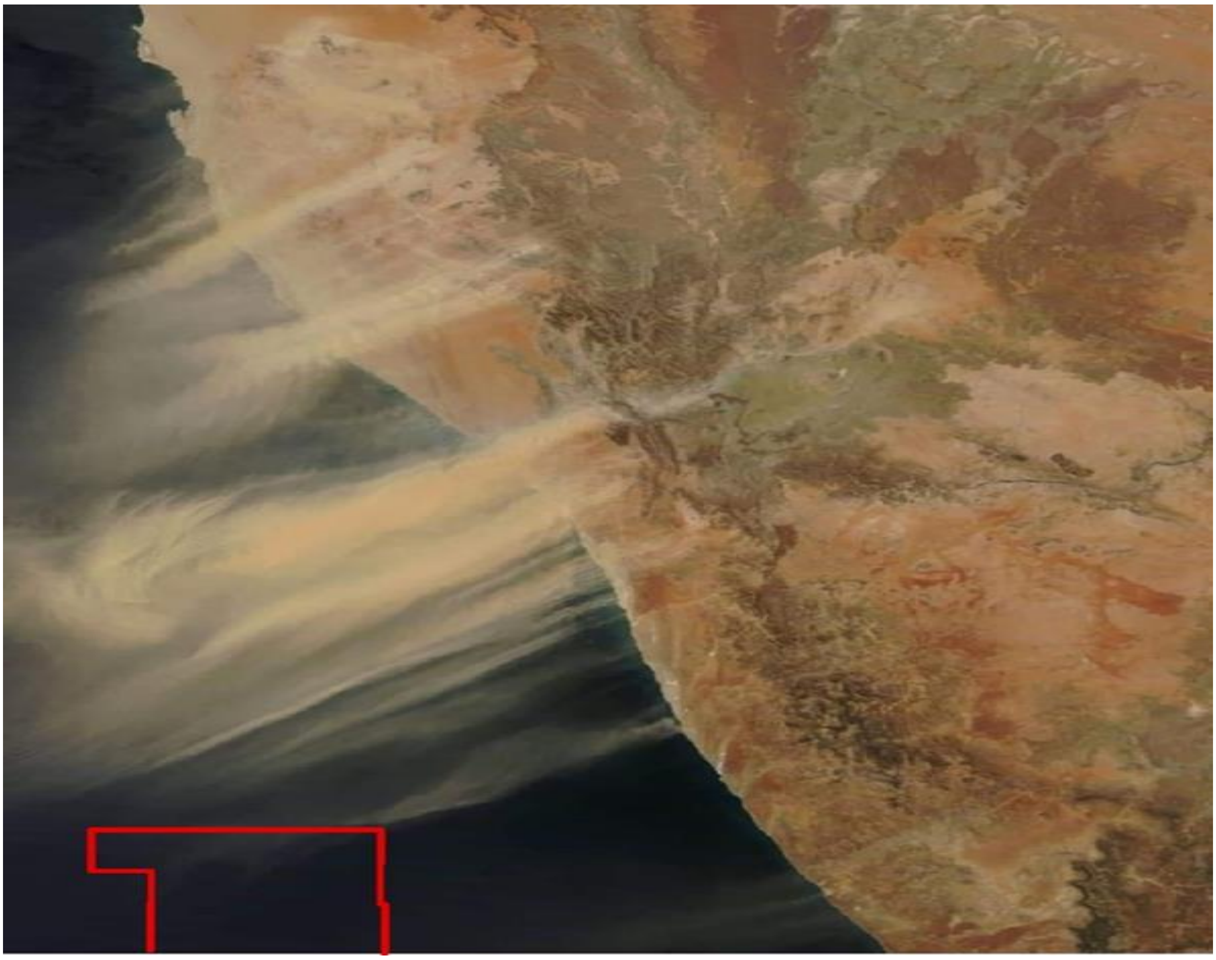


Figure 20: Block 3B/4B (red polygon) in relation to aerosol plumes of sand and dust due to a 'berg' wind event on the southern African west coast in October 2019 (Image Source: LandWaterSA).

8.2.2 LARGE-SCALE CIRCULATION AND COASTAL CURRENTS

The southern African West Coast is strongly influenced by the Benguela Current. Current velocities in continental shelf areas generally range between 10–30 cm/s (Boyd & Oberholster 1994), although localised flows in excess of 50 cm/s occur associated with eddies (PRDW 2013). On its western side, flow is more transient and characterised by large eddies shed from the retroflection of the Agulhas Current. This results in considerable variation in current speed and direction over the domain (PRDW 2013). In the south the Benguela current has a width of 200 km, widening rapidly northwards to 750 km. The surface flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow (Shillington *et al*. 1990; Nelson & Hutchings 1983) (Figure 21). Fluctuation periods of these flows are 3-10 days, although the long-term mean current residual is in an approximate northwest (alongshore) direction. Current speeds decrease with depth, while directions rotate from predominantly north-westerly at the surface to south-easterly near the seabed. Near bottom shelf flow is mainly poleward with low velocities of typically <5 cm/s (Nelson 1989; PRDW 2013). The poleward flow becomes more consistent in the southern Benguela.

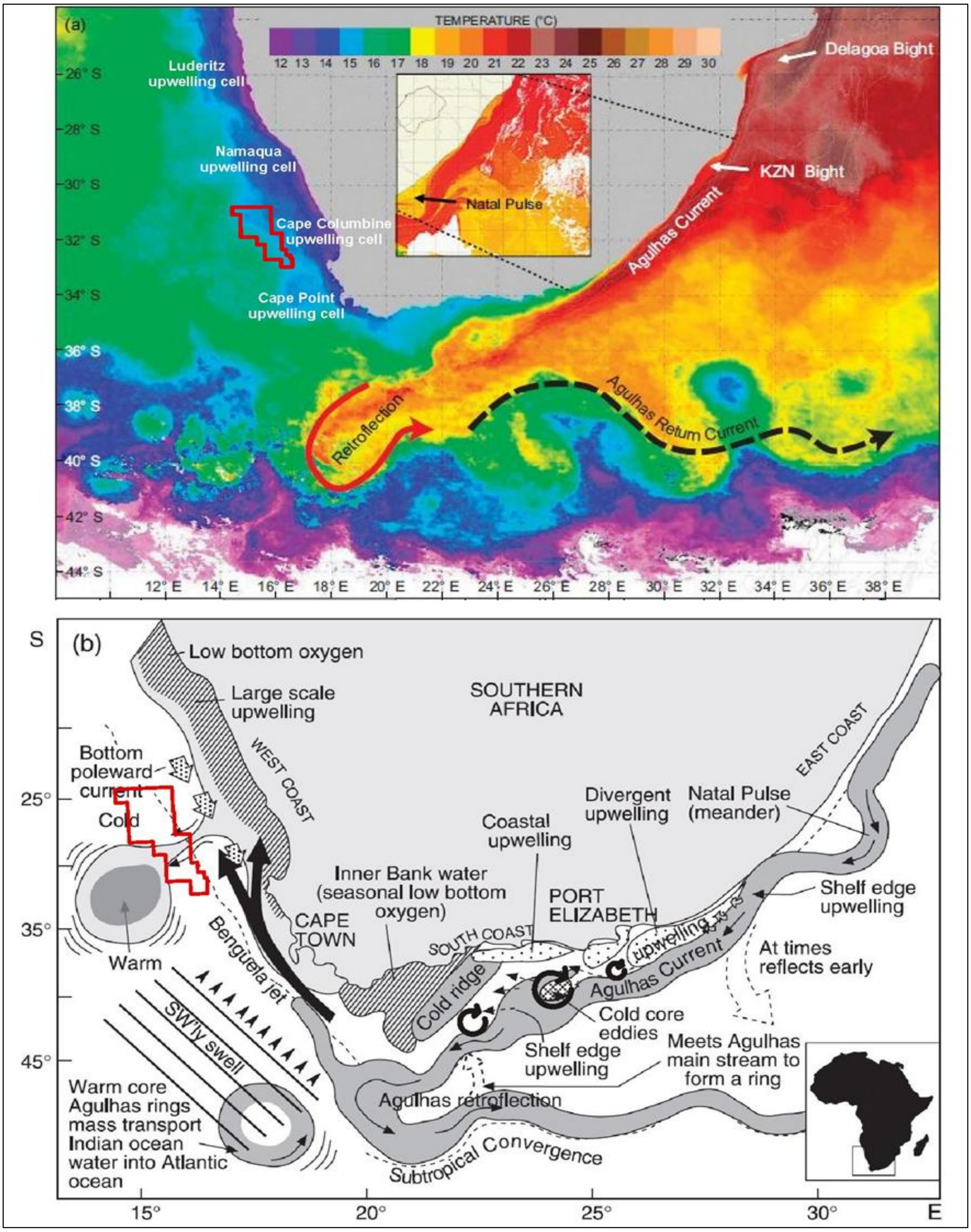


Figure 21: (a) Satellite sea-surface temperature image showing the predominance of the warm Agulhas Current along the South African south coast and the colder upwelled water on the west coast (adapted from Roberts *et al*. 2010), and (b) physical processes and features associated with the Southwest Coast in relation to Block 3B/4B (red polygon) (adapted from Roberts 2005).

Where the Agulhas Current passes the southern tip of the Agulhas Bank (Agulhas Retroflection area), it may shed a filament of warm surface water that moves north-westward along the shelf edge towards Cape Point, and Agulhas Rings, which similarly move north-westwards into the South Atlantic Ocean (Figure 21). These rings may extend to the seafloor and west of Cape Town may split, disperse or join with other rings. During the process of ring formation, intrusions of cold subantarctic water moves into the South Atlantic. The contrast in warm (nutrient-poor) and cold (nutrient-rich) water is thought to be reflected in the presence of cetaceans and large migratory pelagic fish species (Best 2007). The licence area lies offshore of 15°E on the outer edge of these features.

8.2.3 WAVES AND TIDES

Most of the west coast of southern Africa is classified as exposed, experiencing strong wave action, rating between 13-17 on the 20 point exposure scale (McLachlan 1980). Much of the coastline is therefore impacted by heavy south-westerly swells generated in the roaring forties, as well as significant sea waves generated locally by the prevailing moderate to strong southerly winds characteristic of the region (Figure 22 below). The peak wave energy periods fall in the range 9.7 – 15.5 seconds.

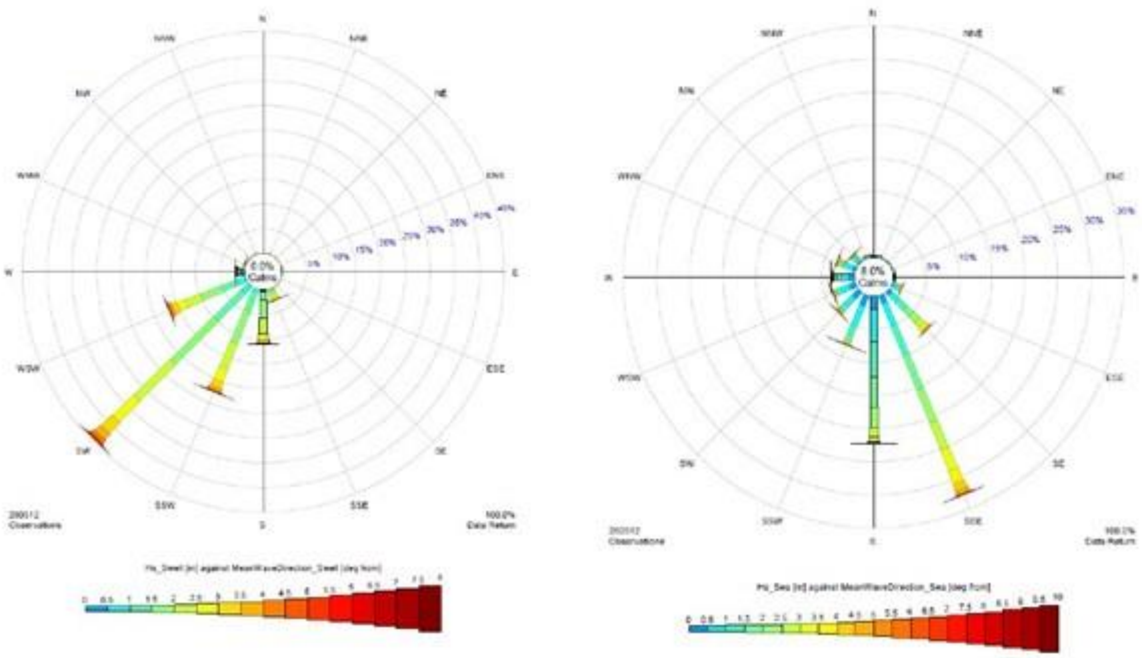


Figure 22: Annual roseplots of significant wave height partitions of swell (left) and wind-sea (right) for GROW1012 hind cast data at location 15°E, 31°S (Pisces, 2023).

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

In comparison, summer swells tend to be smaller on average, typically around 2 m, not reaching the maximum swell heights of winter. There is also a slightly more pronounced southerly swell component in summer. These southerly swells tend to be wind-induced, with shorter wave periods (~8 seconds), and are generally steeper than swell waves. These wind-induced southerly waves are relatively local and, although less powerful, tend to work together with the strong southerly winds of summer to cause the northward-flowing nearshore surface currents, and result in substantial nearshore sediment mobilisation, and northwards transport, by the combined action of currents, wind and waves. In common with the rest of the southern African coast, tides are semi-diurnal, with a total range of some 1.5 m at spring tide, but only 0.6 m during neap tide periods.

8.2.4 WATER

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

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

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, especially on the bottom. SACW itself has depressed oxygen concentrations (~80% saturation value), but lower oxygen concentrations (<40% saturation) frequently occur. Nutrient concentrations of upwelled water of the Benguela system attain 20 µM nitrate-nitrogen, 1.5 µM phosphate and 15-20 µM silicate, indicating nutrient enrichment. This is mediated by nutrient regeneration from biogenic material in the sediments. Modification of these peak concentrations depends upon phytoplankton uptake, which varies according to phytoplankton biomass and production rate. The range of nutrient concentrations can thus be large but, in general, concentrations are high.

8.2.5 UPWELLING & PLANKTON PRODUCTION

The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman & Shannon 1985). During upwelling the comparatively nutrient-poor surface waters are displaced by enriched deep water, supporting substantial seasonal primary phytoplankton production. This, in turn, serves as the basis for a rich food chain up through zooplankton, pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (hake and snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others). High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters. This results in a wind-related cycle of plankton production, mortality, sinking of plankton detritus and eventual nutrient re-enrichment occurring below the thermocline as the phytoplankton decays. Block 3B/4B is located well offshore (>100 km) of these upwelling events and waters are expected to be comparatively warm and nutrient poor (Figure 21).

8.2.6 ORGANIC INPUTS

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

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

An associated phenomenon ubiquitous to the Benguela system is red tides (dinoflagellate and/or ciliate blooms) (see Shannon & Pillar 1985; Pitcher 1998; Pitcher & Calder 2000). Also referred to as Harmful Algal Blooms (HABs), these red tides can reach very large proportions, extending over several square kilometres of ocean (Figure 23, left). Toxic dinoflagellate species can cause extensive mortalities of fish and shellfish through direct poisoning, while degradation of organic-rich material derived from both toxic and non-toxic blooms results in oxygen depletion of subsurface water (Figure 23, right). HABs, being associated primarily with upwelling cells, are unlikely to occur within Block 3B/4B, but may occur inshore of the block.

Figure 23: Red tides can reach very large proportions (Left, Photo: www.e-education.psu.edu) and can lead to mass stranding, or ‘walk-out’ of rock lobsters, such as occurred at Elands Bay in March 2022 (Right, Photo: Henk Kruger/African News Agency).

8.2.7 LOW OXYGEN EVENTS

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations with <40% saturation occurring frequently. The low oxygen concentrations are attributed to nutrient remineralisation in the bottom waters of the system. The absolute rate of this is dependent upon the net organic material build-up in the sediments, with the carbon rich mud deposits playing an important role. As the mud on the shelf is distributed in discrete patches (refer to Figure 16 above), there are corresponding preferential areas for the formation of oxygen-poor water. The two main areas of low-oxygen water formation in the southern Benguela region are in the Orange River Bight and St Helena Bay. The spatial distribution of oxygen-poor water in each of the areas is subject to short- and medium-term variability in the volume of hypoxic water that develops. De Decker (1970) showed that the occurrence of low oxygen water off Lambert’s Bay is seasonal, with highest development in summer/autumn. Bailey & Chapman (1991), on the other hand, demonstrated that in the St Helena Bay area daily variability exists as a result of downward flux of oxygen through thermoclines and short-term variations in upwelling intensity. Subsequent upwelling processes can move this low-oxygen water up onto the inner shelf, and into nearshore waters, often with devastating effects on marine communities.

Periodic low oxygen events in the nearshore region can have catastrophic effects on the marine communities leading to large-scale stranding of rock lobsters, and mass mortalities of marine biota and fish. The development of anoxic conditions as a result of the decomposition of huge amounts of organic matter generated by phytoplankton blooms is the main cause for these mortalities and walkouts. The blooms develop over a period of unusually calm wind conditions when sea surface temperatures where high. Algal blooms usually occur during summer-autumn (February to April) but can also develop in winter during the ‘berg’ wind periods, when similar warm windless conditions occur for extended periods.

8.2.8 TURBIDITY

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulate matter. Total Suspended Particulate Matter (TSPM) can be divided into Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM), the ratios between them varying considerably. The POM usually consists of detritus, bacteria, phytoplankton and zooplankton, and serves as a source of food for filter-feeders. Seasonal microphyte production associated with upwelling events will play an important role in determining the concentrations of POM in coastal waters. PIM, on the other hand, is primarily of geological origin consisting of fine sands, silts and clays. Off Namaqualand, the PIM loading in nearshore waters is strongly related to natural inputs from the Orange River or from ‘berg’ wind events (refer to Figure 20 above). Although highly variable, annual discharge rates of sediments by the Orange River is estimated to vary from 8 - 26 million tons/year. ‘Berg’ wind events can potentially contribute the same order of magnitude of sediment input as the annual estimated input of sediment by the Orange River. For example, a ‘berg’ wind event in May 1979 described by Shannon and Anderson (1982) was estimated to have transported in the order of 50 million tons of sand out to sea, affecting an area of 20 000 km^2.

Concentrations of suspended particulate matter in shallow coastal waters can vary both spatially and temporally, typically ranging from a few mg/ℓ to several tens of mg/ℓ. Field measurements of TSPM and PIM concentrations in the Benguela current system have indicated that outside of major flood events, background concentrations of coastal and continental shelf suspended sediments are generally <12 mg/ℓ, showing significant long-shore variation. Considerably higher concentrations of PIM have, however, been reported from southern African West Coast waters under stronger wave conditions associated with high tides and storms, or under flood conditions. In the vicinity of the Orange River mouth, where river outflow strongly influences the turbidity of coastal waters, measured concentrations ranged from 14.3 mg/ℓ at Alexander Bay just south of the mouth to peak values of 7 400 mg/ℓ immediately upstream of the river mouth during the 1988 Orange River flood.

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

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

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

Offshore of the continental shelf, the oceanic waters are typically clear as they are beyond the influence of aeolian and riverine inputs. The waters in the offshore portions of Block 3B/4B are thus expected to be comparatively clear.

8.2.9 NATURAL HYDROCARBON SEEPS

Petroleum discharges, both from natural seeps at the seabed and discharges occurring during the production and transport of petroleum are a common source of toxic substances in marine ecosystems (NRC 2003a). No oil seep anomalies have been reported off the West Coast.

8.3 BIOLOGICAL ENVIRONMENT

This section provides a description of the biological characteristics of the application area. The information has been sourced from the Marine Ecological Baseline Study undertaken by Pisces Environmental Services (Pty) Ltd. Biogeographically, the study area falls into the cold temperate Namaqua Bioregion, which extends from Sylvia Hill, north of Lüderitz in Namibia to Cape Columbine. Block 3B/4B falls primarily into the Southwest Atlantic Deep Ocean Ecoregion (Figure 24). The coastal, wind-induced upwelling characterising the Western Cape coastline, is the principle physical process which shapes the marine ecology of the southern Benguela region. The Benguela system is characterised by the presence of cold surface water, high biological productivity, and highly variable physical, chemical and biological conditions.

Communities within marine habitats are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. These biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). The offshore marine ecosystems comprise a limited range of habitats, namely unconsolidated seabed sediments, deepwater reefs and the water column. The biological communities 'typical' of these habitats are described briefly below, focussing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed exploration activities.

8.3.1 DEMERSAL COMMUNITIES

8.3.1.1 **BENTHIC INVERTEBRATE MACROFAUNA**

The seabed communities in the Deep Water Orange Basin area lie within the Namaqua sub-photic and continental slope biozones, which extend from a 30 m depth to the shelf edge, and beyond to the lower deep-sea slope, respectively. The benthic habitats of South Africa were mapped as part of the 2018 National Biodiversity Assessment (Sink *et al*. 2019) to develop assessments of the ecosystem threat status and ecosystem protection level. The benthic ecosystem types were subsequently mapped (Figure 25) and assigned an ecosystem threat status based on their level of protection (Figure 26). The Licence Area is characterised by a limited variety of ecosystem types, with the majority of Block 3B/4B characterised by Southeast Atlantic Lower-, Mid- and Upper Slope habitats, with some representation in the northeastern corner by Southern Benguela Sandy Shelf Edge and Shelf Edge Mosaic Abyss habitats.

The AOI for drilling coincides with three ecosystem types, namely:

- Southeast Atlantic Lower Slope - Unknown seabed type on the lower slope of Southeast Atlantic with a depth range of -1 800 m to -3 500 m.
- Southeast Atlantic Mid Slope - Unknown seabed type on the mid slope in the Southeast Atlantic ecoregion spanning depths of -1 000 m to -1 800 m.
- Southeast Atlantic Upper Slope - Unknown seabed type and associated water column on the upper slope (-500 m to -1 000 m) in the Southeast Atlantic ecoregion.

The benthic biota of unconsolidated marine sediments constitute invertebrates that live on (epifauna) or burrow within (infauna) the sediments and are generally divided into macrofauna (animals >1 mm) and meiofauna (<1 mm). Numerous studies have been conducted on southern African West Coast continental shelf benthos, mostly focused on mining, pollution or demersal trawling impacts. These studies, however, concentrated on the continental shelf and nearshore regions, and consequently the benthic fauna of the outer shelf and continental slope (beyond ~450 m depth) are very poorly known. This is primarily due to limited opportunities for sampling as well as the lack of access to Remote Operated Vehicles (ROVs) for visual sampling of hard substrata.

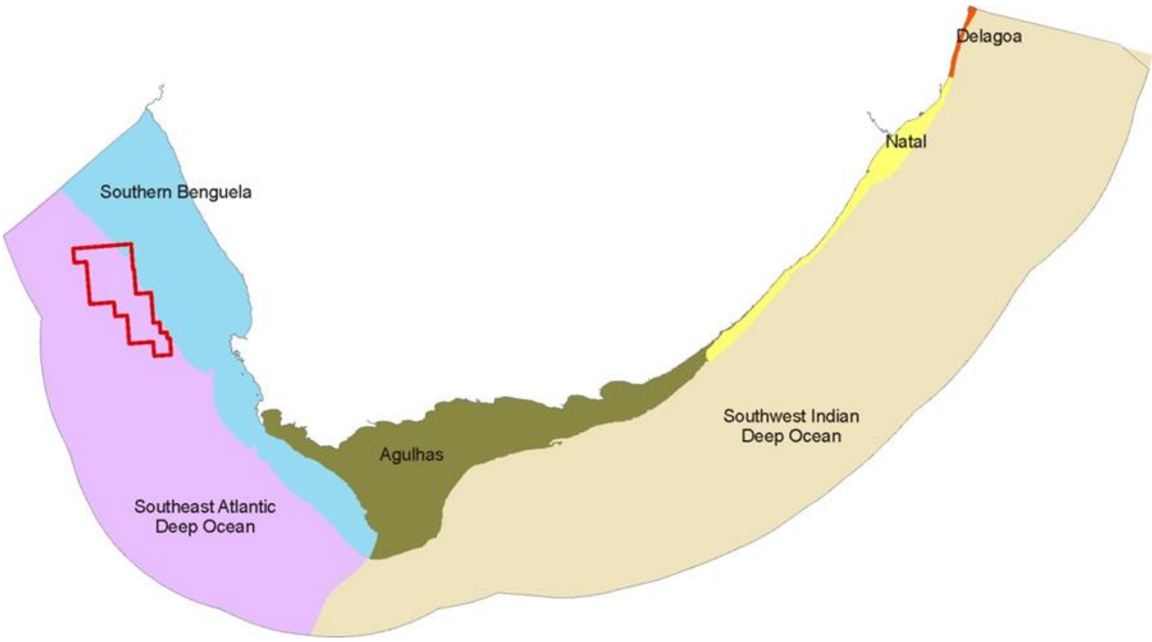


Figure 24: Block 3B/4B (red polygon) in relation to the inshore and offshore ecoregions of the South African coast (adapted from Sink *et al*. 2019).

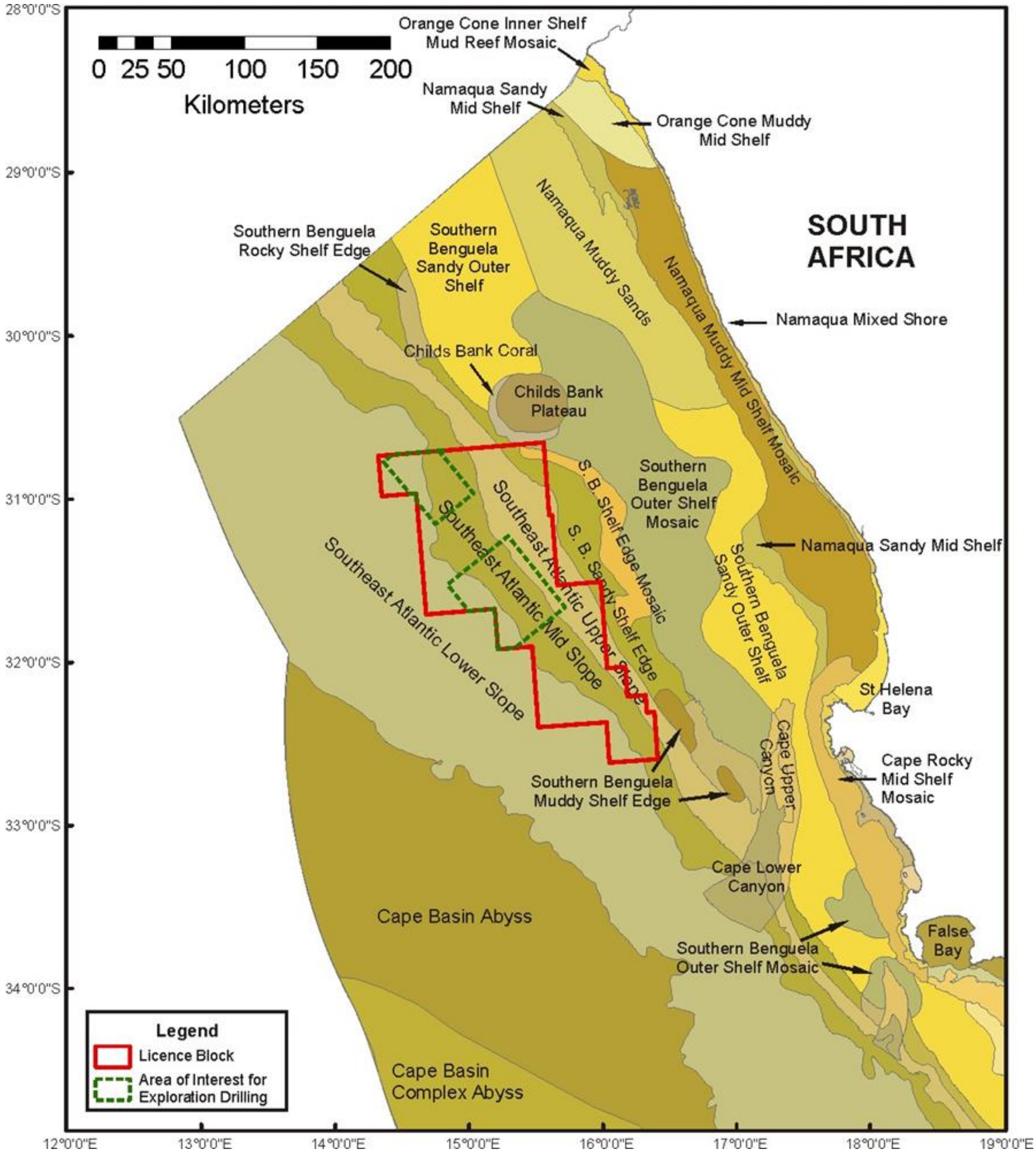


Figure 25: Block 3B/4B (red polygon) in relation to the distribution of ecosystem types along the West Coast (adapted from Sink *et al*. 2019).

To date very few areas on the continental slope off the West Coast have been biologically surveyed. Although sediment distribution studies suggest that the outer shelf is characterised by unconsolidated sediments (Figure 16 above), surveys conducted between 180 m and 480 m depth offshore of the Northern Cape coast revealed high proportions of hard ground rather than unconsolidated sediment, although this requires further verification (unpublished data).

There have also to date been no studies examining connectivity between slope, plateau or abyssal ecosystems in South Africa and there is thus limited knowledge on the benthic biodiversity of all three of these broad ecosystem groups in South African waters. There is no quantitative data describing bathyal ecosystems in South Africa and hence limited understanding of ecosystem functioning and sensitivity. Due to the lack of information on benthic macrofaunal communities beyond the shelf break, no description can be provided specifically for the Licence Area. The description below for areas on the continental shelf, offshore of the Northern Cape coast is drawn from recent surveys.

Three macro-infauna communities have been identified on the inner- (0-30 m depth) and mid-shelf (30-150 m depth. Polychaetes, crustaceans and molluscs make up the largest proportion of individuals, biomass and species on the west coast. The inner-shelf community, which is affected by wave action, is characterised by various mobile gastropod and polychaete predators and sedentary polychaetes and isopods. The mid-shelf community inhabits the mudbelt and is characterised by mud prawns. A second mid-shelf community occurring in sandy sediments is characterised by various deposit-feeding polychaetes. The distribution of species within these communities are inherently patchy reflecting the high natural spatial and temporal variability associated with macro-infauna of unconsolidated sediments with evidence of mass mortalities and substantial recruitments recorded on the South African West Coast.

Despite the current lack of knowledge of the community structure and endemicity of South African macro-infauna off the edge of the continental shelf, the marine component of the 2018 National Biodiversity Assessment, rated the South Atlantic bathyal and abyssal unconsolidated habitat types that characterise depths beyond 500 m, as being of 'Least Concern' (Figure 26), with only those communities occurring along the shelf edge (-500 m) in the eastern portions of Block 3B/4B being considered 'Vulnerable'. This primarily reflects the great extent of these habitats in the South African Exclusive Economic Zone (EEZ).

Studies show that off Namaqualand, species richness increases from the inner-shelf across the mid-shelf and is influenced by sediment type. The highest total abundance and species diversity was measured in sandy sediments of the mid-shelf. Biomass is highest in the inshore (±50 g/m2 wet weight) and decreases across the mid-shelf averaging around 30 g/m2 wet weight. This is contrary to other studies which found that biomass was greatest in the mudbelt at 80 m depth off Lamberts Bay, where the sediment characteristics and the impact of environmental stressors (such as low oxygen events) are likely to differ from those off the northern Namaqualand coast.

Benthic communities are structured by the complex interplay of a large array of environmental factors. Water depth and sediment grain size are considered the two major factors that determine benthic community structure and distribution on the South African west coast and elsewhere in the world. However, studies have shown that shear bed stress - a measure of the impact of current velocity on sediment – oxygen, organic carbon and seafloor temperature may also strongly influence the structure of benthic communities. There are clearly other natural processes operating in the deep water shelf areas of the West Coast that can over-ride the suitability of sediments in determining benthic community structure, and it is likely that periodic intrusion of low oxygen water masses is a major cause of this variability. In areas of frequent oxygen deficiency, benthic communities will be characterised either by species able to survive chronic low oxygen conditions, or colonising and fast-growing species able to rapidly recruit into areas that have suffered oxygen depletion. The combination of local, episodic hydrodynamic conditions and patchy settlement of larvae will tend to generate the observed small-scale variability in benthic community structure.

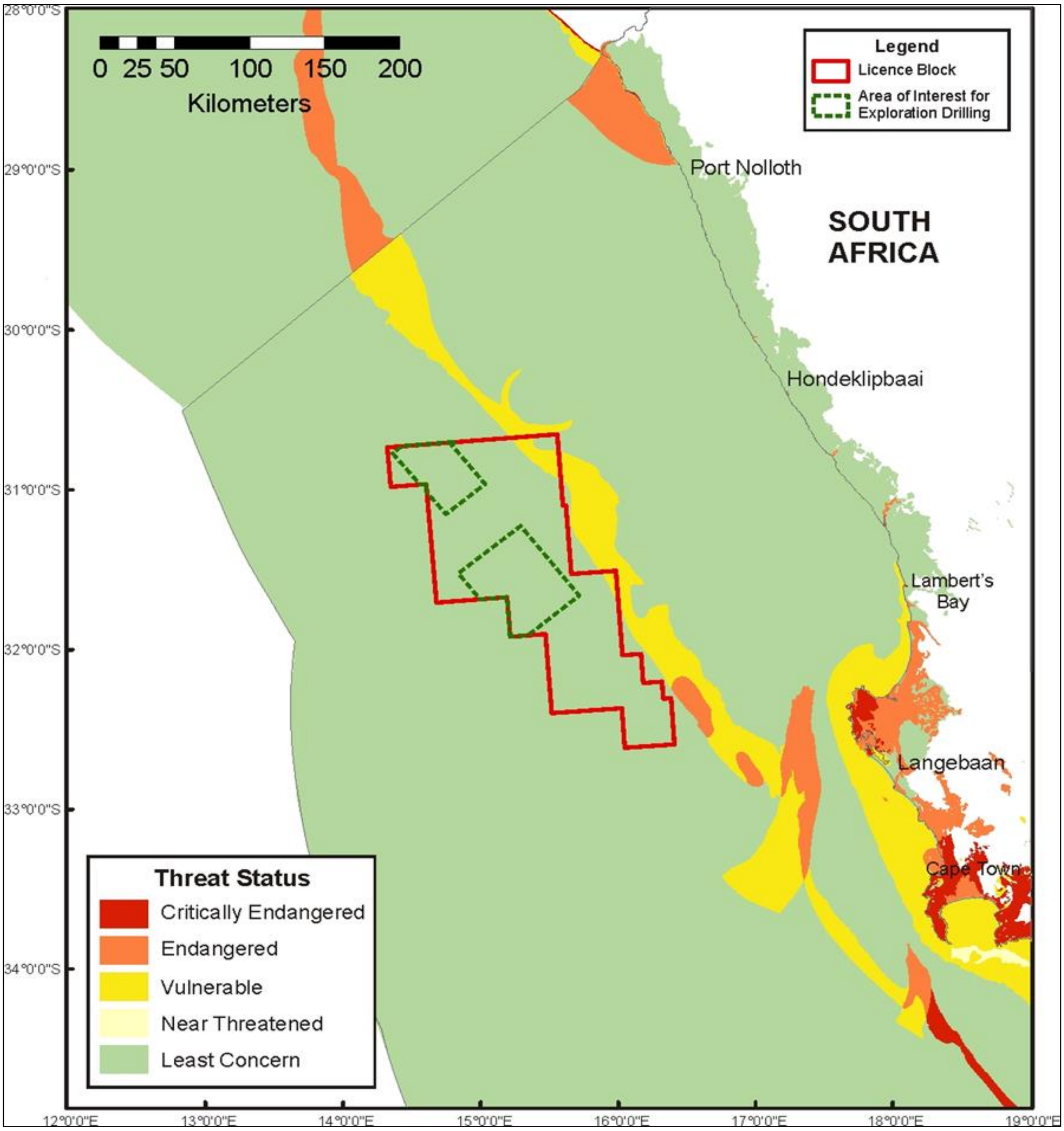


Figure 26: Block 3B/4B (red polygon) in relation to the ecosystem threat status for coastal and offshore benthic and pelagic habitat types on the South African West Coast (adapted from Sink *et al*. 2019). The adjacent Namibian threat status is also shown (adapted from Holness *et al*. 2019).

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

Also associated with soft-bottom substrates are demersal communities that comprise epifauna and bottom-dwelling vertebrate species, many of which are dependent on the invertebrate benthic macrofauna as a food source. The continental shelf on the West Coast between depths of 100 m and 250 m, contained a single epifaunal community characterised by the hermit crabs *Sympagurus dimorphus* and *Parapaguris pilosimanus*, the prawn *Funchalia woodwardi* and the sea urchin *Brisaster capensis*. Numerous species of urchins and burrowing anemones beyond 300 m depth off the West Coast. Unconsolidated sediments beyond 2 000 m depth host a variety of sea pens, sea whips, holothurians, brittle stars and cushion stars, sea urchins, burrowing anemones, crustaceans (shrimps, crabs), larvaceans and cepahlopods (TEEPSA, unpublished data). Information on the benthic fauna of the lower continental slope and abyss (beyond 1 800 m depth) is largely lacking due to limited opportunities for sampling. However, deep water benthic sampling was undertaken as part of the Environmental Baseline Survey for Total E&P Namibia's Block 2913B to the north of Block 3B/4B. This provided valuable information on the benthic infaunal communities of the lower continental slope. As conditions in such deep water habitats tend to be more uniform (low temperatures and low oxygen concentrations characterising the SACW that comprises the bulk of the water in the area), similar communities may be expected in the Deep Water Orange Basin.

The macrofauna in Block 2913B were generally impoverished but fairly consistent, which is typical for deep water sediments. The 105 species recorded, were dominated by polychaetes, which accounted for 64.1% of the total individuals. Molluscs were represented by 11 species (19.6% of total individuals), whilst 20 species of crustaceans were recorded (contributing to only 9.8% of total individuals). Echinoderms were represented by only 3 species (5.8% of total individuals), whilst all other groups (Actiniaria, Nemertea, Nematoda, Ascidiacea and Priapulida) accounted for the remaining 5.9% of individuals. The deposit-feeding polychaete *Spiophanes sp.* was the most abundant species recorded. This small bristleworm can either be a passive suspension feeder or a surface deposit feeder, living off sediment particles, planktonic organisms and meiobenthic organisms. The bivalve mollusc *Microgloma mirmidina* was the second most common species, with the polychaete tentatively identified as a Leiocapitellide being the third most abundant. With the exception of the carnivorous polychaete *Glycera capitata*, most species were suspension or deposit feeders typical of soft unconsolidated sediments.

Examples of the macroinvertebrate infauna of the Namibian Block 2913B area located ~135 km to the west-northwest of Block 3B/4B are illustrated in Figure 27. A wide diversity of macroinvertebrates has been recorded inshore of the 1 000 m depth contour.

The 2018 National Biodiversity Assessment for the marine environment (Sink *et al*. 2019) points out that very few national IUCN Red List assessments have been conducted for marine invertebrate species to date owing to inadequate taxonomic knowledge, limited distribution data, a lack of systematic surveys and limited capacity to advance species red listing for these groups.

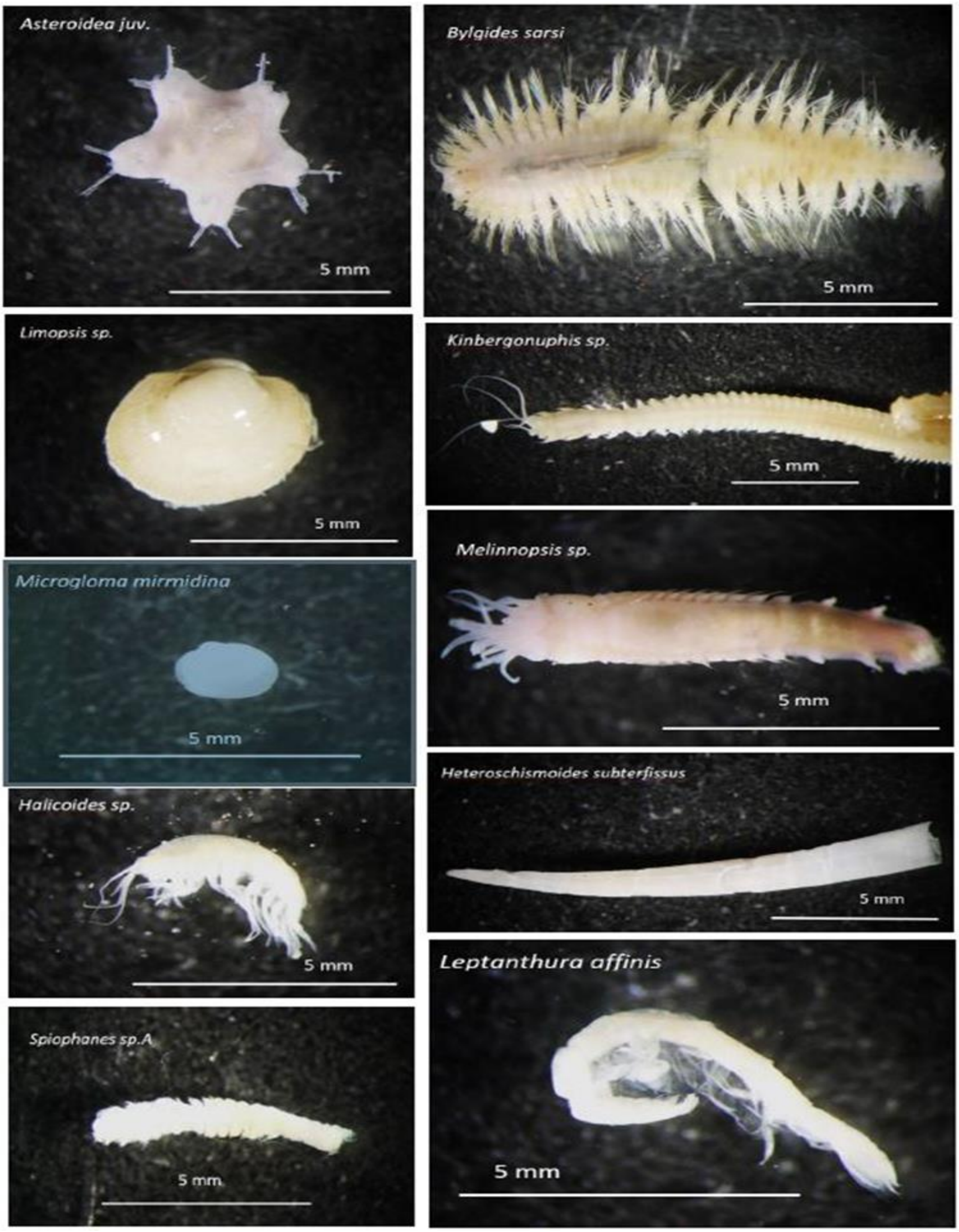


Figure 27: Examples of macroinvertebrates recorded in Block 2913B to the west-northwest of Block 3B/4B (Source Benthic Solutions Ltd 2019).

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

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

The 2018 National Biodiversity Assessment for the marine environment points out that very few national IUCN Red List assessments have been conducted for marine invertebrate species to date owing to inadequate taxonomic knowledge, limited distribution data, a lack of systematic surveys and limited capacity to advance species red listing for these groups.

8.3.1.2 **DEEP-WATER CORAL COMMUNITIES**

There has been increasing interest in deep-water corals in recent years because of their likely sensitivity to disturbance and their long generation times. These benthic filter-feeders generally occur at depths below 150 m with some species being recorded from as deep as 3 000 m. Some species form reefs while others are smaller and remain solitary. Corals add structural complexity to otherwise uniform seabed habitats thereby creating areas of high biological diversity. Deep water corals establish themselves below the thermocline where there is a continuous and regular supply of concentrated particulate organic matter, caused by the flow of a relatively strong current over special topographical formations which cause eddies to form. Nutrient seepage from the substratum might also promote a location for settlement. In the productive Benguela region, substantial areas on and off the edge of the shelf should thus potentially be capable of supporting rich, cold water, benthic, filter-feeding communities, and various species of scleractine and stylastrine corals have been reported from depths beyond -200 m in the Orange Basin.

Such communities would also be expected with topographic features such as seamounts located adjacent to the northern boundary of Block 3B/4B. Nonetheless, our understanding of the invertebrate fauna of the sub-photic zone is relatively poor and the conservation status of the majority of invertebrates in this bioregion is not known.

8.3.1.3 **DEMERSAL FISH SPECIES**

Demersal fish are those species that live and feed on or near the seabed. As many as 110 species of bony and cartilaginous fish have been identified in the demersal communities on the continental shelf of the West Coast (Roel 1987). Changes in fish communities occur both latitudinally (Shine 2006, 2008; Yemane *et al*. 2015) and with increasing depth (Roel 1987; Smale *et al*. 1993; Macpherson & Gordoa 1992; Bianchi *et al*. 2001; Atkinson 2009; Yemane *et al*. 2015), with the most substantial change in species composition occurring in the shelf break region between 300 m and 400 m depth (Roel 1987; Atkinson 2009). The shelf community (<380 m) is dominated by the Cape hake M. capensis, and includes jacopever *Helicolenus dactylopterus*, Izak catshark *Holohalaelurus regain*, soupfin shark *Galeorhinus galeus* and whitespotted houndshark *Mustelus palumbes*. The more diverse deeper water community is dominated by the deepwater hake *Merluccius paradoxus*, monkfish *Lophius vomerinus*, kingklip *Genypterus capensis*, bronze whiptail *Lucigadus ori* and hairy conger *Bassanago albescens* and various squalid shark species. There is some degree of species overlap between the depth zones.

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

The diversity and distribution of demersal cartilaginous fishes on the West Coast is discussed by Compagno *et al*. (1991). The species that may occur in the general project area and on the continental shelf inshore thereof, and their approximate depth range, are listed in Table 6. Details on demersal cartilaginous species beyond the shelf break and in the Deep Water Orange Basin area are lacking, however. The distribution of some of these species was provided in Harris *et al*. (2022) (Figure 28 and Figure 29).

There is limited information about bathyal fish communities in South Africa. South Africa defines its bathyal zone as extending from 500 m to 3 500 m, recognising an upper slope (500-1 000 m), mid slope (1 000-1 800 m) and lower slope (1 800-3 500 m). Typical upper slope fishes (200-2 000 m) include rattails (Macrouridae), tripod and grideyefish (Ipnopidae), greeneyes (*Chlorophthalmus species*), oreos, notacanthids, halosaurs, chimaeras, skates, bythitids such as Cataetyx spp. and morids (deepsea cods) (Smith & Heemstra 2003). Rattails, bythitids, liparidids (snail fishes) and notacanthids (Polyacanthonotus species and halosaurs) are characteristic of the lower bathyal (see also Iwamoto & Anderson 1994; Jones 2014).

Table 7: Demersal cartilaginous species found on the continental shelf along the West Coast, with approximate depth range at which the species occurs (Pisces, 2023).

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Frilled shark	*Chlamydoselachus anguineus*	200-1 000	LC
Six gill cowshark	*Hexanchus griseus*	150-600	NT
Gulper shark	*Centrophorus granulosus*	480	EN
Leafscale gulper shark	*Centrophorus squamosus*	370-800	EN
Bramble shark	*Echinorhinus brucus*	55-285	EN
Black dogfish	*Centroscyllium fabricii*	>700	LC
Portuguese shark	*Centroscymnus coelolepis*	>700	NT
Longnose velvet dogfish	*Centroscymnus crepidater*	400-700	NT
Birdbeak dogfish	*Deania calcea*	400-800	NT
Arrowhead dogfish	*Deania profundorum*	200-500	NT
Longsnout dogfish	*Deania quadrispinosa*	200-650	VU
Sculpted lanternshark	*Etmopterus brachyurus*	450-900	DD
Brown lanternshark	*Etmopterus compagnoi*	450-925	LC
Giant lanternshark	*Etmopterus granulosus*	>700	LC
Smooth lanternshark	*Etmopterus pusillus*	400-500	LC
Spotted spiny dogfish	*Squalus acanthias*	100-400	VU
Shortnose spiny dogfish	*Squalus megalops*	75-460	LC
Shortspine spiny dogfish	*Squalus mitsukurii*	150-600	EN
Sixgill sawshark	*Pliotrema warreni*	60-500	LC
Goblin shark	*Mitsukurina owstoni*	270-960	LC
Smalleye catshark	*Apristurus microps*	700-1 000	LC

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Saldanha catshark	*Apristurus saldanha*	450-765	LC
“grey/black wonder” catsharks	*Apristurus* spp.	670-1 005	LC
Tigar catshark	*Halaelurus natalensis*	50-100	VU
Izak catshark	*Holohalaelurus regani*	100-500	LC
Yellowspotted catshark	*Scyliorhinus capensis*	150-500	NT
Soupfin shark/Vaalhaai	*Galeorhinus galeus*	<10-300	CR (EN)
Houndshark	*Mustelus mustelus*	<100	EN (DD)
Whitespotted houndshark	*Mustelus palumbes*	>350	LC
Little guitarfish	*Rhinobatos annulatus*	>100	VU (LC)
Atlantic electric ray	*Torpedo nobiliana*	120-450	LC
African softnose skate	*Bathyraja smithii*	400-1 020	LC
Smoothnose legskate	*Cruriraja durbanensis*	>1 000	DD
Roughnose legskate	*Cruriraja parcomaculata*	150-620	LC
African dwarf skate	*Neoraja stehmanni*	290-1 025	LC
Thorny skate	*Raja radiata*	50-600	VU
Bigmouth skate	*Raja robertsi*	>1 000	LC
Slime skate	*Dipturus pullopunctatus*	15-460	LC
Rough-belly skate	*Raja springeri*	85-500	LC
Yellowspot skate	*Raja wallacei*	70-500	VU
Roughskin skate	*Dipturus trachydermus*	1 000-1 350	EN
Biscuit skate	*Raja clavata*	25-500	NT
Munchkin skate	*Rajella caudaspinosa*	300-520	LC
Bigthorn skate	*Raja confundens*	100-800	LC
Ghost skate	*Rajella dissimilis*	420-1 005	LC
Leopard skate	*Rajella leopardus*	300-1 000	LC
Smoothback skate	*Rajella ravidula*	500-1 000	LC
Spearnose skate	*Rostroraja alba*	75-260	EN
St Joseph	*Callorhinchus capensis*	30-380	LC (LC)

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Cape chimaera	*Chimaera notafricana*	680-1 000	LC
Brown chimaera	*Chimaera carophila*	420-850	LC
Spearnose chimaera	*Rhinochimaera atlantica*	650-960	LC

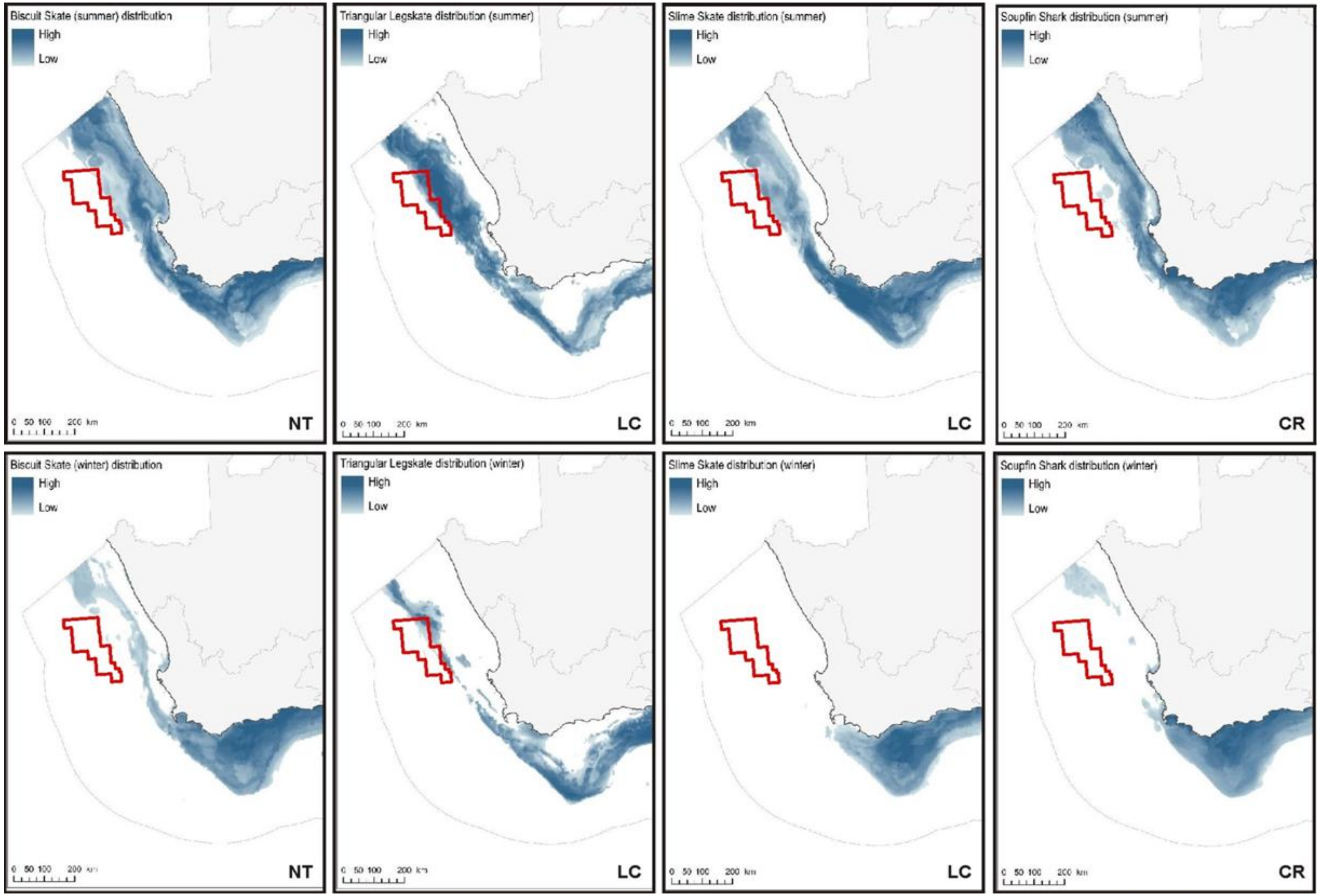


Figure 28: The summer (top) and winter (bottom) distribution of biscuit skate, triangular legskate,slime skate and soupfin shark in relation to Block 3B/4B (red polygon) (adapted from Harris *et al*. 2022). The IUCN conservation status is provided.

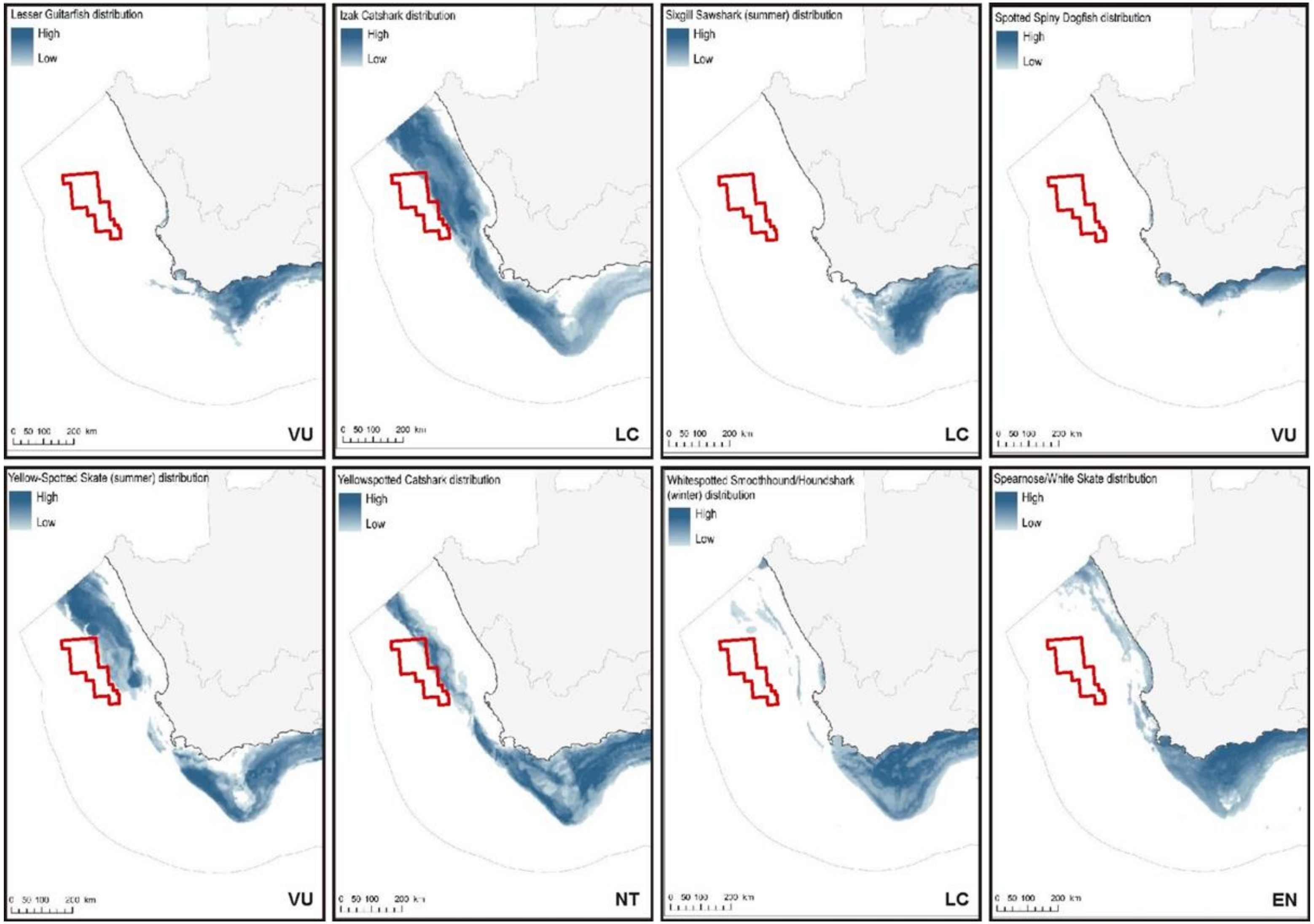


Figure 29: The distribution of various cartilaginous species mentioned in Table 6 in relation to Block 3B/4B (red polygon) (adapted from Harris *et al*. 2022). The IUCN conservation status is provided.

8.3.1.4 SEAMOUNT AND SUBMARINE CANYON COMMUNITIES

Features such as banks, knolls and seamounts (referred to collectively here as "seamounts"), which protrude into the water column, are subject to, and interact with, the water currents surrounding them. The effects of such seabed features on the surrounding water masses can include the up-welling of relatively cool, nutrient-rich water into nutrient-poor surface water thereby resulting in higher productivity (Clark *et al.* 1999), which can in turn strongly influences the distribution of organisms on and around seamounts. Evidence of enrichment of bottom-associated communities and high abundances of demersal fishes has been regularly reported over such seabed features.

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

Such complex benthic ecosystems in turn enhance foraging opportunities for many other predators, serving as mid-ocean focal points for a variety of pelagic species with large ranges (turtles, tunas and billfish, pelagic sharks, cetaceans and pelagic seabirds) that may migrate large distances in search of food or may only congregate on seamounts at certain times (Hui 1985; Haney *et al.* 1995). Seamounts thus serve as feeding grounds, spawning and nursery grounds and possibly navigational markers for a large number of species (SPRFMA 2007; Derville *et al.* 2020).

Enhanced currents, steep slopes and volcanic rocky substrata, in combination with locally generated detritus, favour the development of suspension feeders in the benthic communities characterising seamounts (Rogers 1994). Deep- and cold-water corals (including stony corals, black corals and soft corals) are a prominent component of the suspension-feeding fauna of many seamounts, accompanied by barnacles, bryozoans, polychaetes, molluscs, sponges, sea squirts, basket stars, brittle stars and crinoids (reviewed in Rogers 2004). There is also associated mobile benthic fauna that includes echinoderms (sea urchins and sea cucumbers) and crustaceans (crabs and lobsters) (reviewed by Rogers 1994; Kenyon *et al.* 2003). Some of the smaller cnidarians species remain solitary while others form reefs thereby adding structural complexity to otherwise uniform seabed habitats.

Consequently, the fauna of seamounts is usually highly unique and may have a limited distribution restricted to a single geographic region, a seamount chain or even a single seamount location (Rogers *et al.* 2008). As a result of conservative life histories (*i.e*. very slow growing, slow to mature, high longevity, low fecundity and unpredictable recruitment) and sensitivity to changes in environmental conditions, such biological communities have been identified as Vulnerable Marine Ecosystems (VMEs). They are recognised as being particularly sensitive to anthropogenic disturbance (primarily deep-water trawl fisheries and mining), and once damaged are very slow to recover, or may never recover (FAO 2008).

Geological features of note within the broader project area are Child's Bank and Tripp Seamount, with an unnamed seamount located in ~3 500 m at ~32°20'S; 13°30'E, as well as the Cape Canyon and Cape Point Valley. Child's Bank, which is situated at about 31°S, was described by Dingle *et al.* (1987) to be a carbonate mound (bioherm). The top of this feature is a sandy plateau with dense aggregations of brittle stars, while the steeper slopes have dense invertebrate assemblages including unidentified cold-water corals/rugged limestone feature, bounded at outer edges by precipitous cliffs at least 150 m high (Birch & Rogers 1973). Composed of sediments and the calcareous deposits from an accumulation of carbonate skeletons of sessile organisms (e.g. cold-water coral, foraminifera or marl), such features typically have topographic relief, forming isolated seabed knolls in otherwise low profile homogenous seabed habitats (Kopaska-Merkel & Haywick 2001; Kenyon *et al.* 2003, Wheeler *et al.* 2005, Colman *et al.* 2005). Tripp Seamount situated at about 29°40'S, lies ~110 km north of the northern boundary of the survey area. It rises from the seabed at ~1 000 m to a depth of 150 m and roughly circular with a flat apex that drops steeply on all sides. There is reference to decapods crustaceans from Tripp Seamount (Kensley 1980, 1981) and exploratory deepwater trawl fishing (Hampton 2003), but otherwise knowledge of benthic communities characterising this seamount is lacking.

The Cape Rise comprises a group of NE-SW trending seamounts – the Southeast Atlantic Seamounts - which include Argentina and Protea Seamounts and the recently discovered Mount Marek. These rise up from over -2 500 m depth in the Cape Basin abyss to 700 m deep. Other than a geoscience survey conducted in 1986 using a deep water camera to sample the lower bathyal and abyssal zones, including the seamount flanks, of the Cape Basin (Rogers 1986) no biodiversity surveys are known to have been conducted at Protea and Argentina seamounts. Southern Africa's seamounts and their associated benthic communities have not been sampled by either geologists or biologists (Sink & Samaai 2009) and little is known about the benthic and neritic communities associated with them.

A recent study reporting on the megabenthos and benthopelagic fish on the Southeast Atlantic Seamounts (Bergstad *et al.* 2019) over 250 km to the southeast of the licence area, provides descriptions of the Erica and Schmitt-Ott Seamounts that lie approximately 450 – 500 km southwest of the Argentina Seamount and rise from the surrounding abyss to depths of 770 m and 920 m, respectively. Corals were the most frequent and widespread sessile invertebrate recorded on video transects, dominated by gorgonians whose abundance increased towards the seamount summits. Scleractinian and hydrocorals were also observed as was a diversity of sponges, echinoderms and crustaceans. Fish associated with the seamount included oreo dories, grenadiers and lantern shark. Similar communities might therefore be expected from the seamounts to the west of the licence area.

During 2016-2018 the Department of Environmental Affairs: Oceans and Coast Branch (DEA: O&C) undertook research cruises to explore some of the undocumented areas of seabed off the West Coast, among them the Cape Canyon. Using tow-cameras, benthic grabs and dredges, the biota of the canyon head to -500 m depth were sampled (Figure 30). A diversity of echinoderms, molluscs, and crustaceans were reported to dominate the canyon head, while scavengers such as ophuiroidea and decapoda were prevalent within habitats ranging from sandy areas, to patches of inshore and offshore mud belts. At depths of <100 m inshore of the canyon head, boulder beds hosted gorgonian and stylasterine corals.

The concept of a 'Vulnerable Marine Ecosystem' (VME) centres upon the presence of distinct, diverse benthic assemblages that are limited and fragmented in their spatial extent and dominated (in terms of biomass and/or spatial cover) by rare, endangered or endemic component species that are physically fragile and vulnerable to damage (or structural/biological alteration) by human activities (Parker *et al.* 2009; Auster *et al.* 2011; Hansen *et al.* 2013).

VMEs are known to be associated with higher biodiversity levels and indicator species that add structural complexity, resulting in greater species abundance, richness, biomass and diversity compared to surrounding uniform seabed habitats (Buhl-Mortensen *et al.* 2010; Hogg *et al.* 2010; Barrio Froján *et al.* 2012; Beazley *et al.* 2013, 2015). Compared to the surrounding deep-sea environment, VMEs typically form biological hotspots with a distinct, abundant and diverse fauna, many species of which remain unidentified. Levels of endemism on VMEs are also relatively high compared to the deep sea. The coral frameworks offer refugia for a great variety of invertebrates and fish (including commercially important species) within, or in association with, the living and dead coral framework thereby creating spatially fragmented areas of high biological diversity. The skeletal remains of Scleractinia coral rubble and Hexactinellid poriferans can also represent another important deep-sea habitat, acting to stabilise seafloor sediments allowing for colonisation by distinct infaunal taxa that show elevated abundance and biomass in such localised habitats (Bett & Rice 1992; Raes & Vanreusel 2005; Beazley *et al.* 2013; Ashford *et al.* 2019).

VMEs are also thought to contribute toward the long-term viability of a stock through providing an important source of habitat for commercial species (Pham *et al.* 2015; Ashford *et al.* 2019). They can provide a wide range of ecosystem services ranging from provision of aggregation- and spawning sites to providing shelter from predation and adverse hydrological conditions (Husebø & Nøttestad *et al.* 2002; Krieger & Wing, 2002; Tissot *et al.*, 2006; Baillon *et al.* 2012; Pham *et al.* 2015). Indicator taxa for VMEs are also known to provide increased access to food sources, both directly to associated benthic fauna, and indirectly to other pelagic species such as fish and other predators due to the high abundance and biomass of associated fauna (Krieger & Wing, 2002; Husebø & Nøttestad *et al.* 2002; Buhl-Mortensen *et al*, 2010; Hogg *et al.*, 2010; Auster *et al.* 2011).

Figure 30: Deep water benthic macrofauna from various depths in the Cape Canyon (Source: www.environment.gov.za/dearesearchteamreturnfromdeepseaexpedition).

VME frameworks are typically elevated from the seabed, increasing turbulence and raising supply of suspended particles to suspension feeders (Krieger & Wing 2002; Buhl-Mortensen & Mortensen 2005; Buhl-Mortensen *et al.* 2010). Poriferans and cold-water corals have further been shown to provide a strong link between pelagic and benthic food webs (Pile & Young 2006; Cathalot *et al.* 2015). VMEs are increasingly being recognised as providers of important ecosystem services due to associated increased biodiversity and levels of ecosystem functioning (Ashford *et al.* 2019).

It is not always the case that seamount habitats are VMEs, as some seamounts may not host communities of fragile animals or be associated with high levels of endemism. Evidence from video footage taken on hard-substrate habitats in 100 - 120 m depth off southern Namibia and to the south-east of Child's Bank (De Beers Marine, unpublished data) (Figure 31), and in 190-527 m depth on Child's Bank (Sink *et al.* 2019) suggest that vulnerable communities including gorgonians, octocorals and reef-building sponges and hard-corals do occur on the continental shelf, some of which are thought to be Vulnerable Marine Ecosystem (VME) indicator species (Table 8). The distribution of 22 potential VME indicator taxa for the South African EEZ was recently mapped, with those from the West Coast listed in Table 8 (Atkinson & Sink 2018; Sink *et al.* 2019).

Figure 31: Gorgonians and bryozoans communities recorded on deep-water reefs (100-120 m) off the southern African West Coast (Photos: De Beers Marine).

Table 8: Potential VME species from the continental shelf and shelf edge on the West Coast (Atkinson & Sink 2018)

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

As sampling beyond 1 000 m depth has not taken place (Atkinson & Sink 2018) it is not known whether similar communities may be expected in Block 3B/4B. The distribution of known and potential Vulnerable Marine Ecosystem habitat based on potential VME features, DFFE and SAEON trawl survey data, and many visual surveys indicating the presence of indicator taxa were mapped by Harris *et al*. 2022 (Figure 32). Some sites need more research to determine their status. The location of Block 3B/4B is offshore of these known and potential VMEs emphasising the gaps in our knowledge specific to the vulnerability of marine communities of abyssal habitats.

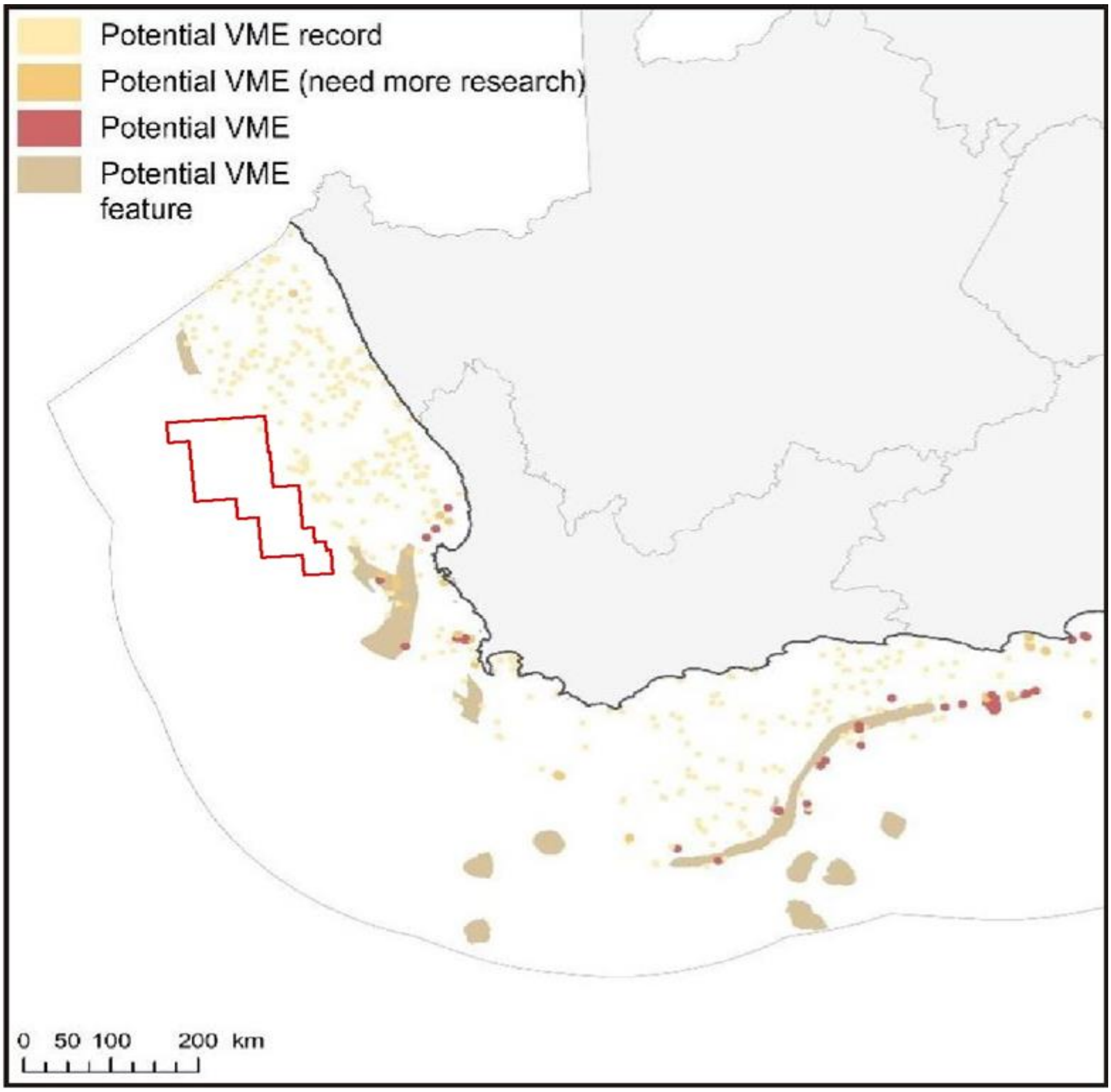


Figure 32: Block 3B/4B (red polygon) in relation to the distribution of known and potential Vulnerable Marine Ecosystem habitat (adapted from Harris *et al*. 2022).

Sediment samples collected at the base of Norwegian cold-water coral reefs revealed high interstitial concentrations of light hydrocarbons (methane, propane, ethane and higher hydrocarbons C4+) (Hovland & Thomsen 1997), which are typically considered indicative of localised light hydrocarbon micro-seepage through the seabed. Bacteria and other micro-organisms thrive on such hydrocarbon pore-water seepages, thereby providing suspension-feeders, including corals and gorgonians, with a substantial nutrient source. Some scientists believe there is a strong correlation between the occurrence of deep-water coral reefs and the relatively high values of light hydrocarbons (methane, ethane, propane and n-butane) in near-surface sediments (Hovland *et al.* 1998, Duncan & Roberts 2001, Hall-Spencer *et al.* 2002, Roberts & Gage 2003). A recent study by January (2018) identified that hydrocarbon seeps and gas escape structures have been identified in the Orange Basin area. Large fluid seep/pockmark fields of varying morphologies were also reported by Palan (2017) to the south of Block 3B/4B.

8.3.2 PELAGIC COMMUNITIES

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

8.3.2.1 PLANKTON

Plankton is particularly abundant in the shelf waters off the West Coast, being associated with the upwelling characteristic of the area. Plankton range from single-celled bacteria to jellyfish of 2 m diameter, and include bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton (Figure 33).

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

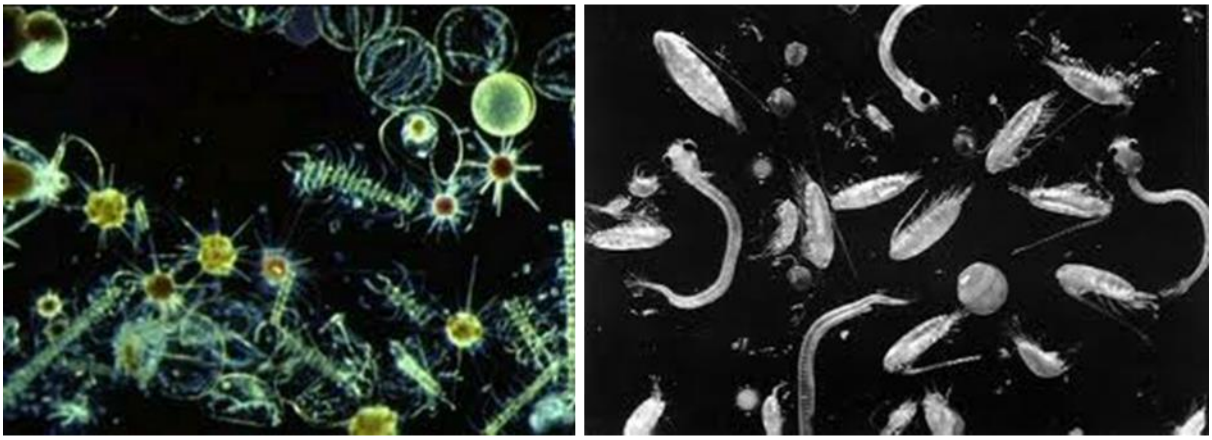


Figure 33: Phytoplankton (left, photo: hymagazine.com) and zooplankton (right, photo: mysciencebox.org) is associated with upwelling cells.

Red tides are ubiquitous features of the Benguela system (see Shannon & Pillar, 1986). The most common species associated with red tides (dinoflagellate and/or ciliate blooms) are *Noctiluca scintillans*, *Gonyaulax tamarensis*, *G. polygramma* and the ciliate *Mesodinium rubrum*. *Gonyaulax* and *Mesodinium* have been linked with toxic red tides. Most of these red-tide events occur quite close inshore although Hutchings *et al.* (1983) have recorded red-tides 30 km offshore. They are unlikely to occur in the offshore regions of Block 3B/4B.

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

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

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

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

Although ichthyoplankton (fish eggs and larvae) comprise a minor component of the overall plankton, it remains significant due to the commercial importance of the overall fishery in the region. Various pelagic and demersal fish species are known to spawn in the inshore regions of the southern Benguela, (including pilchard, round herring, chub mackerel lanternfish and hakes (Crawford *et al.* 1987; Hutchings 1994; Hutchings *et al.* 2002) (see Figure 34, Figure 35 and Figure 36, and Figure 37), and their eggs and larvae form an important contribution to the ichthyoplankton in the region. Spawning of key species is presented below.

- Hake, snoek and round herring move to the western Agulhas Bank and southern west coast to spawn in late winter and early spring (key period), when offshore Ekman losses are at a minimum and their eggs and larvae drift northwards and inshore to the west coast nursery grounds. Figure 36 and Figure 37 highlight the temporal variation in hake eggs and larvae with there being a greater concentration of eggs and larvae between September - October compared to March - April. However, hake are reported to spawn throughout the year (Strømme et al. 2015). Snoek spawn along the shelf break (150-400 m) of the western Agulhas Bank and the West Coast between June and October (Griffiths 2002).
- Horse mackerel spawn over the east/central Agulhas Bank during winter months.
- Sardines spawn on the whole Agulhas Bank during November, but generally have two spawning peaks, in early spring and autumn, on either side of the peak anchovy spawning period (Figure 38, left). There is also sardine spawning on the east coast and even off KwaZulu-Natal, where sardine eggs are found during July–November.
- Anchovies spawn on the whole Agulhas Bank (Figure 38, right), with spawning peaking during mid-summer (November–December) and some shifts to the west coast in years when Agulhas Bank water intrudes strongly north of Cape Point.

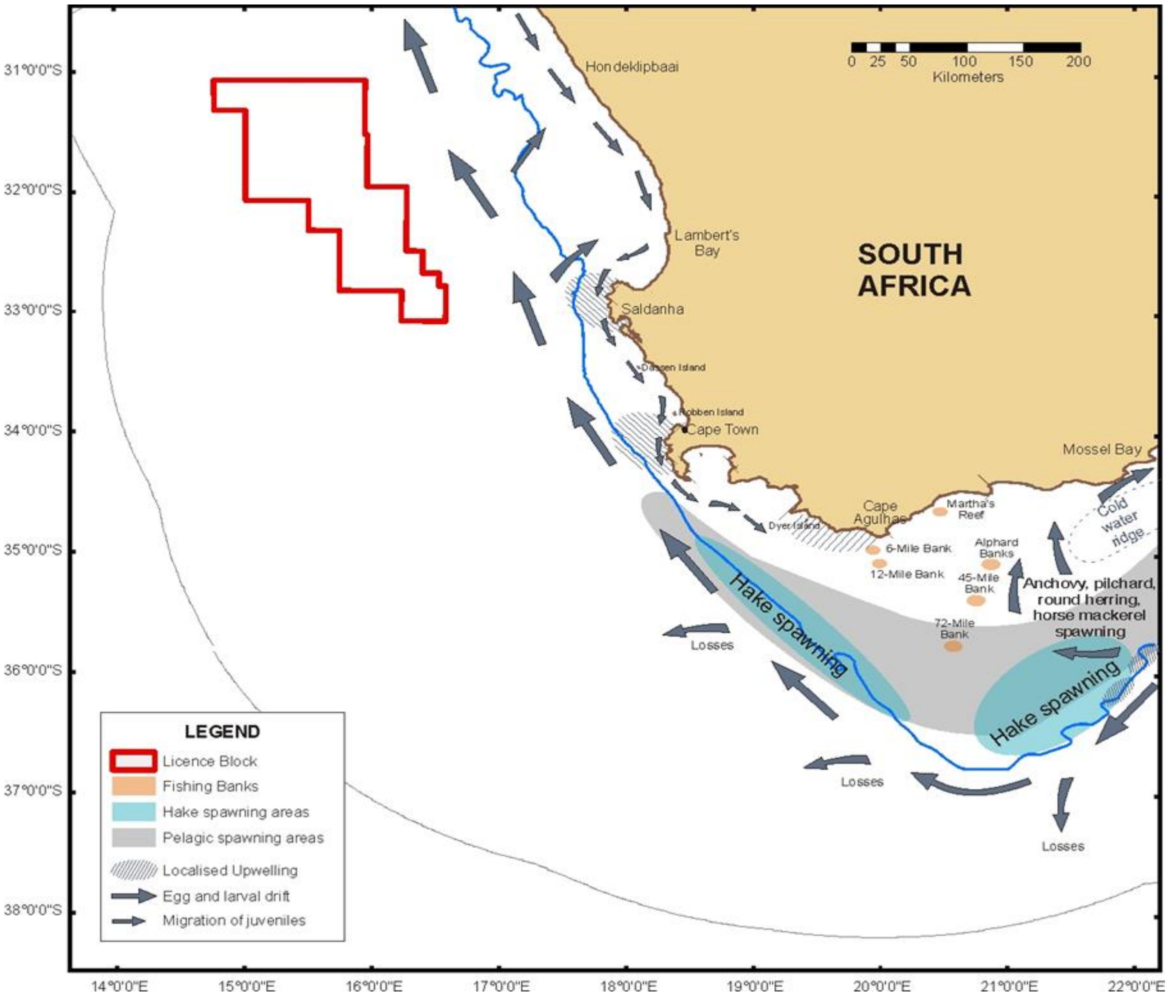


Figure 34: Block 3B/4B (red polygon) in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford *et al*. 1987; Hutchings 1994; Hutchings *et al*. 2002).

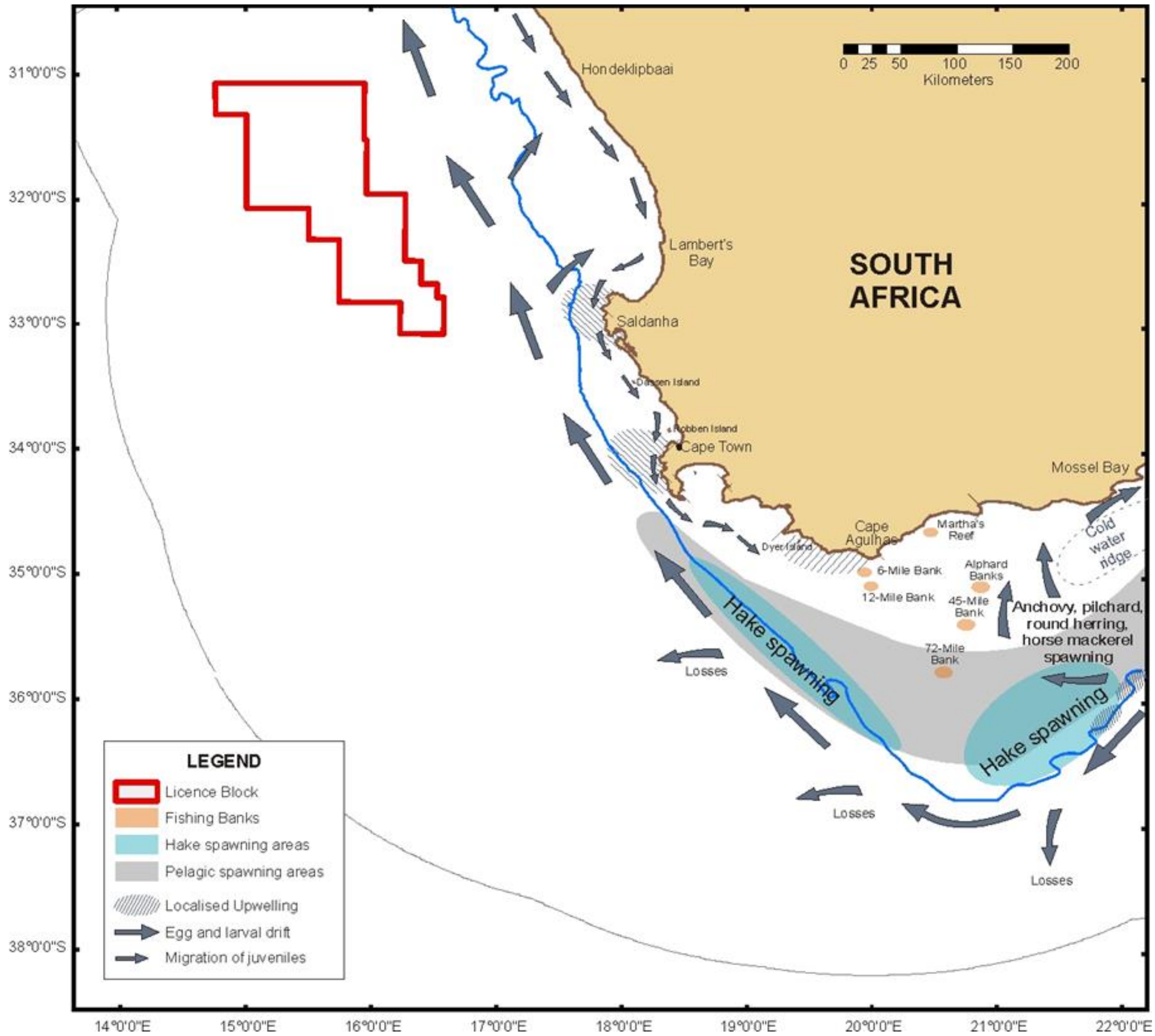


Figure 35: Block 3B/4B (red polygon) in relation to major spawning, recruitment and nursery areas in the southern Benguela region (adapted from Crawford *et al.* 1987; Hutchings 1994; Hutchings *et al.* 2002).

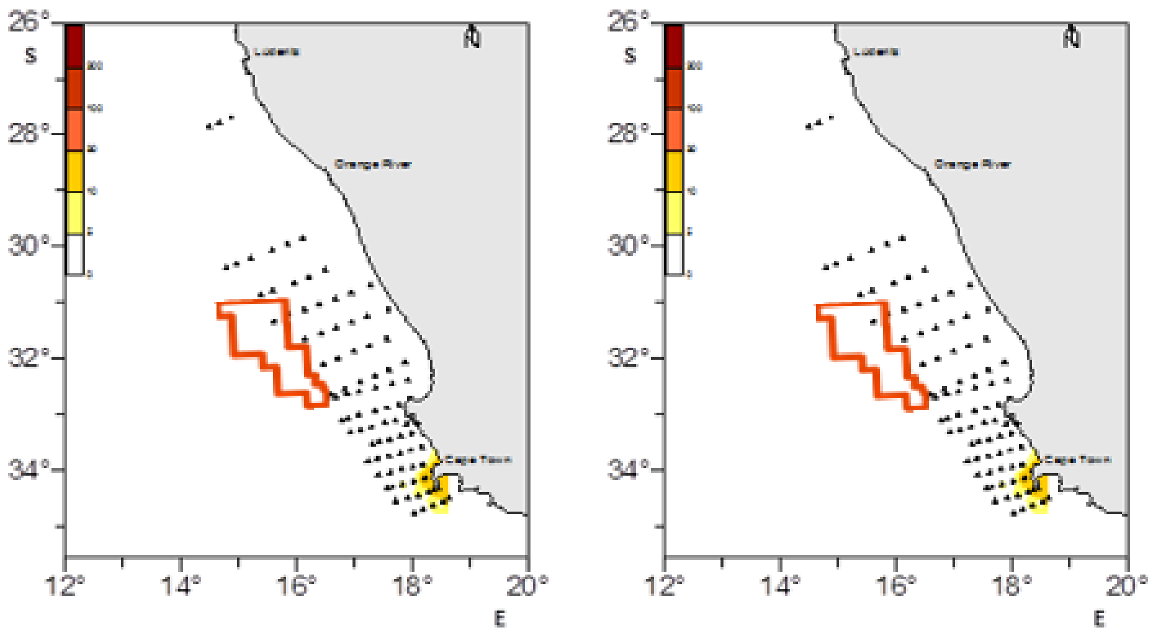


Figure 36: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between September and October 2005 (adapted from Stenevik *et al*. 2008) in relation to Block 3B/4B (red polygon).

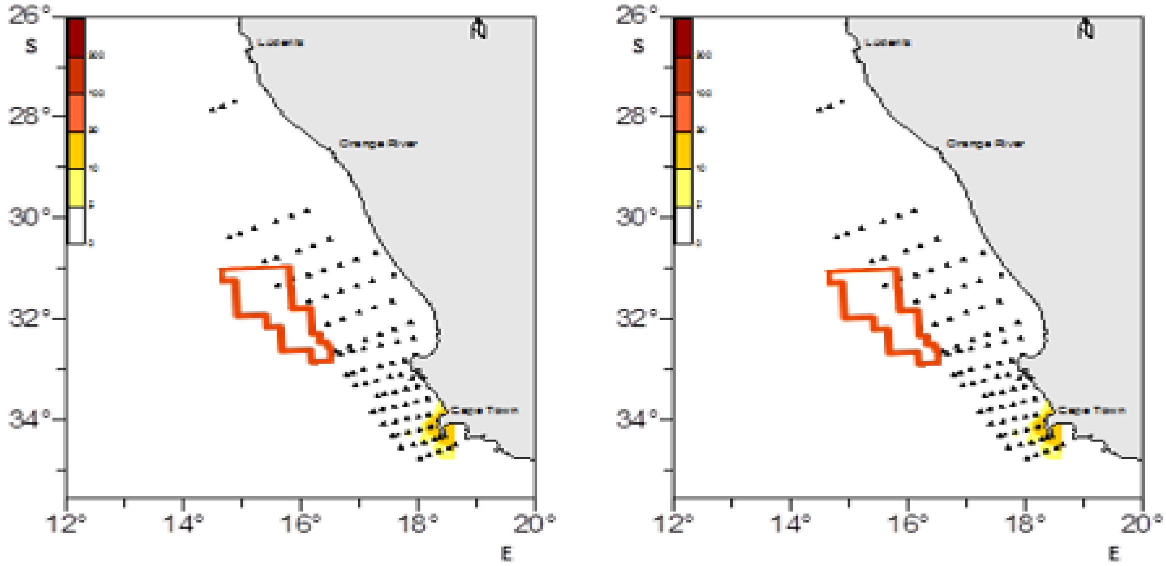


Figure 37: Distribution of hake eggs (left) and larvae (right) off the West Coast of South Africa between March and April 2007 (adapted from Stenevik *et al*. 2008) in relation to Block 3B/4B (red polygon).

The eggs and larvae are carried around Cape Point and up the coast in northward flowing surface waters. At the start of winter every year, the juveniles recruit in large numbers into coastal waters across broad stretches of the shelf between the Orange River and Cape Columbine to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Following spawning, the eggs and larvae of snoek are transported to inshore (<150 m) nursery grounds north of Cape Columbine and east of Danger Point, where the juveniles remain until maturity. There is only limited overlap of the inshore portions of Block 3B/4B with the northward egg and larval drift of commercially important species, and the return migration of recruits (Figure 35). In the offshore oceanic waters of Block 3B/4B, ichthyoplankton abundance is, therefore, expected to be low.

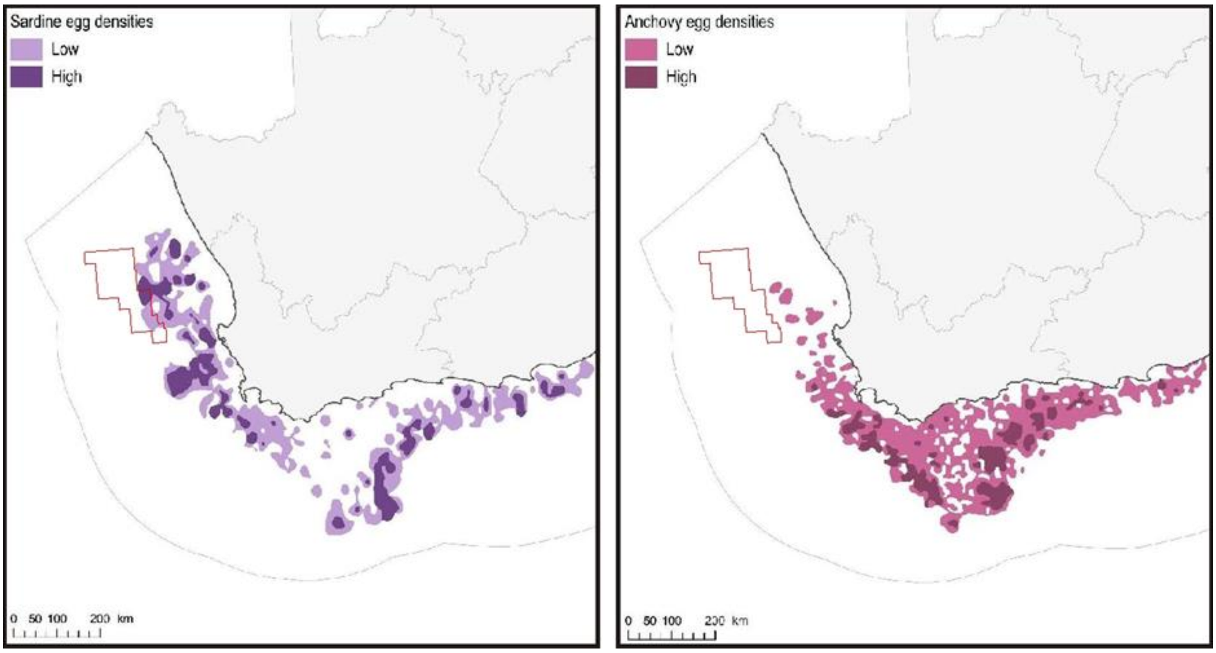


Figure 38: Distribution of sardine (left) and anchovy (right) spawning areas, as measured by egg densities, in relation to Block 3B/4B (red polygon) (adapted from Harris *et al.* 2022).

8.3.2.2 CEPHALOPODS

Fourteen species of cephalopds have been recorded in the southern Benguela, the majority of which are sepiods/cuttlefish (Lipinski 1992; Augustyn *et al.* 1995). Most of the cephalopod resource is distributed on the mid-shelf with *Sepia australis* being most abundant at depths between 60-190 m, whereas *S. hieronis* densities were higher at depths between 110-250 m. *Rossia enigmatica* occurs more commonly on the edge of the shelf to depths of 500 m. Biomass of these species was generally higher in the summer than in winter.

Cuttlefish are largely epi-benthic and occur on mud and fine sediments in association with their major prey item; mantis shrimps (Augustyn *et al.* 1995). They form an important food item for demersal fish.

The colossal squid *Mesonychoteuthis hamiltoni* and the giant squid *Architeuthis* sp. may also be encountered in the project area. Both are deep dwelling species, with the colossal squid's distribution confined to the entire circum-antarctic Southern Ocean Figure 39, top) while the giant squid is usually found near continental and island slopes all around the world's oceans (Figure 39, bottom). Both species could thus potentially occur in the pelagic habitats of the project area, although the likelihood of encounter is extremely low.

Growing to in excess of 10 m in length, they are the principal prey of the sperm whale, and are also taken by beaked whaled, pilot whales, elephant seals and sleeper sharks. Nothing is known of their vertical distribution, but data from trawled specimens and sperm whale diving behaviour suggest they may span a depth range of 300 – 1 000 m. They lack gas-filled swim bladders and maintain neutral buoyancy through an ammonium chloride solution occurring throughout their bodies.

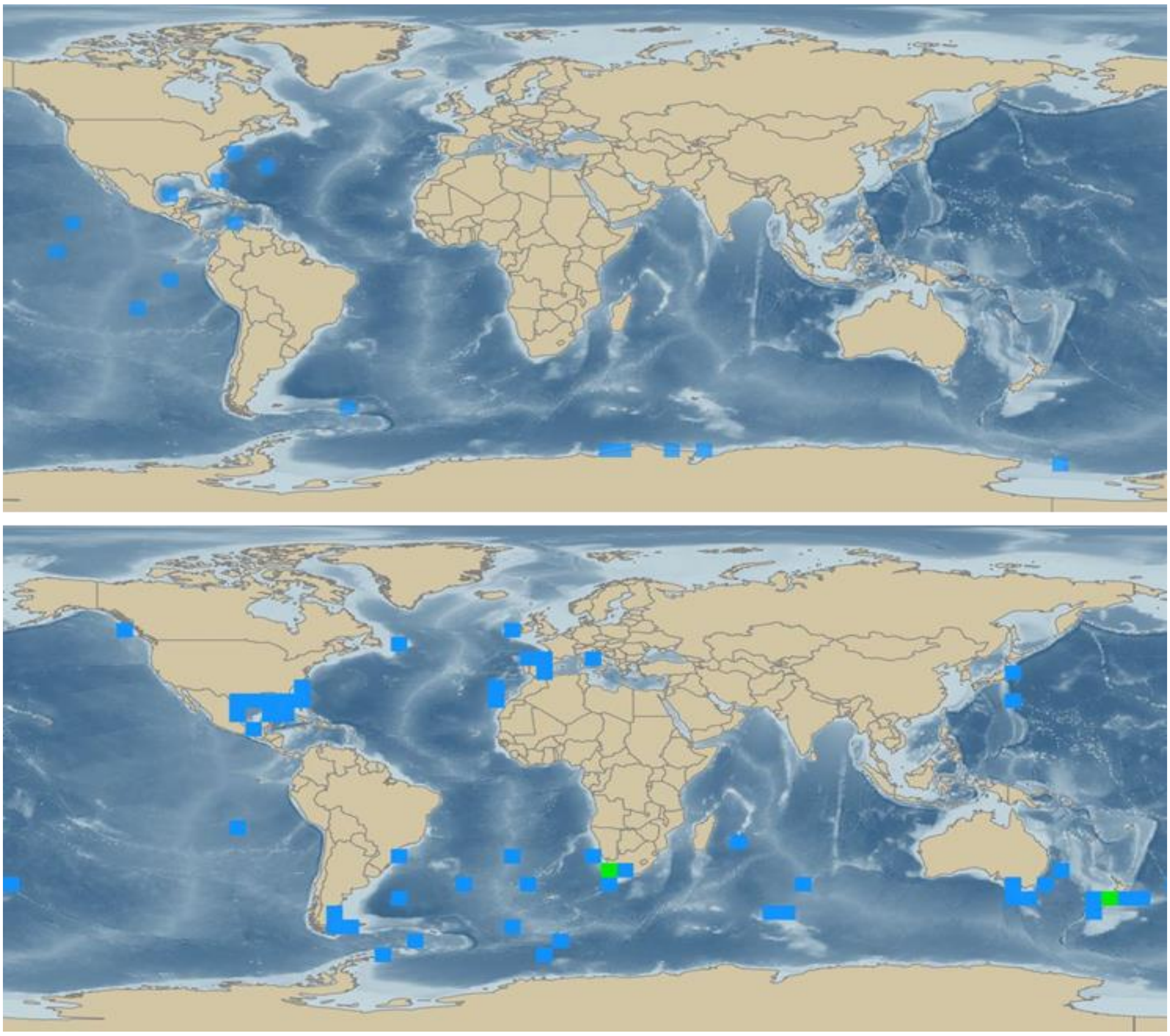


Figure 39: Distribution of the colossal squid (top) and the giant squid (bottom). Blue squares <5 records, green squares 5-10 records (Source: http://iobis.org).

8.3.2.3 PELAGIC FISH

Small pelagic species include the sardine/pilchard (*Sadinops ocellatus*) (Figure 40, left), anchovy (*Engraulis capensis*), chub mackerel (*Scomber japonicus*), horse mackerel (*Trachurus capensis*) (Figure 40). At the start of winter every year, juveniles of most small pelagic shoaling species recruit into coastal waters in large numbers between the Orange River and Cape Columbine. They recruit in the pelagic stage, across broad stretches of the shelf, to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Recruitment success relies on the interaction of oceanographic events and is thus subject to spatial and temporal variability. Consequently, the abundance of adults and juveniles of these small, short-lived (1-3 years) pelagic fish is highly variable both within and between species.

Figure 40: Cape fur seal preying on a shoal of pilchards (left). School of horse mackerel (right) (photos: www.underwatervideo.co.za; www.delivery.superstock.com).

Two species that migrate along the West Coast following the shoals of anchovy and pilchards are snoek *Thyrsites atun* and chub mackerel *Scomber japonicas*. Both these species have been rated as 'Least concern' on the national assessment (Sink *et al.* 2019). While the appearance of chub mackerel along the West and South-West coasts is highly seasonal, adult snoek are found throughout their distribution range and longshore movement are random and without a seasonal basis (Griffiths 2002). Initially postulated to be a single stock that undergoes a seasonal longshore migration from southern Angola through Namibia to the South African West Coast (Crawford & De Villiers 1985; Crawford *et al.* 1987), Benguela snoek are now recognised as two separate sub-populations separated by the Lüderitz upwelling cell (Griffiths 2003). On the West Coast, snoek move offshore to spawn and there is some southward dispersion as the spawning season progresses, with females on the West Coast moving inshore to feed between spawning events as spawning progresses. In contrast, those found further south along the western Agulhas Bank remain on the spawning grounds throughout the spawning season (Griffiths 2002) (Figure 41). They are voracious predators occurring throughout the water column, feeding on both demersal and pelagic invertebrates and fish. Chub mackerel similarly migrate along the southern African West Coast reaching South-Western Cape waters between April and August. They move inshore in June and July to spawn before starting the return northwards offshore migration later in the year. Their abundance and seasonal migrations are thought to be related to the availability of their shoaling prey species (Payne & Crawford 1989). The distribution of snoek and chub mackerel therefore lies well inshore of Block 3B/4B.

The fish most likely to be encountered on the shelf, beyond the shelf break and in the offshore waters of Block 3B/4B are the large migratory pelagic species, including various tunas, billfish and sharks, many of which are considered threatened by the International Union for the Conservation of Nature (IUCN), primarily due to overfishing (Table 9). Tuna and swordfish are targeted by high seas fishing fleets and illegal overfishing has severely damaged the stocks of many of these species. Similarly, pelagic sharks, are either caught as bycatch in the pelagic tuna longline fisheries, or are specifically targeted for their fins, where the fins are removed and the remainder of the body discarded.

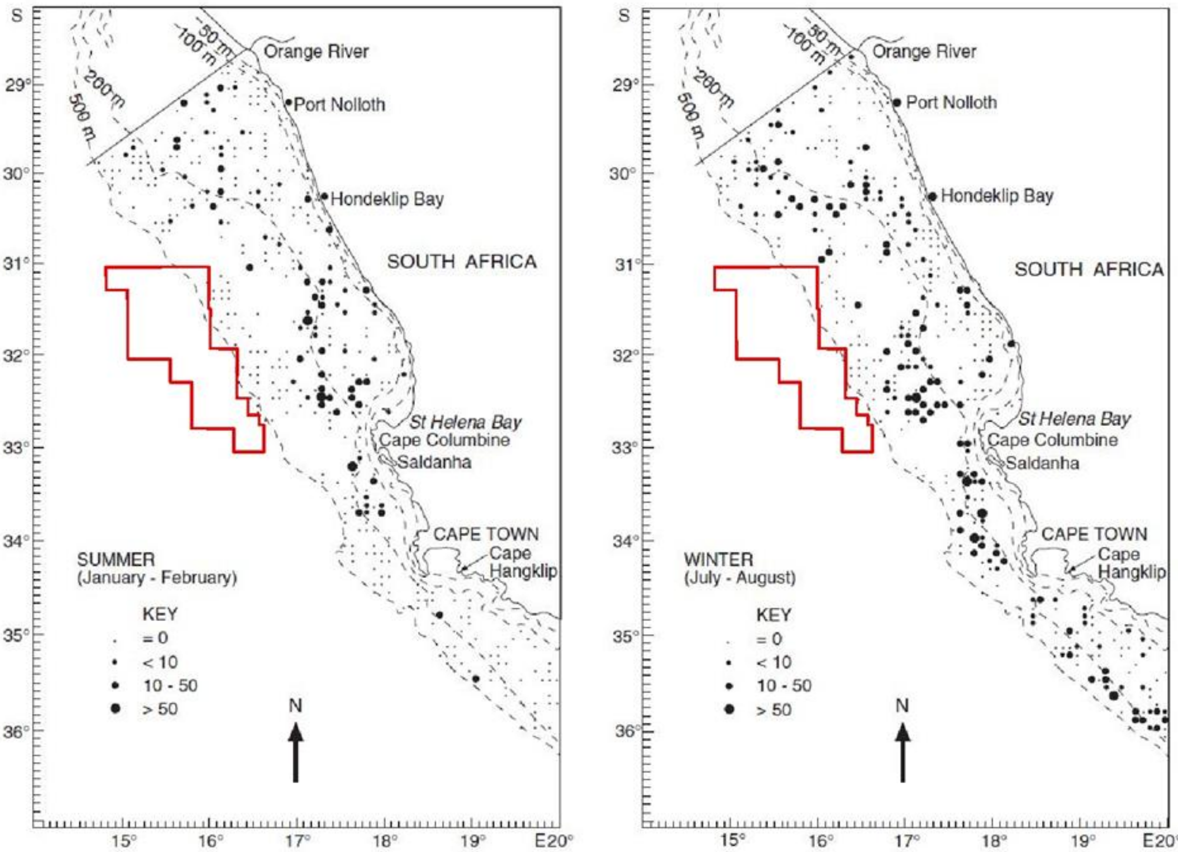


Figure 41: Mean number of snoek per demersal trawl per grid block (5 × 5 Nm) by season for (A) the west coast (July 1985–Jan 1991) and (B) the south coast in relation to Block 3B/4B (red polygon) (Pisces, 2023).

These large pelagic species migrate throughout the southern oceans, between surface and deep waters (>300 m) and have a highly seasonal abundance in the Benguela. Species occurring off western southern Africa include the albacore/longfin tuna *Thunnus alalunga* (Figure 42, right), yellowfin *T. albacares*, bigeye *T. obesus*, and skipjack *Katsuwonus pelamis* tunas, as well as the Atlantic blue marlin *Makaira nigricans* (Figure 42, left), the white marlin *Tetrapturus albidus* and the broadbill swordfish *Xiphias gladius* (Payne & Crawford 1989). The distribution of these species is dependent on food availability in the mixed boundary layer between the Benguela and warm central Atlantic waters. Concentrations of large pelagic species are also known to occur associated with underwater feature such as canyons and seamounts as well as meteorologically induced oceanic fronts (Shannon *et al*. 1989; Penney *et al*. 1992). Seasonal association with Child's Bank and Tripp Seamount occurs between October and June, with commercial catches often peaking in March and April (www.fao.org/fi/fcp/en/NAM/body.htm; see CapMarine 2023 – Fisheries Specialist Study).

Table 9: Some of the more important large migratory pelagic fish likely to occur in the offshore regions of the West Coast (TOPS list under NEMBA, Act 10 of 2004; Sink *et al*. 2019; www.iucnredlist.org;). The National and Global IUCN Conservation Status are also provided. Species reported from Deep Water Orange Basin Area by MMOs are highlighted (CapFish 2013a).

Common Name	Species	National Assessment	IUCN Conservation Status
Tunas			
Southern Bluefin Tuna	*Thunnus maccoyii*	Not Assessed	Endangered
Bigeye Tuna	*Thunnus obesus*	Vulnerable	Vulnerable

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

A number of species of pelagic sharks are also known to occur on the West Coast, including blue *Prionace glauca*, short-fin mako *Isurus oxyrinchus* and oceanic whitetip sharks *Carcharhinus longimanus*. Occurring throughout the world in warm temperate waters, these species are usually found further offshore on the West Coast. Great whites *Carcharodon carcharias* and whale sharks *Rhincodon typus* may also be encountered in coastal and offshore areas, although the latter occurs more frequently along the South and East coasts. The recapture of a juvenile blue shark off Uruguay, which had been tagged off the Cape of Good Hope, supports the hypothesis of a single blue shark stock in the South Atlantic (Hazin 2000; Montealegre-Quijano & Vooren 2010) and Indian Oceans (da Silva *et al*. 2010). Using the Benguela drift in a north-westerly direction, it is likely that juveniles from the parturition off the south-western Cape would migrate through Block 3B/4B *en route* to South America (da Silva *et al.* 2010).

Figure 42: Large migratory pelagic fish such as blue marlin (left) and longfin tuna (right) occur in offshore waters (photos: www.samathatours.com; www.osfimages.com).

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

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

Whale sharks are regarded as a broad ranging species typically occurring in offshore epipelagic areas with sea surface temperatures of 18–32°C (Eckert & Stewart 2001). Adult whale sharks reach an average size of 9.7 m and 9 tonnes, making them the largest non-cetacean animal in the world. They are slow-moving filter-feeders and therefore particularly vulnerable to ship strikes (Rowat 2007). Although primarily solitary animals, seasonal feeding aggregations occur at several coastal sites all over the world, those closest to the project area being off Sodwana Bay in KwaZulu Natal (KZN) (Cliff *et al.* 2007). Satellite tagging has revealed that individuals may travel distances of tens of 1 000s of kms (Eckert & Stewart 2001; Rowat & Gore 2007; Brunnschweiler *et al.* 2009). On the West Coast their summer and winter distributions are centred around the Orange River mouth and between Cape Columbine and Cape Point (Harris *et al*. 2022). The likelihood of an encounter in the offshore waters of Block 3B/4B is relatively low.

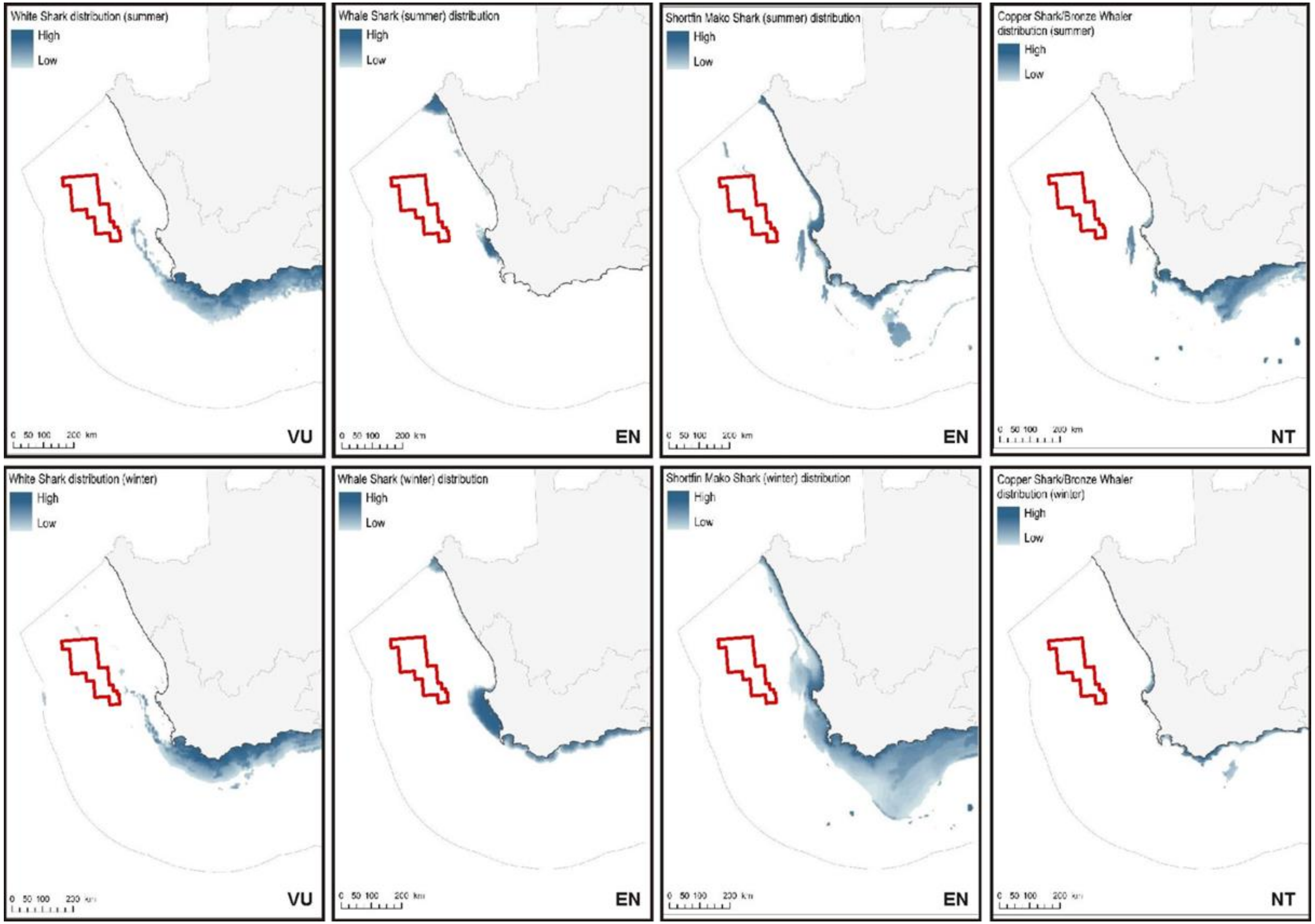


Figure 43: The summer (top) and winter (bottom) distribution of white shark, whale shark, shortfin mako and bronze whaler shark in relation to Block 3B/4B (red polygon) (adapted from Harris *et al.* 2022).

The whale shark and shortfin mako are listed in Appendix II (species in which trade must be controlled in order to avoid utilization incompatible with their survival) of CITES (Convention on International Trade in Endangered Species) and Appendix I and/or II of the Bonn Convention for the Conservation of Migratory Species (CMS). The whale shark is also listed as 'vulnerable' in the List of Marine Threatened or Protected Species (TOPS) as part of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA). The distributions of some of the pelagic sharks (Great white, Bronze whaler, shortfin mako and whale shark) were provided in Harris *et al.* (2022) (Figure 43).

8.3.2.4 **3.3.3.4 TURTLES**

Three species of turtle occur along the West Coast, namely the Leatherback (*Dermochelys coriacea*) (Figure 44, left), and occasionally the Loggerhead (*Caretta caretta*) (Figure 44, right) and the Green (*Chelonia mydas*) turtle. Green turtles are non-breeding residents often found feeding on inshore reefs on the South and East Coasts and are expected to occur only as occasional visitors along the West Coast. The most recent conservation status, which assessed the species on a sub-regional scale, is provided in Table 10.

Figure 44: Leatherback (left) and loggerhead turtles (right) occur along the West Coast of Southern Africa (Photos: Ketos Ecology 2009; www.aquaworld-crete.com).

Table 10: Global and Regional Conservation Status[1] of the turtles occurring off the West Coast showing variation depending on the listing used.

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

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

[1] NT – Near Threatened; V – Vulnerable; E – Endangered; CR – Critically Endangered; DD – Data Deficient; UR – Under Review; * - not yet assessed.

Cape Agulhas (Harris *et al.* 2018; Robinson *et al.* 2018). A sighting of a Loggerhead turtle in the Deep Water Orange Basin Area has, however, been reported by an MMO (CapFish 2013a). The Leatherback is the turtle most likely to be encountered in the offshore waters of west South Africa. The Benguela ecosystem, especially the northern Benguela where jelly fish numbers are high, is increasingly being recognized as a potentially important feeding area for leatherback turtles from several globally significant nesting populations in the south Atlantic (Gabon, Brazil) and south east Indian Ocean (South Africa) (Lambardi *et al.* 2008, Elwen & Leeney 2011; SASTN 2011[2]). Leatherback turtles from the east South Africa population have been satellite tracked swimming around the west coast of South Africa and remaining in the warmer waters west of the Benguela ecosystem (Lambardi *et al.* 2008; Robinson *et al.* 2018) (Figure 45).

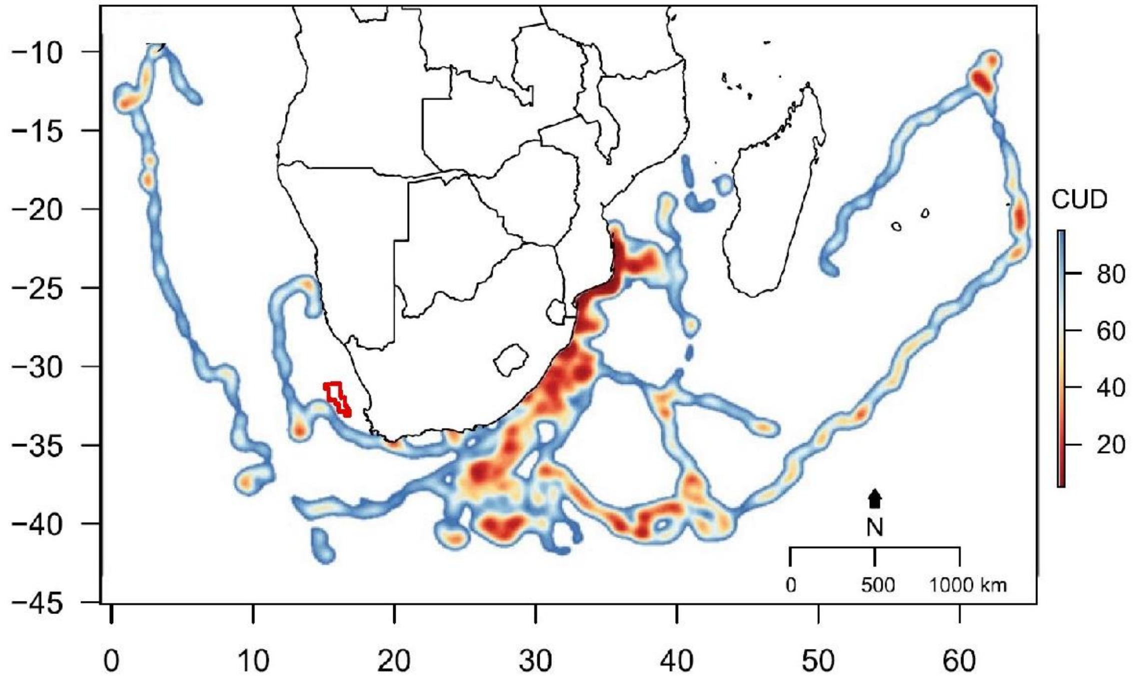


Figure 45: Block 3B/4B (red polygon) in relation to the migration corridors of leatherback turtles in the south-western Indian Ocean. Relative use (CUD, cumulative utilization distribution) of corridors is shown through intensity of shading: light, low use; dark, high use (adapted from Harris *et al.* 2018).

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

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

8.3.2.5 **SEABIRDS**

Large numbers of pelagic seabirds exploit the pelagic fish stocks of the Benguela system. Of the 49 species of seabirds that occur in the Benguela region, 15 are defined as resident, 10 are visitors from the northern hemisphere and 25 are migrants from the southern Ocean. The species classified as being common in the southern Benguela, and likely to occur in Block 3B/4B, are listed in Table 11. The area between Cape Point and the Orange River supports 38% and 33% of the overall population of pelagic seabirds in winter and summer, respectively. Most of the pelagic species in the region reach highest densities offshore of the shelf break (200 – 500 m depth) and are therefore likely to occur in the proposed AOI, with highest population levels during their non-breeding season (winter). Pintado petrels and Prion spp. show the most marked variation here. Support vessels and possible helicopter flights may, however, encounter more coastal seabirds when *en route* between the drilling unit and the port or airport. On the South Coast, 60 seabird species are known, or thought likely to occur. These can be categorised into three categories: 'breeding resident species', 'non-breeding migrant species' and 'rare vagrants' (Shaughnessy 1977; Harrison 1978; Liversidge & Le Gras 1981; Ryan & Rose 1989).

Fifteen species of seabirds breed in southern Africa, including Cape Gannet (Figure 46, left), African Penguin (Figure 46, right), African Black Oystercatcher, four species of Cormorant, White Pelican, three Gull and four Tern species (Table 12). The breeding areas are distributed around the coast with islands being especially important. The closest breeding islands to Block 3B/4B are Bird Island in Lambert's Bay, the Saldanha Bay islands, Dassen Island, Robben Island and Seal Island approximately 180 km, 130 km, 145 km, 190 km and 225 km to the east and southeast of the southern section of Block 3B/4B, respectively. The number of successfully breeding birds at the particular breeding sites varies with food abundance. Most of the breeding seabird species forage at sea with most birds being found relatively close inshore (10-30 km). Cape Gannets, which breed at only three locations in South Africa (Bird Island Lamberts Bay, Malgas Island and Bird Island Algoa Bay) are known to forage within 200 km offshore (Dundee 2006; Ludynia 2007; Grémillet *et al.* 2008; Crawford *et al.* 2011), and African Penguins have also been recorded as far as 60 km offshore. Block 3B/4B lies on the western extent of Cape Gannet foraging and distribution areas and well offshore of African Penguin foraging and distribution areas but overlaps with the foraging ranges of various pelagic bird species, particularly Wandering Albatross and Atlantic, Yellow-nosed Albatross (Figure 47). Cape Cormorant and Bank Cormorant core usage areas lie well inshore of Block 3B/4B (BirdLife South Africa 2021; Harris *et al.* 2022).

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

Figure 46: Cape Gannets *Morus capensis* (left) (Photo: NACOMA) and African Penguins *Spheniscus demersus* (right) (Photo: Klaus Jost) breed primarily on the offshore Islands.

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

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

Table 11: Pelagic seabirds common in the southern Benguela region (Crawford *et al*. 1991; BirdLife 2021). IUCN Red List and Regional Assessment status are provided (Sink *et al*. 2019). Species reported from the adjacent Deep Water Orange Basin Area by MMOs are highlighted (CapFish 2013a, 2013b).

Common Name	Species name	Global IUCN	Regional Assessment
Shy Albatross	*Thalassarche cauta*	Near Threatened	Near Threatened
Black-browed Albatross	*Thalassarche melanophrys*	Least concern	Endangered
Atlantic, Yellow-nosed Albatross	*Thalassarche chlororhynchos*	Endangered	Endangered
Indian, Yellow-nosed Albatross	*Thalassarche carteri*	Endangered	Endangered
Wandering Albatross	*Diomedea exulans*	Vulnerable	Vulnerable
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable	Vulnerable
Northern Royal Albatross	*Diomedea sanfordi*	Endangered	Endangered
Sooty Albatross	*Phoebetria fusca*	Endangered	Endangered
Light-mantled Albatross	*Phoebetria palpebrata*	Near Threatened	Near Threatened
Tristan Albatross	*Diomedea dabbenena*	Critically Endangered	Critically Endangered
Grey-headed Albatross	*Thalassarche chrysostoma*	Endangered	Endangered

Common Name	Species name	Global IUCN	Regional Assessment
Giant Petrel sp.	*Macronectes halli/giganteus*	Least concern	Near Threatened
Southern Fulmar	*Fulmarus glacialoides*	Least concern	Least concern
Pintado Petrel	*Daption capense*	Least concern	Least concern
Blue Petrel	*Halobaena caerulea*	Least concern	Near Threatened
Salvin's Prion	*Pachyptila salvini*	Least concern	Near Threatened
Arctic Prion	*Pachyptila desolata*	Least concern	Least concern
Slender-billed Prion	*Pachyptila belcheri*	Least concern	Least concern
Broad-billed Prion	*Pachyptila vittata*	Least concern	Least concern
Kerguelen Petrel	*Aphrodroma brevirostris*	Least concern	Near Threatened
Greatwinged Petrel	*Pterodroma macroptera*	Least concern	Near Threatened
Soft-plumaged Petrel	*Pterodroma mollis*	Least concern	Near Threatened
White-chinned Petrel	*Procellaria aequinoctialis*	Vulnerable	Vulnerable
Spectacled Petrel	*Procellaria conspicillata*	Vulnerable	Vulnerable
Cory's Shearwater	*Calonectris diomedea*	Least concern	Least concern
Sooty Shearwater	*Puffinus griseus*	Near Threatened	Near Threatened
Flesh-footed Shearwater	*Ardenna carneipes*	Near Threatened	Least concern
Great Shearwater	*Puffinus gravis*	Least concern	Least concern
Manx Shearwater	*Puffinus puffinus*	Least concern	Least concern
Little Shearwater	*Puffinus assimilis*	Least concern	Least concern
European Storm Petrel	*Hydrobates pelagicus*	Least concern	Least concern
Leach's Storm Petrel	*Oceanodroma leucorhoa*	Vulnerable	Critically Endangered
Wilson's Storm Petrel	*Oceanites oceanicus*	Least concern	Least concern
Black-bellied Storm Petrel	*Fregetta tropica*	Least concern	Near Threatened
White-bellied Storm Petrel	*Fregetta grallaria*	Least concern	Least concern
Pomarine Jaeger	*Stercorarius pomarinus*	Least concern	Least concern
Subantarctic Skua	*Catharacta antarctica*	Least concern	Endangered
Parasitic Jaeger	*Stercorarius parasiticus*	Least concern	Least concern
Long-tailed Jaeger	*Stercorarius longicaudus*	Least concern	Least concern
Sabine's Gull	*Larus sabini*	Least concern	Least concern

Common Name	Species name	Global IUCN	Regional Assessment
Lesser Crested Tern	*Thalasseus bengalensis*	Least concern	Least concern
Sandwich Tern	*Thalasseus sandvicensis*	Least concern	Least concern
Little Tern	*Sternula albifrons*	Least concern	Least concern
Common Tern	*Sterna hirundo*	Least concern	Least concern
Arctic Tern	*Sterna paradisaea*	Least concern	Least concern
Antarctic Tern	*Sterna vittata*	Least concern	Endangered

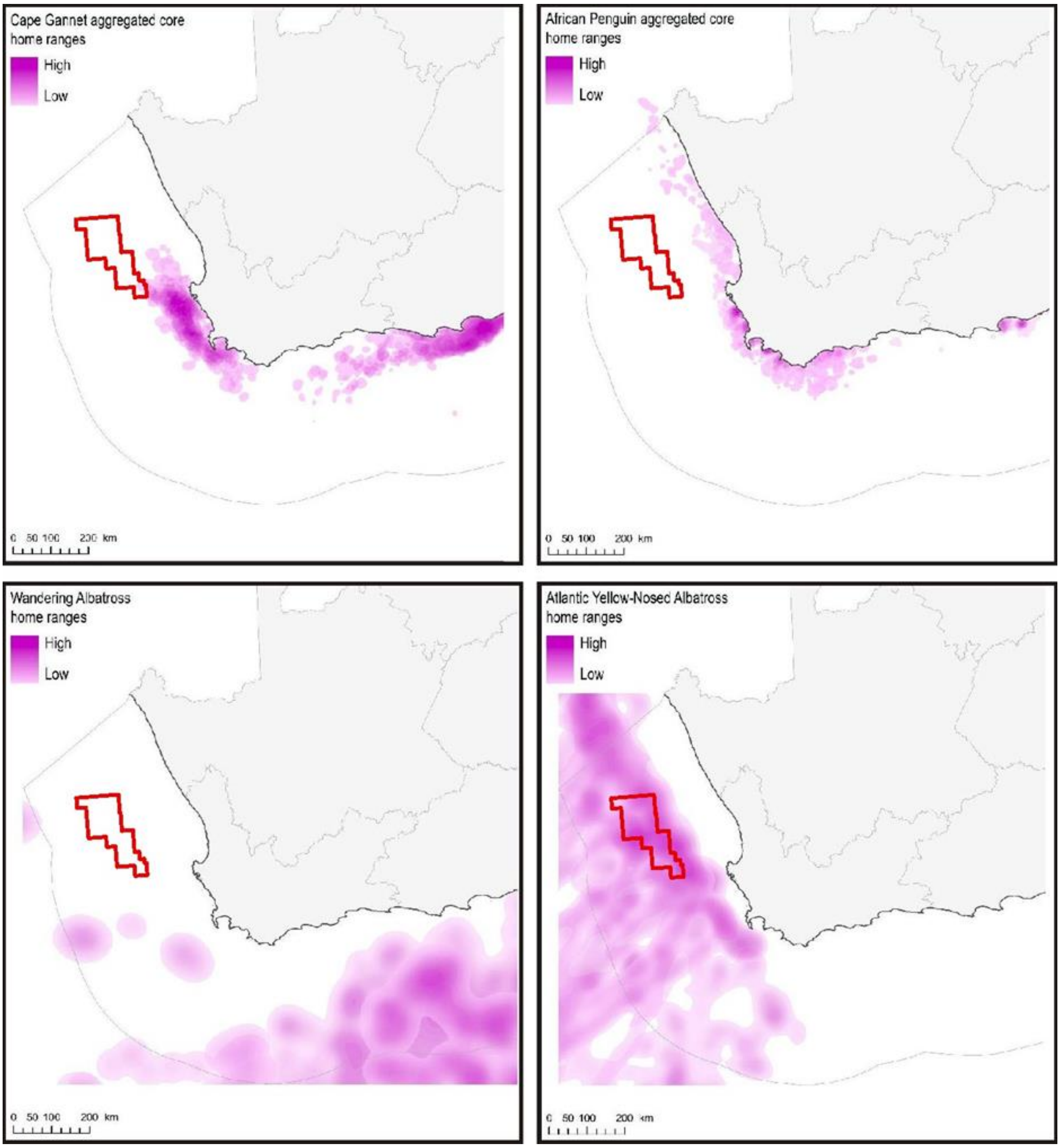


Figure 47: Block 3B/4B (red polygon) in relation to aggregate core home ranges of Cape Gannet (top left), African Penguin (top right) for different colonies and life-history stages, and foraging areas of Wandering Albatross

(bottom left) and Atlantic, Yellow-nosed Albatross (bottom right). For foraging areas, darker shades are areas of higher use and where foraging areas from different colonies overlap (adapted from Harris *et al*. 2022).

Table 12: Breeding resident seabirds present along the South-West Coast (adapted from CCA & CMS 2001). IUCN Red List and National Assessment status are provided (Sink *et al*. 2019). Species reported from the adjacent Deep Water Orange Basin Area by MMOs are highlighted (CapFish 2013a, 2013b). * denotes endemicity.

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

8.3.2.6 MARINE MAMMALS

The marine mammal fauna occurring off the southern African coast includes several species of whales and dolphins and one resident seal species. Thirty five species or sub-species/populations of whales and dolphins are known (based on historic sightings or strandings records) or likely (based on habitat projections of known species parameters) to occur in the waters of the South-West Coast. Of the species listed, the blue whale is considered 'Critically Endangered', fin and sei whales are 'Endangered' and one is considered vulnerable (IUCN Red Data list Categories). Altogether 17 species are listed as 'data deficient' underlining how little is known about cetaceans, their distributions and population trends. The offshore areas have been particularly poorly studied with most available information from deeper waters (>200 m) arising from historic whaling records prior to 1970. In the past ten years, passive acoustic monitoring and satellite telemetry have begun to shed light on current patterns of seasonality and movement for some large whale species Best 2007; Elwen *et al.* 2011; Rosenbaum *et al.* 2014; Shabangu *et al.* 2019; Thomisch *et al.* 2019) but information on smaller cetaceans in deeper waters remains poor. Records from marine mammal observers on exploration vessels have provided valuable data into cetacean presence although these are predominantly during summer months (Purdon *et al.* 2020). Information on general distribution and seasonality is improving but data population sizes and trends for most cetacean species occurring on the west coast of southern Africa is lacking.

Block 3B/4B extends from Hondeklipbaai to Cape Columbine from roughly the 300 m isobath to ~2 600 m water depth. Oceanographically this area lies largely within the cool waters of the Benguela Ecosystem and receives some input from the warm Agulhas Current as well as the warm waters of the South Atlantic. In terms of cetacean distribution patterns, the area thus covers a broad range of habitats and species associated with each of those water masses may occur within the target area. Records from stranded specimens show that the area between St Helena Bay (~32° S) and Cape Agulhas (~34° S, 20° E) is an area of transition between Atlantic and Indian Ocean species, and includes records from Benguela associated species such as dusky dolphins, Heaviside's dolphins and long finned pilot whales, and those of the warmer east coast such as striped and Risso's dolphins (Findlay *et al.* 1992). Species such as rough toothed dolphins, Pan-tropical spotted dolphins and short finned pilot whales are known from the southern Atlantic. Owing to the uncertainty of species occurrence offshore, species that may occur there have been included here for the sake of completeness.

The distribution of cetaceans can largely be split into those associated with the continental shelf and those that occur in deep, oceanic water. Importantly, species from both environments may be found on the continental slope (200 – 2 000 m) making this the most species rich area for cetaceans and also high in density (De Rock *et al.* 2019; SLR data). Cetacean density on the continental shelf is usually higher than in pelagic waters as species associated with the pelagic environment tend to be wide ranging across 1 000s of km. The most common species within the project area (in terms of likely encounter rate not total population sizes) are likely to be the long-finned pilot whale, common dolphin, sperm whale and humpback whale.

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

Table 13 lists the cetaceans likely to be found within the project area, based on all available data sources but mainly: Findlay *et al.* (1992), Best (2007), Weir (2011), De Rock *et al.* (2019), Purdon *et al.* (2020a, 2020b, 2020c). The majority of data available on the seasonality and distribution of large whales in the project area is the result of commercial whaling activities mostly dating from the 1960s. Changes in the timing and distribution of migration may have occurred since these data were collected due to extirpation of populations or behaviours (e.g., migration routes may be learnt behaviours). The large whale species for which there are current data available are the humpback and southern right whale, although almost all data is limited to that collected on the continental shelf close to shore. A review of the distribution and seasonality of the key cetacean species likely to be found within the project area is provided below.

8.3.2.7 **MYSTICETE (BALEEN) WHALES**

The majority of mysticetes whales fall into the family Balaenopeteridae. Those occurring in the area include the blue, fin, sei, Antarctic minke, dwarf minke, humpback and Bryde's whales. The southern right whale (Family Balaenidae) and pygmy right whale (Family Neobalaenidae) are from taxonomically separate groups. The majority of mysticete species occur in pelagic waters with only occasional visits to shelf waters. All of these species show some degree of migration either to or through the latitudes encompassed by the broader project area when en route between higher latitude (Antarctic or Subantarctic) feeding grounds and lower latitude breeding grounds.

Table 13: Cetaceans occurrence off the West Coast of South Africa, their seasonality, likely encounter frequency with proposed exploration activities and South African (Child *et al*. 2016) and Global IUCN Red List conservation status.

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

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Sperm whales							
Pygmy sperm whale	*Kogia breviceps*	VHF	Edge	Yes	Year round	Data Deficient	Least Concern
Dwarf sperm whale	*Kogia sima*	VHF	Edge	Yes	Year round	Data Deficient	Least Concern
Sperm whale	*Physeter macrocephalus*	HF	Edge	Yes	Year round	Vulnerable	Vulnerable

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
			Beaked whales				
Cuvier's	*Ziphius cavirostris*	HF	No	Yes	Year round	Data Deficient	Least Concern
Arnoux's	*Beradius arnouxii*	HF	No	Yes	Year round	Data Deficient	Least Concern
Southern bottlenose	*Hyperoodon planifrons*	HF	No	Yes	Year round	Least Concern	Least Concern
Layard's	*Mesoplodon layardii*	HF	No	Yes	Year round	Data Deficient	Least Concern
True's	*Mesoplodon mirus*	HF	No	Yes	Year round	Data Deficient	Least Concern
Gray's	*Mesoplodon grayi*	HF	No	Yes	Year round	Data Deficient	Least Concern
Blainville's	*Mesoplodon densirostris*	HF	No	Yes	Year round	Data Deficient	Least Concern
			Baleen whales				
Antarctic Minke	*Balaenoptera bonaerensis*	LF	Yes	Yes	>Winter	Least Concern	Near Threatened
Dwarf minke	*B. acutorostrata*	LF	Yes	Yes	Year round	Least Concern	Least Concern
Fin whale	*B. physalus*	LF	Yes	Yes	MJJ & ON	Endangered	Vulnerable
Blue whale (Antarctic)	*B. musculus intermedia*	LF	No	Yes	Winter peak	Critically Endangered	Critically Endangered
Sei whale	*B. borealis*	LF	Yes	Yes	MJ & ASO	Endangered	Endangered
Bryde's (inshore)	*B brydei (subspp)*	LF	Yes	Edge	Year round	Vulnerable	Least Concern
Bryde's (offshore)	*B. brydei*	LF	Edge	Yes	Summer (JFM)	Data Deficient	Least Concern
Pygmy right	*Caperea marginata*	LF	Yes	?	Year round	Least Concern	Least Concern

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Humpback sp.	*Megaptera novaeangliae*	LF	Yes	Yes	Year round, SONDJF	Least Concern	Least Concern
Humpback B2 population	*Megaptera novaeangliae*	LF	Yes	Yes	Spring/Summer peak ONDJF	Vulnerable	Not Assessed
Southern Right	*Eubalaena australis*	LF	Yes	No	Year round, ONDJFMA	Least Concern	Least Concern

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

Table 14: Seasonality of baleen whales in the broader project area based on data from multiple sources, predominantly commercial catches (Best 2007 and other sources) and data from stranding events (NDP unpublished data). Values of high (H), Medium (M) and Low (L) are relative within each row (species) and not comparable between species. For abundance / likely encounter rate within the broader project area.

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

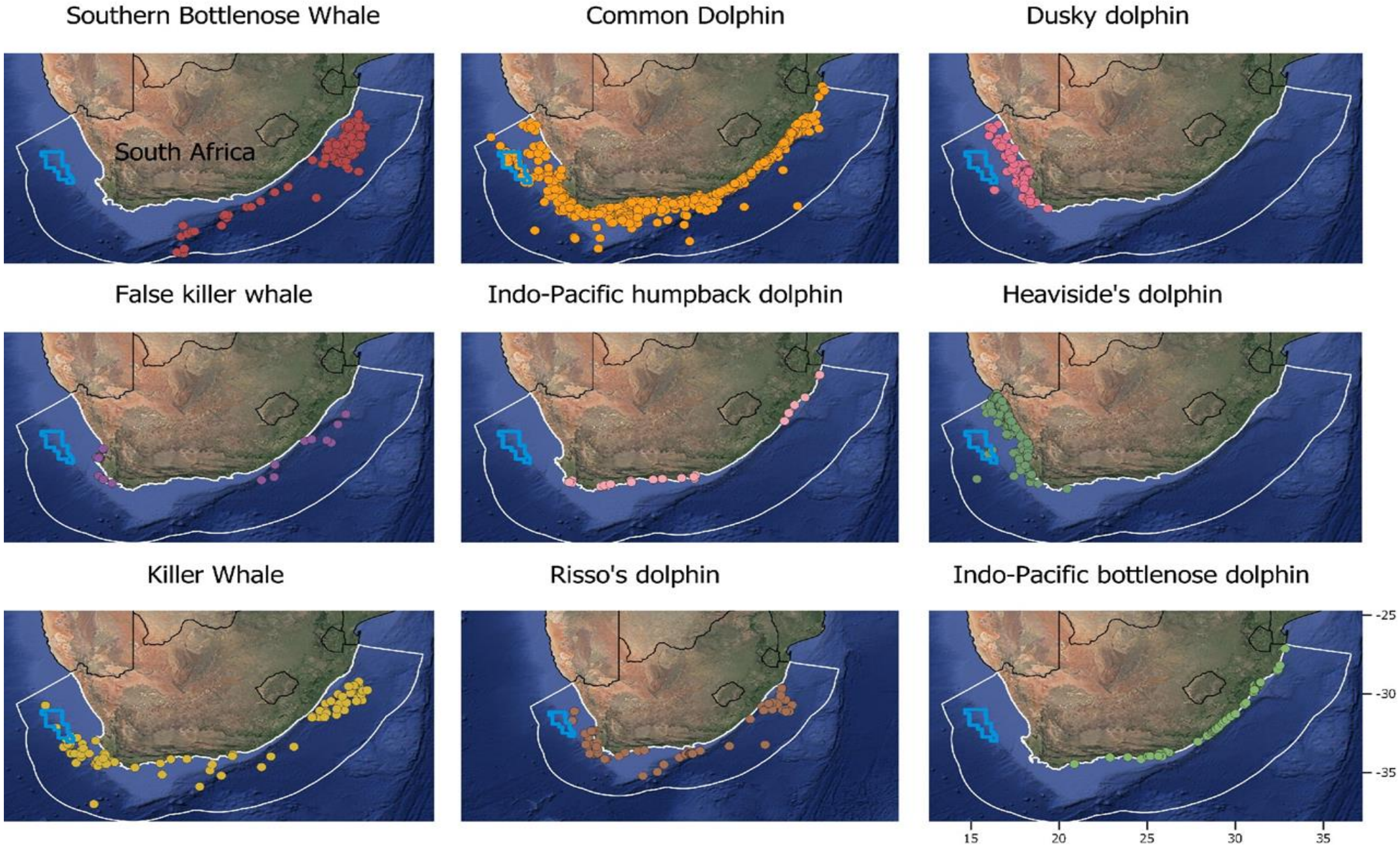


Figure 48: Block 3B/4B (cyan polygon) in relation to projections of predicted distributions for nine odontocete species off the coast of South Africa (adapted from: Purdon *et al.* 2020a).

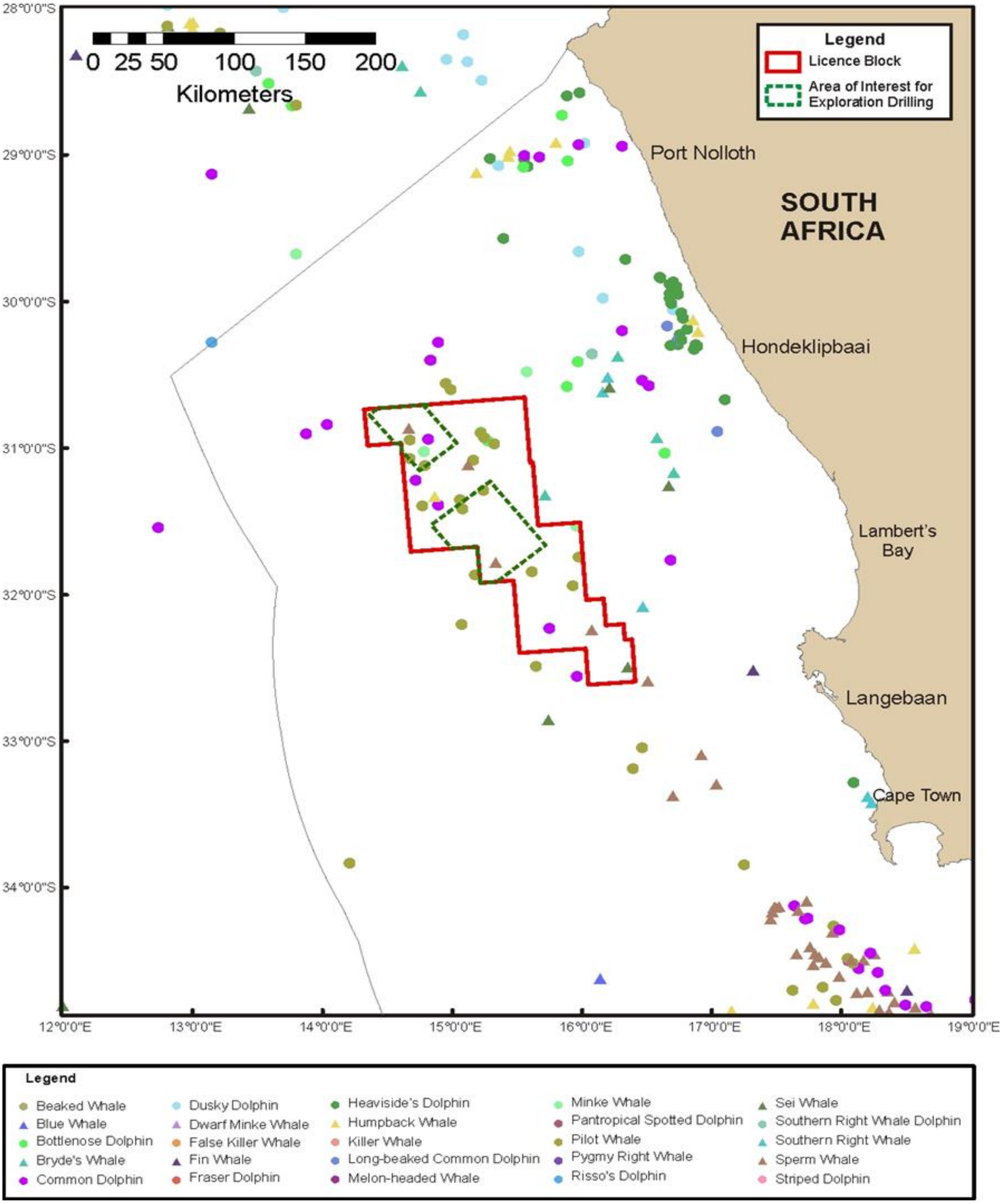


Figure 49: Block 3B/4B (red polygon) in relation to the distribution and movement of cetaceans along the West and South Coasts collated between 2001 and 2020 (SLR MMO database). Note: Figure depicts MMO sightings from seismic surveys undertaken between 2001 and 2020

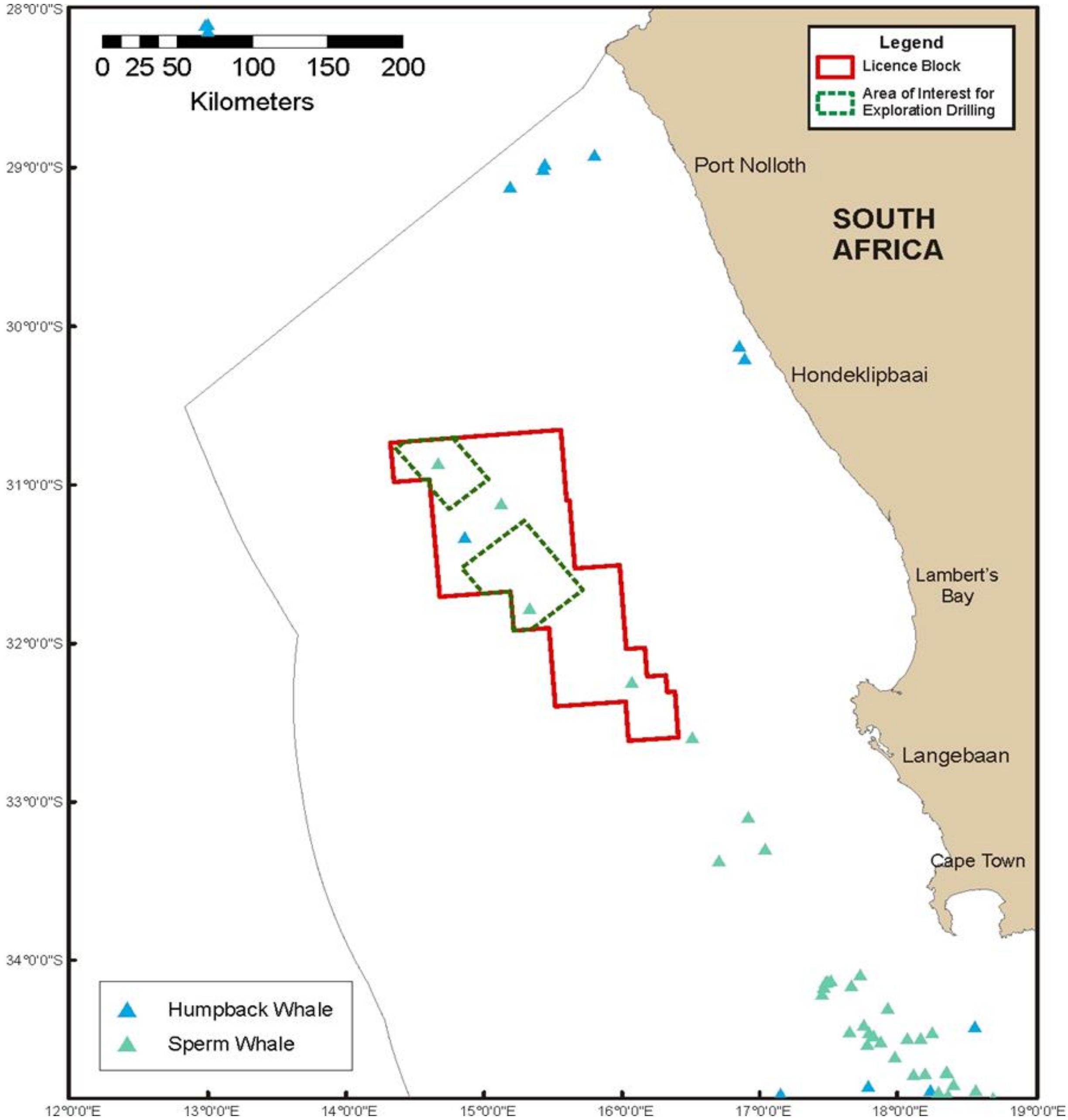


Figure 50: Block 3B/4B (red polygon) in relation to the distribution and movement of Humpback whales and Sperm whales along the southern African coast collated between 2001 and 2020 (SLR MMO database).

Depending on the ultimate location of these feeding and breeding grounds, seasonality may be either unimodal, usually in winter months (June-August, e.g. minke and blue whales), or bimodal (e.g. May to July and October to November), reflecting a northward and southward migration through the area. Northward and southward migrations may take place at different distances from the coast due to whales following geographic or oceanographic features, thereby influencing the seasonality of occurrence at different locations. Because of the complexities of the migration patterns, each species is discussed separately below.

Bryde's whales: Two genetically and morphologically distinct populations of Bryde's whales (Figure 52, left) live off the coast of southern Africa (Best 2001; Penry 2010). The "offshore population" lives beyond the shelf (>200 m depth) off west Africa and migrates between wintering grounds off equatorial west Africa (Gabon) and summering grounds off western South Africa. Its seasonality on the West Coast is thus opposite to the majority of the balaenopterids with abundance likely to be highest in the area in January - March. The "inshore population" of Bryde's whale lives mainly on the continental shelf and Agulhas Bank and is unique amongst baleen whales in the region by being non-migratory. The inshore population has recently been recognised as its own (yet to be named) sub species (*Balaenoptera brydei edeni*, Penry *et al.* 2018) with a total population for this subspecies of likely fewer than 600 individuals. The published range of the population is the continental shelf and Agulhas Bank of South Africa ranging from Durban in the east to at least St Helena Bay off the west coast with possible movements further north up the West Coast and into Namibia during the winter months (Best 2007). The offshore stock was subjected to heavy whaling in the mid-20th century (Best 2001) and there are no current data on population size or stock recovery therefrom and is currently listed as 'Data deficient' (offshore population) and Vulnerable (inshore population) on the South African Red List. The inshore stock is regarded as extremely vulnerable and listed as such on the South African red list as it regularly suffers losses from entanglement in trap fisheries and has been subject to significant changes in its prey base due to losses and shifts in the sardine and small pelagic stocks around South Africa. Encounters in the offshore waters of the licence block are unlikely.

Sei whales: Almost all information is based on whaling records 1958-1963, most from shore-based catchers operating within a few hundred km of Saldanha Bay. At this time the species was not well differentiated from Bryde's whales and records and catches of the two species intertwined. There is no current information on population recovery, abundance or much information on distribution patterns outside of the whaling catches and the species remains listed as 'Endangered' on the South African Red List. Sei whales feed at high latitudes (40-50˚S) during summer months and migrate north through South African waters to unknown breeding grounds further north (Best 2007). Their migration pattern thus shows a bimodal peak with numbers west of Saldanha Bay being highest in May and June, and again in August, September and October. All whales were caught in waters deeper than 200 m with most occurring deeper than 1 000 m (Best & Lockyer 2002). A recent survey to Vema Seamount ~1 000 km west of Cape Town during October to November 2019, encountered a broadly spread feeding aggregation of over 30 sei and fin whales at around 200 m water depth (Elwen *et al.* in prep). This poorly surveyed area (roughly 32˚S, 15˚E) is just to the Northwest of the historic whaling grounds suggesting this region remains an important feeding area for the species. As sei whales have been reported by MMOs to the east of and within Block 3B/4B, encounters are possible.

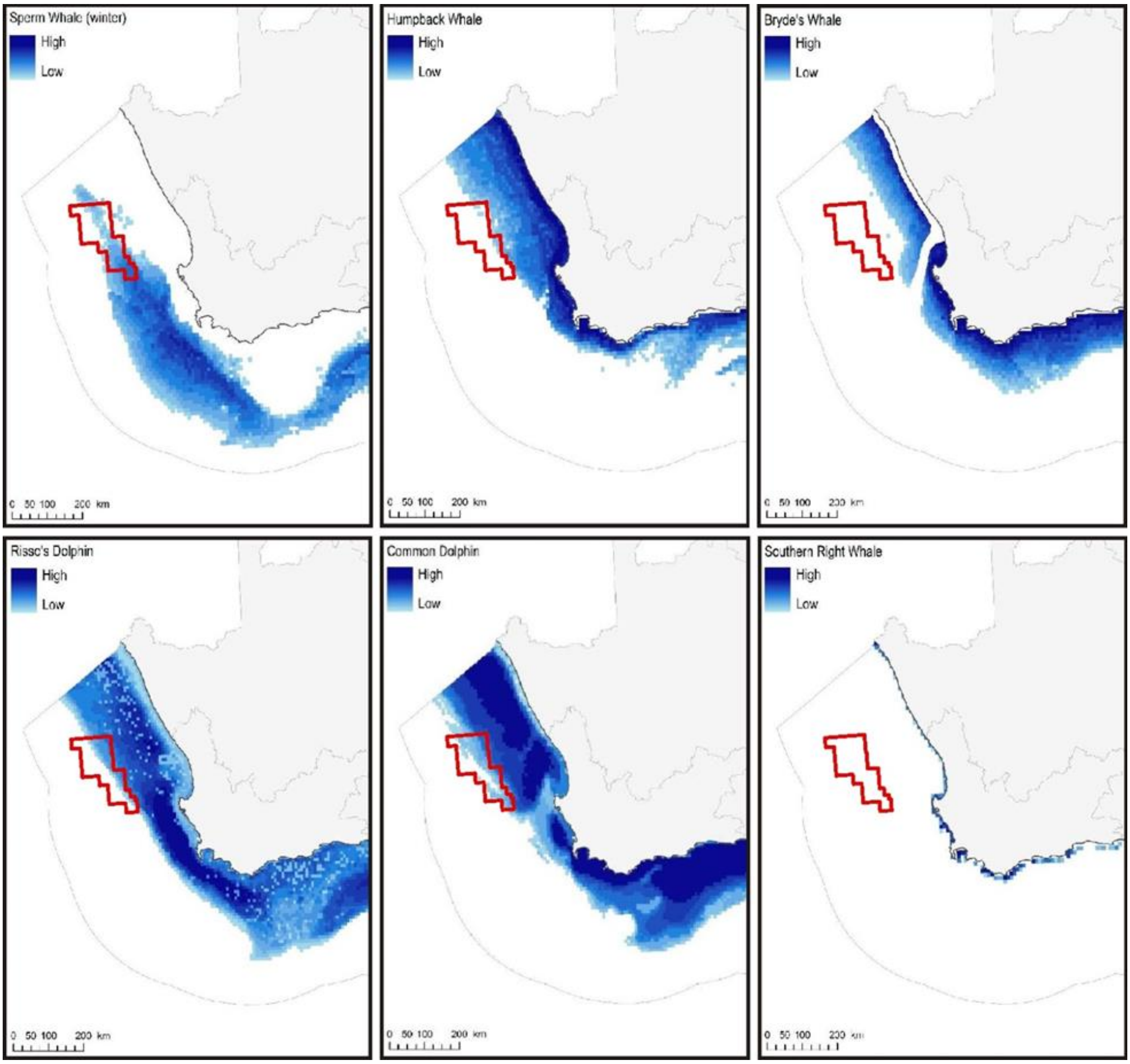


Figure 51: Block 3B/4B (red polygon) in relation to the predicted distribution of sperm whales (winter distribution)(top left), humpback whale (top middle), Bryde's whale (top right), Risso's dolphin (bottom left), common dolphin (bottom middle) and southern right whale (bottom right) with darker shades of blue indicating highest likelihood of occurrence (adapted from Harris *et al*. 2022).

Figure 52: The Bryde's whale *Balaenoptera brydei* (left) and the Minke whale *Balaenoptera bonaerensis* (right) (Photos: www.dailymail.co.uk; www.marinebio.org).

Fin whales: Fin whales were historically caught off the West Coast of South Africa, with a bimodal peak in the catch data suggesting animals were migrating further north during May-June to breed, before returning during August-October en route to Antarctic feeding grounds. However, the location of the breeding ground (if any) and how far north it is remains a mystery (Best 2007). Some juvenile animals may feed year round in deeper waters off the shelf (Best 2007). The occasional single whale has been reported during humpback whale research in November in the southern Benguela, and a feeding aggregation of ~30 animals was observed in November 2019 ~200 km west of St Helena Bay in ~2 000 m of water. Current sightings records support the bimodal peak in presence observed from whaling data (but with some chance of year-round sightings) with animals apparently feeding in the nutrient rich Benguela during their southward migration as is observed extensively for humpback and right whales (see below) there is clearly a chance of encounters year round. There are no recent data on abundance or distribution of fin whales off western South Africa. The sighting of a fin whale was reported by MMOs during a 3D seismic survey in the Deep Water Orange Basin Area (CapFish 2013a). Encounters in the licence area are thus possible.

Blue whales: Although Antarctic blue whales were historically caught in high numbers off the South African West Coast, with a single peak in catch rates during July in Namibia and Angola suggesting that these latitudes are close to the northern migration limit for the species in the eastern South Atlantic (Best 2007). Although there were only two confirmed sightings of the species in the area between 1973 and 2006 (Branch *et al*. 2007), evidence of blue whale presence off Namibia is increasing. Recent acoustic detections of blue whales in the Antarctic peak between December and January (Tomisch *et al*. 2016) and off the South African West Coast (Shanbangu *et al*. 2019; Seakamela *et al*. 2022) and in northern Namibia between May and July (Thomisch 2017) support observed timing from whaling records. Several recent (2014-2015) sightings of blue whales during seismic surveys off the southern part of Namibia (water depth >1 000 m) confirm their existence in the area and occurrence in Autumn months (April to June). Blue whales have previously been sighted by MMOs in the Deep Water Orange Basin Area (CapFish 2013a) although the chance of encounters is considered low. As the species is 'Critically Endangered' all precautions must be taken to avoid impact.

Minke whales: Two forms of minke whale (Figure 52, right) occur in the southern Hemisphere, the Antarctic minke whale (*Balaenoptera bonaerensis*) and the dwarf minke whale (*B. acutorostrata* subsp.); both species occur in the Benguela (Best 2007). Antarctic minke whales range from the pack ice of Antarctica to tropical waters and are usually seen more than ~50 km offshore. Although adults migrate from the Southern Ocean (summer) to tropical/temperate waters (winter) to breed, some animals, especially juveniles, are known to stay in tropical/temperate waters year-round. Recent data available from passive acoustic monitoring over a two-year period off the Walvis Ridge (Namibia) shows acoustic presence in June - August and November - December (Thomisch *et al*. 2016), supporting a bimodal distribution in the area. The dwarf minke whale has a more temperate distribution than the Antarctic minke and they do not range further south than 60-65°S. Dwarf minkes have a similar migration pattern to Antarctic minkes with at least some animals migrating to the Southern Ocean during summer. Dwarf minke whales occur closer to shore than Antarctic minkes and have been seen <2 km from shore on several occasions around South Africa. Both species are generally solitary and densities are likely to be low in Block 3B/4B, although sightings have been reported in the general project area (SLR data). Thus, encounters within Block 3B/4B may occur.

The pygmy right whale is the smallest of the baleen whales reaching only 6 m total length as an adult (Best 2007). The species is typically associated with cool temperate waters between 30°S and 55°S with records from southern and central Namibia being the northern most for the species (Leeney *et al*. 2013). Its distribution off the West Coast of South Africa is thus likely to be limited to the cooler shelf waters of the main Benguela upwelling areas and encounters within Block 3B/4B may thus occur.

The most abundant baleen whales in the Benguela are southern right whales and humpback whales (Figure 53). Both species have long been known to feed in the Benguela Ecosystem and numbers since 2000 have grown substantially. The feeding peak in the Benguela is spring and early summer (October – February) and follows the 'traditional' South African breeding season (June – November) and its associated migration (Johnson *et al.* 2022). Some individual right whales are known to move directly from the south coast breeding area into the west coast feeding area where they remained for several months (Barendse *et al.* 2011; Mate *et al.* 2011). Increasing numbers of summer records of both species, from the southern half of Namibia suggest that animals may also be feeding in the Lüderitz upwelling cell (NDP unpublished data).

Figure 53: The Humpback whale *Megaptera novaeangliae* (left) and the Southern Right whale *Eubalaena australis* (right) are the most abundant large cetaceans occurring along the southern African West Coast (Photos: www.divephotoguide.com; www.aad.gov.au).

Humpback whales: The majority of humpback whales passing through the Benguela are migrating to breeding grounds off tropical West Africa, between Angola and the Gulf of Guinea (Rosenbaum *et al.* 2009; Barendse *et al.* 2010). Until recently it was believed that that these breeding grounds were functionally separate from those off east (Mozambique-Kenya-Madagascar), with only rare movements between them (Pomilla & Rosenbaum 2005) and movements to other continental breeding grounds being even more rare. Recent satellite tagging of animals between Plettenberg Bay and Port Alfred during the northward migration, showed them to turn around and end up feeding in the Southern Benguela (Seakamela *et al*. 2015) before heading offshore and southwards using the same route as whales tracked off Gabon and the West Coast of South Africa. Unexpected results such as this highlight the complexities of understanding whale movements and distribution patterns and the fact that descriptions of broad season peaks in no way captures the wide array of behaviours exhibited by these animals. Furthermore, four separate matches have been made between individuals off South Africa and Brazil by citizen scientist photo-identification (www.happywhale.com; Ramos *et al*. 2023). This included whales from the Cape Town and Algoa Bay-Transkei areas. Analysis of humpback whale breeding song on Sub-Antarctic feeding grounds also suggests exchange of singing male whales from western and eastern South Atlantic populations (Darling & Sousa-Lima 2005; Schall *et al.* 2021; but see also Darling *et al.* 2019; Tyarks *et al*. 2021).

In southern African coastal waters, the northward migration stream is larger than the southward peak (Best & Allison 2010; Elwen *et al.* 2014), suggesting that animals migrating north strike the coast at varying places north of St Helena Bay, resulting in increasing whale density on shelf waters and into deeper pelagic waters as one moves northwards. On the southward migration, many humpbacks follow the Walvis Ridge offshore then head directly to high latitude feeding grounds, while others follow a more coastal route (including the majority of mother-calf pairs) possibly lingering in the feeding grounds off west South Africa in summer (Elwen *et al.* 2014; Rosenbaum *et al.* 2014). Although migrating through the Benguela, there is no existing evidence of a clear 'corridor' and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration (Barendse *et al.* 2010; Best & Allison 2010; Elwen *et al.* 2014). The only available abundance estimate put the number of animals in the West African breeding population (Gabon) to be in excess of 9 000 individuals in 2005 (IWC 2012) and it is likely to have increased substantially since this time at about 5% per annum (IWC 2012; see also Wilkinson 2021). The number of humpback whales feeding in the southern Benguela has increased substantially since estimates made in the early 2000s (Barendse *et al.* 2011). Since ~2011, 'supergroups' of up to 200 individual whales have been observed feeding within 10 km from shore (Findlay *et al.* 2017) with many hundred more passing through and whales are now seen in all months of the year around Cape Town. It has been suggested that the formation of these super-groups may be in response to anomalous oceanographic conditions in the Southern Benguela, which result in favourable food availability, thereby leading to these unique humpback whale feeding aggregations (Dey *et al.* 2021; see also Avila *et al.* 2019; Meynecke *et al.* 2020; Cade *et al.* 2021). Humpback whales are thus likely to be the most frequently encountered baleen whale in the project area (Figure 53), ranging from the coast out beyond the shelf, with year round presence but numbers peaking during the northward migration in June – February and a smaller peak with the southern breeding migration around September – October but with regular encounters until February associated with subsequent feeding in the Benguela ecosystem. Humpback whale sightings have been reported by MMOs during a 2012 3D seismic survey in the adjacent Deep Water Orange Basin Area (CapFish 2013a) and encounters within Block 3B/4B are thus likely.

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

Figure 54: Block 3B/4B (red polygon) in relation to 'blue corridors' or 'whale superhighways' showing tracks of Humpback whales (orange) and Southern Right whales (green) between southern Africa and the Southern Ocean feeding grounds (adapted from Johnson *et al*. 2022).

Southern right whales: The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baie dos Tigres) and is considered to be a single population within this range (Roux *et al.* 2011). The most recent abundance estimate for this population is available for 2017 which estimated the population at ~6 100 individuals including all age and sex classes, and still growing at ~6.5% per annum (Brandaõ *et al.* 2017). When the population numbers crashed in 1920, the range contracted down to just the south coast of South Africa, but as the population recovers, it is repopulating its historic grounds including Angola (Whitt *et al*. 2023), Namibia (Roux *et al.* 2001, 2015; de Rock *et al.* 2019) and Mozambique (Banks *et al.* 2011).

Some southern right whales move from the South Coast breeding ground directly to the West Coast feeding ground (Mate *et al.* 2011). When departing from feeding ground all satellite tagged animals in that study took a direct south-westward track, which would take them across the southern portion of Block 3B/4B. Mark-recapture data from 2003-2007 estimated roughly one third of the South African right whale population at that time were using St Helena Bay for feeding (Peters *et al.* 2005). While annual surveys have revealed a steady population increase since the protection of the species from commercial whaling, the South African right whale population has undergone substantial changes in breeding cycles and feeding areas (Van Den Berg *et al.* 2020), and numbers of animal using our coast since those studies were done – notably a significant decrease in the numbers of cow-calf-pairs following the all-time record in 2018, a marked decline of unaccompanied adults since 2010 and variable presence of mother-calf pairs since 2015 (Roux *et al.* 2015; Vermeulen *et al.* 2020). The change in demographics are indications of a population undergoing nutritional stress and has been attributed to likely spatial and/or temporal displacement of prey due to climate variability (Vermeulen *et al.* 2020; see also Derville *et al.* 2019; Kershaw *et al.* 2021; van Weelden *et al.* 2021). Recent sightings (2018-2021) confirm that there is still a clear peak in numbers on the West Coast (Table Bay to St Helena Bay) between February and April. Given this high proportion of the population known to feed in the southern Benguela, and current numbers reported, it is highly likely that several hundreds of right whales can be expected to pass through the southern portion of Block 3B/4B when migrating southwards from the feeding areas between April and June (Figure 54).

8.3.2.8 ODONTOCETES (TOOTHED) WHALES AND DOLPHINS

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

Sperm whales: Most information about sperm whales in the southern African sub-region results from data collected during commercial whaling activities prior to 1985 when over 10 000 whales were taken, (Best 1974; Best 2007) although passive acoustic monitoring (Shabangu & Andrew 2020) and sightings from MMOs are beginning to provide insights into current behaviour. Sperm whales are the largest of the toothed whales and have a complex, structured social system with adult males behaving differently to younger males and female groups. They live in deep ocean waters, usually greater than 1 000 m depth, although they occasionally come onto the shelf in water 500 - 200 m deep (Best 2007) (Figure 55, left). They are considered to be relatively abundant globally (Whitehead 2002), although no estimates are available for South African waters. Seasonality of historical catches off west South Africa suggests that medium and large sized males are more abundant in winter months while female groups are more abundant in autumn (March - April), although animals occur year round (Best 2007). Analysis of recent passive acoustic monitoring data from the edge of the South African continental shelf (800 – 1 000 m water depth, roughly 80 km WSW of Cape Point) confirms year-round presence. Sperm whales have also been regularly identified by Marine Mammal Observers (MMOs) working in this area (Figure 50). Sperm whales feed at great depths during dives in excess of 30 minutes making them difficult to detect visually, however, the regular echolocation clicks made by the species when diving make them relatively easy to detect acoustically using Passive Acoustic Monitoring (PAM). Sperm whales were the most commonly reported species sighted by MMOs and detected with PAM during 2D and 3D seismic surveys undertaken in the adjacent Deep Water Orange Basin Area (CapFish 2013a, 2013b).

There are almost no data available on the abundance, distribution or seasonality of the smaller odontocetes (including the beaked whales and dolphins) known to occur in oceanic waters (>200 m) off the shelf of the southern African West Coast. Beaked whales are all considered to be true deep-water species usually being seen in waters in excess of 1 000 – 2 000 m deep (see various species accounts in Best 2007). Presence in the project area may fluctuate seasonally, but insufficient data exist to define this clearly. Beaked whales seem to be particularly susceptible to man-made sounds and several strandings and deaths at sea, often *en masse,* have been recorded in association with naval mid-frequency sonar (Cox *et al.* 2006; MacLeod & D'Amico 2006) and a seismic survey for hydrocarbons also running a multi-beam echo-sounder and sub bottom profiler (Cox *et al.* 2006). Although the exact reason that beaked whales seem particularly vulnerable to man-made noise is not yet fully understood, the existing evidence clearly shows that animals change their dive behaviour in response to acoustic disturbance (Tyack *et al.* 2011), and all possible precautions should be taken to avoid causing any harm. Sightings of beaked whales in the project area are expected to be very low.

Figure 55: Sperm whales *Physeter macrocephalus* (left) and killer whales *Orcinus orca* (right) are toothed whales likely to be encountered in offshore waters (Photos: www.onpoint.wbur.org; www.wikipedia.org).

Pygmy and Dwarf Sperm Whales: The genus *Kogia* currently contains two recognised species, the pygmy (*K. breviceps*) and dwarf (*K. sima*) sperm whales, both of which occur worldwide in pelagic and shelf edge waters, with few sighting records of live animals in their natural habitat (McAlpine 2018). Their abundance and population trends in South African waters are unknown (Seakamela *et al*. 2021). Due to their small body size, cryptic behaviour, low densities and small school sizes, these whales are difficult to observe at sea, and morphological similarities make field identification to species level problematic, although their narrow-band high frequency echolocation clicks make them detectable and identifiable (at least to the genus) using passive acoustic monitoring equipment. The majority of what is known about the distribution and ecology of Kogiid whales in the southern African subregion is derived mainly from stranding records (e.g. Ross 1979; Findlay *et al.* 1992; Plön 2004; Elwen *et al.* 2013 but see also Moura *et al*. 2016). *Kogia* species most frequently occur in pelagic and shelf edge waters and are thus likely to occur in Block 3B/4B at low levels. Dwarf sperm whales are associated with warmer tropical and warm-temperate waters, being recorded from both the Benguela and Agulhas ecosystem (Best 2007) in waters deeper than ~1 000 m.

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

Killer whales: Killer whales in South African waters were referred to a single morphotype, Type A, although recently a second 'flat-toothed' morphotype that seems to specialize in an elasmobranch diet has been identified but only 5 records are known all from strandings (Best *et al.* 2014). Killer whales have a circum-global distribution being found in all oceans from the equator to the ice edge (Best 2007). Killer whales occur year-round in low densities off South Africa (Best *et al.* 2010, Elwen *et al.* in prep), Namibia (Elwen & Leeney 2011) and in the Eastern Tropical Atlantic (Weir *et al.* 2010). Historically sightings were correlated with that of baleen whales, especially sei whales on their southward migration. In more recent years – their presence in coastal waters (e.g. False Bay) has been strongly linked to the presence and hunting of common dolphins (Best *et al.* 2010; Sea Search unpublished data) and great white sharks (Towner *et al.* 2022). Further from shore, there have been regular reports of killer whales associated with long-line fishing vessels on the southern and eastern Agulhas Bank, and the Cape Canyon to the south-west of Cape Point. Killer whales are found in all depths from the coast to deep open ocean environments and may thus be encountered in the project area at low levels.

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

Pilot Whales: Long finned pilot whales display a preference for temperate waters and are usually associated with the continental shelf or deep water adjacent to it but moving inshore to follow prey (primarily squid) (Mate *et al.* 2005; Findlay *et al.* 1992; Weir 2011; Seakamela *et al*. 2022). They are regularly seen associated with the shelf edge by MMOs, fisheries observers and researchers. The distinction between long-finned and short finned pilot whales is difficult to make at sea. As the latter are regarded as more tropical species confined to the southwest Indian Ocean (Best 2007), it is likely that the majority of pilot whales encountered in the project area will be long-finned. There are many confirmed sighting of pilot whales along the shelf edge of South Africa and Namibia including within the project area since 2010 (de Rock *et al.* 2019; Sea Search unpublished data, SLR data, CapFish 2013a, 2013b). Observed group sizes range from 8-100 individuals (Seakamela *et al*. 2022). Pilot whales were commonly sighted by MMOs and detected by PAM during 2D and 3D seismic surveys in the adjacent Deep Water Orange Basin Area (CapFish 2013a, 2013b). A recent tagging study showed long-finned pilot whale movements within latitudes of 33-36°S, along the shelf-edge from offshore of Cape Columbine to the Agulhas Bank, with concentrations in canyon areas, especially around the Cape Point Valley, and to a lesser degree around the Cape Canyon. It is postulated that the pilot whales target prey species in these productive areas (Seakamela *et al*. 2022).

Common dolphin: Two forms of common dolphins occur around southern Africa, a long-beaked and short-beaked form (Findlay *et al.* 1992; Best 2007), although they are currently considered part of a single global species (Cunha *et al.* 2015). The long-beaked common dolphin lives on the continental shelf of South Africa rarely being observed north of St Helena Bay on the west coast or in waters more 500 m deep (Best 2007), although more recent MMO sightings suggest presence to 1 000 m or more (SLR data, Sea Search data). Group sizes of common dolphins can be large, averaging 267 (± *SD* 287) for the South Africa region (Findlay *et al.* 1992). Far less is known about the short-beaked form which is challenging to differentiate at sea from the long-beaked form. Group sizes are also typically large. It is likely that common dolphins encountered in the Northern Cape or deeper than 2 000 m are of the short-beaked form. Sightings of common dolphins were reported by MMOs during the 2012/13 3D seismic survey in the adjacent Deep Water Orange Basin Area (CapFish 2013a). Encounters in Block 3B/4B are thus likely to occur.

Dusky dolphin: In water <500 m deep, dusky dolphins (Figure 56, left) are likely to be the most frequently encountered small cetacean as they are very "boat friendly" and often approach vessels to bowride. The species is resident year-round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep (Findlay *et al*. 1992). A recent abundance estimate from southern Namibia calculated roughly ~3 500 dolphins in the ~400 km long Namibian Islands Marine Protected area (Martin *et al*. 2020), at a density of 0.16 dolphins/km^2 and similar density is expected to occur off the South African coast where they are regularly encountered in nearshore waters between Cape Town and Lamberts Bay (Elwen *et al*. 2010; NDP unpublished data) with group sizes of up to 800 having been reported (Findlay *et al*. 1992). Encounters in the offshore waters of Block 3B/4B are unlikely.

Figure 56: The dusky dolphin Lagenorhynchus obscurus (left) and endemic Heaviside's Dolphin Cephalorhynchus heavisidii (left) (Photos: Simon Elwen, Sea Search Research and Conservation).

Heaviside's dolphins: Heaviside's dolphins (Figure 56, right) are relatively abundant in the Benguela ecosystem region with 10 000 animals estimated to live in the 400 km of coast between Cape Town and Lamberts Bay (Elwen *et al*. 2009) and ~1 600 in the ~400 km long Namibian Islands Marine Protected Area (Martin *et al*. 2020). This species occupies waters from the coast to at least 200 m depth, (Elwen *et al*. 2006; Best 2007; Martin *et al*. 2020), and may show a diurnal onshore-offshore movement pattern (Elwen *et al*. 2010a, 2010b), as they feed offshore at night. Heaviside's dolphins are resident year round but will mostly occur inshore of Block 3B/4B.

Bottlenose dolphin: Two species of bottlenose dolphins occur around southern Africa. The smaller Indo-Pacific bottlenose dolphin (aduncus form) occurs exclusively to the east of Cape Point in water usually less than 50 m deep and generally within 1 km of the shore (Ross 1984; Ross *et al*. 1987). The larger common bottlenose dolphin (truncatus form) is widely distributed in tropical and temperate waters throughout the world, but frequently occur in small (10s to low 100s) isolated coastal populations. An offshore 'form' of common bottlenose dolphins occurs around the coast of southern Africa including Namibia and Angola (Best 2007) with sightings restricted to the continental shelf edge and deeper. Offshore bottlenose dolphins frequently form mixed species groups, often with pilot whales or Risso's dolphins. Encounters in the offshore waters of Block 3B/4B are likely to be low.

Risso's Dolphin: A medium sized dolphin with a distinctively high level of scarring and a proportionally large dorsal fin and blunt head. Risso's dolphins are distributed worldwide in tropical and temperate seas and show a general preference for shelf edge waters <1 500 m deep (Best 2007; Purdon *et al*. 2020a, 2020b). Many sightings in southern Africa have occurred around the Cape Peninsula and along the shelf edge of the Agulhas bank. Presence within Block 3B/4B is possible (see also Figure 56).

Other Delphinids: Several other species of dolphins that might occur in deeper waters at low levels include the pygmy killer whale, southern right whale dolphin, rough toothed dolphin, pantropical spotted dolphin and striped dolphin (Findlay *et al*. 1992; Best 2007). Nothing is known about the population size or density of these species in the project area but encounters are likely to be rare.

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

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

8.3.2.9 **SEALS (PINNIPEDS)**

The Cape fur seal (*Arctocephalus pusillus pusillus*) is the only species of seal resident along the west coast of Africa, occurring at numerous breeding and non-breeding sites on the mainland and on nearshore islands and reefs (Figure 57). The South African population, which includes the West Coast colonies, was estimated at ca. 725 000 individuals in 2020. This is about 40% of the total southern African population, which has previously been estimated at up to 2 million (Seakamela *et al*. 2022). Vagrant records from four other species of seal more usually associated with the subantarctic environment have also been recorded: southern elephant seal (*Mirounga leoninas*), subantarctic fur seal (*Arctocephalus tropicalis*), crabeater (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*) (David 1989).

Figure 57: Colony of Cape fur seals *Arctocephalus pusillus pusillus* (Photo: Dirk Heinrich).

There are a number of Cape fur seal breeding colonies within the broader study area: at Bucchu Twins near Alexander Bay, at Cliff Point (~17 km north of Port Nolloth), at Kleinzee (incorporating Robeiland), Strandfontein Point (south of Hondeklipbaai), Paternoster Rocks and Jacobs Reef at Cape Columbine, Vondeling Island, Robbesteen near Koeberg and Seal Island in False Bay. The colony at Kleinzee has the highest seal population and produces the highest seal pup numbers on the South African Coast (Wickens 1994). The closest breeding colonies to Block 3B/4B are at Bucchu Twins, Cliff Point, Kleinzee, Strandfontein Point and Cape Columbine located between 150 km and 250 km inshore of the Block.

Non-breeding colonies and haul-out sites occur at Doringbaai south of Cliff Point, Rooiklippies, Swartduin and Noup between Kleinzee and Hondeklipbaai, at Spoeg River and Langklip south of Hondeklip Bay, on Bird Island at Lambert's Bay, at Paternoster Point at Cape Columbine and Duikerklip in Hout Bay. These colonies all fall well inshore and to the east of Block 3B/4B, although overlap with foraging trips may occur in the inshore portions of the licence area.

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979), with bulls ranging further out to sea than females (Figure 58). Their diet varies with season and availability and includes pelagic species such as horse mackerel, pilchard, and hake, as well as squid and cuttlefish. Although Cape fur seals are primarily epipelagic foragers, some degree of geographic and temporal variation in resource and habitat use have been demonstrated (Botha *et al*. 2023). Benthic feeding to depths of up to 454 m has been recorded in females from the Kleinzee colony on the West Coast, with individual modal dive durations of 0.2 – 5.6 minutes (Kirkman *et al*. 2015; Kirkman *et al*. 2019). Botha *et al*. (2020) reported diel foraging patterns in females from the Kleinzee and False Bay colonies, with dive depth and benthic foraging increasing during daylight hours likely reflecting the vertical movements of prey species.

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

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

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

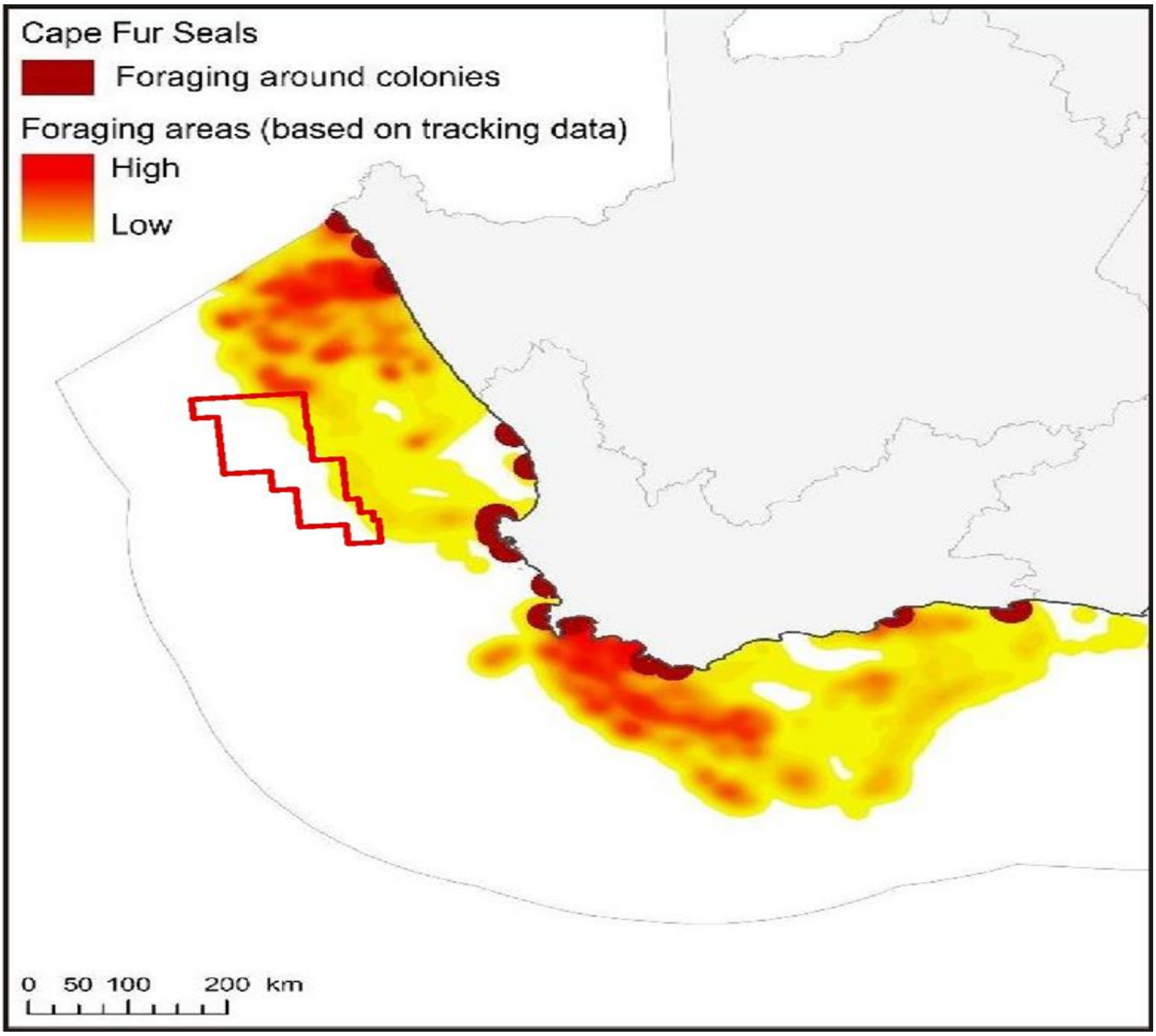


Figure 58: Block 3B/4B (red polygon) in relation to seal foraging areas on the West and South Coasts. Brown areas are generalised foraging areas around colonies, and areas in shades of red are foraging areas based on tracking data. Darker shades of red indicate areas of higher use (Adapted from Harris *et al*. 2022).

8.3.2.10 COASTAL COMMUNITIES

The coastline of the broader project area is characterised by a mixture of intertidal sandy beaches and rocky shores, but also estuaries, rocky subtidal habitats and kelp beds. These were categorised into ecosystem types by Sink *et al*. (2019) and assigned a threat status depending on their geographic extent and extent of ecosystem degradation. Numerous methods of classifying beach zonation have been proposed, based either on physical or biological criteria. The general scheme proposed by Branch & Griffiths (1988) is used, *supplemented* by data from various publications on West Coast sandy beach biota (e.g. Bally 1987; Brown et al. *1989*; Soares et al. 1996*,* 1997; Nel 2001; Nel et al. 2003; *Soares* 2003; Branch et al. 2010; Harris *2012)*. The macrofaunal communities of sandy beaches are generally ubiquitous throughout the southern African West Coast region, being particular only to substratum type, wave exposure and/or depth zone. Due to the exposed nature of the coastline in the study area, most beaches are of the intermediate to reflective type. The upper beach dry zone (supralittoral) is situated above the high water spring (HWS) tide level and receives water input only from large waves at spring high tides or through sea spray. This zone is characterised by a mixture of air breathing terrestrial and semi-terrestrial fauna, often associated with and feeding on kelp deposited near or on the driftline. Terrestrial species include a diverse array of beetles and arachnids and some oligochaetes, while semi-terrestrial fauna include the oniscid isopod Tylos granulatus, and amphipods *of the* genus Talorchestia. The mid-beach retention zone and low-beach saturation zone (intertidal zone or mid-littoral zone) has a vertical range of about

2 m. This mid-shore region is characterised by the cirolanid isopods Pontogeloides latipes, Eurydice (longicornis*=)* kensleyi, *and Excirolana natalensis,* the polychaetes *Scolelepis squamata*, Orbinia angrapequensis, Nepthys hombergii *and Lumbrineris* tetraura*, and* amphipods *of the* families Haustoridae and Phoxocephalidae. In some areas, juvenile and adult sand mussels Donax serra may also be present in considerable numbers.

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

summarises the threat status of these ecosystem types in the broader project area.

A general description of intertidal and shallow subtidal habitats on the West Coast is provided below. Although well inshore of Block 3B/4B and unlikely to be directly impacted by proposed exploration drilling operations, these habitats fall into the area of indirect influence possibly affected in the event of an oil spill.

8.3.2.11 **INTERTIDAL SANDY BEACHES**

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

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

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

Table 15: Threat status of the intertidal and shallow subtidal ecosystem types in the broader project area (Sink *et al*. 2019).

Ecosystem Type	2019 Threat Status
Agulhas Boulder Shore	Near threatened
Agulhas Dissipative Intermediate Sandy Shore	Least Concern
Agulhas Dissipative Sandy Shore	Near threatened
Agulhas Exposed Rocky Shore	Vulnerable
Agulhas Exposed Stromatolite Rocky Shore	Vulnerable
Agulhas Intermediate Sandy Shore	Least Concern
Agulhas Island	Vulnerable
Agulhas Kelp Forest	Vulnerable
Agulhas Mixed Shore	Near threatened
Agulhas Reflective Sandy Shore	Vulnerable
Agulhas Sheltered Rocky Shore	Endangered
Agulhas Stromatolite Mixed Shore	Vulnerable
Agulhas Very Exposed Rocky Shore	Vulnerable
Agulhas Very Exposed Stromatolite Rocky Shore	Near threatened
Cape Bay	Endangered
Cape Boulder Shore	Vulnerable
Cape Exposed Rocky Shore	Vulnerable
Cape Island	Endangered
Cape Kelp Forest	Vulnerable
Cape Mixed Shore	Vulnerable
Cape Sheltered Rocky Shore	Endangered
Cape Very Exposed Rocky Shore	Near threatened

Ecosystem Type	2019 Threat Status
Eastern Agulhas Bay	Vulnerable
False and Walker Bay	Vulnerable
Namaqua Exposed Rocky Shore	Vulnerable
Namaqua Kelp Forest	Vulnerable
Namaqua Mixed Shore	Vulnerable
Namaqua Sheltered Rocky Shore	Vulnerable
Namaqua Very Exposed Rocky Shore	Vulnerable
Southern Benguela Dissipative Intermediate Sandy Shore	Least Concern
Southern Benguela Dissipative Sandy Shore	Least Concern
Southern Benguela Intermediate Sandy Shore	Near threatened
Southern Benguela Reflective Sandy Shore	Endangered
St Helena Bay	Vulnerable
Western Agulhas Bay	Endangered

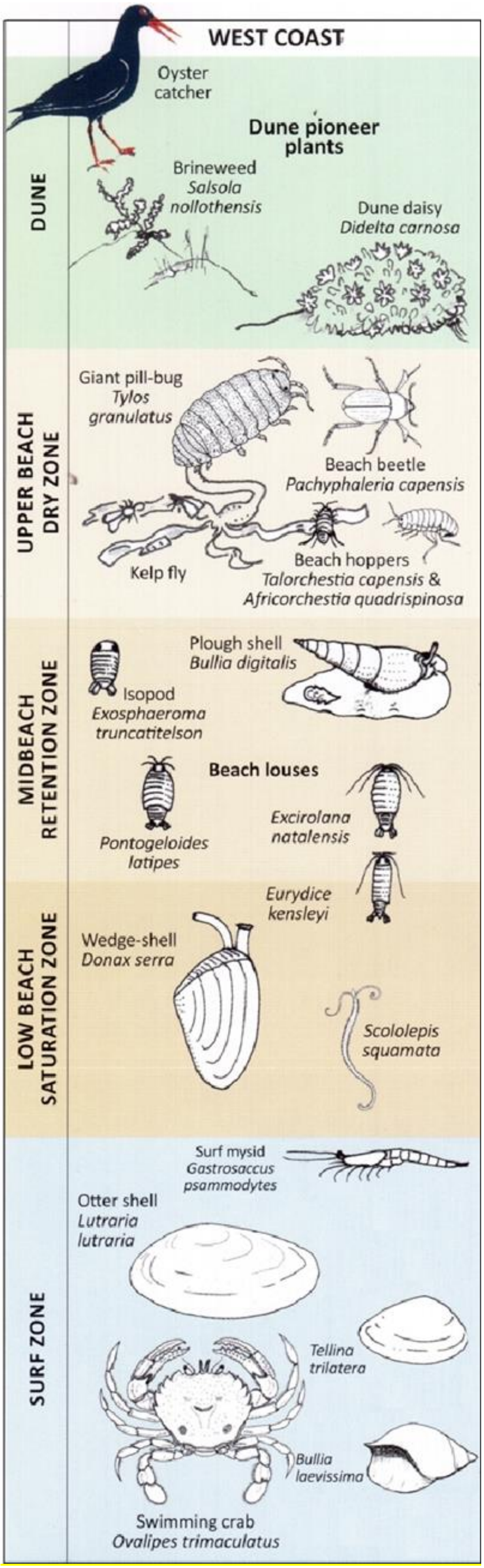


Figure 59: Schematic representation of the West Coast intertidal beach zonation (adapted from Branch & Branch 2018).

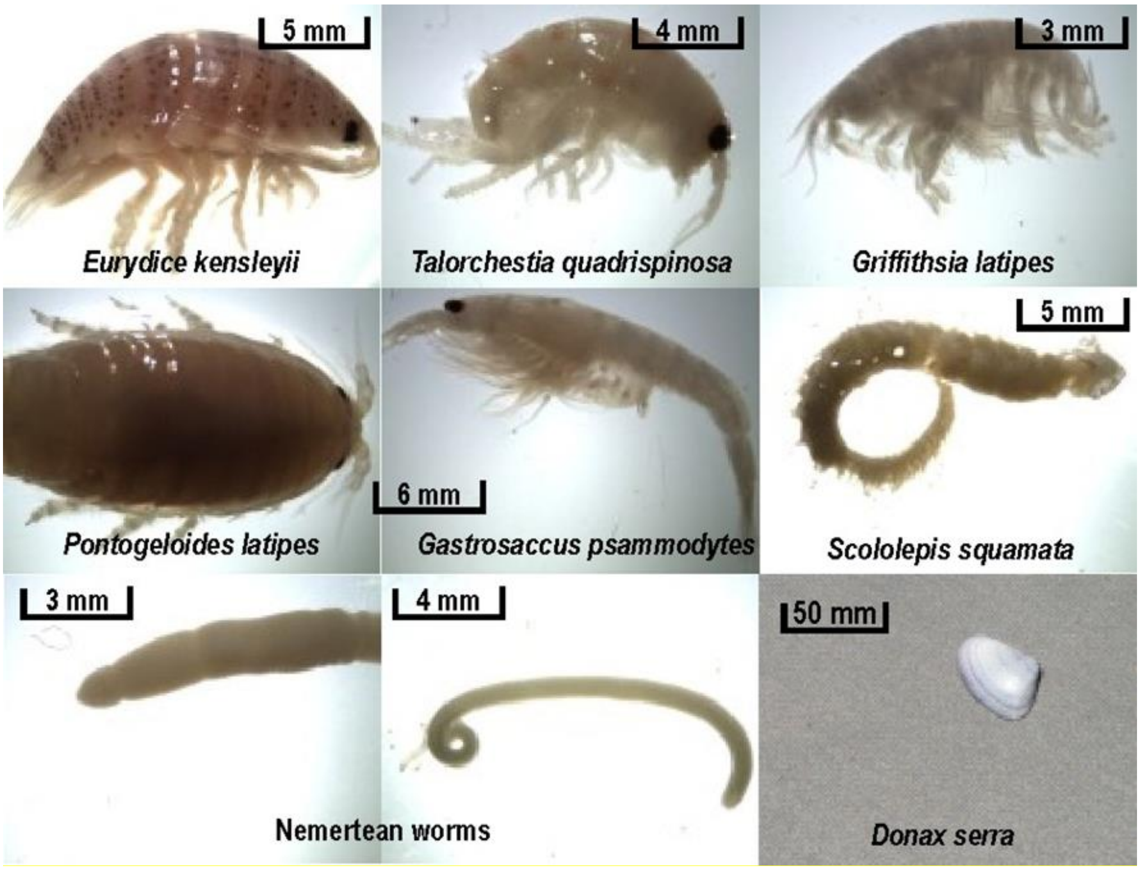


Figure 60: Common beach macrofaunal species occurring on exposed West Coast beaches.

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

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

8.3.2.12 INTERTIDAL ROCKY SHORES

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

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

West Coast rocky intertidal shores can be divided into five zones on the basis of their characteristic biological communities: The Littorina, Upper Balanoid, Lower Balanoid, Cochlear/Argenvillei and the Infratidal Zones. These biological zones correspond roughly to zones based on tidal heights (Figure 61 and Figure 62). Tolerance to the physical stresses associated with life on the intertidal, as well as biological interactions such as herbivory, competition and predation interact to produce these five zones.

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

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

Toward the lower Mid-littoral or Lower Balanoid zone, biological communities are determined by exposure to wave action. On sheltered and moderately exposed shores, a diversity of algae abounds with a variable representation of green algae – *Ulva* spp, *Codium* spp.; brown algae – *Splachnidium rugosum*; and red algae – *Aeodes orbitosa*, *Mazzaella (=Iridaea) capensis*, *Gigartina polycarpa* (=*radula*), *Sarcothalia* (=*Gigartina*) *stiriata*, and with increasing wave exposure *Plocamium rigidum* and *P. cornutum*, and *Champia lumbricalis*. The gastropods *Cymbula granatina* and *Burnupena* spp. are also common, as is the reef building polychaete *Gunnarea capensis*, and the small cushion starfish *Patiriella exigua*. On more exposed shores, almost all of the primary space can be occupied by the dominant alien invasive mussel *Mytilus galloprovincialis*. First recorded in 1979 (although it is likely to have arrived in the late 1960's), it is now the most abundant and widespread invasive marine species spreading along the entire West Coast and parts of the South Coast (Robinson *et al.* 2005). *M. galloprovincialis* has partially displaced the local mussels *Choromytilus meridionalis* and *Aulacomya ater* (Hockey & Van Erkom Schurink 1992) and competes with several indigenous limpet species (Griffiths *et al.* 1992; Steffani & Branch 2003a, b). Recently, another alien invasive has been recorded, the acorn barnacle *Balanus glandula*, which is native to the west coast of North America where it is the most common intertidal barnacle. The presence of *B. glandula* in South Africa was only noticed a few years ago as it had always been confused with the native barnacle *Cthamalus dentatus* (Simon-Blecher *et al.* 2008). There is, however, evidence that it has been in South Africa since at least 1992 (Laird & Griffith 2008). At the time of its discovery, the barnacle was recorded from 400 km of coastline from Elands Bay to Misty Cliffs near Cape Point (Laird & Griffith 2008). Thus, it is likely that it occurs inshore of Block 3B/4B. When present, the barnacle is typically abundant at the mid zones of semi-exposed shores.

Along the sublittoral fringe, the large kelp-trapping limpet *Scutellastra argenvillei* dominates forming dense, almost monospecific stands achieving densities of up to 200/m^2 (Bustamante *et al.* 1995). Similarly, *C. granatina* is the dominant grazer on more sheltered shores, also reaching extremely high densities (Bustamante *et al.* 1995). On more exposed shores *M. galloprovincialis* dominates. There is evidence that the arrival of the alien *M. palloprovincialis* has led to strong competitive interaction with *S. argenvillei* (Steffani & Branch 2003a, 2003b, 2005). The abundance of the mussel changes with wave exposure, and at wave-exposed locations, the mussel can cover almost the entire primary substratum.

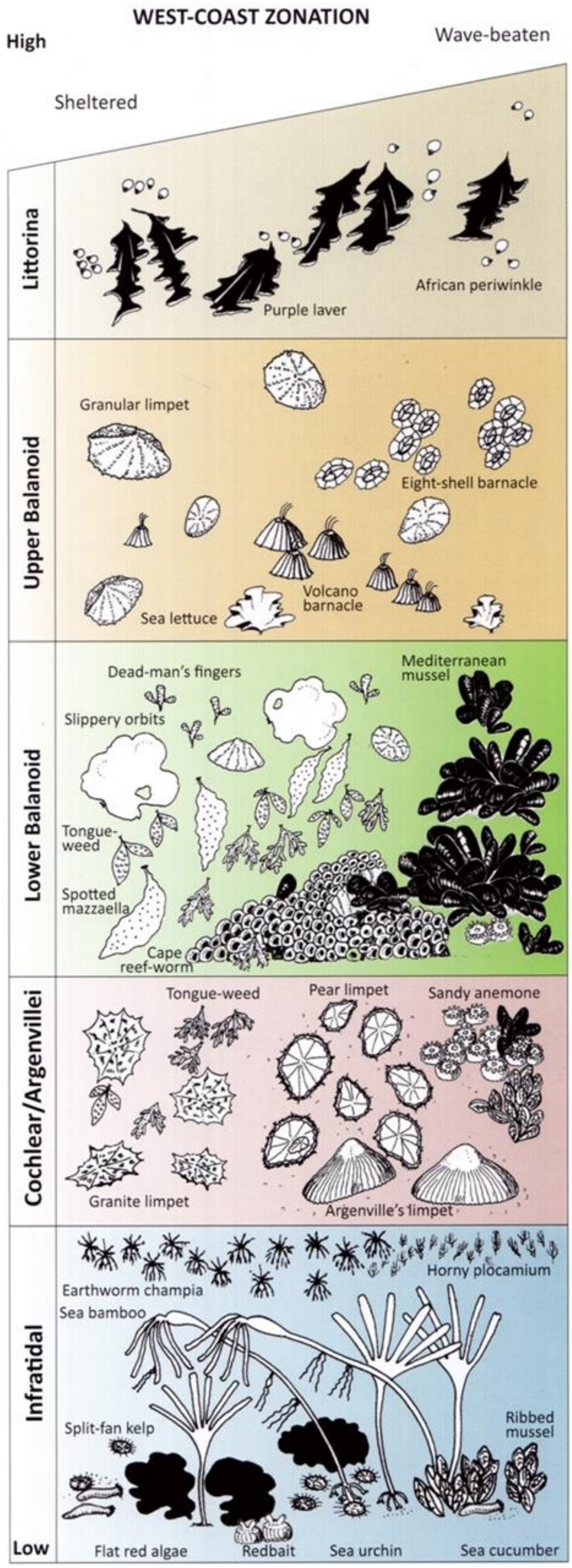


Figure 61: Schematic representation of the West Coast intertidal rocky shore zonation (adapted from Branch & Branch 2018).

Figure 62: Typical rocky intertidal zonation on the southern African west coast.

whereas in semi-exposed situations it is never abundant. As the cover of *M. galloprovincialis* increases, the abundance and size of *S. argenvillei* on rock declines and it becomes confined to patches within a matrix of mussel bed. As a result exposed sites, once dominated by dense populations of the limpet, are now largely covered by the alien mussel. Semi-exposed shores do, however, offer a refuge preventing global extinction of the limpet. In addition to the mussel and limpets, there is variable representation of the flora and fauna described for the lower mid-littoral above, as well as the anemone *Aulactinia reynaudi*, numerous whelk species and the sea urchin *Parechinus angulosus*. Some of these species extend into the subtidal below.

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

8.3.2.13 ROCKY SUBTIDAL HABITAT AND KELP BEDS

Biological communities of the rocky sublittoral on the southwest coast can be broadly grouped into an inshore zone from the sublittoral fringe to a depth of about 10 m dominated by flora, and an offshore zone below 10 m depth dominated by fauna. This shift in communities is not knife-edge, and rather represents a continuum of species distributions, merely with changing abundances.

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

Kelp beds absorb and dissipate much of the typically high wave energy reaching the shore, thereby providing important partially-sheltered habitats for a high diversity of marine flora and fauna, resulting in diverse and typical kelp-forest communities being established (Figure 63).

Figure 63: The canopy-forming kelp *Ecklonia maxima* provides an important habitat for a diversity of marine biota (Photo: Geoff Spiby).

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

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

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

There is substantial spatial and temporal variability in the density and biomass of kelp beds, as storms can remove large numbers of plants and recruitment appears to be stochastic and unpredictable (Levitt *et al.* 2002; Rothman *et al.* 2006). Some kelp beds are dense, whilst others are less so due to differences in seabed topography, and the presence or absence of sand and grazers.

8.3.2.14 **ESTUARIES**

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

Predominantly open estuaries, estuarine lagoons and estuarine bays are particularly important for recruitment for some inshore linefish species and are the most vulnerable to marine pollution events as they receive tidal inflows almost constantly.

Estuarine habitats are highly variable environments with salinity, temperature pH and other variables change with the tides, seasons and climatic conditions. Changes in the extent of water coverage and flow may alternately expose estuarine organisms to desiccation and scouring floods. This high variability has led to a high degree of specialisation within estuaries.

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

There are 64 estuarine systems along the West Coast between the Orange River and Cape Agulhas (SANBI 2018). Approximately 75% of the Cool Temperate bioregion estuarine ecosystem (West Coast) types are 'Critically Endangered' or 'Endangered', while 13% are considered 'Vulnerable' (

Approximately 176 estuarine associated plant species are known within South Africa, with 56 species associated with salt marsh habitat. Salt marsh dominates the vegetation in the cool temperate estuaries along the West coast. The Langebaan and Olifants estuaries support large salt marsh habitat, with the combined area of inter- and supratidal habitat of 1 350 ha and 1 010 ha, respectively. There is a high degree of endemism with only 66 estuarine plant species occurring in five or more estuaries nationally (van Niekerk *et al.* 2019).

The vulnerable freshwater mullet *Pseudomyxus capensis* is one of the few marine fish species that spawns at sea but makes extensive use of the estuarine environment as a nursery area. Endemic to South Africa it occurs predominantly from Kosi Bay to Table Bay but has recently been recorded in a few estuaries on the West Coast as far north as the Orange River indicating that it may be expanding its range in response to climate change. The razor clam *Solen capensis* is endemic to estuaries in the cool temperate bioregions in South Africa, occurring from the Olifants Estuary on the West Coast to St Lucia on the East Coast.

Even the common species in the West and Southwest Coast estuaries have ranges restricted to southern Africa; sand and mud prawns *Callichirus krausii* and *Upogebia africana* are limited to southern Africa, while the freshwater sand-shrimp (*Paleamon capensis*) is endemic to South Africa (van Niekerk *et al.* 2019). Turpie *et al.* (2012) and Hockey *et al.* (2005) also list 35 bird species that are likely to be dependent on estuaries, many of which occur throughout the West and Southwest Coast.

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

Location of estuaries on the West and South-West Coast and their conservation status are summarised in this section and Table 16.

Table 16: Threat status of the estuaries in the broader project area from the Namibian Border to Cape Agulhas (Van Niekerk *et al*. 2019). Only true estuaries, not micro-systems are listed.

Estuary	2018 Threat Status	Estuary	2018 Threat Status
Orange	Endangered	Krom	Endangered
Buffels	Endangered	Silwermyn	Critically Endangered
Swartlintjies	Endangered	Zand	Critically Endangered
Spoeg	Endangered	Zeekoei	Endangered
Groen	Endangered	Eerste	Critically Endangered
Sout (noord)	Endangered	Lourens	Endangered
Olifants	Endangered	Sir Lowry's Pass	Endangered
Jakkals	Critically Endangered	Steenbras	Least Concern
Wadrift	Endangered	Rooiels	Endangered
Verlorenvlei	Endangered	Buffels (Oos)	Endangered
Groot Berg	Endangered	Palmiet	Critically Endangered
Langebaan	Vulnerable	Bot/Kleinmond	Endangered
Diep/Rietvlei	Critically Endangered	Onrus	Endangered
Sout (Wes)	Critically Endangered	Klein	Endangered
Disa	Critically Endangered	Uilkraals	Endangered
Wildevoëlvlei	Critically Endangered	Ratel	Endangered
Schuster	Endangered	Heuningnes	Endangered

8.3.2.15 **COASTAL SENSITIVITY**

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

8.4 FISHERIES

This section provides a description of the fisheries activities of the application area. The information has been sourced from the Fisheries Baseline Study undertaken by CapMarine.

8.4.1 OVERVIEW OF FISHERIES SECTORS

South Africa is home to a diverse and complex marine environment, with two distinct ecosystems along its extensive 3 623 km coastline. The western coastal shelf boasts highly productive commercial fisheries, similar to other upwelling ecosystems around the world, while the east coast is known for its high species diversity and endemics but has a less productive fishing industry. Licence Block 3B/4B is situated within the southern Benguela Large Marine Ecosystem, which is considered one of the largest and most productive of the world's coastal upwelling systems.

Fisheries in South Africa are regulated and monitored by the DFFE, which is responsible for ensuring the sustainable use of marine resources. The DFFE plays a critical role in managing and conserving the country's marine environment, including the allocation of fishing rights, setting sustainable total allowable catch (TAC) and total allowable effort (TAE), and developing flexible Operational Management Procedures (OMPs) that can accommodate changes in fish populations.

All fishing activities, as well as the processing, sale, and trade of marine resources in South Africa, are subject to regulation under the Marine Living Resources Act of 1998. This act provides the legal framework for the conservation and management of marine resources and ensures their sustainable use, while also protecting the marine ecosystem from the negative impacts of human activities such as oil and gas exploration. The DFFE is responsible for monitoring and controlling these activities to prevent damage to the marine environment and ensure the sustainability of South Africa's fishing industry.

The fisheries sector is worth around R8 billion a year and the commercial sector directly employs approximately 28 000 people with many thousands more people depending on fisheries resources to meet basic needs in the small-scale and recreational sectors.

Approximately 22 different fisheries sectors are monitored and managed by DFFE. Table 18 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 indicated in Figure 64. Fisheries are generally divided into commercial and non-commercial fishing. The largest and most valuable commercial sectors include the deep-sea trawl fishery, 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). These species play a crucial role in the marine food chain, serving as a food source for larger predatory fish and marine mammals.

The traditional linefishery targets a large assemblage of species close to shore including snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), Silver kob (*Argyrosomus inodorus*), yellowtail (*Seriola lalandi*) and other reef fish. This type of fishing has a long history in South Africa, with many communities relying on this fishery as a source of livelihood and food. The traditional line fishery operates mostly inshore and utilises hook and line but excludes the use of longlines.

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 along 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.

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 313 people who are permanent and approximately 1450 people who are employed seasonally. Most of the employed people are women from previously disadvantaged backgrounds. E. maxima is primarily used by the abalone aquaculture industry as abalone feed.

Marine aquaculture in South Africa involves the farming of species such as abalone, mussels, and oysters in ocean-based pens or cages. This industry has shown steady growth in recent years as demand for sustainably farmed seafood products has increased. The aquaculture sector creates jobs and contributes to the economy in coastal communities, while also helping to relieve pressure on wild fish stocks. The South African government has actively supported the development of the aquaculture industry through the implementation of regulations and initiatives aimed at promoting sustainable and responsible practices.

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 Gqeberha 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, Hondeklipbaai, Dooringbaai, Laaiplek, Hout Bay and Gansbaai harbours. On the East Coast, Durban and Richards Bay are deployment ports for crustacean trawl and large pelagic longline sectors.

The recreational fishing sector in South Africa includes a diverse range of activities, from shore and boat-based angling to spearfishing and collecting of marine species. This sector targets a wide range of line fish species, some of which are also targeted by commercial operators. Divers participate in the collection of rock lobsters and other subtidal invertebrates. Bait collection is another popular activity, where mussels, limpets, and red bait are gathered for use as bait. Net fisheries are limited to cast netting within the recreational sector. These activities provide an important source of recreation for South Africans and help to support the local economy by providing a source of livelihood for many people involved in the sector.

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 landed catch. To reduce user conflicts between commercial and recreational fishing, and to protect stocks during breeding periods, certain areas have been declared closed areas.

The Small-Scale Fisheries sector in South Africa is relatively new and permits the harvesting of a variety of species for commercial and consumptive use. This sector is established through the allocation of rights to co-operative groups and management co-operatives that represent over 230 small-scale fishing communities along the South African coastline. These co-operatives are comprised of more than 10 000 individual fishers who work together to harvest a variety of species for commercial purposes. The small-scale fisheries sector provides important livelihoods and food security for these communities, and the allocation of rights through co-operative management helps to ensure that the sector is sustainable and equitable.

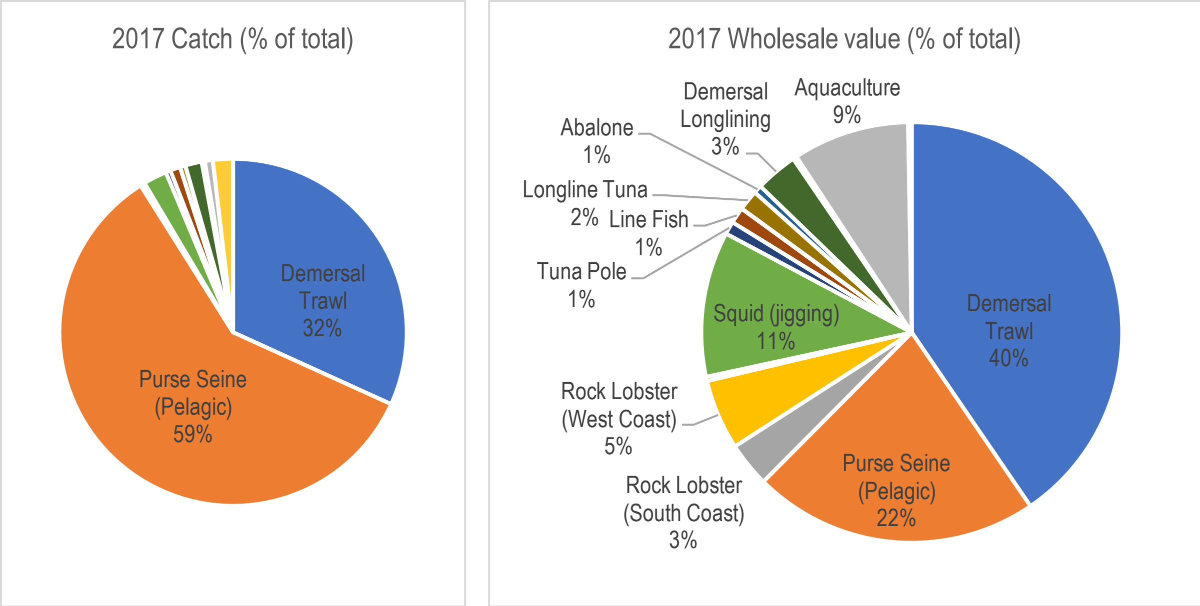


Figure 64: Pie chart showing percentage of landings by weight (left) and wholesale value (right) of each commercial fishery sector as a contribution to the total landings and value for all commercial fisheries sectors combined (2017). Source: DEFF, 2019.

Table 17: South African offshore commercial fishing sectors: 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)	313 476	313 476	2 164 224	22.0
Demersal trawl (offshore)	50 (45)	163 743	98 200	3 891 978	39.5
Demersal trawl (inshore)	18 (31)	4 452	2 736	90 104	0.9
Midwater trawl	34 (6)	19 555			
Demersal longline	146 (64)	8 113	8 113	319 228	3.2
Large pelagic longline	30 (31)	2 541	2 541	154 199	1.6
Tuna pole-line	170 (128)	2 399	2 399	97 583	1.0
Traditional linefish	422 (450)	4 931	4 931	122 096	1.2
Longline shark demersal		72	72	1 566	0.0
South coast rock lobster	13 (12)	699	451	337 912	3.4
West coast rock lobster	240 (105)	1 238	1 238	531 659	5.4
Crustacean trawl	6 (5)	310	310	32 012	0.3

Sector	No. of Rights Holders (Vessels)	Catch (tons)	Landed Catch /sales (tons)	Wholesale Value of Production in 2017 (R'000)	% of Total Value
Squid jig	92 (138)	11 578	11 578	1 099 910	11.2
Miscellaneous nets	190 (N/a)	1 502	1 502	25 589	0.3
Oysters	146 pickers	42	42	3 300	0.0
Seaweeds	14 (N/a)	9 877	6 874	27 095	0.3
Abalone	N/a (N/a)	86	86	61 920	0.6
Aquaculture		3 907	3 907	881 042	9.0
Total		528 966	458456	9 841 417	100

Table 18: South African offshore fishing sectors, areas of operation 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, Gqeberha	Deepwater hake (Merluccius paradoxus), shallow-water hake (Merluccius capensis)
Demersal trawl (inshore)	South Coast	Cape Town, Saldanha, Mossel Bay	East coast sole (*Austroglossus pectoralis*), shallow-water hake (*Merluccius capensis*), juvenile horse mackerel (*Trachurus capensis*)
Midwater trawl	West, South Coast	Cape Town, Gqeberha	Adult horse mackerel (*Trachurus capensis*)
Demersal longline	West, South Coast	Cape Town, Saldanha, Mossel Bay, Gqeberha, Gansbaai	Shallow-water hake (*Merluccius capensis*)
Large pelagic longline	West, South, East Coast	Cape Town, Durban, Richards Bay, Gqeberha	Yellowfin tuna (*T. albacares*), big eye tuna (*T. obesus*), Swordfish (*Xiphius gladius*), southern bluefin tuna (*T. maccoyii*)
Tuna pole-line	West, South Coast	Cape Town, Saldanha	Albacore tuna (T. alalunga), yellowfin tuna
Linefish	West, South, East Coast	All ports, harbours and beaches around the coast	Snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), Silver kob

Sector	Areas of Operation	Main Ports in Priority	Target Species
			(*Argyrosomus inodorus*), yellowtail (*Seriola lalandi*), Sparidae, Serranidae, Carangidae, Scombridae, Sciaenidae
South coast rock lobster	South Coast	Cape Town, Gqeberha	*Palinurus gilchristi*
West coast rock lobster	West Coast	Hout Bay, Kalk Bay, St Helena	Jasus lalandii
Crustacean trawl	East Coast	Durban, Richards Bay	Tiger prawn (*Panaeus monodon*), white prawn (*Fenneropenaeus indicus*), brown prawn (*Metapenaeus monoceros*), pink prawn (*Haliporoides triarthrus*)
Squid jig	South Coast	Gqeberha, St Francis	Squid/chokka (Loligo vulgaris reynaudii)
Gillnet	West Coast	False Bay to Port Nolloth	Mullet / harders (*Liza richardsonii*)
Beach seine	West, South, East Coast	Coastal	Mullet / harders (*Liza richardsonii*)
Oysters	South, East Coast	Coastal	Cape rock oyster (*Striostrea margaritaceae*)
Seaweeds	West, South, East	Coastal	Beach-cast seaweeds (kelp, *Gelidium spp*. and *Gracilaria spp.*)
Abalone	West Coast	Coastal	*Haliotis midae*
Small-scale fishery	West, South, East	Coastal	Various

8.4.2 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 Luderitz, 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 habitats 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. The central Namibian shelf region is also identified as important, but to a lesser extent of a - c. 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.

8.4.2.1 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 (refer to Figure 65).

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.

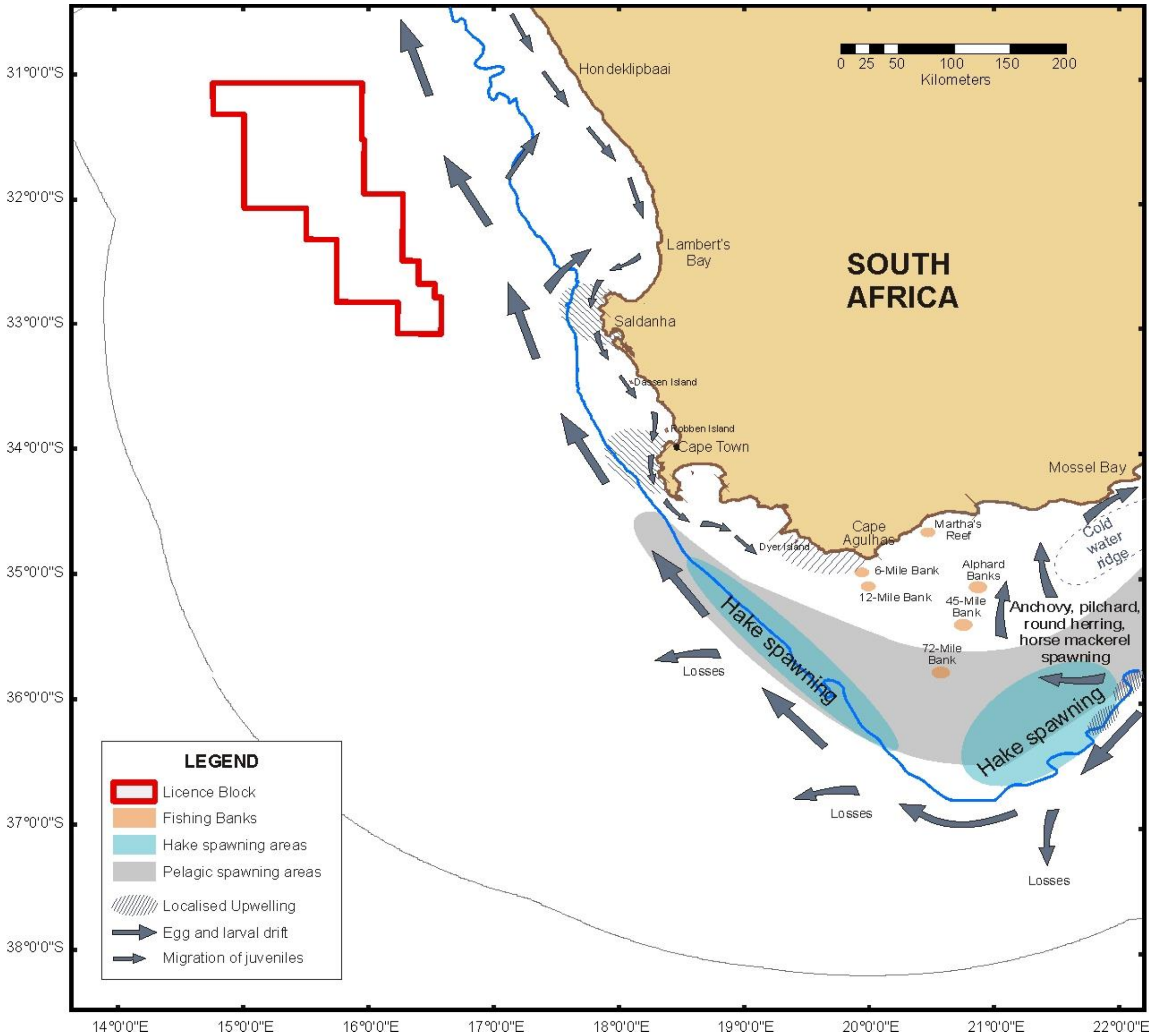


Figure 65: Block 3B/4B (red polygon) in relation to major spawning areas in the southern Benguela region (Source: Pulfrich, 2023 adapted from Cruikshank, 1990).

8.4.2.2 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.

8.4.2.3 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; Figure 66). 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; Figure 67). 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).

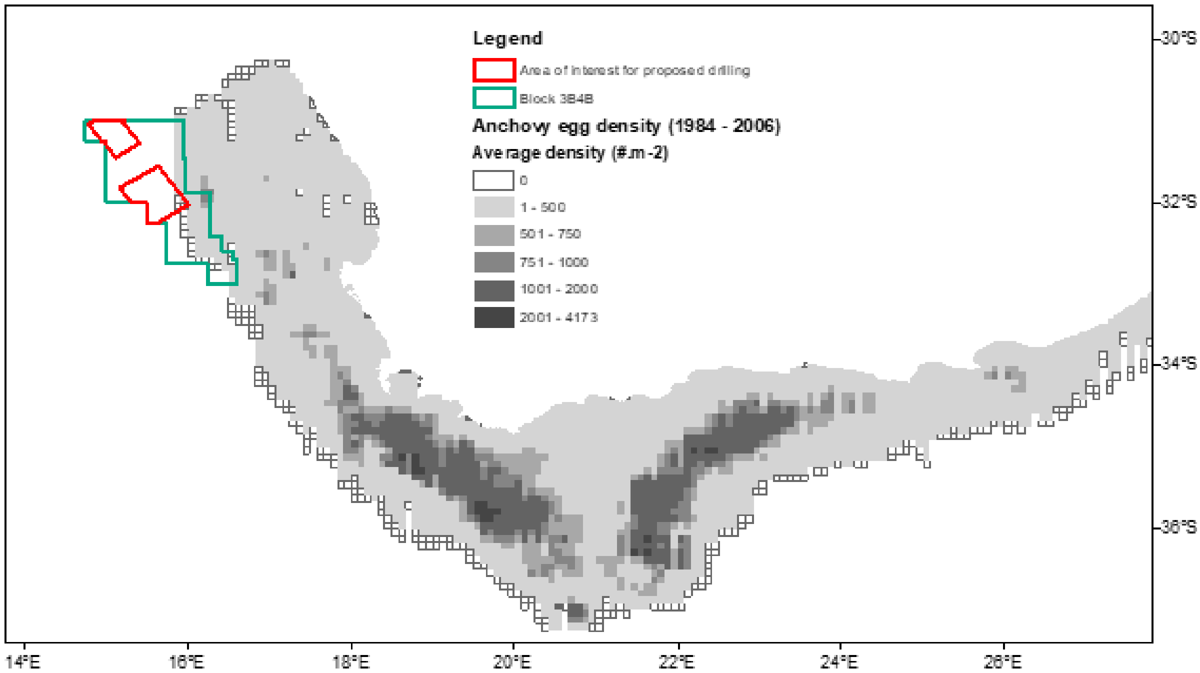


Figure 66: Block 3B/4B (Green polygon) and the AOI for drilling (Red polygon) in relation to the distribution of anchovy spawning areas, as measured by egg densities (DFFE).

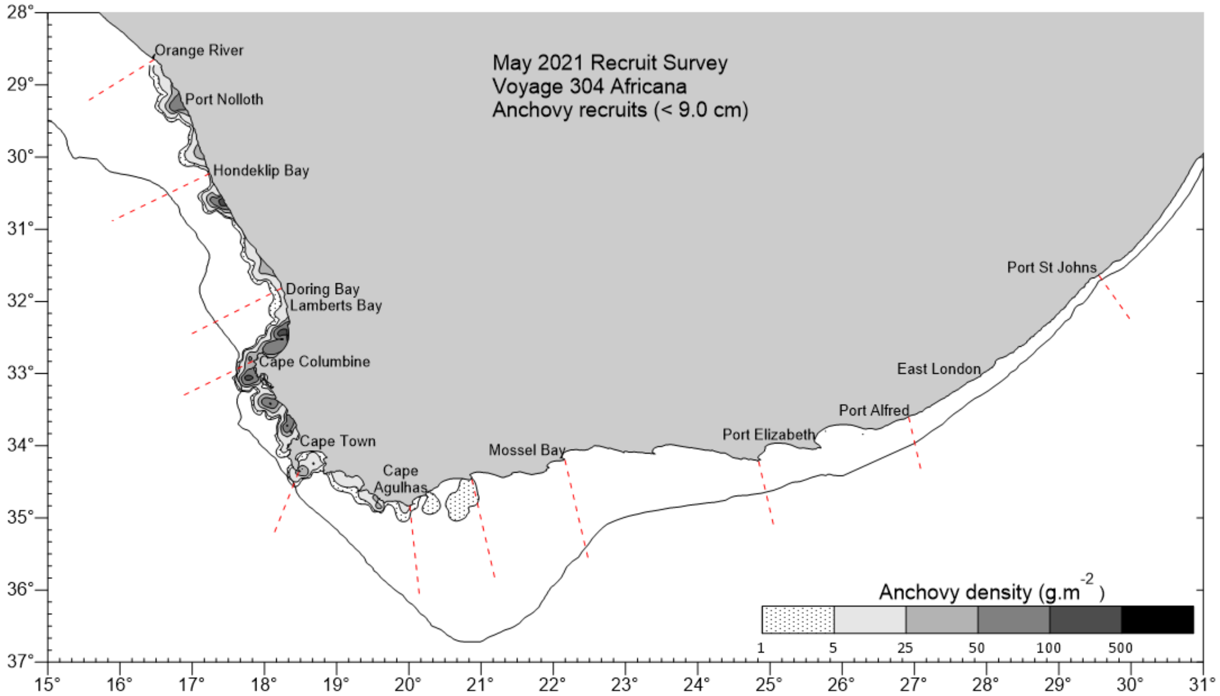


Figure 67: Distribution and relative abundance of anchovy recruits (< 9 cm) (Source: DFFE Small Pelagic Scientific Working Group FISHERIES/2021/JUL/SWG-PEL/51draft

8.4.2.4 **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, Figure 68). In the West Coast Spawning Ground the stock of interest is the CTS.

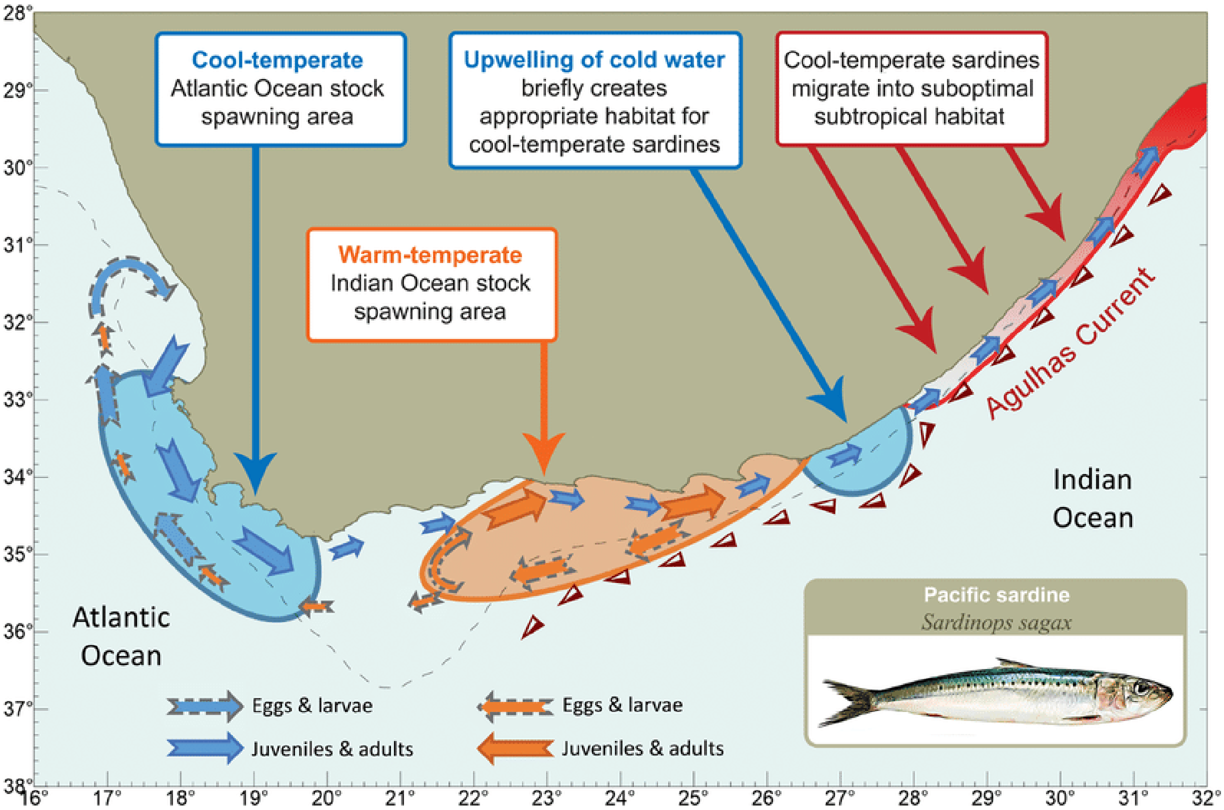


Figure 68: Stock structure of Pacific sardine, S. sagax, in South African waters. The spawning area in the Atlantic Ocean (blue) is numerically dominated by cool-temperate sardine, and the spawning area in the Indian Ocean (orange) is dominated by warm-temperate sardines (Source: Teske *et al*. 2021)

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 westwards 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; Figure 69). 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 (Figure 70). 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.

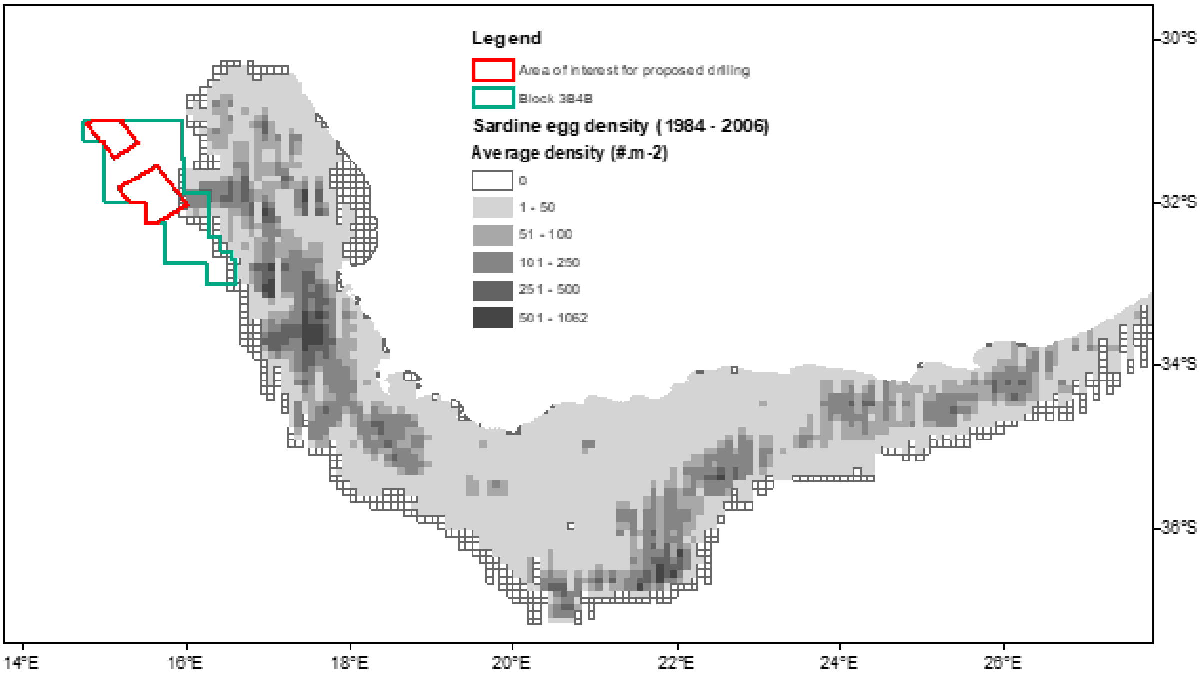


Figure 69: Block 3B/4B (Green polygon) and the AOI for drilling (Red polygon) in relation to the distribution of sardine spawning areas, as measured by egg densities (collected during spawner biomass surveys by DFFE over the period 1984 to 2006).

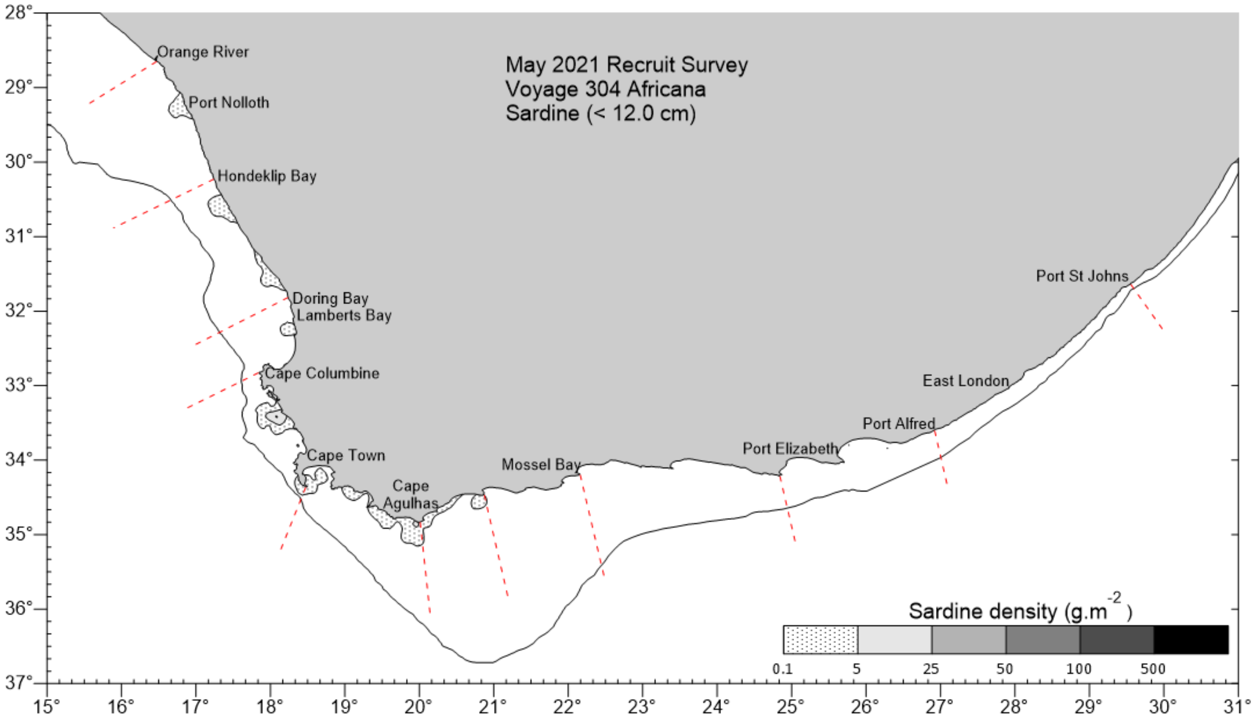


Figure 70: Distribution and relative abundance of sardine recruits (< 12 cm) (Source: DFFE Small Pelagic Scientific Working Group FISHERIES/2021/JUL/SWG-PEL/51draft

8.4.2.5 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; Figure 71).

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; Figure 72).

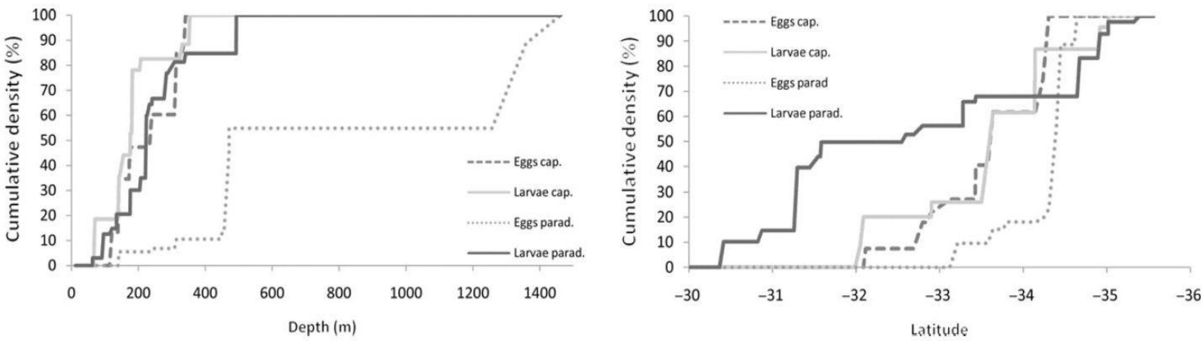


Figure 71: Cumulative density plots of Cape hake eggs and larvae sorted by (left panel) increasing seafloor depth and (right panel) increasing latitude (degrees south) (Source: Stenevik *et al*., 2008).

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).

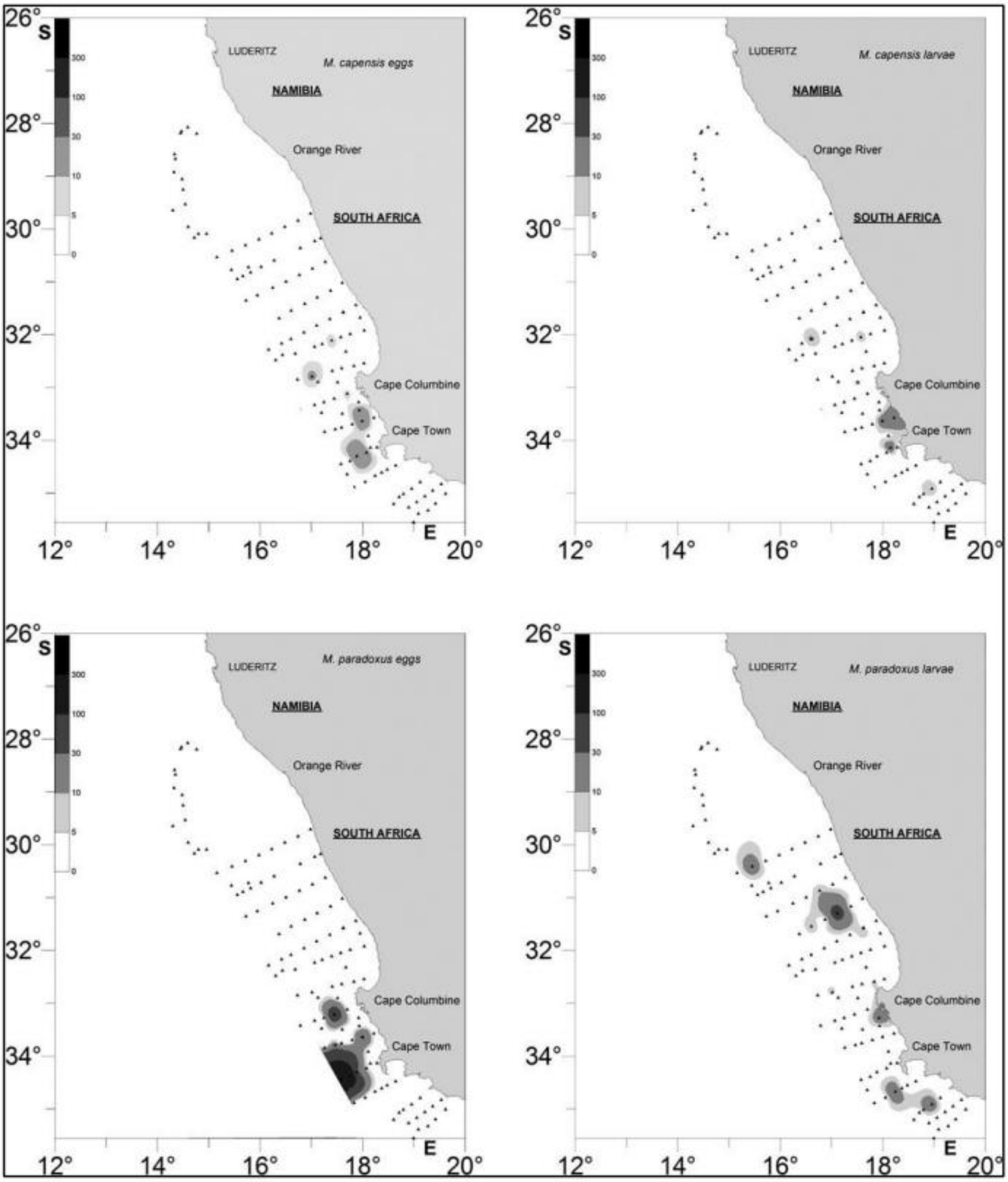


Figure 72: Station map showing the distribution of eggs (left) and larvae (right) of Cape hakes (M. capensis upper and M. paradoxus lower) during a research survey conducted between September and October 2005. Numbers per 10 m2 (Stenevik *et al*., 2008).

8.4.2.6 **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 73). 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.

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 behaviours 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 73 for the spawning grounds and nursery areas for snoek).

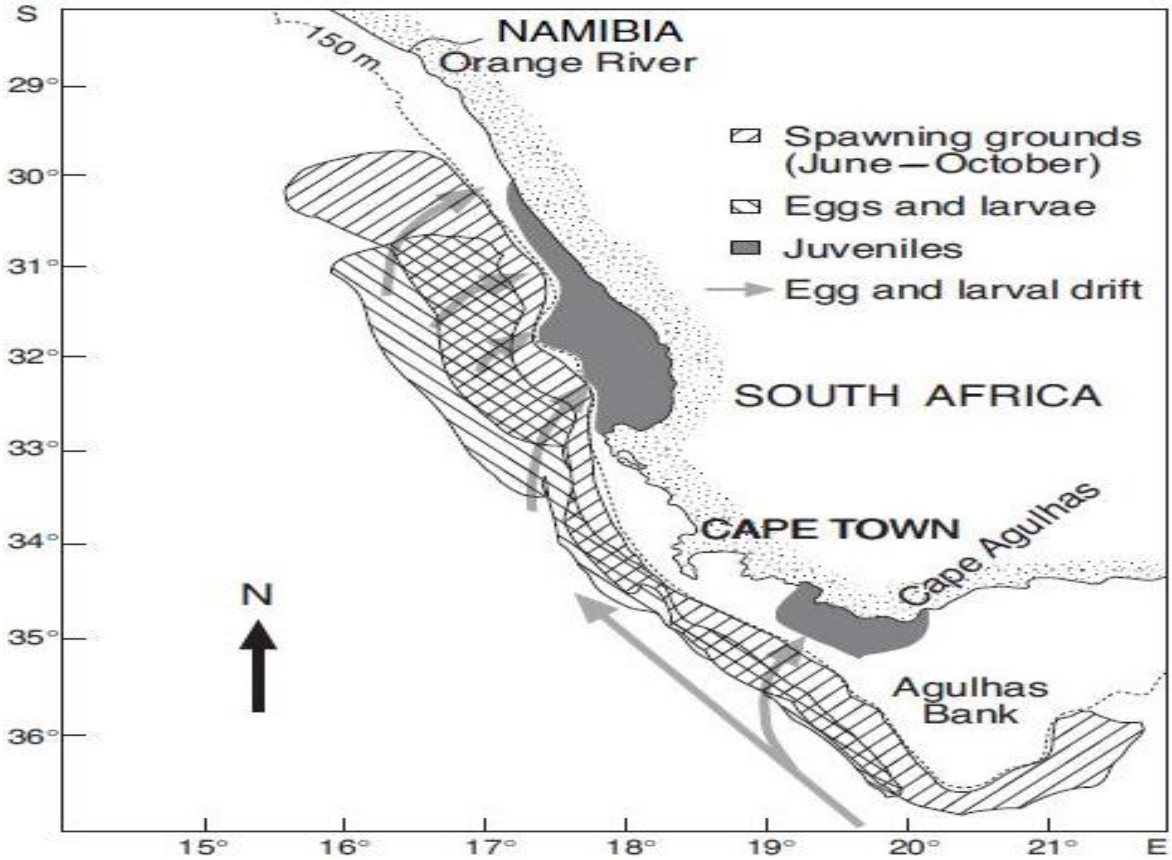


Figure 73: Conceptual model depicting the life history of snoek (left; Source: Griffiths, 2002) in the southern Benguela ecosystem, including spawning grounds, distribution and transport of eggs and larvae, and the nursery areas.

8.4.2.7 **SQUID**

Although the West Coast spawning ground is of little importance to Squid (Loligo spp.) spawning, paralarvae have been found West of Cape Agulhas so for the purpose of the current application it will feature here. Squid spawn in the nearshore zone on the eastern Agulhas Bank, principally in shallow waters (<50 m) between Knysna and Gqeberha (Figure 74). Their distribution and abundance are erratic and linked to temperature, turbidity, and currents (Augustyn *et al*. 1994; Schön *et al*. 2002). This niche area on the eastern Agulhas Bank optimises their spawning and early life stage as nowhere else on the shelf are both bottom temperature and bottom dissolved oxygen simultaneously at optimal levels for egg development (Roberts 2005; Oosthuizen & Roberts

2009). The greatest concentration of their food (copepods) tends to be found further west in the cold-water ridge on the central Agulhas Bank (Roberts & van den Berg 2002). Squid are not broadcast spawners but instead they lay benthic egg sacs. The paralarvae that hatch from the sacs are distributed close inshore and juveniles are dispersed over the entire shelf region of the Agulhas Bank. Larvae and juveniles are carried offshore and westwards (via the Benguela jet) to feed and mature, before returning to the spawning grounds to complete their lifecycle (Olyott *et al*. 2007).

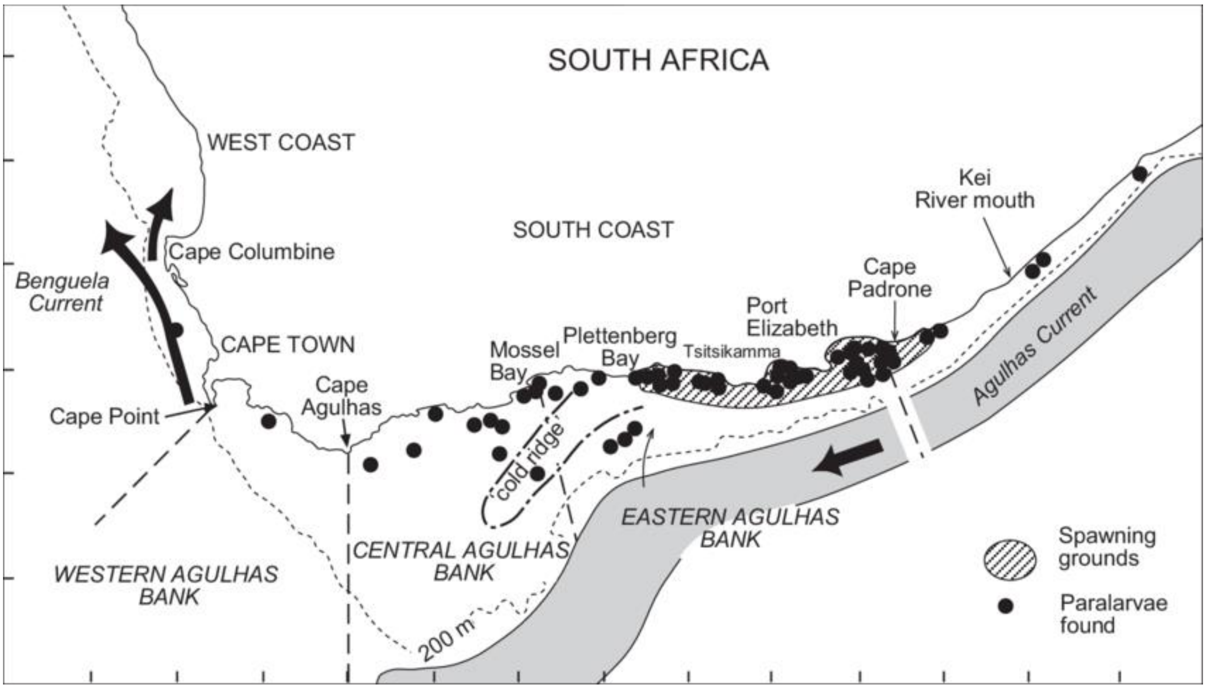


Figure 74: Main spawning grounds of Squid (Loligo spp.) on the eastern Agulhas Bank, east of the 'cold ridge'. Positions where paralarvae have been found are indicated (data from Augustyn *et al*. 1994).

8.4.2.8 **CENTRAL NAMIBIAN SPAWNING AND NURSERY GROUND**

The spawning of several types of fish, including hake, sardines, and horse mackerel, occurs in the waters off the coast of Namibia, from the Lüderitz upwelling center in the north down to the Angola-Benguela Front in the south (Sundby *et al*. 2001; Figure 75). The circulation patterns in this area are complex, with eddying and southward and onshore transport occurring beneath the surface drift to the northwest (Sundby *et al*. 2001). Sardine spawning peaks offshore in September and October, and larvae occur slightly further out to sea, with recruits appearing closer to shore (Sundby *et al*. 2001). Spawning also occurs in mid-summer in the Angola-Benguela Front region (Crawford *et al*. 1987), and warm water from the Angolan Current pushes southwards into central Namibian waters during late summer, which may transport pelagic spawning products into nursery grounds off central Namibia (Shannon 1985).

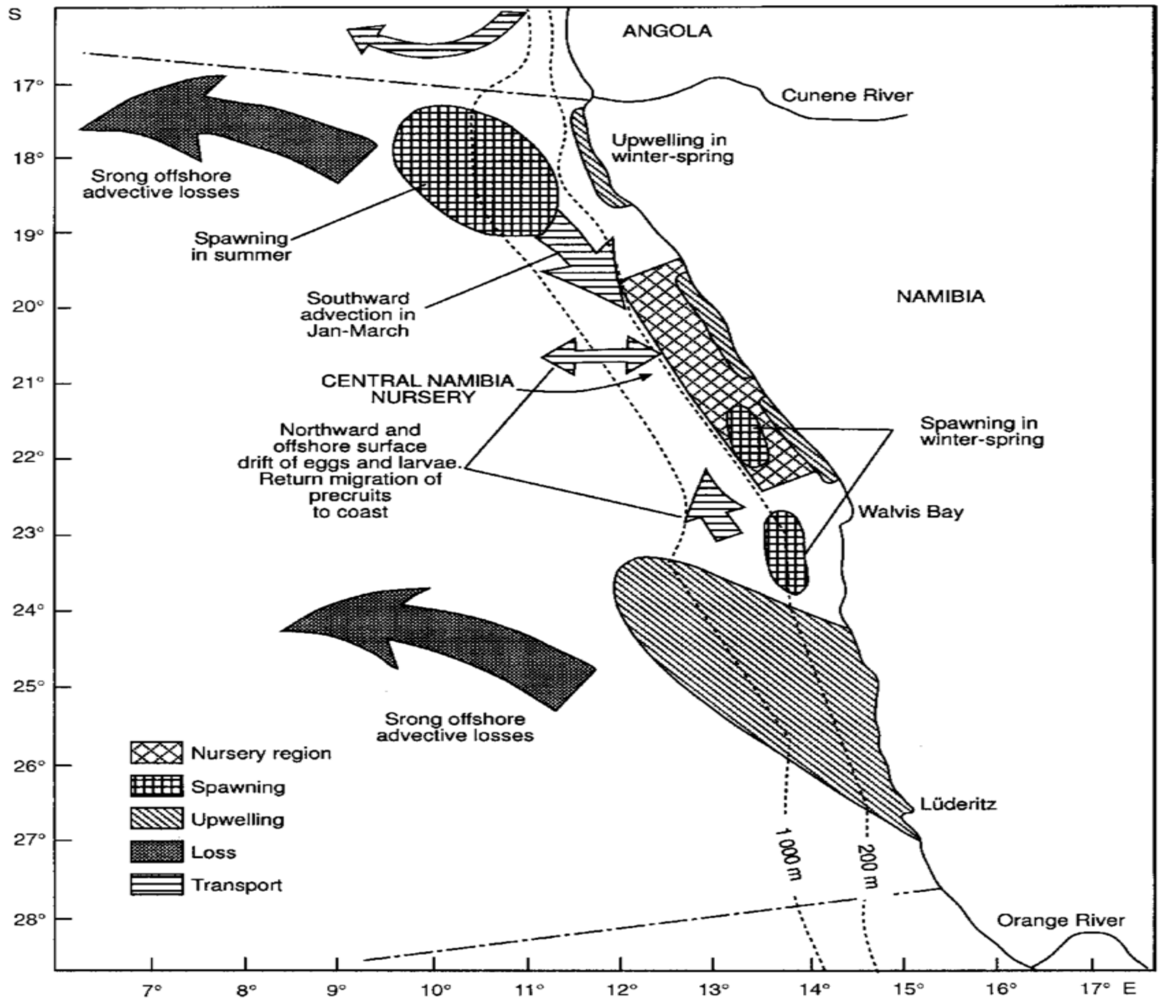


Figure 75: Central Namibian spawning/nursery ground, between the Lüderitz upwelling cell and the Angola-Benguela Front (Hutchings *et al*. 2002).

8.4.2.9 **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 Table 19 below. Table 20 shows known spawning periods of key commercial species off the West Coast of South Africa.

Table 19: 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 20: Summary table of known spawning periods for key commercial species off the West Coast of South Africa.

Commercial Species	Breeding/Spawning Season	Breeding/spawning Locality	Recruits	DWOB OVERLAP
Horse Mackerel	June to August	Central / Eastern Agulhas bank	Inshore southern Cape	No
Anchovies	October to March, peaks November to December	Agulhas Bank and West Coast nursery grounds	Inshore West Coast	No
Sardine	August to February	West Coast and Agulhas nursery grounds, into KZN.	Migrate South East back to Agulhas bank	No
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	No
Snoek	June to October	West Coast and Agulhas bank	Cape Columbine and Danger Point nursery	No
Squid	Throughout with peaks in November, and December.	Nearshore Eastern Agulhas Bank	Offshore and Westward	No

8.4.3 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 during January/February. 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 76 shows the spatial distribution of research trawls in relation to the licence block and the proposed AOI for drilling. Over the period 2013 to 2021, 46 research trawls were carried out within the licence block (average 5 trawls per survey), at a seafloor depth range of 345 m to 950 m. Surveys in the licence block take place over the period January to March. Over the period 2013 to 2021 no demersal research trawls were undertaken within the AOI for well drilling.

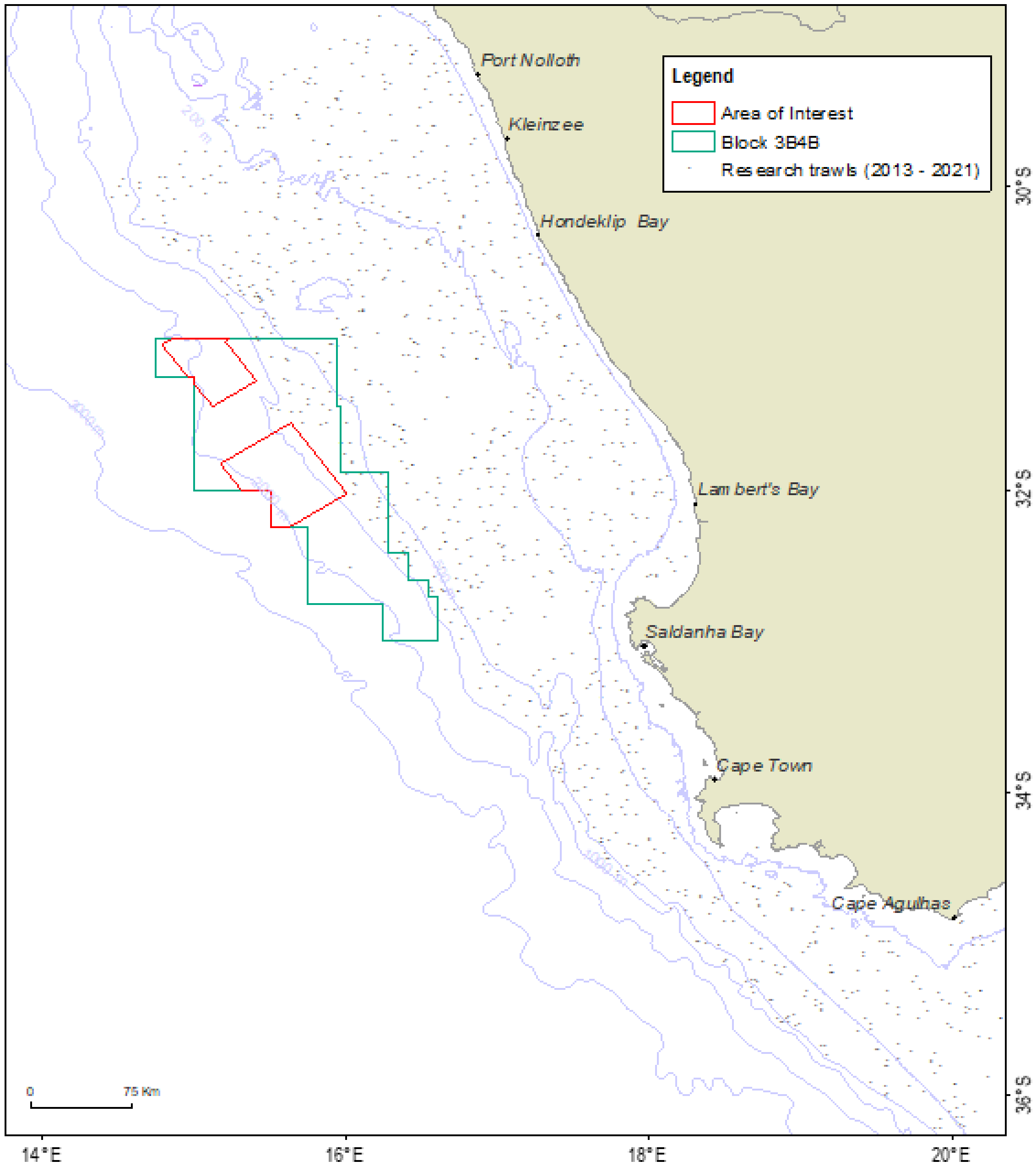


Figure 76: Spatial distribution of trawling effort expended by DFFE over the period 2013 to 2021 in assessing the biomass of demersal fish species.

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 1 000 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 1 000 m. Figure 77 shows the research survey transects undertaken by DFFE in November 2020 and May 2021 in respect to the licence block and AOI for proposed drilling. No transects coincided with the licence block or AOI for well drilling.

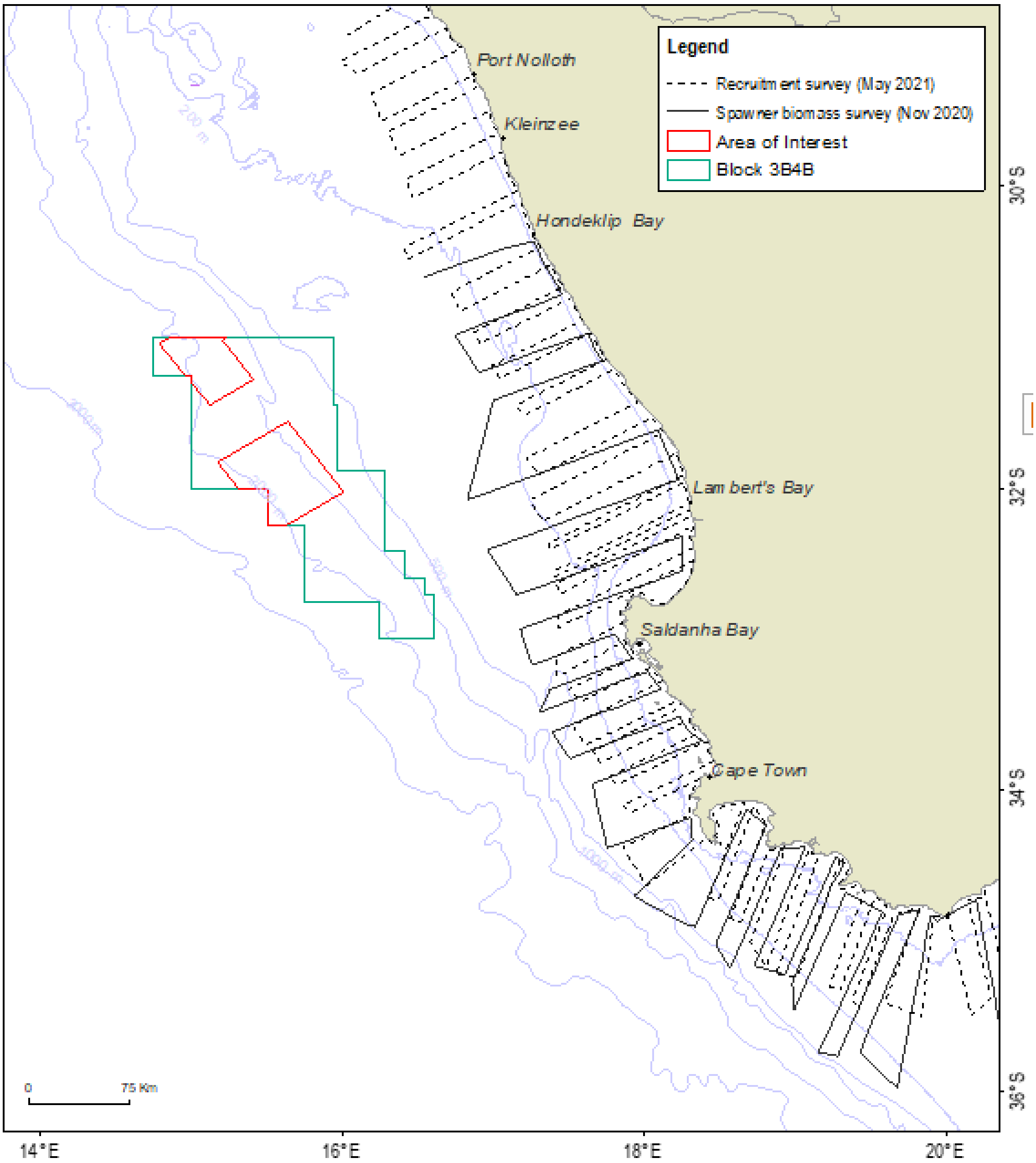


Figure 77: Spatial distribution of survey transects undertaken by DFFE during November 2020 and May 2021 during the research surveys of recruitment and spawner biomass of small pelagic species, respectively.

8.4.4 COMMERCIAL FISHERIES SECTORS

8.4.4.1 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 (Figure 78). 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.

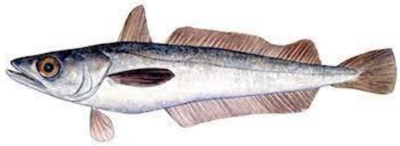
Fish species	*Reference Image*	*Targeted or Bycatch*
Deepwater Hake Merluccius paradoxus		Targeted
Shallow water Hake Merluccius capensis		Targeted
Monkfish Lophius vomerinus		Bycatch
Kingklip Genypterus capensis		Bycatch
Snoek Thyrsites atun		Bycatch

Figure 78: Commercially important target and bycatch species in the South African Demersal Trawl Fishery. Reference images courtesy of SAIAB.

Vessels operating in the fishery usually trawl throughout the traditional “inshore” area i.e., in waters shallower than the 110 m isobaths, but are not restricted from operating in deeper water. By contrast, vessels operating in the deep-sea trawl fishery may not operate in water depths of less than 110 m or within 20 nautical miles of the coast, whichever is the greater distance from the coast.

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. In 2020 the offshore trawl industry was values at R4.3 billion. The latest value estimates (Table 21) show a steady increase to R6 billion and R550 million for the offshore and inshore trawl fishery, respectively. The 2022 TAC for Cape hakes was set at 8 131 and 110 448 tonnes for the inshore and offshore trawl fisheries, respectively. Of the national TAC for Cape Hakes a further 10% is allocated to the hake demersal longline sector.

Table 21: Estimates for the inshore and offshore demersal hake trawl fisheries. This includes financially value of the fishery (as of 2021) and TAC as of 2022.

Values	Inshore	Offshore
Number of rights holders	32	28
Value of catch (2021, quayside)	R550 million	R6 billion
Tac 2022	8 131 tonnes	110 448 tonnes
Employment creation	4 500	7 300
Rights valid until	31 December 2031	31 December 2037

The annual TAC limits and landings of hake (both species) by the trawl and longline sectors is listed in Table 22. A time-series of total hake catch as well as hake catch by sector is shown in Figure 79.

Table 22: 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).

	M. paradoxus					*M. capensis*						TOT bo spe
TAC	Deep-sea		Longline		TOTAL	Deep-sea		Inshore	Longline		TOTAL	
	WC	SC	WC	SC		WC	SC	SC	WC	SC		
119831	69709	15457	2394	1527	89087	10186	4055	5472	3086	3024	26098	11
131780	76576	17904	2522	140	97142	15673	4086	6013	3521	3047	35525	12
144671	81411	16542	4358	306	102616	12928	4584	3223	2570	1737	25050	12
156075	74341	28859	6056	60	109316	8761	4475	2920	2606	1308	20071	12
155280	73252	41156	6879	8	121295	9671	6286	2965	2123	315	21361	14
147500	77521	31745	4001	18	113286	12727	4085	3077	2325	53	22217	13
147500	93173	18968	2806	1	114948	14744	2810	3973	4360	2	25889	14
140125	72326	30961	5288	25	108600	15273	4466	2812	2807	126	25488	13
133119	64252	29218	5217	90	98777	12689	12863	3983	2615	481	32668	13
146431	70608	22201	5328	34	98171	14193	9454	4149	3623	299	31718	12
146400	97093	10061	5847	47	113048	18115	3500	4536	2348	321	28820	14
139109	102865	15597	5892	18	124372	15585	2937	4517	2932	194	26165	15

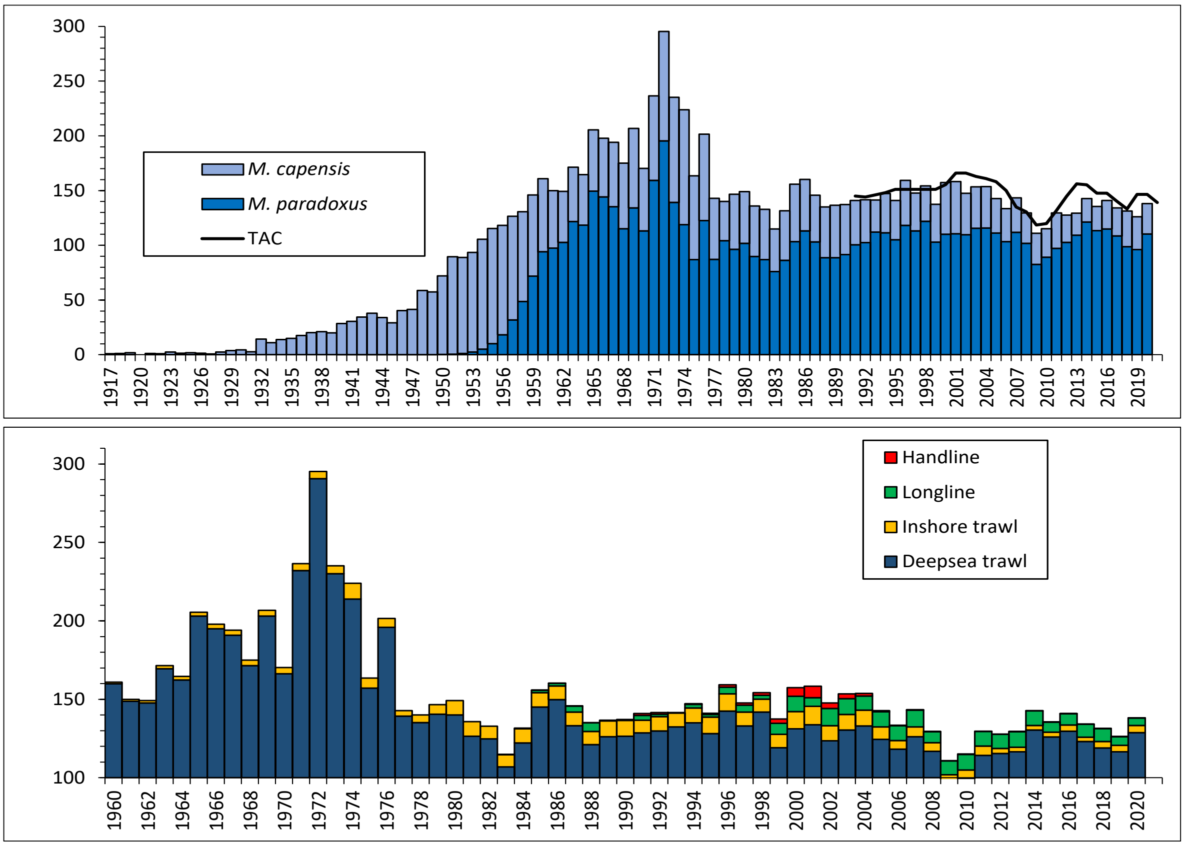


Figure 79: (Top panel) Total catches (‘000 tonnes) of Cape hakes split by species over the period 1917–2020 and the TAC set each year since the 1991. (Bottom panel) Catches of Cape hakes per fishing sector for the period 1960–2020. Prior to 1960, all catches are attributed to the deep-sea trawl sector. Note that the vertical axis commences at 100 000 tonnes to better clarify the contributions by each sector (Source DFFE, 2022).

8.4.4.2 OFFSHORE DEMERSAL TRAWL FISHERY

The offshore demersal trawl fleet consists of 53 trawlers. Twenty-six fresh fish trawlers preserve hake on ice and return it to shore for processing, while 27 freezer vessels produce frozen headed and gutted (H&G) hake or sea-frozen fillets. Wetfish vessels range between 24 m and 56 m in length while freezer vessels are usually larger, ranging up to 90 m in length. Figure 80 shows a photograph of a wetfish trawler operating in South Africa’s offshore demersal trawl fishery. Inshore vessels range in length from 15 m to 40 m. Trips average three to five days in length and all catch is stored on ice. These vessels 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.

Between 2014 and 2019, a five-year benthic trawl experiment was conducted by the South African Deep Sea Trawling Industry Association (SADSTIA), in collaboration with the DFFE, the University of Cape Town, the South African Environmental Observation Network and the South African National Biodiversity Institute. The aim of the study was to assess the environmental impact of demersal trawling in South African waters. The offshore demersal trawl sector catches between 118 000 and 166 000 tonnes, with 90% of the catch being M. paradoxus and 10% M. capensis. The trawler owners and operators produce fresh and frozen products, which are sold in retail and food-service markets locally and internationally, with the main export markets being in Europe, Australia and the United States (Durholtz *et al*., 2015).

The main bycatch species are kingklip and monk. Monkfish-directed trawlers tend to fish shallower waters than hake-directed vessels on mostly muddy substrates. Trawling on rough ground near the Cape Canyon (off Saldanha Bay) started in the late 1990s and has been fished regularly since then. With improvements in technology and experience, rough ground in areas such as “the Blades” off Cape Point (an area of irregular hard ground near the Cape Valley) became more frequently trawled with less damage or loss of gear. At present, the Cape Valley, the southern canyon off Cape Point, has a high trawling effort in the South African context, and this area has been quite intensively fished for the last 25 years (Sink *et al*., 2012).

Trawl nets are generally towed parallel to the depth contours (thereby maintaining a relatively constant depth) in a north-westerly or south-easterly direction. Trawlers also target fish aggregations around bathymetric features, in particular seamounts and canyons, where there is an increase in seafloor slope and in these cases the direction of trawls follow the depth contours. As mentioned, the offshore sector is prohibited from operating in waters shallower than 110 m or within five nautical miles of the coastline. There are other measures in place to ease socio-economic concerns and environmental sustainability (Figure 81).

Figure 80: Photograph of MFV Harvest Mzansi, a wetfish vessel operating in the South African offshore demersal trawl sector source: www.sadstia.co.za).

Since South Africa declared its exclusive economic zone (EEZ) under the United Nations Law of the Sea in November 1977, the offshore demersal trawl fishery for hake has been closely managed and regulated. South Africa has implemented a range of regulatory and conservation measures to rehabilitate hake stocks that were previously overfished by international fishing fleets, working closely with the trawling industry (Durholtz et al., 2015). Today, the primary management measure for regulating hake fisheries is the setting of an annual total allowable catch (TAC). However, a comprehensive suite of additional measures has been developed over time to address socio-economic and ecosystem concerns, including spatial and temporal closures, gear restrictions, and bycatch limits (SADSTIA, 2021).

1. Restrictions on **vessel power and size** implemented in 2003 for inshore trawl fishery.
2. **Capacity management** measures introduced in 2008 to offshore demersal trawl fishery.
3. **Capacity-limitation** models developed to avoid fleet overcapacity.
4. Minimum **mesh size** regulations introduced in 1974 to minimize juvenile fish catch.
5. **Paired trawling** prohibited in 1977 to limit seabed impact of fishing.
6. **Limits** on bobbins and foot ropes size/weight introduced in 2003 to reduce seabed impact of fishing.
7. **Marine protected areas** introduced, some impacting deep-sea trawling, e.g., for protecting kingklip spawning grounds.
8. **Ring-fencing**, a voluntary measure adopted in 2008, to prevent further impact on benthic habitat.
9. **Mitigation** of seabird mortalities includes vessel-specific waste management measures, mandatory deployment of bird-scaring devices, and regulations on trawl warps.
10. **Bycatch** limitation measures introduced, including precautionary upper catch limits, "move-on" rules, and bycatch species proportion restrictions per landing.

Figure 81: Additional management protocols for offshore demersal trawlers in South Africa (SADSTIA 2017).

8.4.4.3 INSHORE DEMERSAL TRAWL FISHERY

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 primarily target shallow water hake (*M. capensis*). The Agulhas sole (*Austroglossus pectoralis*) is the second most important catch close inshore between Struisbaai and Mossel Bay, between the 50 m and 80 m isobaths. Catches display a much higher species mix than those of the deep-sea trawl fishery. The vessels are smaller and less powerful than those used in the deep-sea trawl fishery; they range in length from 14 to 36 m and engine size is restricted to 1 000 hp. Modern stern trawlers, as well as much older side trawlers, form part of the fishing fleet. The inshore fishery also targets Hakes further offshore, where they can encounter both Hake species, in traditional grounds between 100 m and 200 m depth in fishing grounds known as the Blues located on the Agulhas Bank.

The activity of both the inshore and offshore fishery is restricted by permit condition to operating within the confines of a historical “footprint” – an area of approximately 57 300 km^2 and 17 000 km^2 for the offshore and inshore fleets, respectively.

8.4.4.4 OTTER TRAWLING

Otter trawling is the main trawling method used in the South African hake fishery. This method of trawling makes use of trawl doors (also known as otter boards) that are dragged along the seafloor ahead of the net, maintaining the horizontal net opening. Bottom contact is made by the footrope and by long cables and bridles between the doors and the footrope. Behind the trawl doors are bridles connecting the doors to the wings of the net (to the ends of the footrope and headrope). A headline, bearing floats and the weighted footrope (that may include rope, steel wire, chains, rubber discs, spacers, bobbins or weights) maintain the vertical net opening. The "belly", "wings" and the "cod-end" (the part of the net that retains the catch) may contact the seabed (Figure 82).

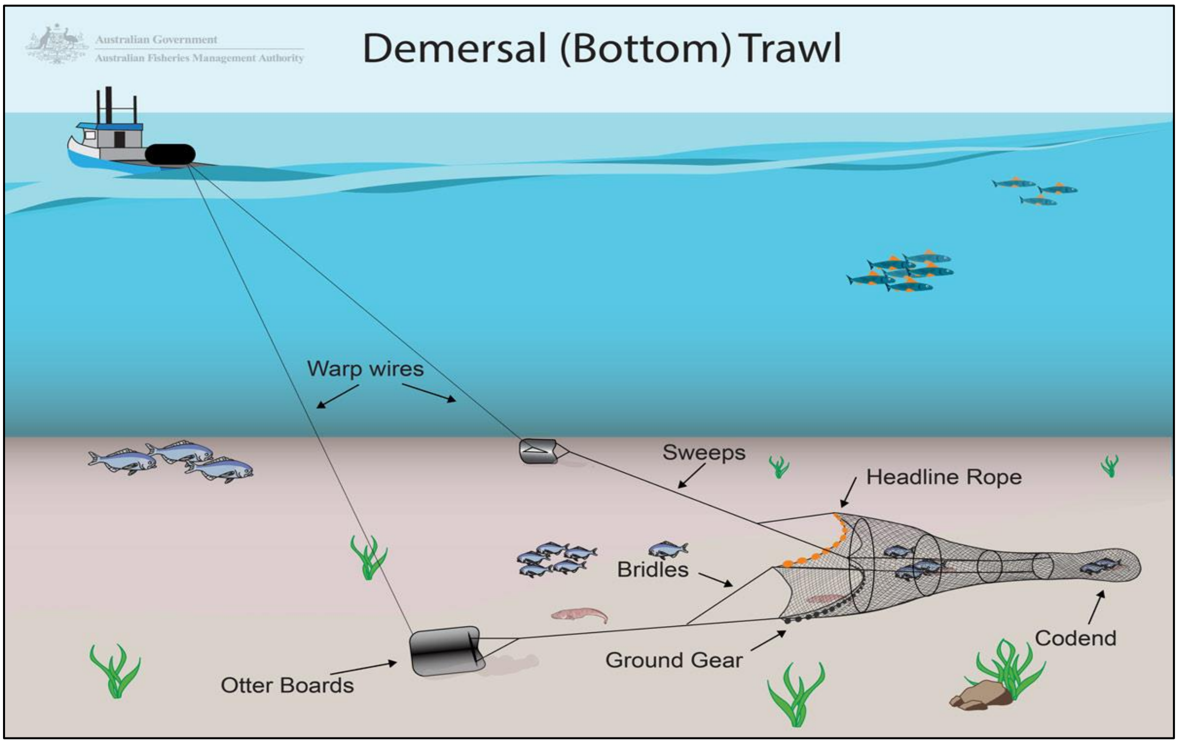


Figure 82: Gear configuration similar to that used by the offshore demersal trawlers targeting hake (Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling).

The configuration of trawling gear is similar for both offshore and inshore vessels however inshore vessels are smaller and less powerful than those operating within the offshore sector. Trawl depth records ranged from approximately 20 to 980 m, though very few trawls were recorded deeper than 800 m (Currie *et al*., 2021).

Licence Block 3B/4B does overlap the spatial extent of demersal trawling ground whereas the northern and central AOI are situated 25 km and 10 km, respectively, from the trawl footprint. A 500 m safety zone around the drilling unit would therefore not coincide with trawl ground nor present an exclusion to fishing operations or loss of access to fishing ground. Refer to Figure 83 which shows the location of demersal trawling grounds in relation to the AOI for well drilling.

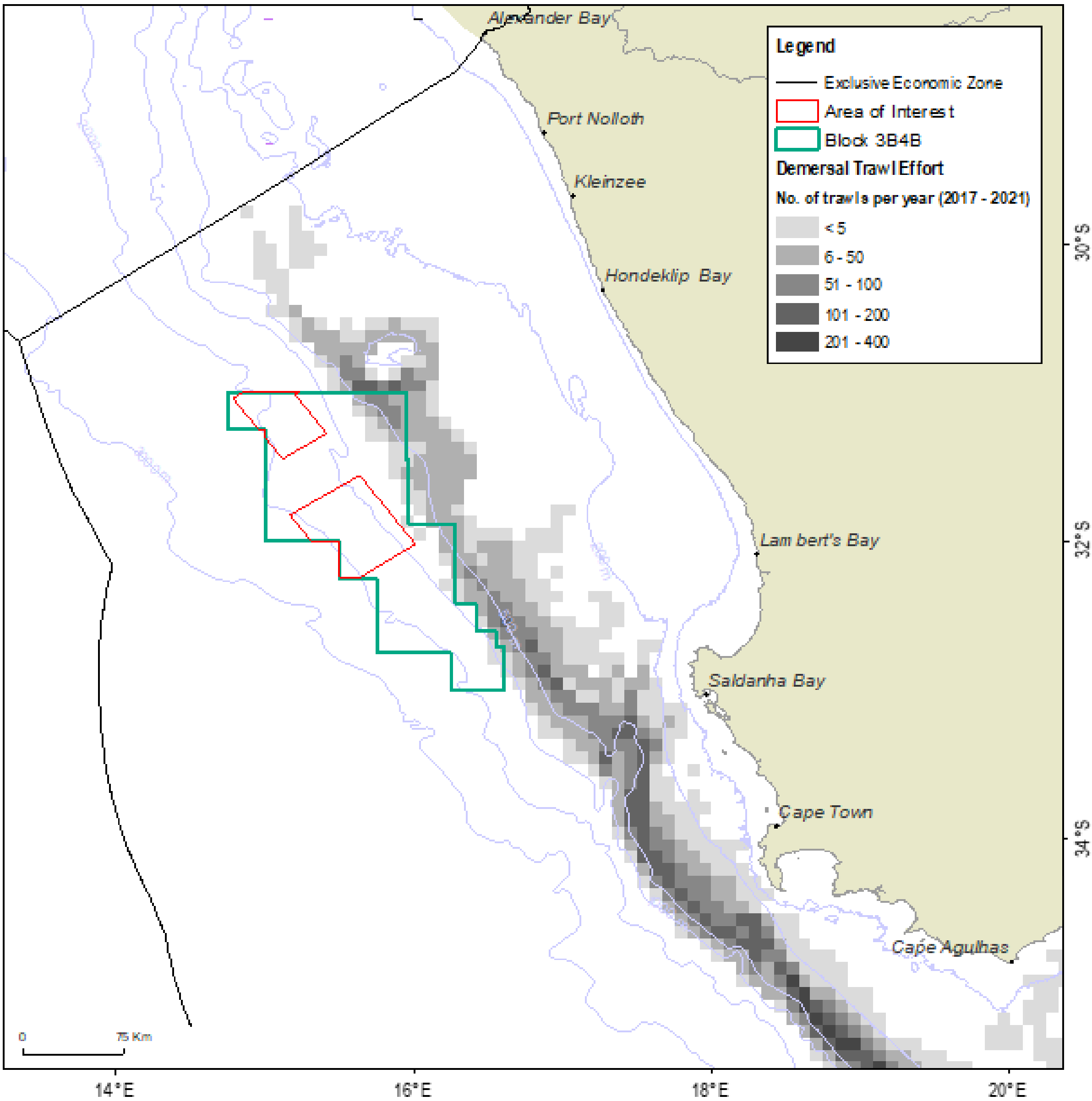


Figure 83: Overview of the spatial distribution of demersal trawl effort (2017 - 2021) in relation the licence block and AOI for proposed drilling.

8.4.4.5 **MIDWATER TRAWL**

The midwater trawl fishery targets adult Cape horse mackerel (*Trachurus capensis*) (Figure 84), which aggregate in highest concentration on the Agulhas Bank. Cape horse mackerel are semi-pelagic shoaling fish that occur on the continental shelf off southern Africa from southern Angola to the Wild Coast. Off South Africa, adult horse mackerel are currently more abundant off the South Coast than the West Coast. Horse mackerel yield a low-value product and are a source of cheap protein (DEFF, 2020).

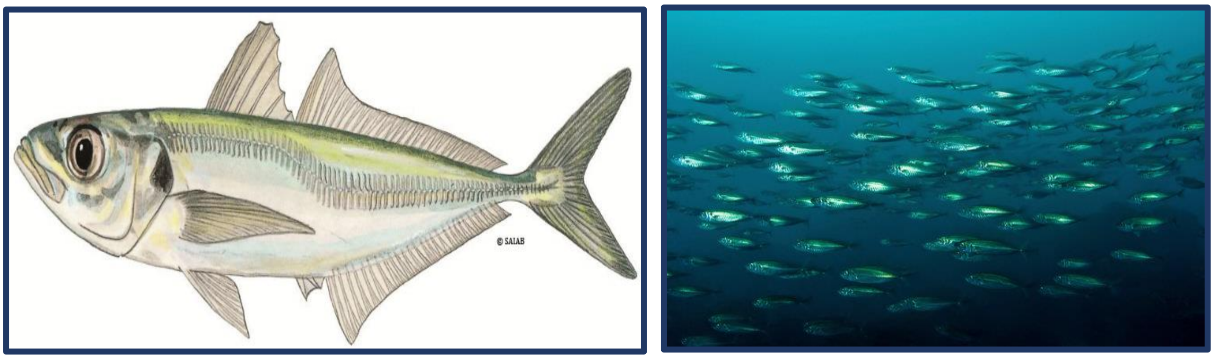


Figure 84: Cape horse mackerel (Trachurus capensis), primary target species of the Midwater Trawl Fishery in South Africa. Images courtesy of SAIAB (left) and Oceana (Right).

This sector comprises six vessels and 34 rights holders which landed a total catch of 19 555 in 2019. The fleet is split between dual rights holders who fish horse mackerel on hake-directed trawlers and others that combine their allocation on a single large midwater trawl vessel. Dual rights holders fishing only occurs if horse mackerel availability is high when fishing for hake at which point that may switch from bottom trawl to midwater trawl. The amounts of horse mackerel caught by these vessels is a relatively small component of the horse mackerel TAC. Those horse mackerel rights holders that do not have hake rights or who do not have a suitable vessel to catch horse mackerel allow their share of the horse mackerel to be caught on a single large midwater trawler. This facilitates the economic use of a single large vessel that can more efficiently catch their horse mackerel allowing the vessels to fish year round. The area fished by this vessel is restricted largely (but not exclusively) to water deeper than 110 m or more than 20 nm from the coast and in an area east of Cape Point. The dual vessels may fish in a broader area, mostly on or near the hake fishing grounds.

Midwater 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 sea bed and the surface of the sea without continuously touching the bottom. In practice, midwater trawl gear does occasionally come into contact with the seafloor. Midwater trawling gear configuration is similar to that of demersal trawlers, except that the net is manoeuvred vertically through the water column (refer to Figure 85) for a schematic diagram of gear configuration). 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 are 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.

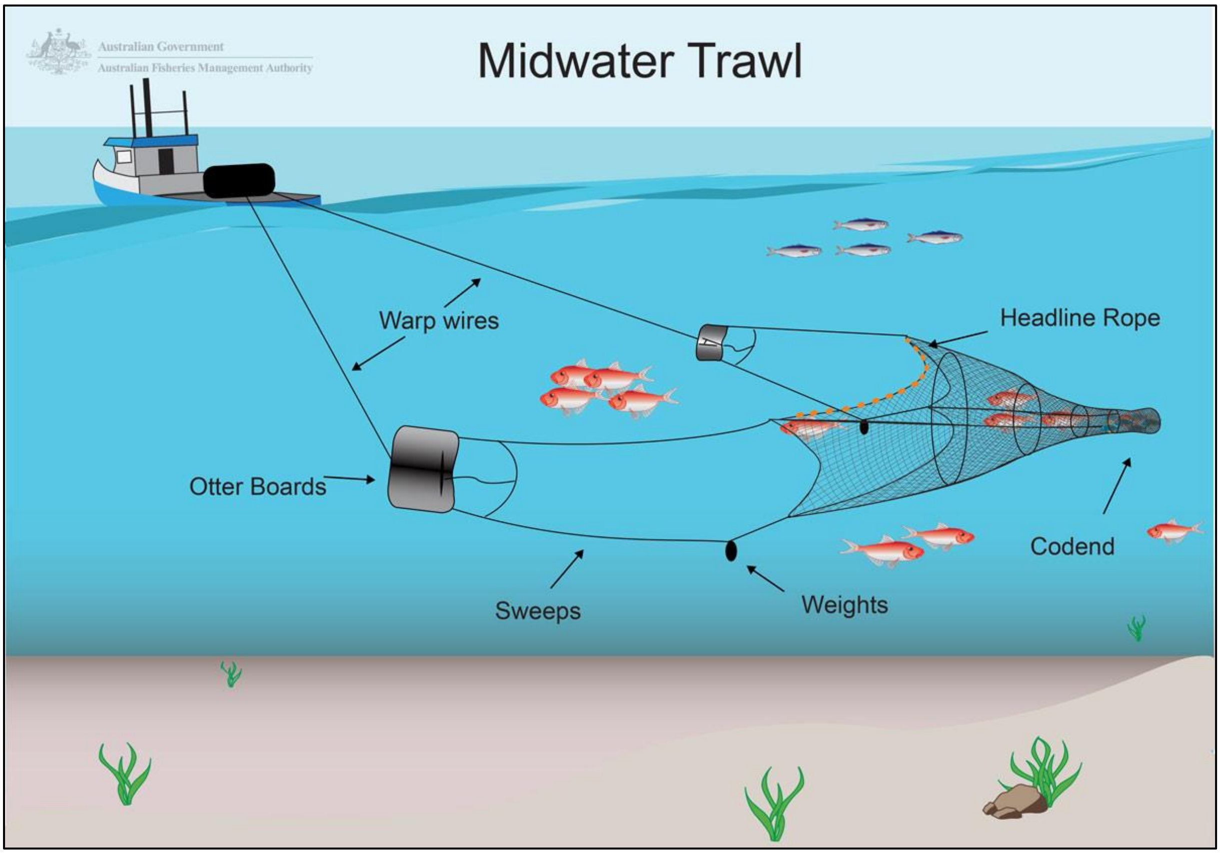


Figure 85: Schematic diagram showing the typical gear configuration of a midwater trawler. Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling.

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. Since 2017, DFFE has permitted experimental fishing to take place westward of 20°E and horse mackerel is occasionally targeted around Child's Bank situated east of the licence block.

Figure 86 shows the spatial extent of grounds fished by mid-water trawlers in relation to the licence block and AOI for drilling. There is no overlap of fishing grounds with either the licence block or the AOI.

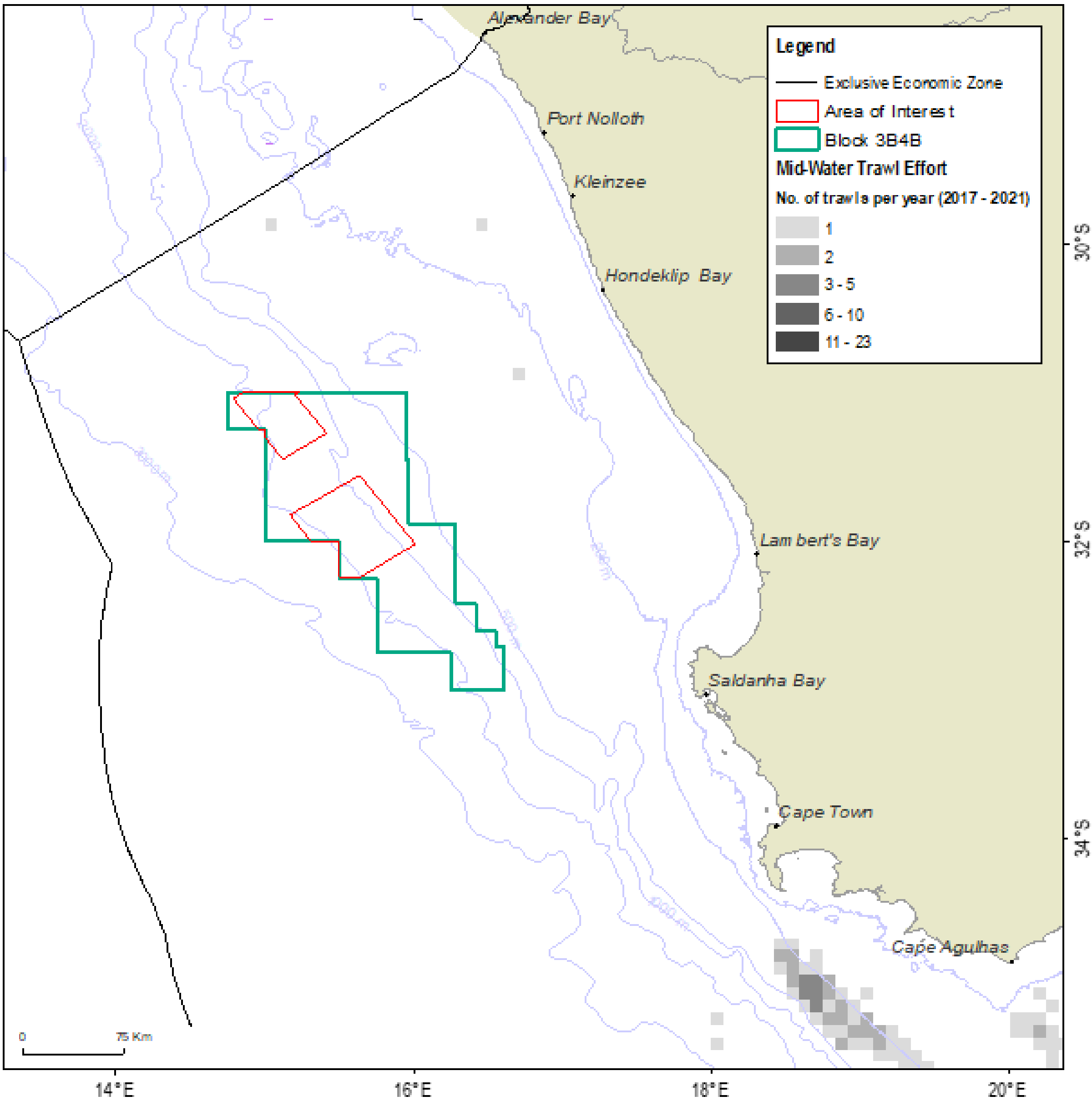


Figure 86: Overview of the spatial distribution of fishing effort expended by the midwater trawl sector (2017-2019) targeting horse mackerel in relation to the AOI for proposed drilling (red polygon) and block 3B/4B (green polygon).

8.4.4.6 HAKE DEMERSAL LONGLINE

In 1983, a demersal longline fishery aimed at catching Kingklip *Genypterus capensis* was launched in the continental shelf waters of South Africa, but the fishery was closed in 1990 due to concerns over the sustainability of the Kingklip resource (Japp, 1993). In 1994, a new experimental longline fishery was started, targeting Cape hakes Merluccius capensis and M. paradoxus (Japp, 1993; Japp & Wissema, 1999). In 2017, 8 113 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 8 230 tons were reported in 2018.

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.

Currently 64 hake-directed vessels are active (this can vary between 32 and 71 vessels Japp & Wissema 1999) within the fishery, most of which operate from the harbours of Cape Town, Hout Bay, Mossel Bay and Gqeberha. Secondary points of deployment include St Helena Bay, Saldanha Bay, Hermanus, Gansbaai, Plettenberg Bay and Cape St Francis. Vessels based in Cape Town and Hout Bay operate almost exclusively on the West Coast (west of 20° E). Fishing grounds are similar to those targeted by the hake-directed demersal 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 87 shows the spatial distribution of hake demersal longline fishing areas in relation to the licence block and proposed drilling area. The AOI for proposed drilling area is situated offshore of the main fishing grounds which, in this area extend up to the 380 m bathymetric contour; the closest point of fishing effort to the boundary of the AOI is 15 km. There is no overlap of fishing grounds with the AOI.

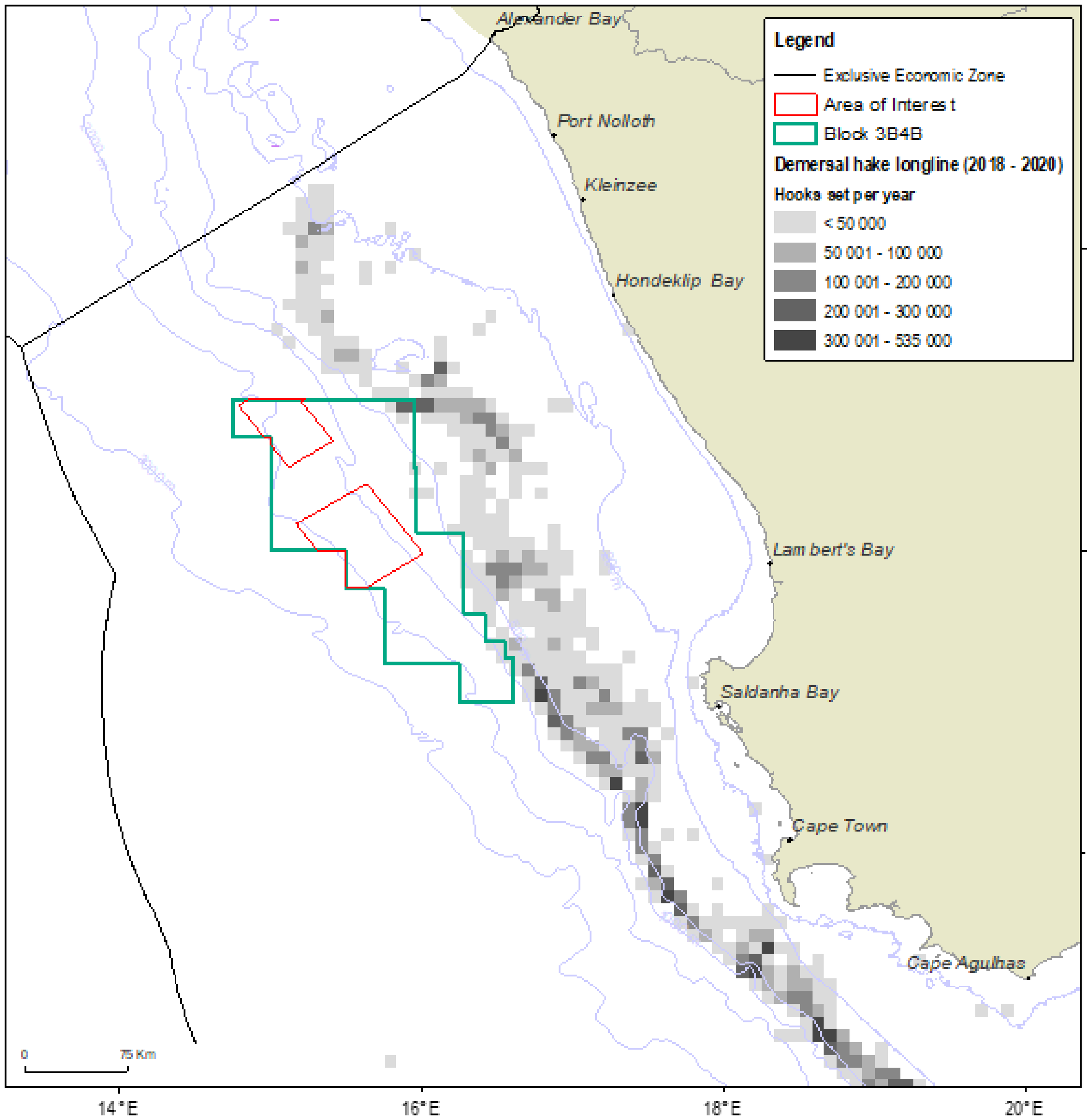


Figure 87: An overview of the spatial distribution of fishing effort expended by the hake demersal longline sector in relation to the licence block 3B/4B (green polygon) and AOI for proposed drilling (red polygon).

8.4.4.7 SHARK DEMERSAL LONGLINE

After the tuna longline fishery declined in the mid-1960s, South African longline fishers shifted their focus to more profitable stocks. In 1991, permits were granted for the demersal shark longline fishery, which initially arose from exploiting regulatory loopholes to catch hake with longline gear, an activity that had been discontinued in 1990. Fishers targeted hake and kingklip under the guise of shark permits, but when bycatch limits for these species were lowered in the shark fishery, fishing effort decreased significantly. The number of permits issued was reduced from over 30 to just 6 by 2006, due to poor performance in the fishery. In the past decade, only 4 vessels have been active at any given time, despite 6 rights being allocated during the previous allocation process, with 2 of those vessels remaining inactive. As the majority of Right Holders own additional Rights in other fisheries, the number of active vessels fluctuates over the year but rarely exceeds four vessels operating at the same time. Annual landings have fluctuated widely due to variation in demand and price. Rights are due to be re-allocated during the fishing Rights allocation process in 2021/2022.

The demersal shark longline fishery is permitted to operate in coastal waters from the Orange River on the West Coast to the Kei River on the East Coast but fishing rarely takes place north of Table Bay. Vessels are typically

<30 m in length and use nylon monofilament Lindgren Pitman spool systems to set weighted longlines baited with up to 2 000 hooks (average = 917 hooks). The fishery operates in waters generally shallower than 100 m and uses bottom-set gear to target predominantly soupfin sharks and smoothhound sharks (Figure 88). Following an initial period of adjustment to catching and marketing demersal sharks, catches of soupfin and smoothhound sharks started increasing in 2006, and reporting became more reliable.

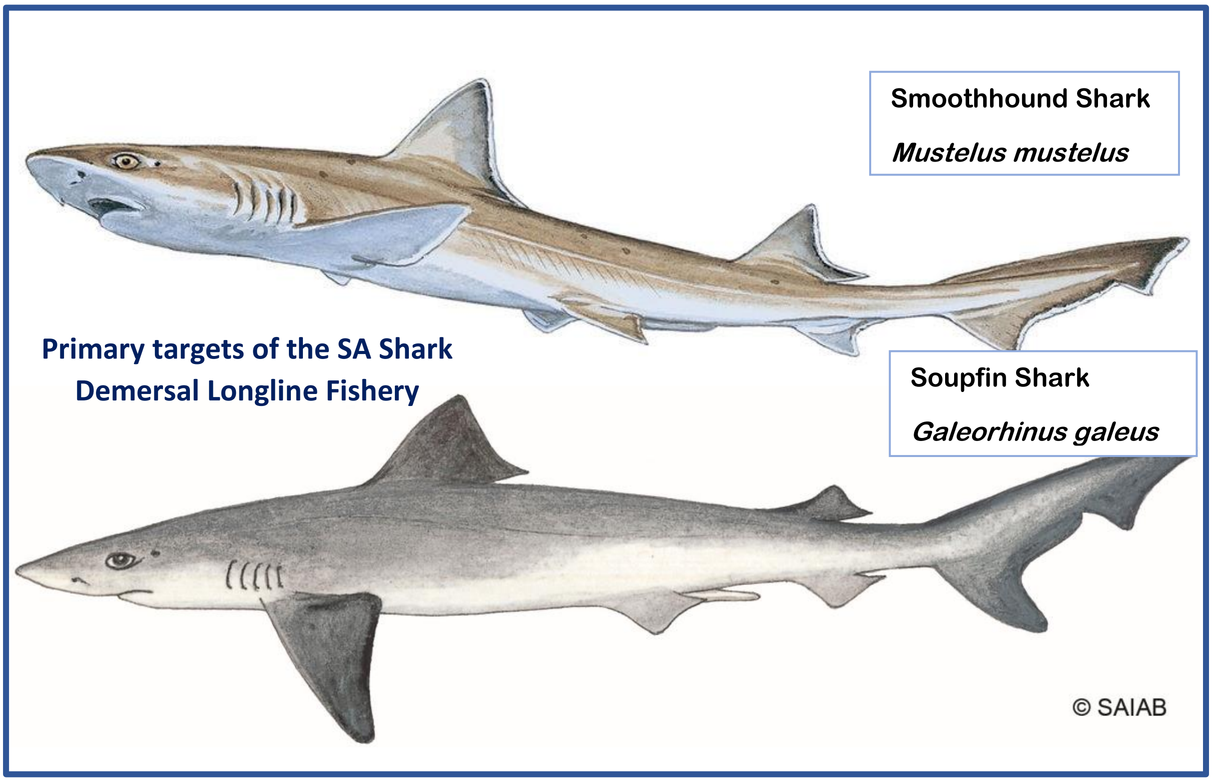


Figure 88: Primary target species of the Shark Demersal Longline fishery in South Africa, the Smoothhound and Soupfin shark. Images courtesy of Shark Research Institute and SAIAB.

The commercial-scale exploitation of sharks began in the 1930s around traditional fishing villages in the Western Cape. This fishery used handlines and targeted inshore demersal sharks for their livers to be used in the production of Vitamin A oil. By the 1940s, catches of soupfin sharks had declined (Davies 1964) as targeting shifted. Refer to Figure 89 for the concerning stock status of Soupfin sharks based on stock status estimates. To date, this Western Cape soupfin fishery has not recovered to historical catch levels. To compensate for declining catch rates of high-value line fish species, a rapid increase was seen in shark catches between 1990 and 1993. After 2000, species-specific reporting came into effect and sharks continued to constitute a large proportion of the livelihood of these fishers around South Africa, with the establishment of a number of dedicated shark processing facilities.

Shark catches by the line fishery since the 1990s have typically fluctuated in response to the availability of higher priced line fish species and market influences. With the traditional linefishery being the largest participant in shark catches. It was only in the mid-2000s when participation in shark landing was seen in other fisheries (See Soupfin estimated landings example in Figure 89). Species targeted include soupfin sharks, smoothhound sharks, dusky sharks Carcharhinus obscurus, bronze whaler sharks C. brachyurus, and various skate species.

Table 23 lists 2018 landings of the main demersal shark and skate species caught by line and Figure 90 shows the spatial distribution of catch between 2017 and 2019. Fishing effort is coastal and directed inshore of the 100 m depth contour. The proposed drilling area is situated approximately 350 km from the closest expected fishing activity and there is no overlap of fishing grounds with the AOI for proposed drilling.

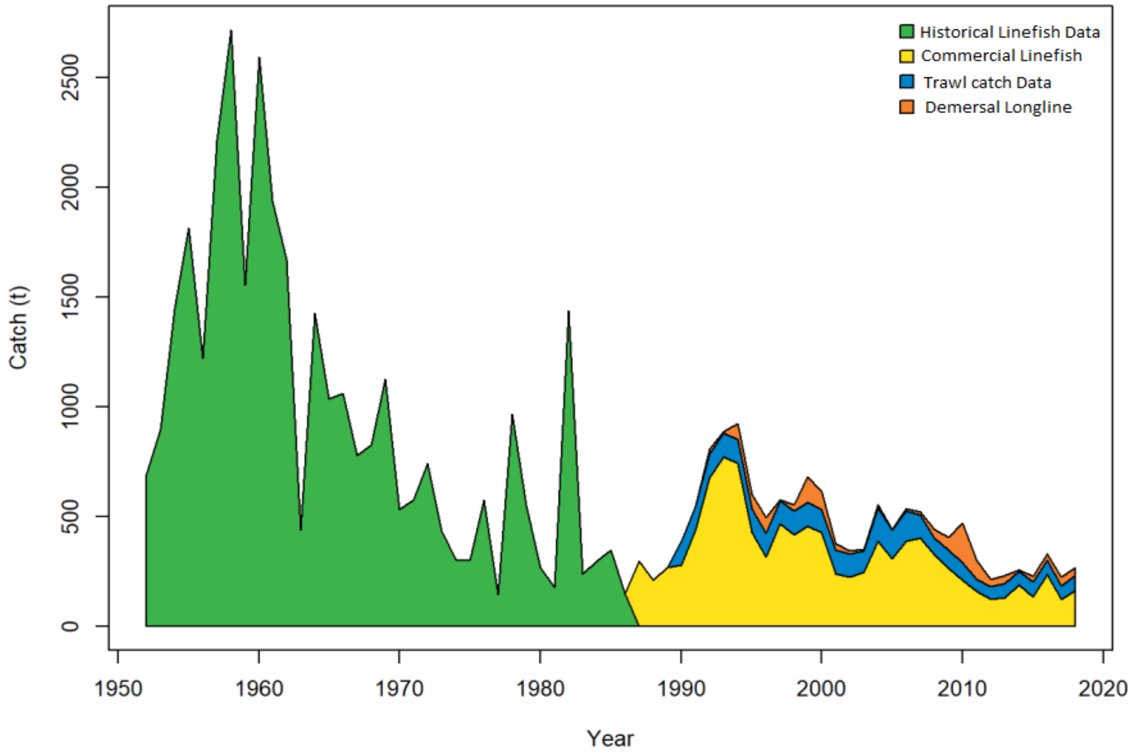


Figure 89: Time-series of estimated catch in metric tons (t) for soupfin sharks *Galeorhinus galeus* (1952-2018) showing the linefish historical data (green), commercial linefish data (yellow), trawl catch data (blue) and demersal shark longline catch data (orange; A century of shark fishing in SA, DFFE).

Table 23: Total catches per FAO area of demersal shark (2018).

Species	Catch by FAO Area (kg)			Total
	1.6	2.1	2.2	
Soupfin shark	7	2017	365	2388
Smoothhound shark	6	4244	5340	9591
Bronze shark	6	384	0	390
St. Joseph shark	0	112	33	144
Skate	0	145	444	589
Total	19	6902	6183	13103

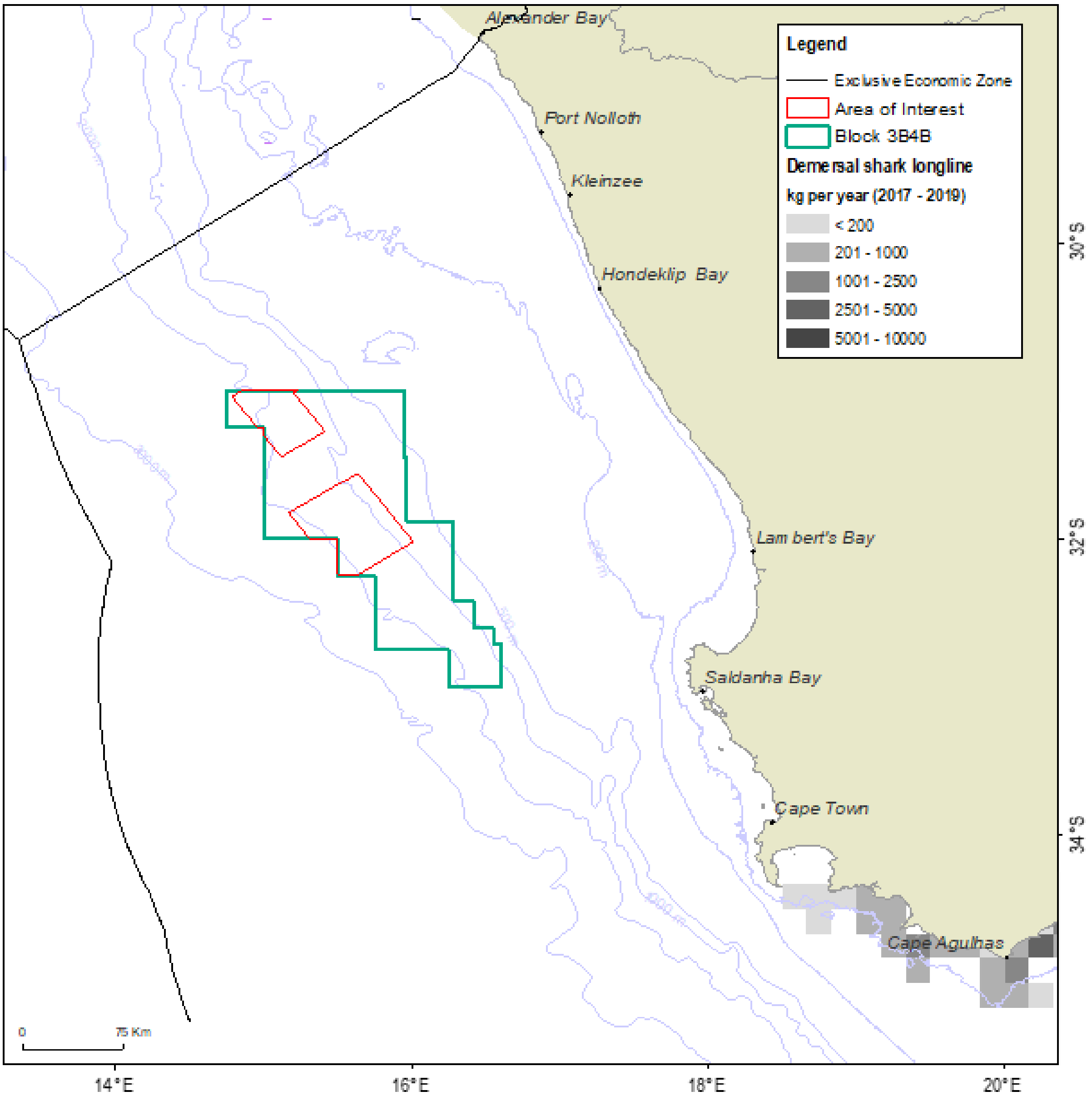


Figure 90: Spatial distribution of catch taken by the demersal shark longline fishery (2017 – 2019) in relation to the licence block 3B/4B (green polygon) and the AOI for proposed drilling (red polygon).

8.4.4.8 SMALL PELAGIC PURSE-SEINE

The South African small pelagic fishery developed in the 1940s primarily targeting adult sardine (*Sardinops sagax*) along the West Coast. However, the sardine catch collapsed in the early 1960s, possibly due to overfishing. The industry then switched to smaller meshed nets and targeted anchovy (*Engraulis encrasicolus*) instead, which dominated catches from about 1964 to the mid-1990s. Recovery of the sardine stock was achieved under a stock rebuilding management strategy and catches of both species have been at similar levels (around 250 000 tons) as biomass increased from the mid-1990s. The fishery also targets round herring (Etrumeus whiteheadi) to a lesser degree, which, along with anchovy, is processed into fishmeal and fish oil (93% of processed mass in the small pelagic fishery is fish oil and fish meal, SAPFIA). Bycatch species are mainly juvenile sardine, horse mackerel, and chub mackerel. The industry precautionary upper catch limits (PUCLs) are currently set at 60 000 t for round herring (Red Eye) and 25 000 t for Lantern and Lightfish (combined). The TACs and PUCLs have been repeatedly reduced to allow for stock stabilisation. Anchovy and Sardine directed fishing have been further decreased by 10% for 2023 (See Figure 91 for 2023 TAC and PUCLs).

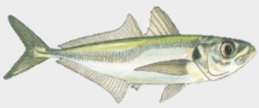
2023 TAC Small Pelagic Fishery			
	Directed Anchovy	Has been decreased by 10%	222 750t
	Juvenile Sardine	Has been decreased by 10%, associated with anchovy directed catches	4 500t
	Directed Sardine	Has been decreased by 10%, not to exceed 70% West of Cape Agulhas and 30% East of Cape Agulhas	18 000t
2023 Pools and Precautionary Upper Limits			
	Anchovy, Sardine-only permit holders	Not to be actively targeted	100t
	Red Eye	Associated with Sardine and Anchovy permit holders	60 000t
	Adult Sardine	Associated with directed Red Eye and Anchovy fishing, not to be targeted	2 000t
	Juvenile Sardine	Associated with directed Red Eye and Sardine fishing, not to be targeted	500t
	Horse Mackerel	Not to be targeted	6 200t
 	Lantern and Lightfish (combined)	Associated with Sardine and Anchovy permit holders	25 000t

Figure 91: Small pelagic anchovy and sardine TACs, PUCL's, and Pools for the 2023 season (DFFE notice, 20 Dec 2022)

The pelagic-directed purse-seine fishery is the largest South African fishery by volume and the second most important in terms of economic value. The wholesale value of catch landed by the sector during 2018 was R3.2 billion, or more than 22% of the total value of all fisheries combined. However, 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. This is below both long-term (338 000 t) and short-term (294 000 t) averages (Figure 92).

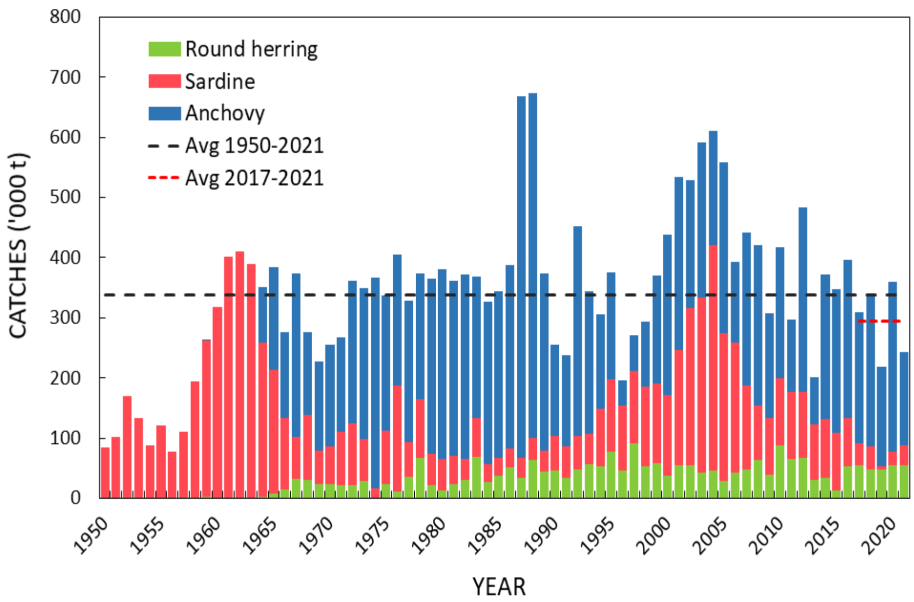


Figure 92: The annual combined catch of anchovy, sardine and round herring. Also shown is the average combined catch since the start of the fishery (1950-2021; black dashed line) and for the past five years (red solid line). Source DFFE, 2022.

The abundance and distribution of small pelagic species fluctuates considerably 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 fleet consists of approximately 100 vessels ranging in length from 11 m to 48 m (Figure 93). Once a shoal of the targeted species is located, the vessel encircles it with a large net extending to a depth of 60 m to 90 m. Netting walls surround the 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 onboard 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, which may take up to 1.5 hours. Vessels usually operate overnight and return to offload their catch the following day.

The majority of the fleet operates 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 Gqeberha. The ports of deployment correspond to the location of canning factories and fish reduction plants along the coast. Approximately 80% of the sardine catch in South Africa is processed by six canneries located in St Helena Bay (4), Gans Bay (1) and Mossel Bay (1), with the remaining catch packed by a decreasing number of pack-and-freeze processors, down from around 26 in 2004 to 12 in 2013. In addition to canning sardines, five of the canneries located west of Cape Agulhas produce fishmeal and fish oil from reduction processing of anchovy, round herring, small quantities of mesopelagic species (e.g. lanternfish and light fish) and sardine offal. However, the canning of round herring has been discontinued due to limited seasonal availability and issues with fish quality.

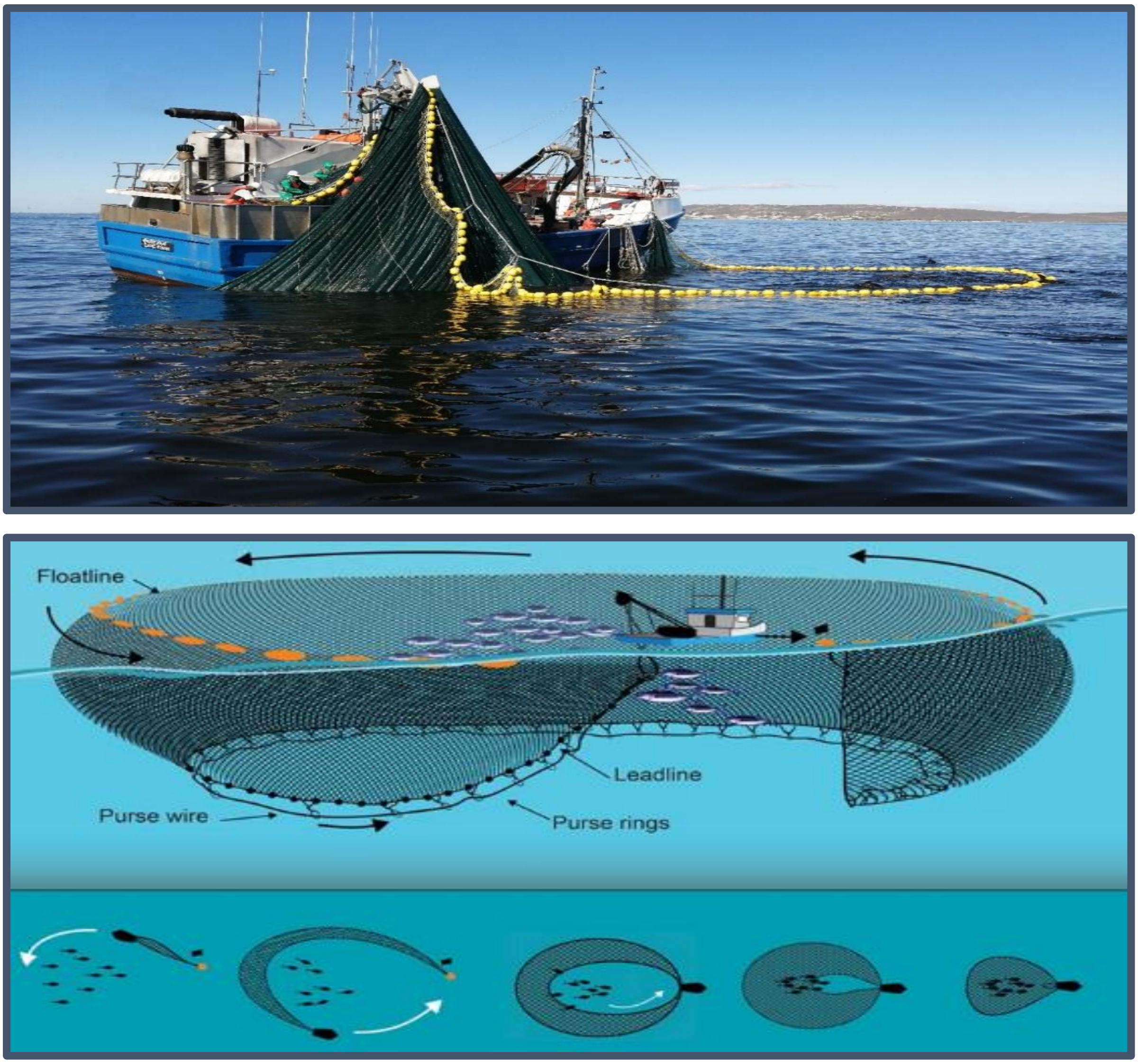


Figure 93: (Above) Photograph of a purse-seine vessel registered to fish for small pelagic species (credit C. Heinecken, CapMarine). (Below) Typical configuration and deployment of a small pelagic purse seine for targeting anchovy, sardine and round herring as used in South African waters. Source: http://www.afma.gov.au/portfolio-item/purse-seine.

Between 2005 and 2008, in response to the decline in sardine biomass west of Cape Agulhas, the directed sardine catch was mostly made east of Cape Point, with over 50% of the catch taken east of Cape Agulhas. This shift had socio-economic impacts for the industry due to the mismatch between processing capacity (which was mostly located in St Helena Bay) and the area of sardine availability. As a result, sardines were caught using smaller vessels in the Mossel Bay area and transported at additional cost to the west coast processors. This shift also led to the development of canning capacity in Mossel Bay and resulted in some restructuring of vessel use and operational procedures (FAO, 2016). As of the 2023 TAC and PUCL updates, it is specified that a maximum of 70% of directed sardine catches must be made West of Cape Agulhas with no more than 30% maximum East of Cape Agulhas.

The geographical distribution and intensity of the fishery are largely dependent on the seasonal fluctuation and distribution of the targeted species. The sardine-directed fleet concentrates its 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 Gqeberha. The anchovy-directed fishery takes place predominantly on the South-West Coast from Lambert's Bay to Kleinbaai (19.5°E) and is most active in the period from March to September. Round herring is targeted when available, 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 catch and effort statistics for this sector are recorded by skippers on a grid block basis at a resolution of 10 by 10 nm. The fishery operates throughout the year with a short seasonal break from mid-December to mid-January. Seasonality of catches is shown in Figure 94 with an increase in fishing effort and landings evident during the winter months.

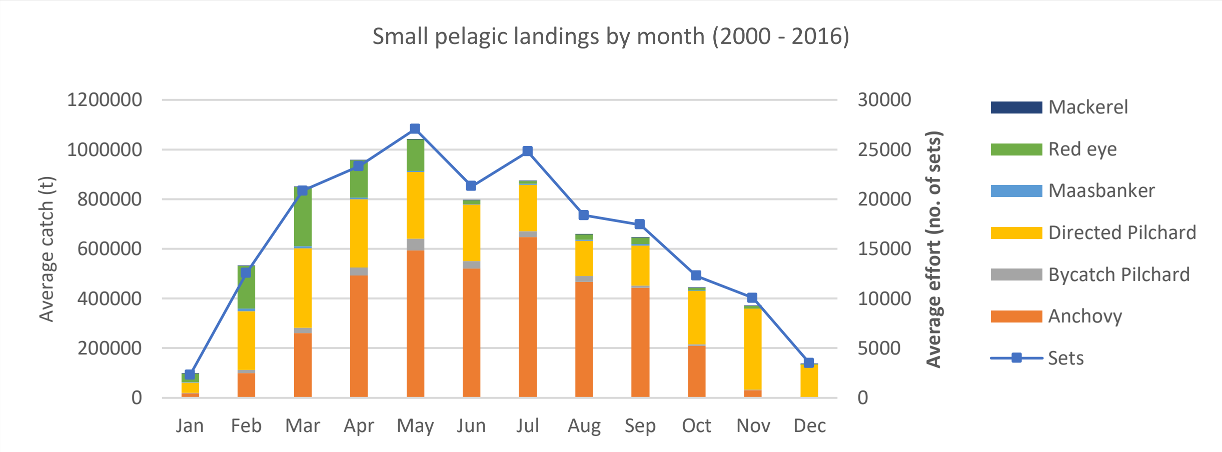


Figure 94: Graph showing monthly catch (tons) and effort (number of sets) reported for the small pelagic purse-seine fleet over the period 2000 to 2016 (cumulative). Source: DFFE.

Figure 95 shows the spatial extent of fishing grounds in relation to the license block and AOI for proposed drilling. There is no direct overlap and the AOI which is situated at least 100 km from fishing grounds.

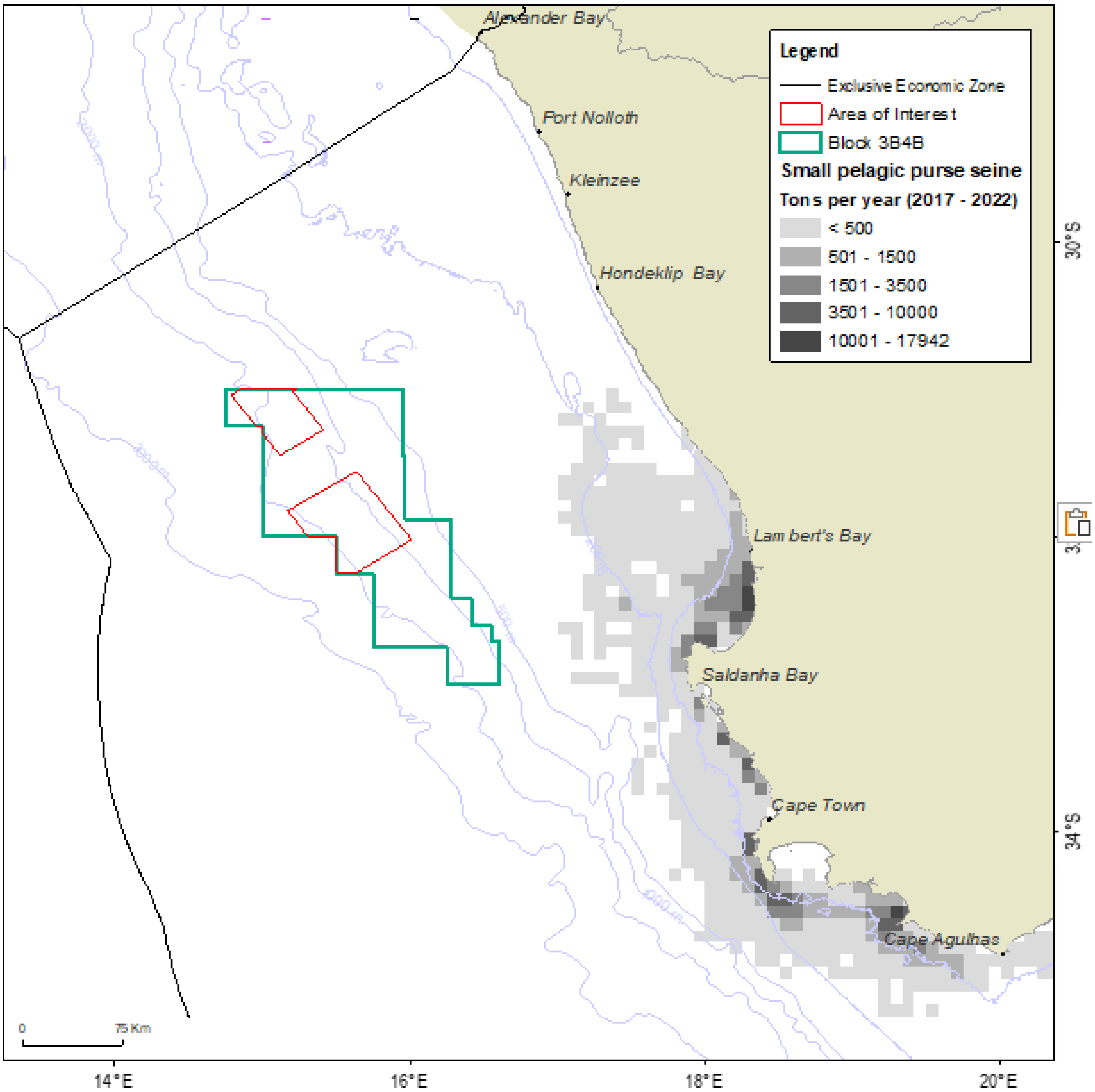


Figure 95: An overview of the spatial distribution of effort expended by the purse-seine sector targeting small pelagic species in in relation to the licence block 3B/4B (Green polygon) and the proposed AOI for drilling (Red Polygon).

8.4.4.9 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*), swordfish (*Xiphias gladius*) and shark species (Figure 96). 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 2 541 tons (2017) and 2 815 tons (2018). Catch by species and number of active vessels for each year from 2005 to 2018 are given in Table 24.

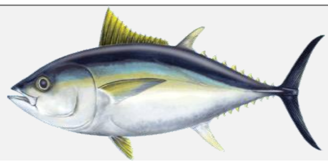
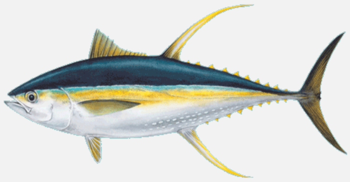
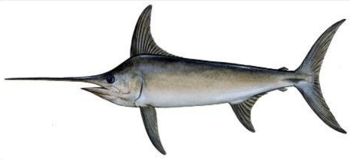
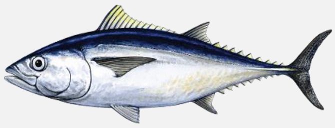
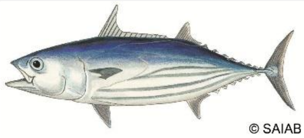
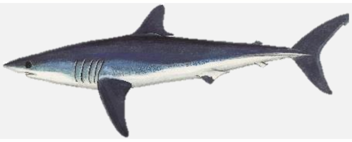
SPECIES NAME	REFERENCE IMAGE	LARGE PELAGIC LONGLINE (LPL) / TUNA POLE (TP)
BIGEYE TUNA (THUNNUS *OBESUS*)		LPL & TP
ALBACORE (*THUNNUS ALALUNGA*)		LPL & TP
YELLOWFIN TUNA (*THUNNUS ALBACARES*)		LPL & TP
SWORDFISH (*XIPHIAS GLADIUS*)		LPL
SOUTHERN BLUEFIN (*THUNNUS MACCOYII*)		LPL
SKIPJACK TUNA (*KATSUWONUS PELAMIS*)		TP
SHORTFIN MAKO (*ISURUS OXYRINCHUS*)		LPL
BLUE SHARK (*PRIONACE GLAUCA*)		LPL

Figure 96: Primary species targets for the Large Pelagic Longline Fishery (LPL) and Tuna Pole Fishery in South Africa. Images courtesy of WWF-SASSI and SAIAB.

Table 24: Total catch (t) and number of active domestic and foreign-flagged vessels targeting large pelagic species for the period 2005-2018 (Source: DEFF, 2019).

Year	Bigeye tuna	Yellowfin tuna	Albacore	Southern bluefin tuna	Swordfish	Shortfin mako shark	Blue shark	Number of active vessels	
								Domestic	Foreign-flagged
2005	1077	1603	189	27	408	700	225	13	12
2006	138	337	123	10	323	457	121	19	0
2007	677	1086	220	48	445	594	259	22	12
2008	640	630	340	43	398	471	283	15	13
2009	765	1096	309	30	378	511	286	19	9
2010	940	1262	165	34	528	591	312	19	9
2011	907	1182	339	49	584	645	542	16	15
2012	822	607	245	79	445	314	333	16	11
2013	882	1091	291	51	471	482	349	15	9
2014	544	486	114	31	223	610	573	16	4
2015	399	564	151	11	341	778	531	Fleets merged under SA flag with only a few foreign boats : up to 30 boats operating	
2016	315	439	85	18	275	883	528		
2017	497	400	172	47	246	726	523		
2018	478	478	238	208	313	613	592		

Total catch and effort figures reported by the fishery for the years 2000 to 2018 are shown in Figure 97. 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 98.

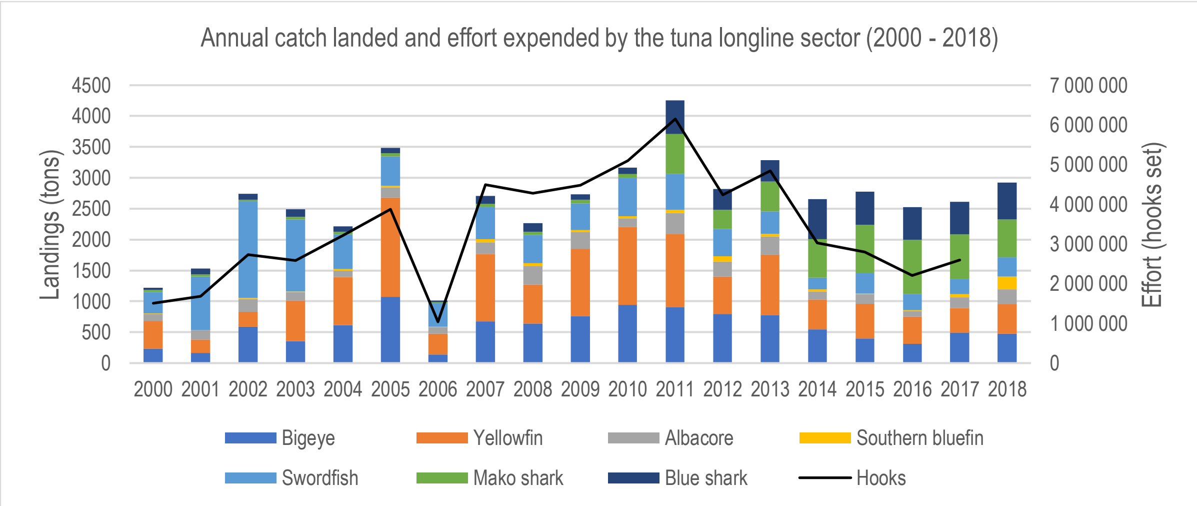


Figure 97: Inter-annual variation of catch landed and effort expended by the large pelagic longline sector in South African waters as reported to the two regional management organisations, ICCAT and IOTC (2000 – 2018; Source: DEFF, 2019).

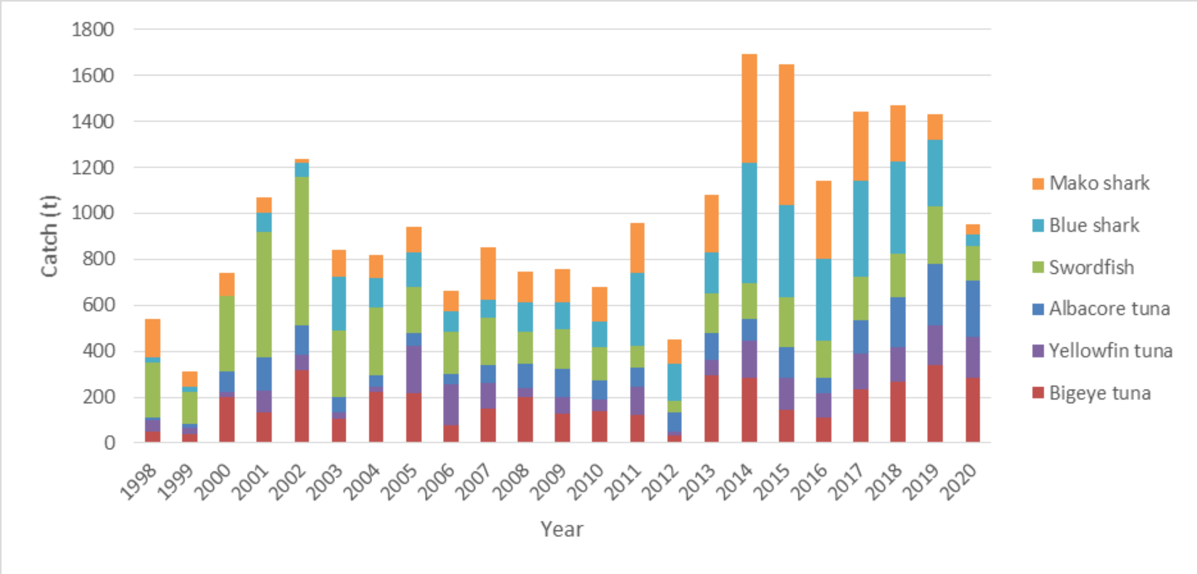


Figure 98: Inter-annual variation of catch landed by the large pelagic longline sector operating in the ICCAT region of South African waters (i.e. West of 20°E from 1998 – 2020).

Tuna and billfish are migratory stocks and are managed as a "shared resource" among various countries under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). South Africa has a long history of commercial longlining for tuna, which began in the 1960s and initially focused on southern bluefin tuna and albacore. The fishery declined after the mid-1960s due to a poor market for low-quality bluefin and albacore. Interest in longline fishing for tuna and swordfish in South African waters was revived in 1995, and 30 experimental longline permits were issued in 1997. The primary objective of the fishery was to develop a large pelagic catch performance for South Africa so that it could receive equitable quotas from RFMOs (Regional Fisheries Management Organisations) such as ICCAT and IOTC.

During the experimental phase of the fishery, catches peaked at over 2,500 t, but swordfish comprised the bulk of the catch in each year. Targeting of swordfish led to sharp declines in swordfish abundance in South Africa's EEZ. In 2005, long-term rights were made available, with 17 rights issued to the swordfish-directed fishery and 26 to the tuna-directed fishery. The primary objectives of this allocation were to develop a tuna catch performance for South Africa and to South Africanize the fishery. Catches improved to over 3,500 t in 2005 with the assistance of foreign-flagged charters. However, none of the Asian-flagged vessels reflagged South African, and no further provision was made for the use of foreign-flagged charters in 2006. Consequently, catches declined to less than 500 t.

In 2007, foreign-flagged vessels were once again allowed to fish in South Africa to improve its catch performance, transfer skills to South African crew, and eventually reflag South African. To date, an average of 10-15 foreign-flagged vessels takes out permits to fish in South Africa each year. In March 2011, the Department consolidated the tuna/swordfish longline fishery and the pelagic shark fishery, absorbing the 6 pelagic shark vessels into the tuna/swordfish longline fishery. The decision to terminate the targeting of pelagic sharks was due to several reasons, including concerns over substantial pelagic shark bycatch in the tuna/swordfish fisheries, the slow-growing, late-maturing, and low fecundity nature of sharks, and the threats to the survival of blue and mako shark populations.

In 2017, 60 fishing rights were allocated for a period of 15 years, with the total number of active longline vessels within South African waters being 22. Of these, 18 fished exclusively in the Atlantic (West of 20°E) and were domestic vessels, while three Japanese vessels fished exclusively in the Indian Ocean (East of 20°E) in joint ventures with South African companies.

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. 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 99 and photographs of monofilament fishing line and marker buoys are included in Figure 100 below. 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.

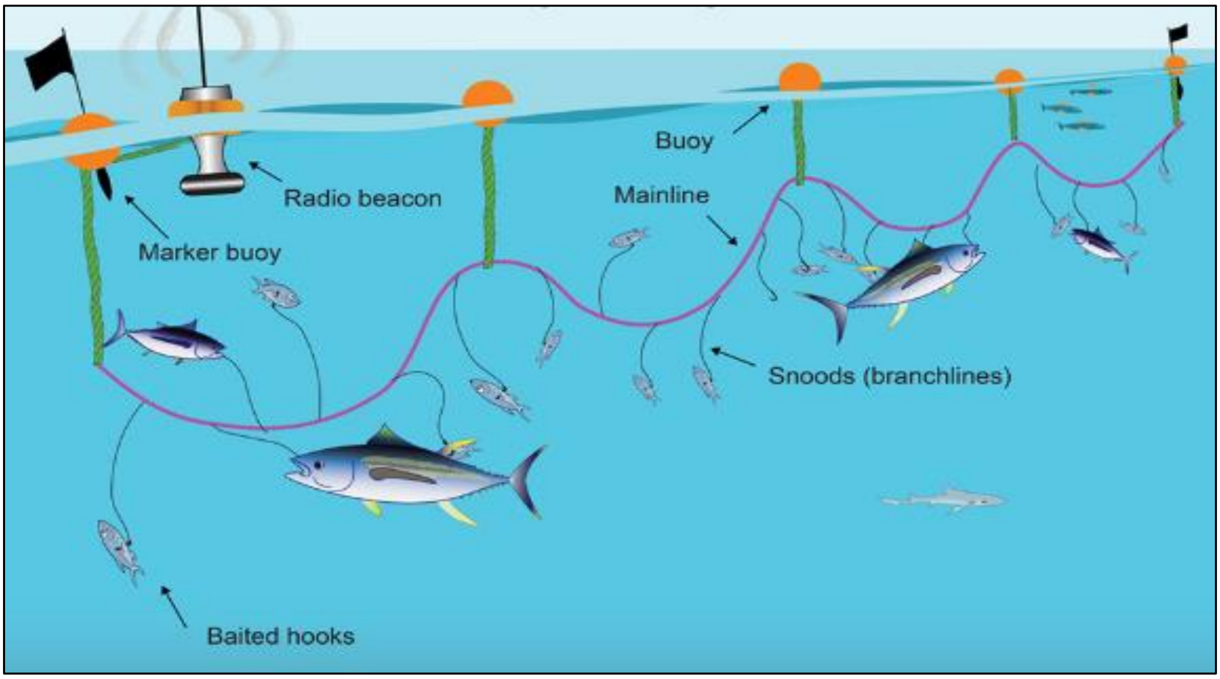


Figure 99: Typical large pelagic longline gear (Source: http://www.afma.gov.au/portfolio-item/longlining).

Figure 100: Photographs showing marker buoys (left), radio buoys (centre) and monofilament branch lines (right) (Source: CapMarine, 2015).

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 shown by foreign-flagged longliners (Figure 101). 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).

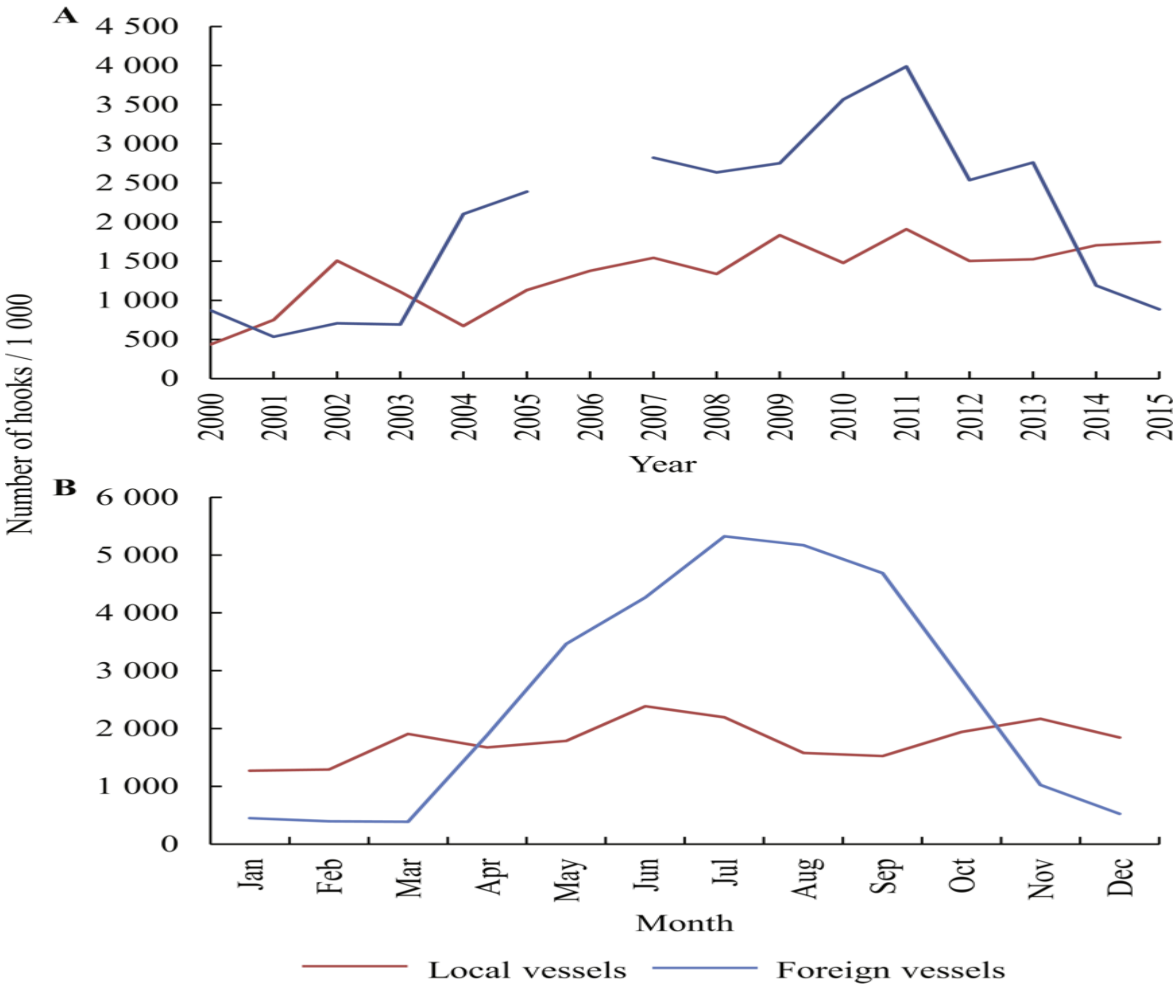


Figure 101: Numbers of hooks set per (A) year (2000–2015) and (B) per calendar month, as reported by local and foreign pelagic longliners (Jordaan *et al*., 2018).

Fishing areas are subdivided into the SE Atlantic (reporting to ICCAT) and the SW Indian Ocean (reporting to IOTC) along 20°E, and the West, Southwest, South and East sampling areas are shown in Figure 102. Bubble size is proportional to the numbers of hooks set per line.

The numbers of hooks set by foreign vessels peak between May and October each year, whereas local vessels fish throughout the year, with marginally fewer hooks set in January and February than other months (Figure 101). Foreign vessels venture further southwards than local vessels, which tend to remain within the EEZ (Figure 102; Jordaan *et al*., 2018).

Local vessels fish in all four areas, but in the East their range is limited to the northern half of the area, near a landing site at Richards Bay. Foreign vessels fish mainly in the SW Indian Ocean, with the bulk of all hooks set in the South (58%) and East (33%) areas, and the remaining 9% in the SE Atlantic. Foreign vessels set an average of 2 493 ± 597 (SD) hooks per line, compared to only 1 282 ± 250 hooks per line used by local vessels.

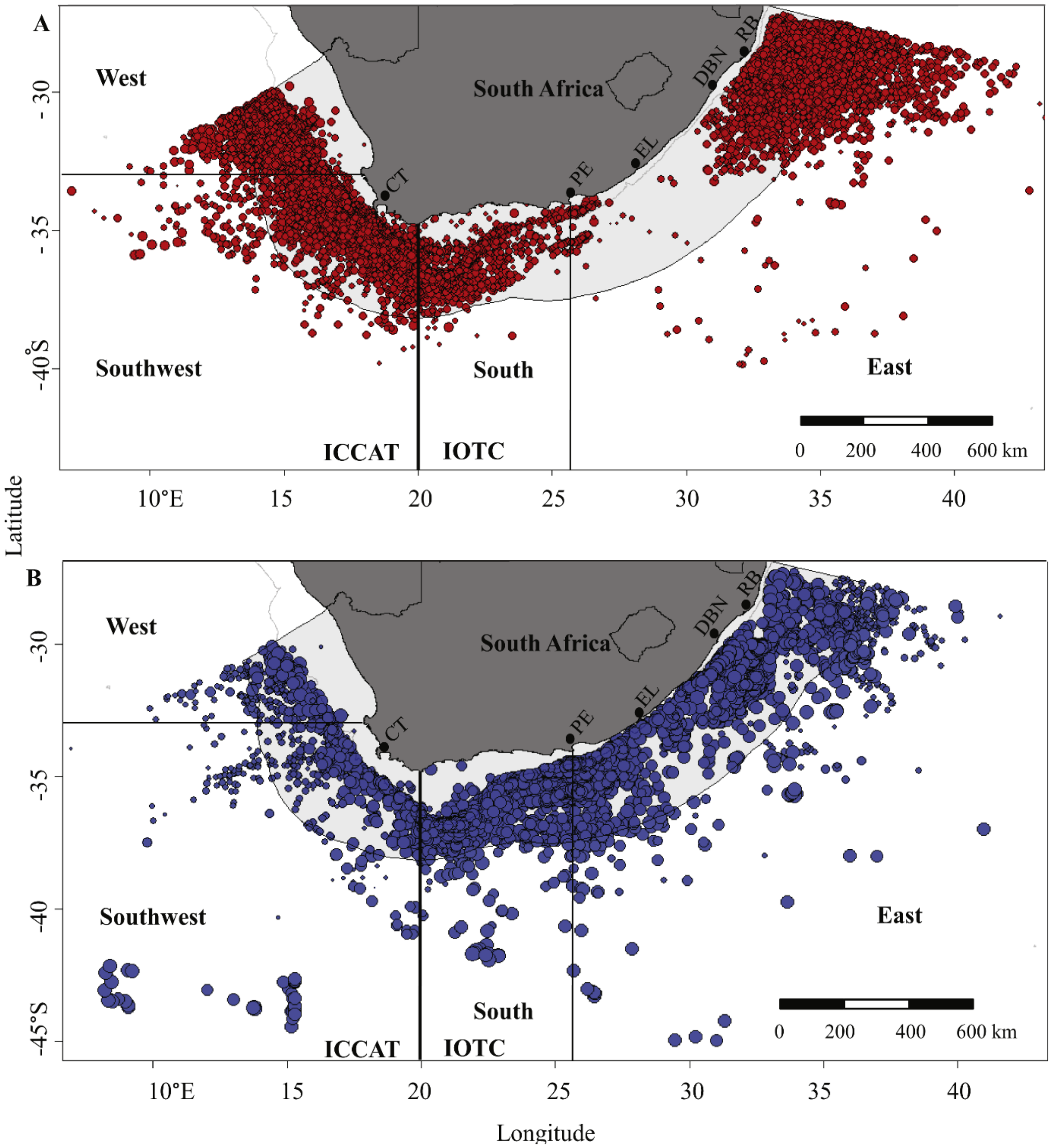


Figure 102: Geographical distribution of fishing effort by (A) local and (B) foreign pelagic longliners between 2000 and 2015, based on logbook data provided by vessel skippers (Jordaan *et al*., 2018).

The fishery operates extensively within the South African EEZ, primarily along the continental shelf break and further offshore. Figure 103 shows the spatial extent of pelagic longline fishing grounds in relation to the licence block and AOI for proposed drilling.

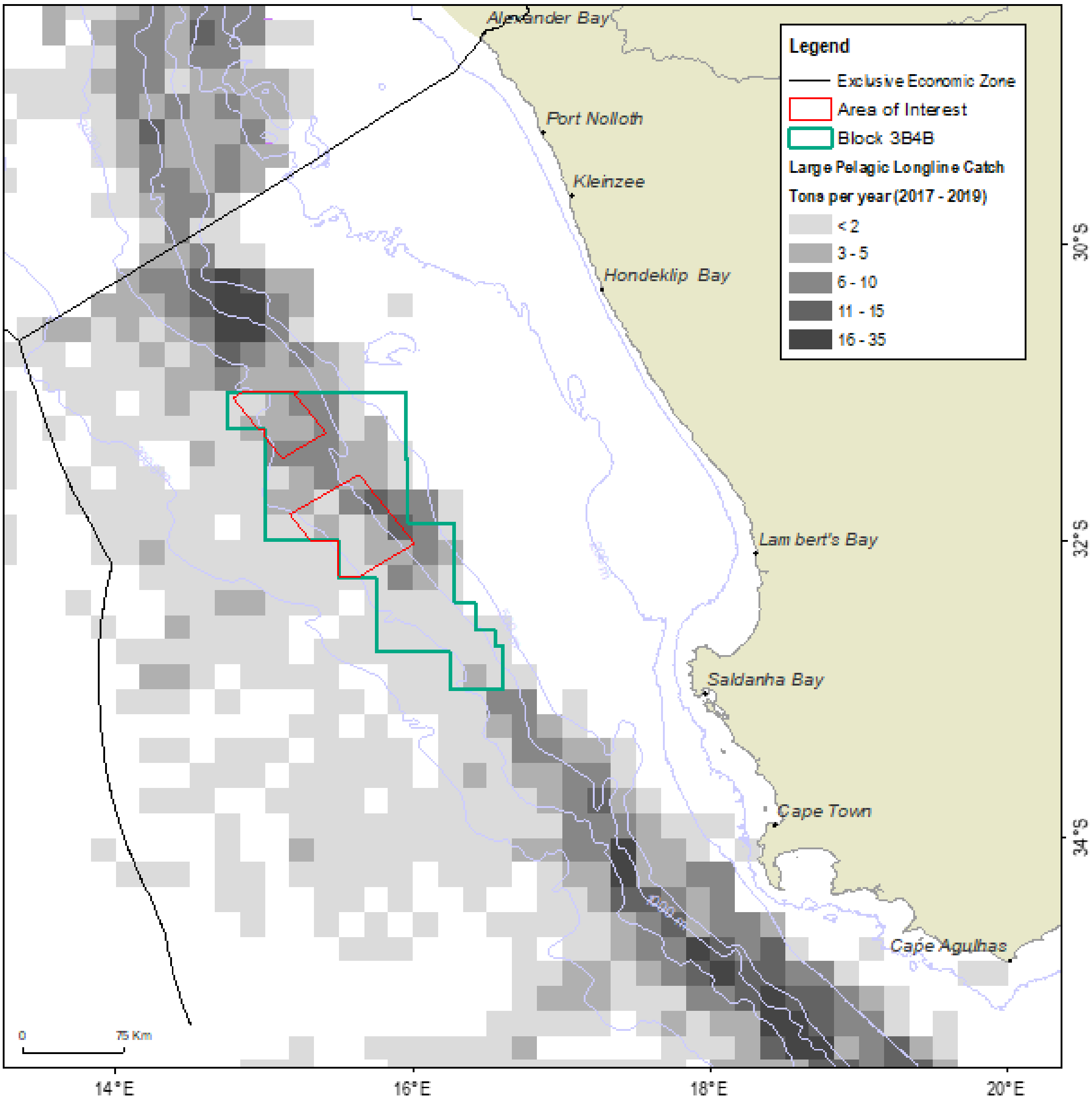


Figure 103: An overview of the spatial distribution of fishing effort expended by the longline sector targeting large pelagic fish species in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon).

Over the period 2017 to 2019 an average of 95 lines per year were set within the AOI yielding 127 tonnes of catch. Fishing activity takes place over the entire AOI for proposed exploration drilling but is concentrated towards the shelf break. Fishing effort within the AOI is highest during the period May, June and July. The 500 m safety zone around the drilling unit would result in an exclusion area of 0.79 km^2. Since surface longlines are buoyed and unattended, they drift in surface currents and cover a large area before they are retrieved. The potential area of exclusion to fishing operations would therefore not be limited to the 500 m safety zone around the drilling unit. Vessel operators would be obliged to take a precautionary approach in order to avoid gear entanglement with the (stationary) drilling unit by avoiding a much wider area. Based on an assumed average line length of 60 km, operators could be expected to avoid setting lines within a distance of 30 km of the drilling unit, in order to avoid potential gear entanglement.

8.4.4.10 **TUNA POLE-LINE**

The tuna pole fishery in South Africa has been operating since 1980, and traditionally targets high volume, low-value albacore (Thunnus alalunga) for canning along the west coast of the country. In recent years, some vessels have also begun targeting low volume, high-value yellowfin tuna (T. albacares) for sashimi markets. The fishery has faced challenges due to the seasonality of tuna in South African waters, with catches of albacore fluctuating around 3 000 tonnes per year, largely dependent on the availability of the species in near-shore waters between October and May.

To reduce conflict with the traditional linefish sector, access to additional species, including snoek (Thyrsites atun) and yellowtail (*Seriola lalandi*), has been granted to the tuna pole fishery. However, some operators have exacerbated the situation by targeting these species without also targeting tuna. As a result, the South African government has instituted bag limits for yellowtail of 10 per person per trip, and a minimum vessel size of 10 m, unless the vessel can demonstrate good performance on tuna. Access to snoek is still under deliberation.

The fishery is managed by a total allowable effort (TAE) of 200 vessels, with 200 rights made available in a long-term allocation process in 2005. The four major contracting parties actively fishing for albacore in the South Atlantic are Chinese-Taipei, South Africa, Brazil, and Namibia. The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for conducting stock assessments, devising control measures, and issuing country allocations. In 2011, the stock assessment for southern Atlantic longfin tuna (albacore) determined a total allowable catch (TAC) of 24 000 MT for the region, with South Africa and Namibia allocated a combined total of 104 000 tonnes. This allocation is currently being managed on an Olympic-type system.

Fishing for tuna occurs along the entire west coast of South Africa beyond the 200 m bathymetric contour, along the shelf break with favoured fishing grounds between 60 km and 120 km offshore of Saldanha Bay and north of Cape Columbine. Fishing activity for snoek is seasonal and takes place inshore of the 100 m depth contour along the coast between March and July, with a peak in activity during April and May.

Overall, the South African tuna pole fishery has faced challenges due to the seasonality of the target species and competition with the traditional linefish sector. The government has implemented bag limits and vessel size restrictions to reduce conflict, and the fishery is managed through an allocation system overseen by ICCAT. 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 3 941 tons. A historical time series of catch and effort reported by the South African sector operating within the Atlantic region is shown in Figure 104. The total effort of 4 131 catch days within the ICCAT convention area in 2019 represents an increase in effort of 9% compared to 2018.

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 are 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 (Figure 105).

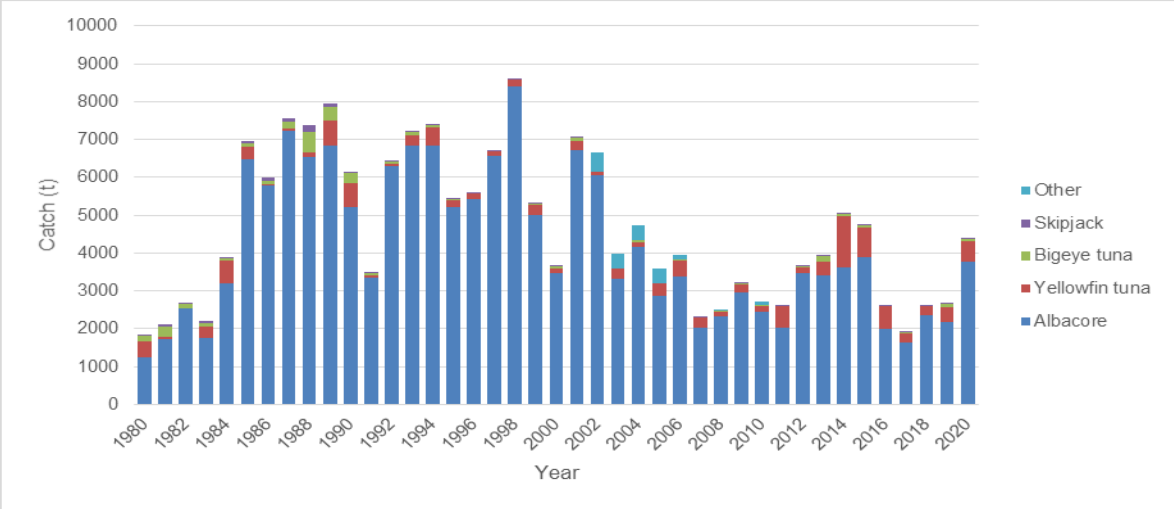


Figure 104: Catches (tons) of pelagic species by the South Africa pole-line ("Baitboat") fleet between 1980 and 2020 (ICCAT, 2022).

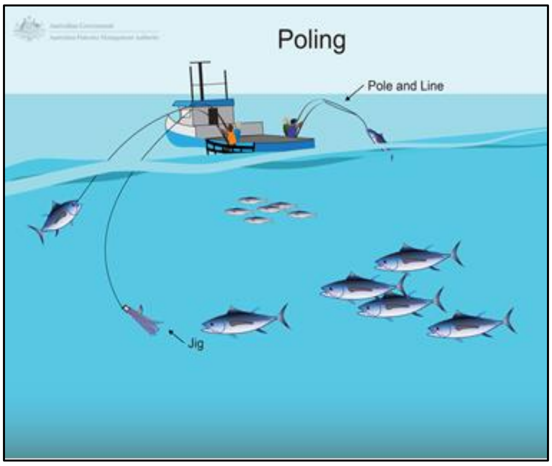


Figure 105: Schematic diagram of pole and line operation (Source: http://www.afma.gov.au/portfolio-item/minor-lines).

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.

Figure 106 shows the location of fishing activity in relation to the licence block and AOI for proposed drilling. Fishing records received from DFFE for the reporting period 2017 to 2019 show fishing within the licence block but no activity within the AOI.

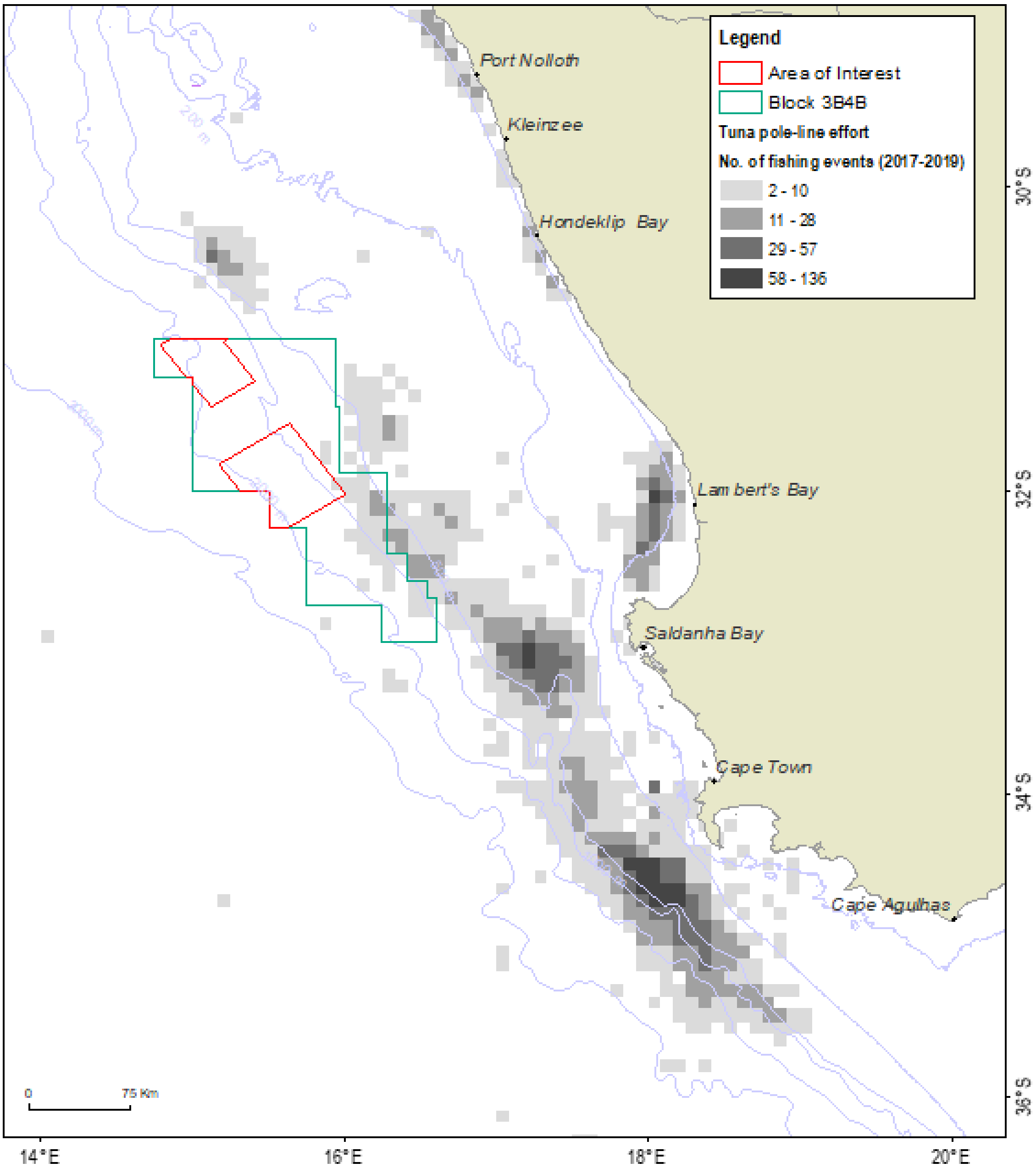


Figure 106: An overview of the spatial distribution of fishing effort expended by the pole- line sector targeting pelagic tuna (offshore areas) and snoek (inshore areas) in relation to the licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon).

8.4.4.11 COMMERCIAL OR TRADITIONAL LINE FISH

The commercial linefish sector is one of the oldest fisheries in South Africa and has its origins from the recreational sector. Essentially recreational linefishers 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 exploiting 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. 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. Almost all of the traditional line fish catch is consumed locally.

Of all South African marine fisheries, the linefishery is the most vulnerable to external impacts. Linefish resources are at risk of overcapacity as they area 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.

The traditional linefishery is the country's third most important fishery in terms of tonnage landed and economic value. It is a long-standing, nearshore fishery based on a large assemblage of different species using hook and line but excludes the use of longlines. Within 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).

The traditional commercial line fishery is a relatively low-cost and labour-intensive industry, therefore 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.

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 is currently 425. For the 2021/2022 fishing season, 325 vessels were apportioned to commercial fishing, whilst 122 vessels apportioned to small-scale fishing.

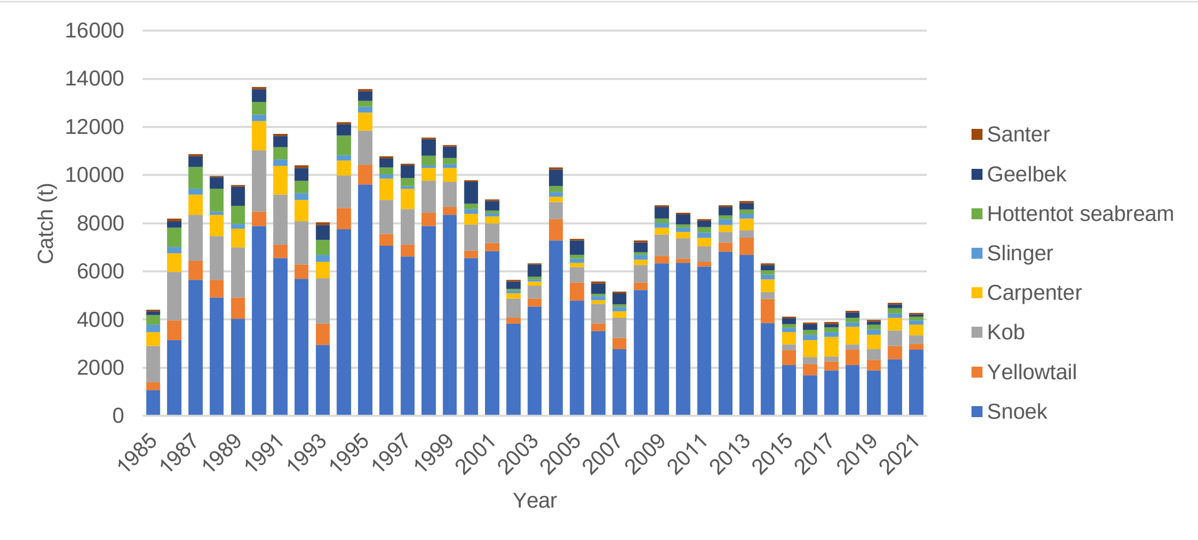


Figure 107: Annual catch (t) of the eight most important linefish species for the period 1985-2021 (DFFE, 2022).

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).

Annual catches prior to the reduction of the commercial effort were estimated at 16 000 tons for the traditional commercial line fishery. Almost all of the traditional line fish catch is consumed locally. The fishery is widespread along the country's shoreline from Port Nolloth on the West Coast to Cape Vidal on the East Coast. Effort is managed geographically with the spatial effort of the fishery 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.

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. Fishing takes place throughout the year but there is some seasonality in catches.

Crew use hand line or rod-and-reel to target approximately 200 species of marine fish along the full 3 000 km coastline, of which 50 species may be regarded as economically important. To distinguish between line fishing and long lining, line fishers are restricted to a maximum of 10 hooks per line. Target species include resident reef-fish, coastal migrants and nomadic species. Many species allocated to the small-scale fisheries “baskets” are primary targets of the commercial and recreational linefish sectors, and these shared resources must be carefully monitored given the increased fishing pressure expected. A revision of the linefish management protocol (LMP) is also underway to ensure the future sustainability of linefish stocks.

Snoek is an important linefish species as it makes up the largest annual catch in terms of biomass, contributing more than 80% to the total catch west of Cape Infanta. 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). Snoek are caught within the inshore zone along most of the South African coastline with the majority of catches being made along the West and South-West Coast of South Africa. Although snoek can be caught year-round, during the snoek seasonal migration (between April and July) when they shoal nearshore, they are caught more frequently using handlines by the linefishery (Figure 108). Snoek are not distributed offshore of the 1000 m depth contour and therefore not targeted or caught by the commercial linefishery in the AOI for proposed drilling.

Figure 108: Fishermen landing snoek on board a vessel operating in the traditional linefishery (photo credit Jaco Barendse).

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, associated reporting complexities and also the unwillingness of local fisherman to share fishing locations, inaccuracies in the spatial representation are to be expected. This fishery's operational footprint may at times be limited by operating costs and is sensitive to local reports of fish availability. Vessels range in length between 4.5 m and 11 m and the offshore operational range is restricted by vessel category to 40 nautical miles (75 km). Fishing effort at this outer limit is sporadic. Operating ranges vary greatly but most of the activity is conducted within 15 km of a launch site.

Figure 109 shows the spatial extent of traditional linefish grounds in relation to the licence block and AOI for proposed drilling. Fishing effort is primarily coastal, with vessels operating in waters shallower than 100 m. Activity in deeper waters are reflected in the vicinity of Cape Canyon at a distance of 55 km offshore of Saldanha Bay, as well as and Hope Canyon due South of Cape Point. There is no overlap with the licence block or the AOI.

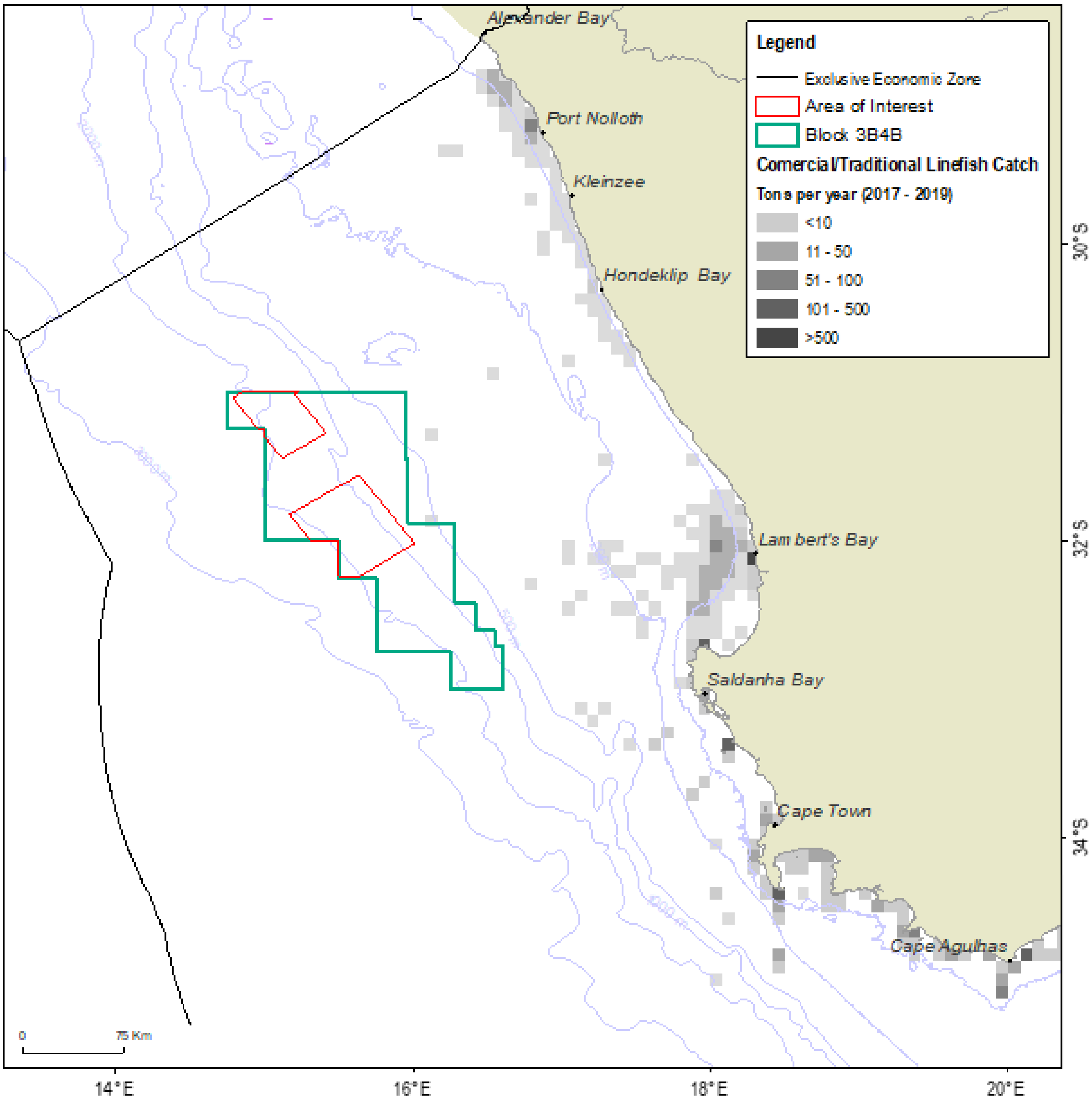


Figure 109: An overview of the spatial distribution of catch taken by the line fish sector in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon).

8.4.4.12 WEST COAST ROCK LOBSTER

The West Coast rock lobster (*Jasus lalandii*) 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. 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 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%.

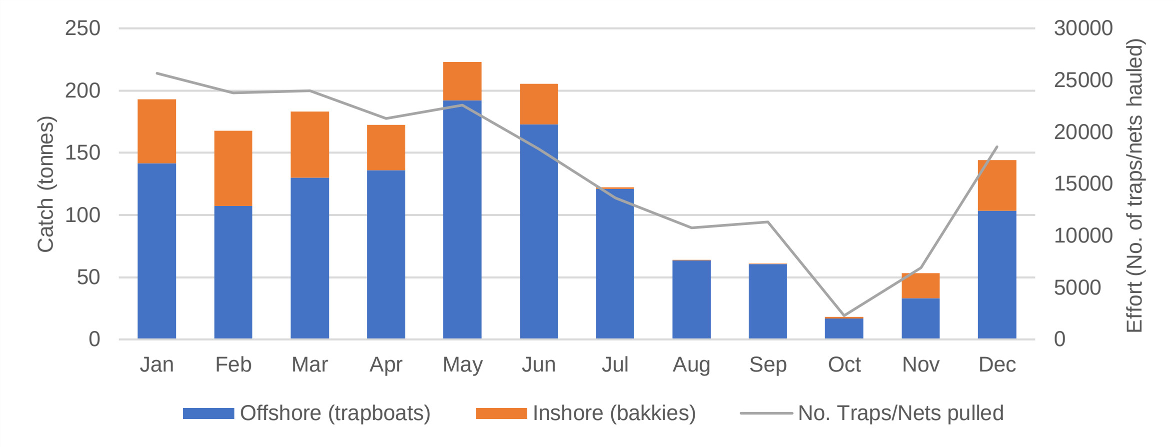


Figure 110: Graph showing the average monthly catch (tonnes) and effort (number of traps hauled) reported by the offshore (trap boat) and inshore (bakkie) rock lobster sectors over the period 2006 to 2020.

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 25.

Table 25: 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 15 – 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 111. 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 112 shows rock lobster catch by area for the commercial offshore and nearshore sub-sectors over the period 2005 to 2016.

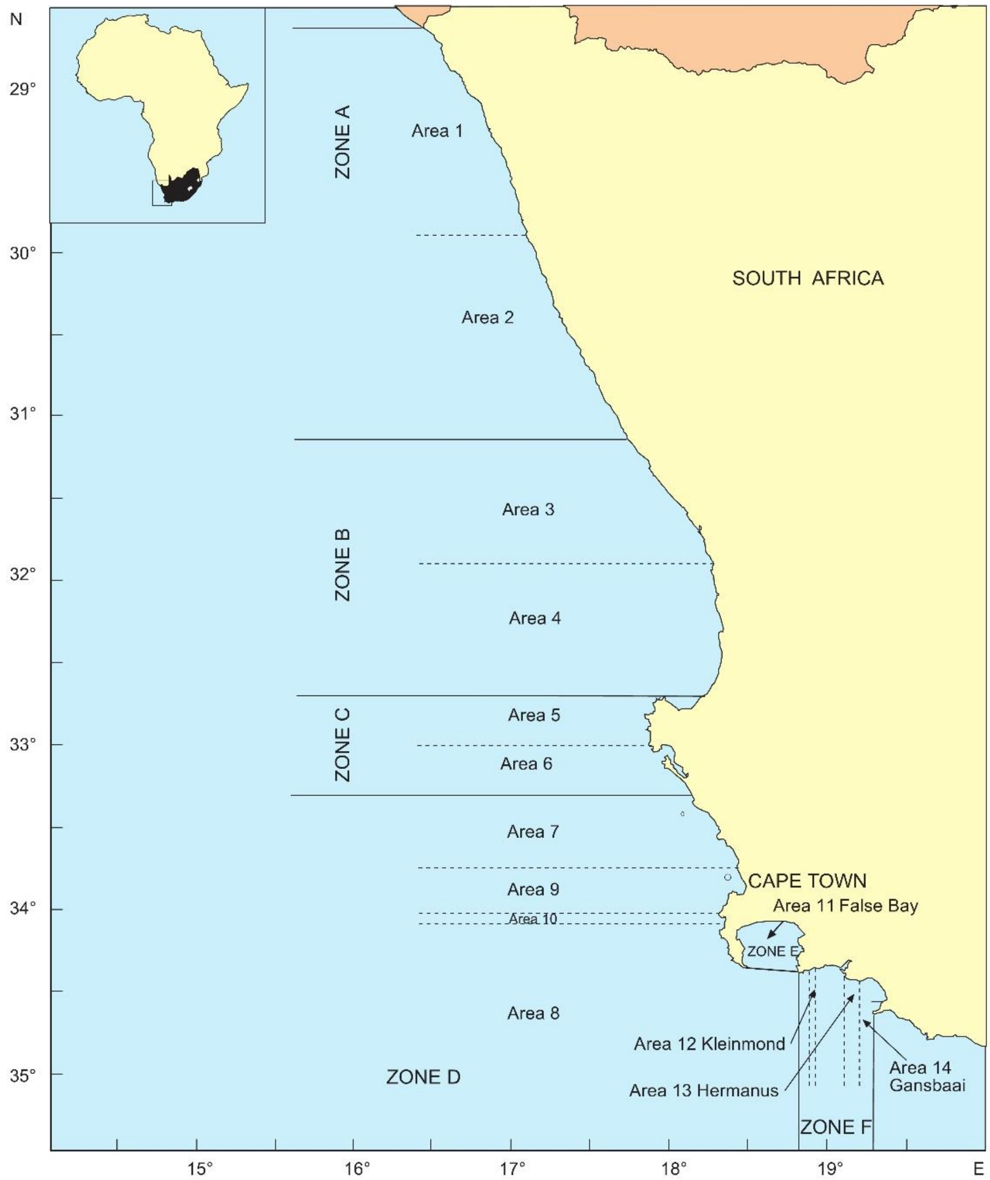


Figure 111: West Coast rock lobster fishing zones and areas. The five super-areas are: areas 1–2, corresponding to zone A; areas 3–4, to zone B; areas 5–6, to zone C; area 7, being the northernmost area within zone D; and area 8+, comprising area 8 of zone D as well as zones E and F.

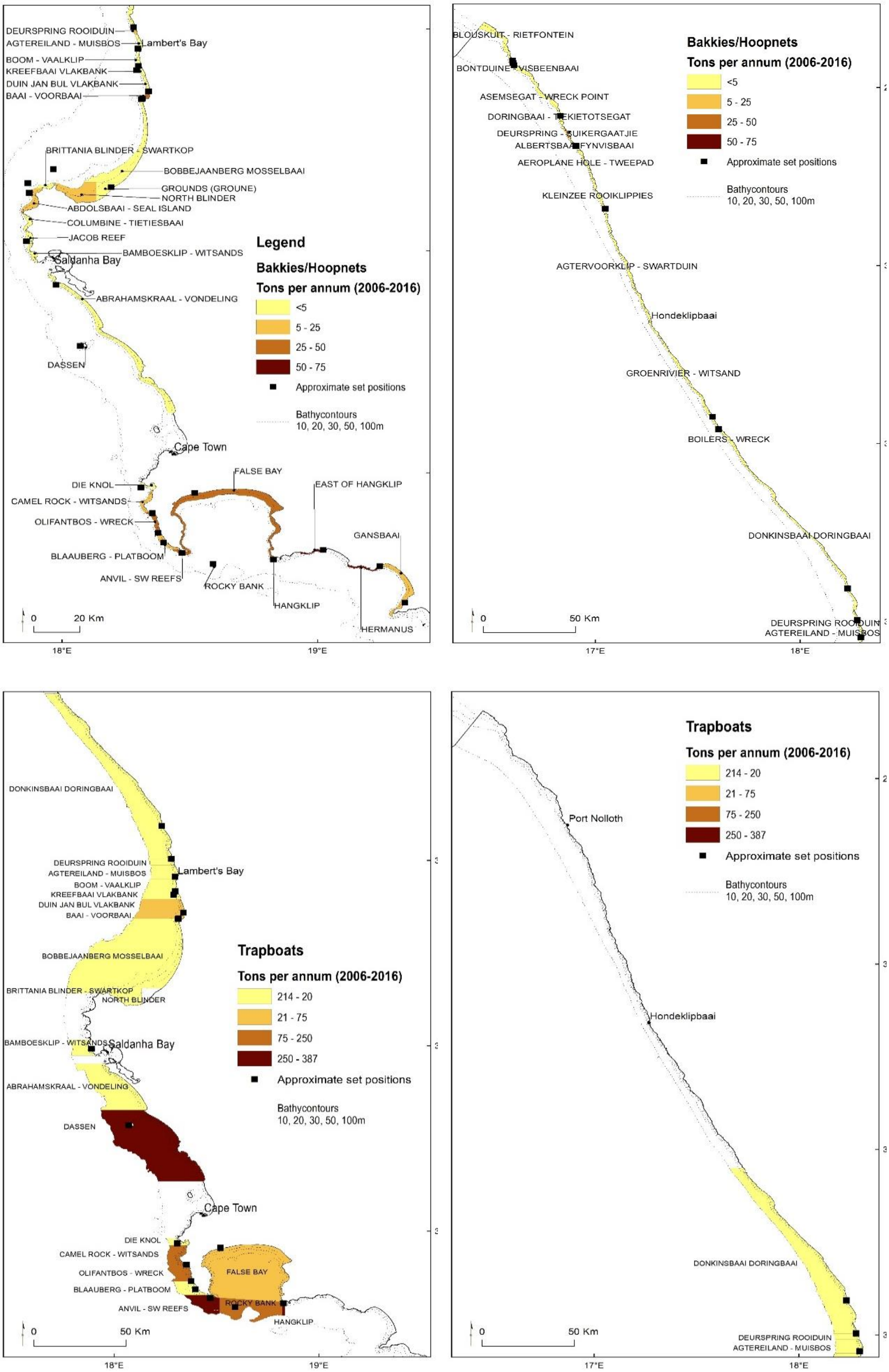


Figure 112: An overview of the spatial distribution of fishing effort expended by the west coast rock lobster nearshore (above) and offshore (below) sub-sectors within demarcated lobster management zones.

The licence area is situated offshore of rock lobster management zones B and A; and offshore of the depth range at which rock lobster is targeted. Over the period 2006 to 2020, there was no fishing activity reported by the (Figure 113).

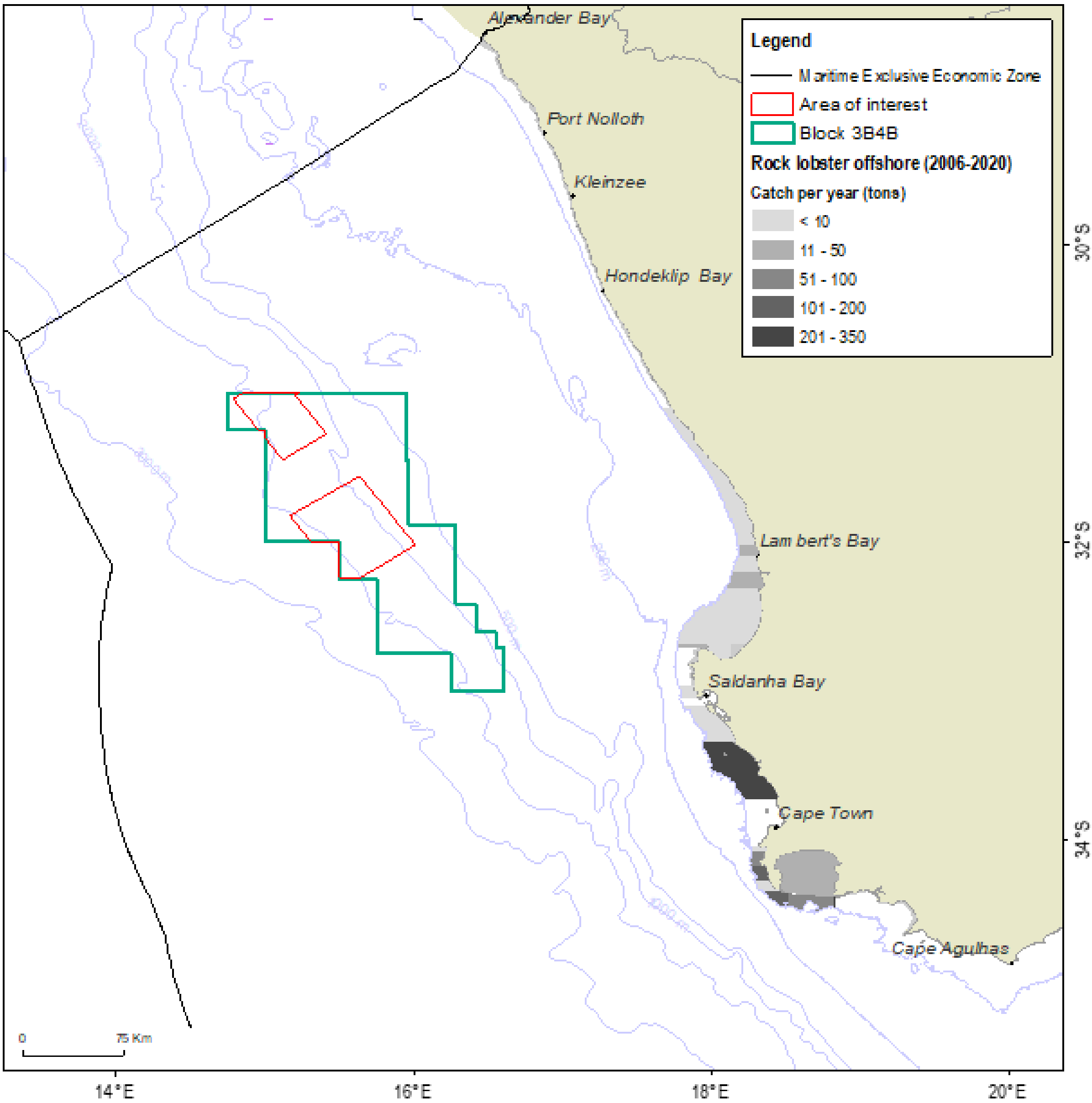


Figure 113: Spatial distribution of lobster catch by management sub-area over the period 2006 to 2020 (offshore/trap boat sub-sector) in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon). Depth contours range from 100 m to 1000 m.

8.4.4.13 **WHITE MUSSELS**

White mussels of the species *Donax serra* are found in the intertidal zone of sandy beaches ranging from northern Namibia to the Eastern Cape of South Africa. Their abundance is highest along the West Coast because of the higher plankton production in that area, compared with the rest of the South African coast, which is associated with upwelling of the Benguela Current.

The fishery for white mussels started in the late 1960s as part of the general commercial bait fishery and was suspended in 1988 when the bait Rights were revoked. Subsequent to stock assessments conducted in 1988/1989, harvesting of white mussels was retained as a commercial fishing sector and limited to seven areas along the West Coast, the closest of which (between Doring Bay and Lambert's Bay) is located between 280 km and 380 km to the south-east of the Area if Interest for proposed drilling.

Surveys conducted in the 1990s showed that commercial catches amounted to less than 1% of the standing biomass in the relevant areas and the stock is therefore considered to be under-exploited.

Prior to 2007, each Right Holder was limited to a monthly maximum catch of 2 000 mussels. However, data from the fishery were unreliable, due to under-reporting and difficulties with catch monitoring, and hence catch limits were not considered to be an adequate regulatory tool to manage this fishery. As of October 2006, the monthly catch limit was lifted. Since 2007 the commercial sector has been managed by means of a total allowable effort (TAE) allocation of seven Right Holders (a Right Holder may have up to seven "pickers"), each harvesting within only one of the seven fishing areas along the West Coast. In 2013, the fishing Rights allocation process (FRAP 2013) for this fishery started and new Rights were granted in addition to those of some of the previous Right Holders. After an appeal process, 26 commercial Rights were confirmed in 2015, until December 2020. In August 2019, it was announced that the FRAP 2020 process would be extended to December 2021 and is currently ongoing. Each Right Holder was allocated a specific number of pickers. The Interim Relief sector was started in 2007 to authorize exemption to harvest certain species until the small-scale policy has been finalized. During the 2013/2014 season, 1 995 Interim Relief permits were issued for the Western and Northern Cape combined. This sector is subject to a limit of 50 mussels per person per day. The recreational sector is also limited by a daily bag limit of 50 mussels per person per day. For all sectors, a minimum legal size of 35 mm applies.

In the decades preceding the 1990s, commercial catches declined continuously. The lifting of the commercial upper catch limit in 2006 led to a steep increase in the number of white mussels collected by this sector over the last few years. In addition, the development of a bait market in Namibia in recent years has created a greater demand for the resource. Recently, CPUE has remained relatively stable overall at between 300 and 500 mussels per hour harvested.

It should be noted that not all the areas allocated are being harvested, and that the largest component of the overall catch of white mussels is that of the recreational sector, but these catches are not monitored. There are also information gaps regarding the level of exploitation by Interim Relief harvesters and the levels of illegal take. On account of irregularities, and despite the improvement post-2006, the catch-and-effort data are still considered to be unreliable.

8.4.4.14 **OYSTERS**

The Cape rock oyster (*Striostrea margaritacea*) occurs on rocky reefs from Cape Agulhas to Mozambique and is targeted by the fishery along with smaller amounts of Crassostrea gigas. The harvesting of oysters is managed by DEFF within four broad areas namely, Southern Cape, Gqeberha, KwaZulu-Natal (KZN) North and KZN South. The coastal locations of boundaries between management zones for the Southern Cape area are shown Figure 114.

Shore-based collectors pry oysters off rocks and sell the oysters locally. Harvesting takes place during spring low tides from the intertidal zone and shallow subtidal rocky reefs and areas of operation can be considered to extend from the shoreline to the 10 m depth contour. DEFF proposes that oysters will be reclassified as a small-scale fishing species and that, from 2021, will be managed under the small-scale fisheries sector (DEFF 2020).

Total catch in the Southern Cape region was at least 373 306 oysters in 2018. In 2019, there were 73 individuals listed with commercial rights to harvest oysters and these rights were due to expire on 31 December 2020. From 01 January 2021 the sector was re-classified under the small-scale fisheries sector. Most oyster pickers sell to middlemen who in turn sell to local restaurants. However, some of the catch is sold directly to the public on the beach. The fishery is managed using total applied effort (TAE) based on the catch returns received. Due to the uncertain status of the resource, and evidence of over-exploitation in the Southern Cape, this region has been prioritised for research efforts aimed at establishing indices of abundance, estimating density and population size structure, and determining a more accurate TAE. The number of pickers is limited based on the TAE and a daily bag limit of 190 oysters applies in KZN. A rotational harvesting system is implemented in KZN, whereby the north and south coast are each divided into four zones. Harvesting is limited to only one zone on the north coast and one zone on the south coast for a period of one year, affording each zone a fallow period of three years.

The change over to a new zone occurs on the 1st of November of every year, which is the start of the peak oyster breeding season in KZN and thus, promotes the recovery of the exploited oyster beds (Schleyer 1988). Oysters are broadcast spawners and those along the KZN coast spawn throughout the year, with peaks during spring and summer.

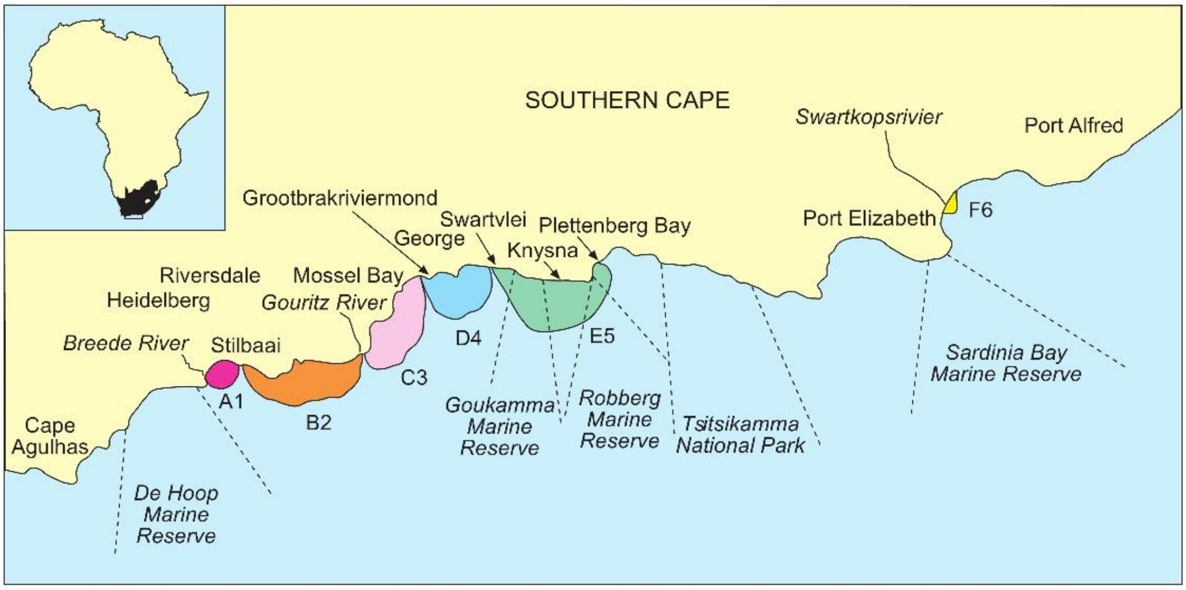


Figure 114: Oyster fishery in Gqeberha and the Southern Cape. Colour areas denote dedicated oyster collection zones (DEFF, 2020)

8.4.4.15 **ABALONE**

Abalone (*Haliotis midae*) are widely distributed around the South African coastline, from St Helena Bay on the West Coast to just north of Port St Johns on the East Coast. Once a lucrative commercial fishery, earning up to approximately R100 million annually at the turn of the century, rampant illegal harvesting and continued declines in the abundance of the resource resulted in the prohibition of recreational harvesting since 2003/4 and a total closure of the commercial fishery during the 2008/9 season. In 2010 the commercial fishery was reopened with an annual quota of 150 tons; however, this was reduced in 2013/14 to 96 tons and further reduced in 2019/2020 to 50.5 tons (refer to Figure 3.60). Estimated weight and number of illegally-harvested abalone for the years 2000–2020 is shown in Figure 3.61.

Currently the fishery is commercial, however, DFFE proposes that 50% of the TAC be apportioned to small-scale fisheries, from 2021 (DEFF Government Gazette No. 1129, 23 October 2020).

Landings of abalone (kg), effort (hours) and catch per unit effort (CPUE) are managed by harvesting area (zones A to G – refer to Figure 3.62). Wild abalone may only be harvested by quota holders and is harvested by divers during specified harvesting seasons. The collection range is assumed to be from the coastline to 20 m depth contour, thus well inshore of the licence block and AOI for proposed drilling.

In order to sustain and protect wild populations of abalone, they are bred in abalone farms along the South African coast. Land-based flow-through systems (also referred to as raceways) using pumped seawater are the most common abalone farming systems used in South Africa. However, ocean-based abalone farming is also done in four designated areas in the Northern Cape. This is called ‘ranching’. Today there are 18 abalone farms along the South African coast, from Saldanha in the West Coast and along the South Coast up to the East Coast.

Figure 115: Abalone fishing Zones A to G, including sub-zones, and distribution of abalone (insert). The experimental fisheries (2010/11-2013/14) on the western and eastern sides of False Bay and in the Eastern Cape are also shown. These areas within False Bay, included in the commercial fishery recommendations for 2017/18, are referred to as Sub-zone E3 and Sub-zone D3 (DEFF, 2020)

8.4.4.16 **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).

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). Abalone ranching 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 ranching areas (Anchor Environmental, 2012). The potential to increase this 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 DAFF issued rights for each of four Concession Area Zones. 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.

The AOI is situated 185 km offshore of the ranching zones (refer to Figure 116). The maximum depth of seeding is considered to be approximately 10 m within each of the zones.

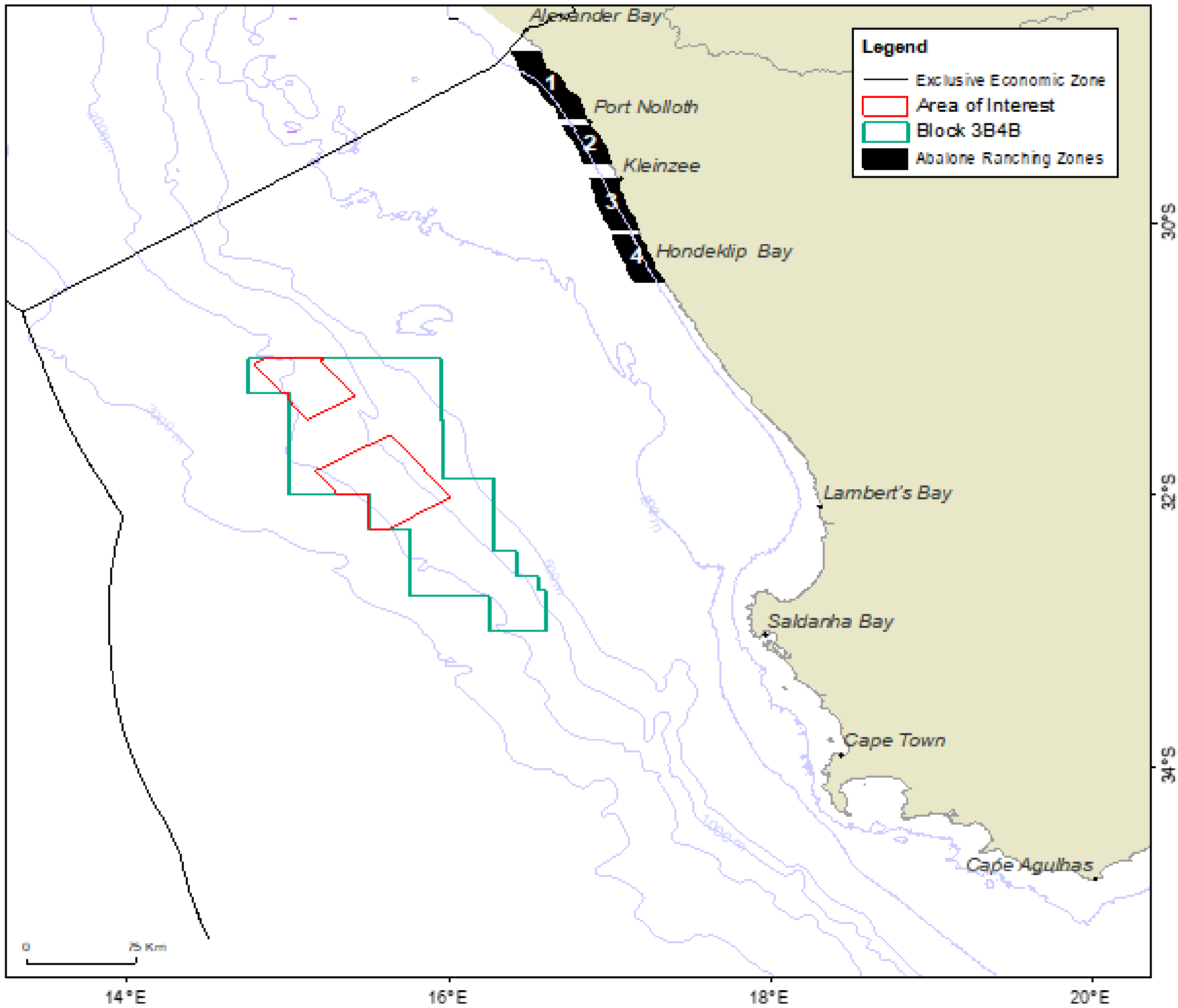


Figure 116: An overview of the spatial distribution of abalone ranching concession areas 1 – 4 in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon).

8.4.4.17 BEACH-SEINE AND GILLNET FISHERIES ("NETFISH" SECTOR)

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, *Chelon richardsonii*), 10% St Joseph shark (*Callorhinchus capensis*) and 30% "bycatch" species such as galjoen (*Dichistius capensis*), yellowtail (*Seriola lalandii*) and white steenbras (*Lithognathus lithognathus*). Catch-per-unit-effort declines eastwards from 294 and 115 kg·net-day−1 for the beach-seine and gill-net 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 Figure 117 for the fishing areas). The number of Rights Holders operating on the West Coast from Port Nolloth to False Bay is listed as 28 for beach-seine and 162 for gillnet (DAFF, 2021). 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.

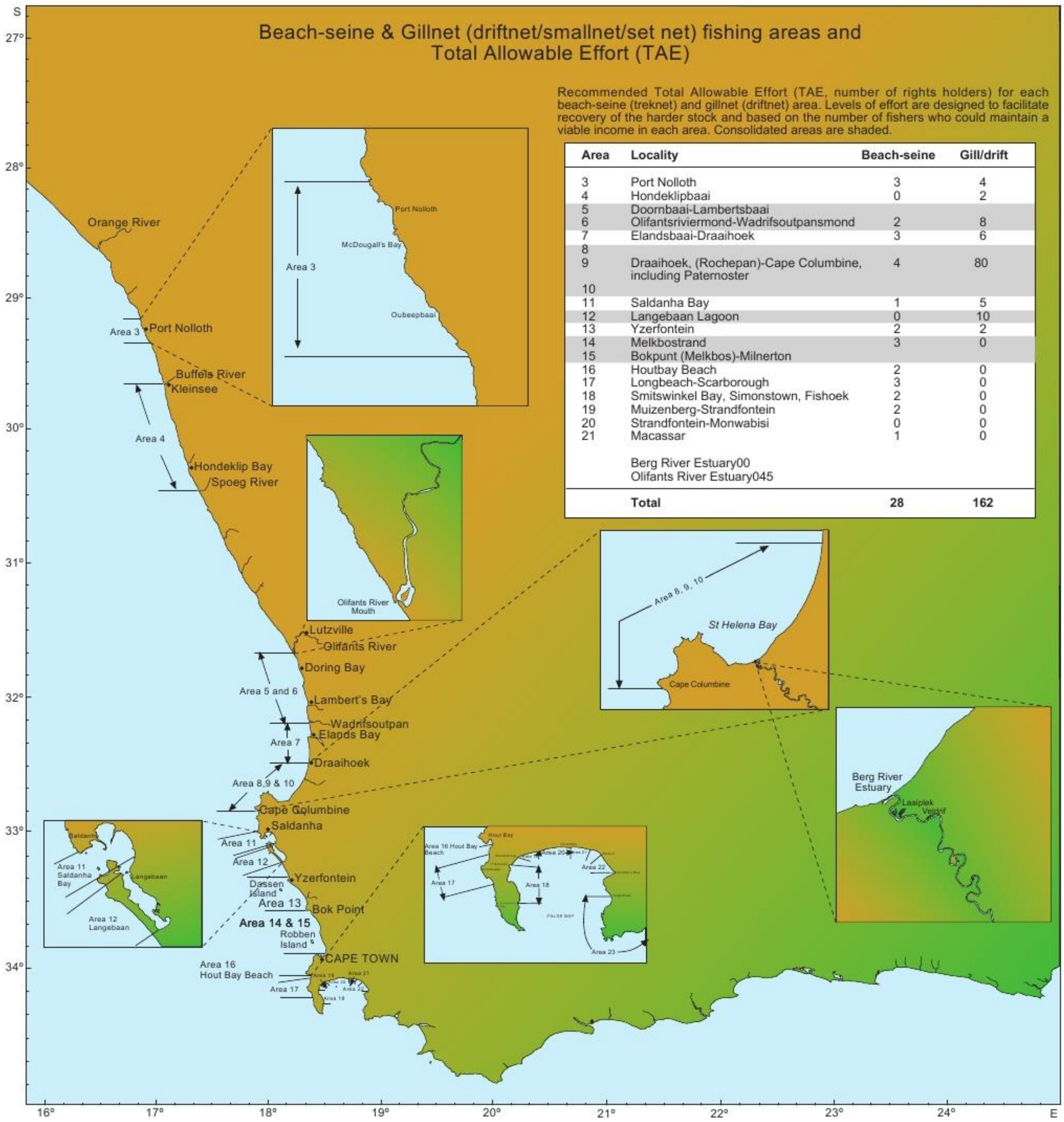


Figure 117: Beach-seine and gillnet fishing management areas and TAE (DAFF, 2014)

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).

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.

The range of gillnets (50 m) and that of beach-seine activity (20 m) will not overlap with the licence block or the AOI for proposed drilling. Figure 118 shows the expected range of gillnet fishing activity off the west coast of South Africa.

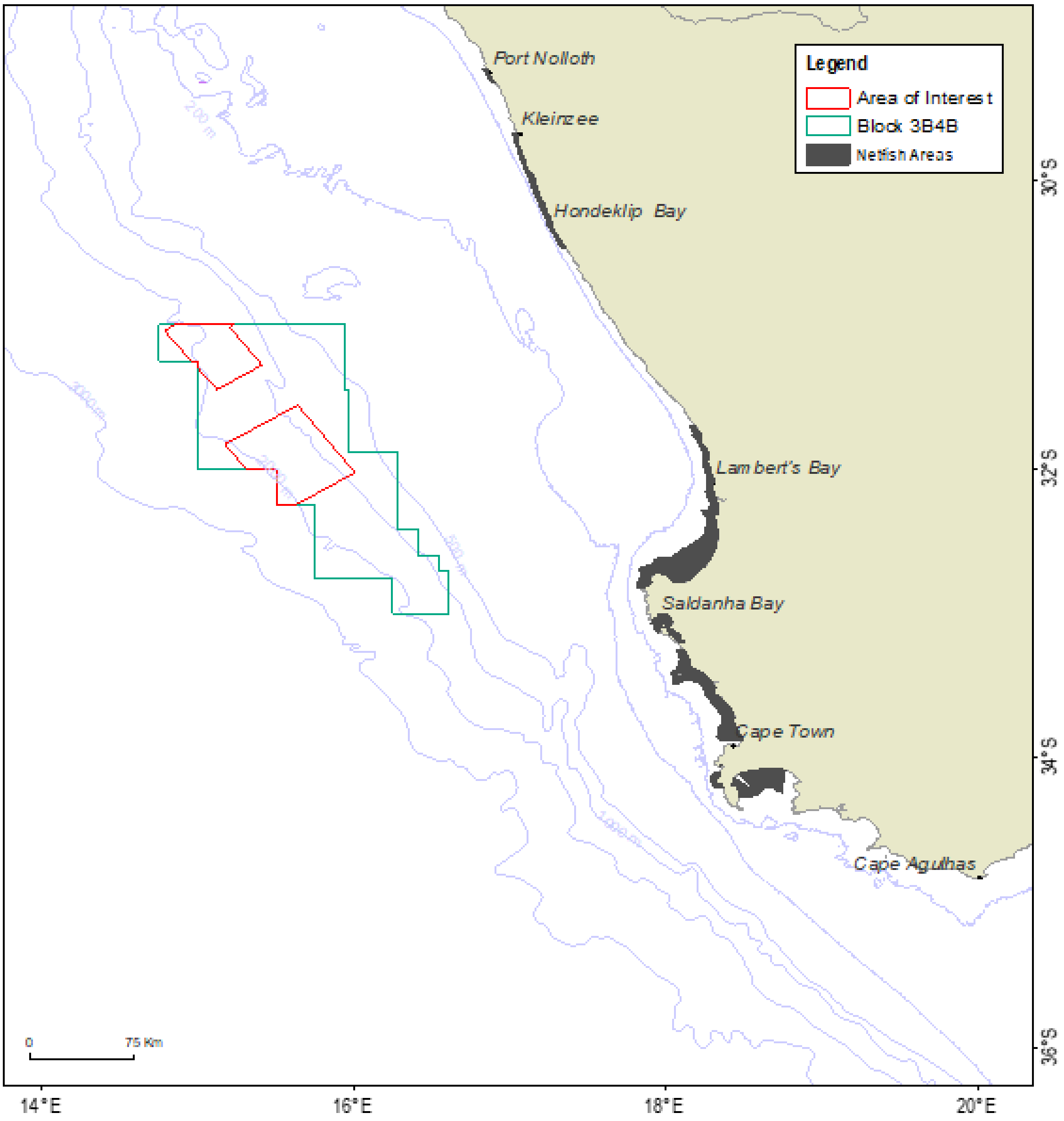


Figure 118: Netfish (gillnet and beach-seine) management areas (DAFF, 2016/17) in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon).

8.4.4.18 SEAWEED

The South African seaweed industry is based on the commercial collection of kelps (*Ecklonia maxima* and *Laminaria pallida*) and red seaweed (*Gelidium spp.*) as well as small quantities of several other species. In the Northern and Western Cape, the industry is currently based on the collection of beach-cast kelps and harvesting of fresh kelps. Beach-cast red seaweeds were collected in Saldanha Bay and St Helena Bay, but there has been no commercial activity there since 2007. Gelidium species are harvested in the Eastern Cape (DAFF, 2014a).

The seaweed sector employs approximately 1 700 people, 92% of whom are historically disadvantaged persons. 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 principle 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. The South African coastline is divided between the Orange River and Port St Johns into 23 seaweed Rights areas (Figure 119).

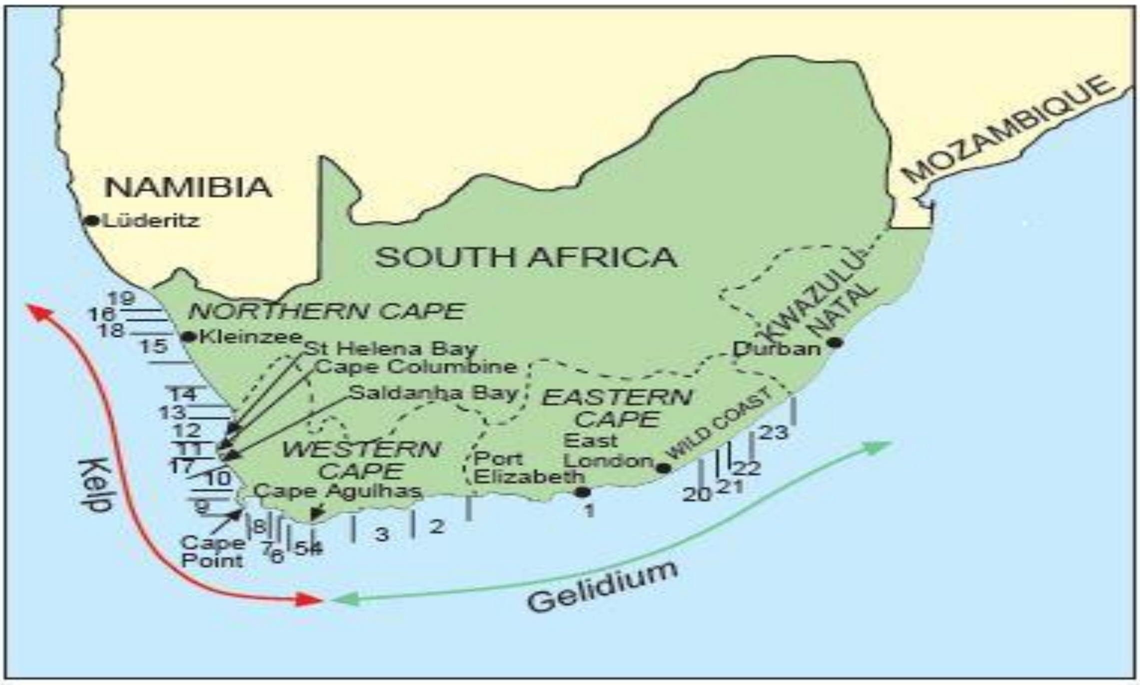


Figure 119:Map of seaweed rights areas in South Africa (DEFF, 2020).

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 4560 tonnes per annum of dry harvested kelp (beach cast) and 367 tonnes per annum of wet harvested kelp were reported within collection areas 5 to 11. An additional 1397 tonnes per annum of kelp was harvested for KELPAK (fertilizer). Amounts harvested within these collection areas amounts to approximately 98.5% of the total kelp harvests, nationally.

The AOI for proposed drilling lies offshore of Kelp collection areas 5 – 11 (Figure 120). Permit conditions stipulate that within this area kelp may be harvested using a diver deployed from a boat or the shore but is not expected to coincide with the depth range at which divers could harvest kelp. No kelp plants with a stipe less than 50 cm long may be cut or harmed. Beach cast plants may be collected by hand. The harvesting areas therefore do not coincide with the licence area, which lies far beyond the safe depth range at which divers could harvest kelp.

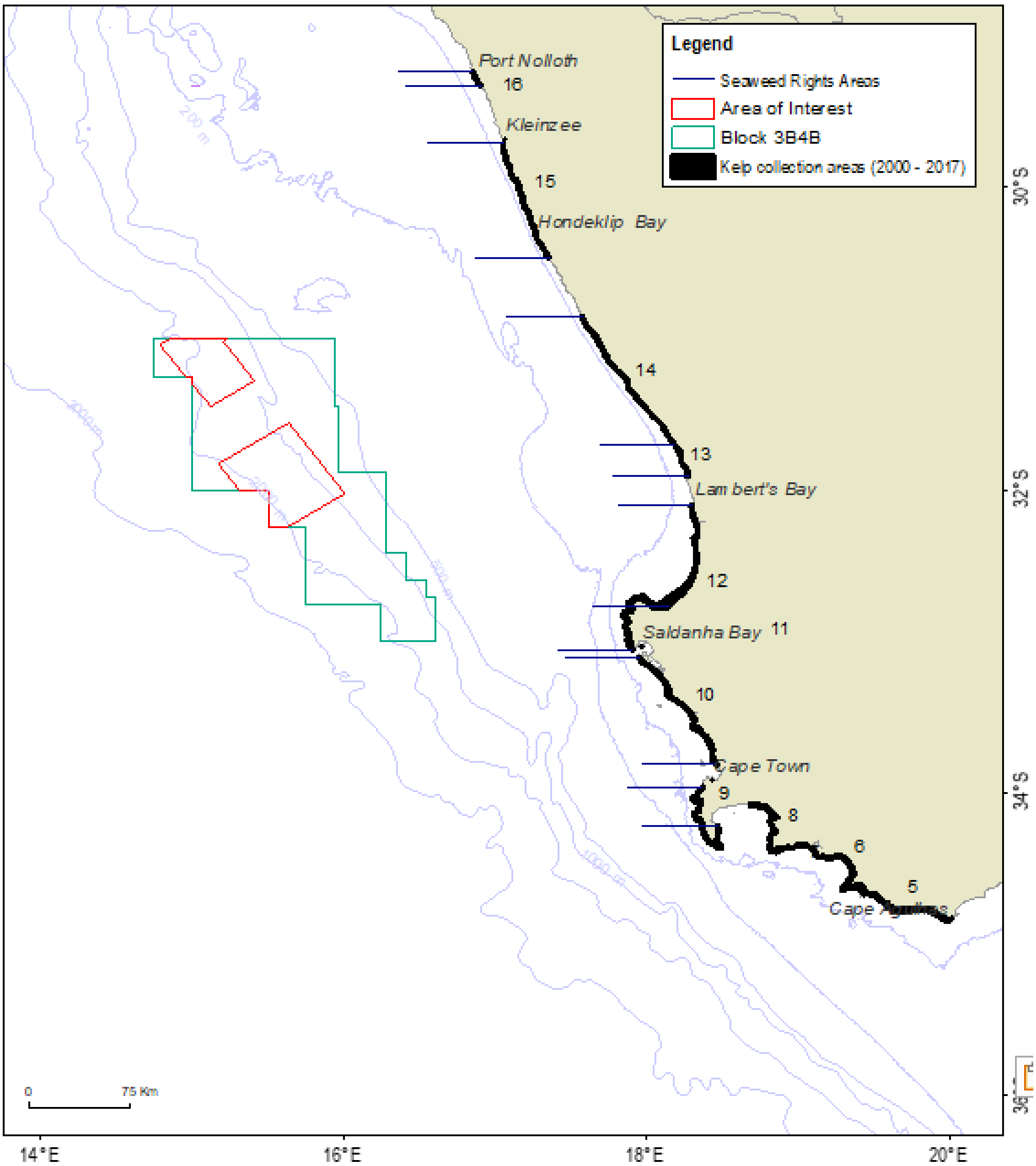


Figure 120: Location of seaweed rights areas (numbered) and kelp collection areas in relation to licence block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon).

8.4.4.19 MARICULTURE

In support of the Government's Operation Phakisa to implement the National Development Goals and boost economic growth, a Strategic Environmental Assessment (SEA) was undertaken in 2019 (CSIR, 2019) for the purpose of identifying and assessing aquaculture development zones (ADZs) to streamline and accelerate authorisation of aquaculture projects. Eight ADZs were proposed around South Africa's coastline of which four are located in the Western Cape Province: Strandfontein-Lamberts Bay, Velddrif-Saldanha, Hermanus-Arniston, and George-Gouritz zones (Figure 121). The Orange-Hondeklip Bay and Strandfontein-Lamberts Bay are the closest ADZs to the licence block.

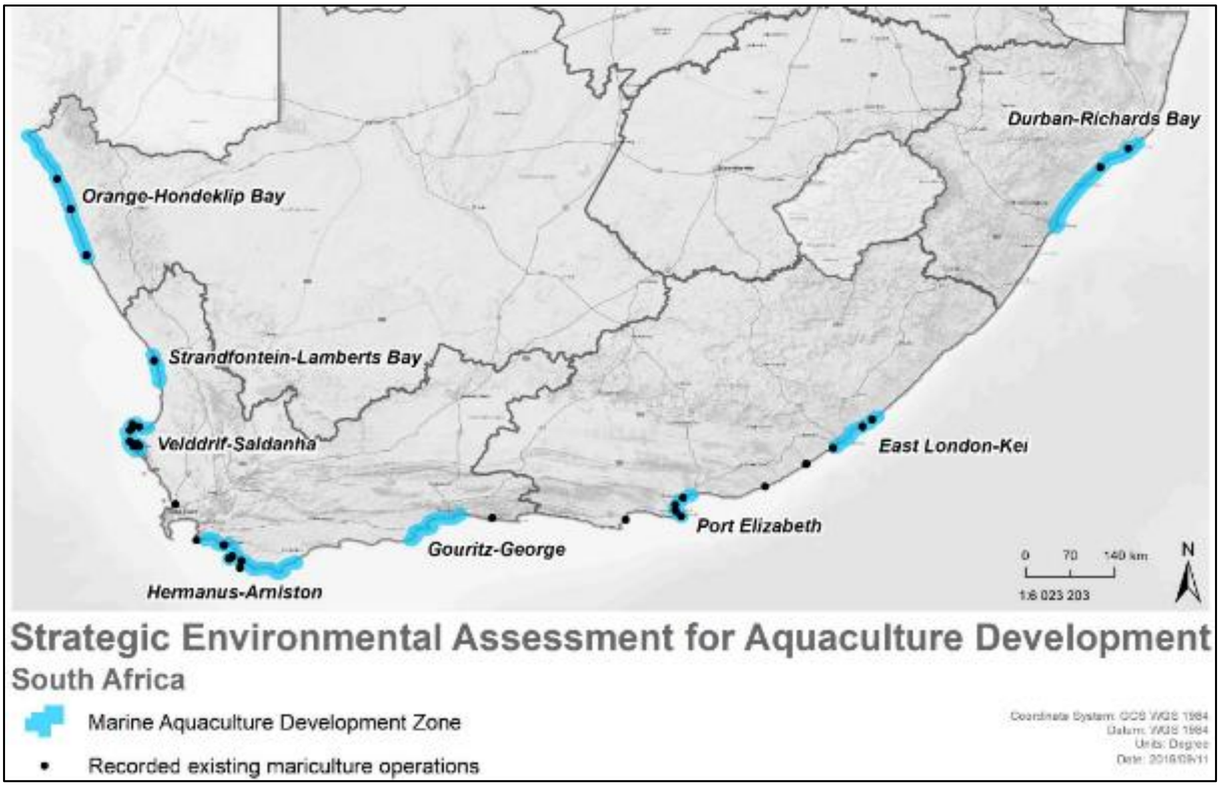


Figure 121: Proposed Marine Aquaculture Development Zones and existing mariculture operations.

Currently, 39 marine aquaculture farms operate in South Africa, most of them are experimental or of a small-scale commercial nature. The Western Cape is the highest provincial contributor with 71.7% of the national marine aquaculture production. There are 30 marine aquaculture farms operating in the Western Cape Province. Western Cape mariculture is composed of four sub-sectors namely abalone (13) finfish (2), oysters (4) and mussels (11), several farms produce multiple products (DFFE, 2019).–Northern Cape Province contributed 4.1% (175.6 tons) to the national marine aquaculture production. In 2018, there were five marine farms in the province comprising four abalone and one oyster facility. Refer to Figure 122 for mariculture methods and Figure 123 for locations in South Africa.

In 2018, the Western Cape Province recorded a production of 3701.5 tons and was the main contributor of the total marine aquaculture production in South Africa. In the Western Cape the mussel sub-sector was the highest contributor recording a production of 2182.1 tons, followed by the abalone sub-sector recording a total production of 1208.2 tons, the oyster sub-sector recorded a total production of 282.7 tons and finfish sub-sector recorded the lowest production of 28.5 tons (DFFE, 2019). It is expected that the scale of production at individual farms will increase over time along with the number of farms and the variety of products within the ADZ's, particularly of finfish (DFFE, 2019).

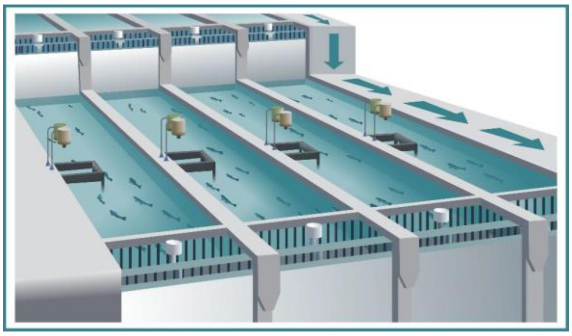
The mussel sub-sector is the highest biomass contributor to aquaculture in South Africa. The sub-sector is entirely represented by the Western Cape Province with eight longline culture operations and three raft culture operations. The species cultured in South Africa are the exotic Mediterranean mussel (*Mytilus galloprovincialis*) and the indigenous black mussel (*Choromytilus meridionalis*) (DFFE, 2019).

In the Western Cape Province thirteen abalone farms were operational with one farm operating as an abalone hatchery (some also produce seaweed as a by-product). Of the thirteen abalone farms, twelve farms are operating as flow-through operations and one farm is operating as a cage culture operation. The abalone species currently being cultivated in South Africa is the indigenous Haliotis midae (DFFE, 2019).

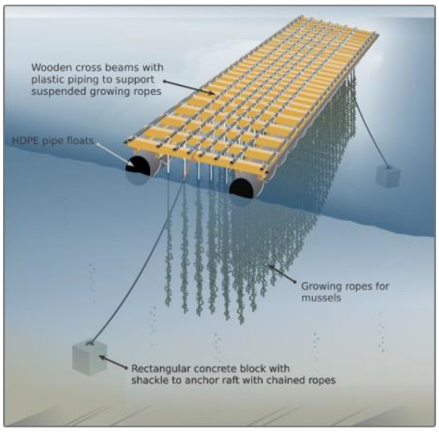
There were four Oyster farms recorded in the Western Cape, which are represented by three longline systems and one raft system. The species cultivated in South Africa is the exotic Pacific oyster (Crassostrea gigas) (DFFE, 2019).

Finfish farming of exotic salmonids in the Western Cape Province is represented by two farms; a cage culture system situated in Saldanha Bay and a semi re-circulating aquaculture system (RAS) (DFFE, 2019). Finfish currently farmed include dusky kob and yellowtail and the exotic salmonids (Atlantic salmon, Coho salmon and king salmon).

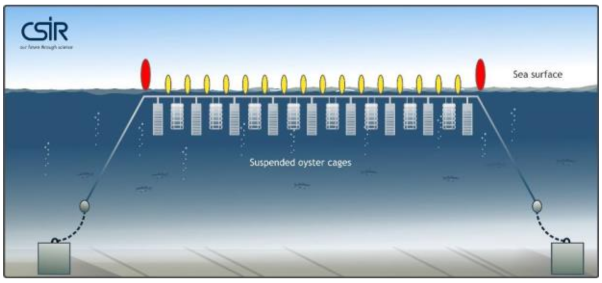
Cage culture involves the placing of cages in oceans to contain and protect the fish until they can be harvested. Finfish cage culture types include nearshore gravity net cages or pens, and open water floating, submersible and/or semi-submersible cages.



Flow-through systems are single-pass production systems where a continuous supply of water from the ocean, a storage reservoir or other water source is channelled via an inlet through tanks, ponds or channels before returning to the environment via an outlet. This system also allows for high density aquaculture production.



Raft culture is a form of suspended culture in which the "on-growing" structures (i.e. ropes) are suspended and submerged beneath a floating raft. Rafts are mostly used for marine shellfish culture, especially mussels.



Longline culture is a form of open-water suspended culture in which species are grown on ropes or in containers such as baskets, stacked trays or lantern nets, which are suspended from anchored and buoyed surface or sub-surface ropes. Longlines are commonly used for the culture of bivalve molluscs including mussels, oysters, clams and scallops, as well as marine macro algae.

Figure 122: Schematic diagrams of the types of aquaculture systems a) cage, b) flow-through, c) raft and d) longline.

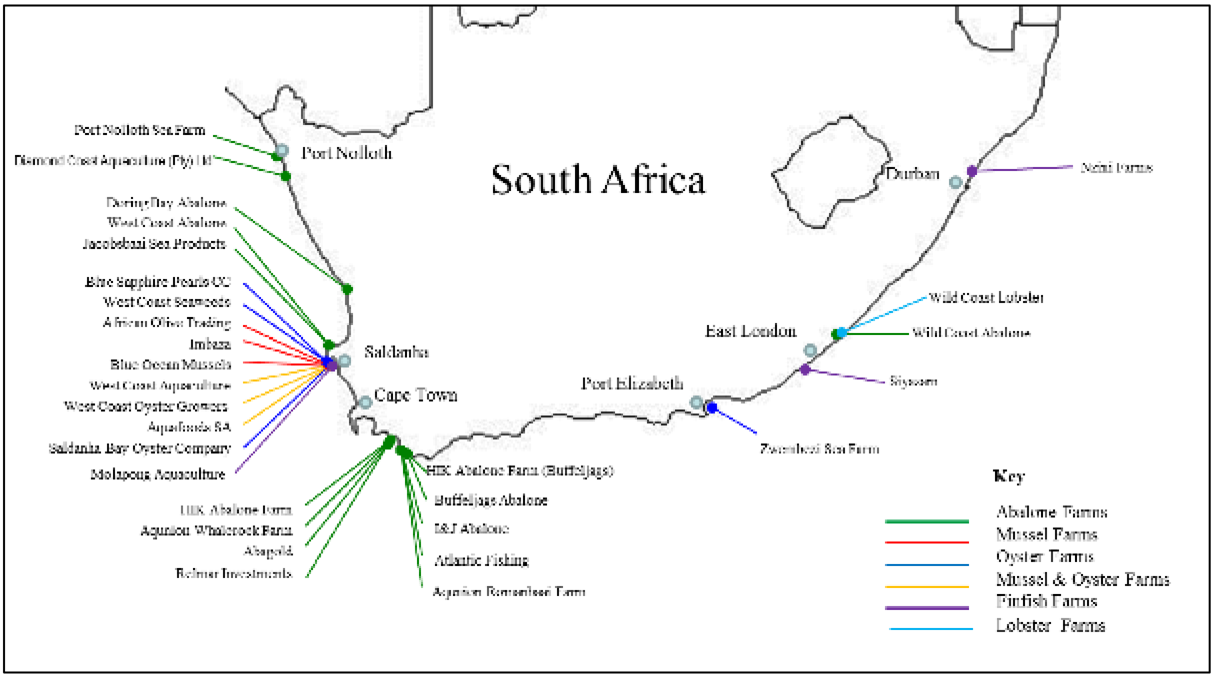


Figure 123: Distribution of aquaculture farms along the South African coast.

8.4.5 SMALL-SCALE FISHERY SECTOR

Small Scale Fishers are defined as "…persons that fish to meet food and basic livelihood needs or are directly involved in harvesting/ processing or marketing of fish, traditionally operate on or near shore fishing grounds, predominantly employ traditional low technology or passive fishing gear, usually undertake single day fishing trips, and are engaged in the sale or barter or are involved in commercial activity" (Small-Scale Fisheries Policy, 2012).

Small scale fishers in South Africa can apply for a subsistence and small-scale fishing exemption if they reside in a coastal community and wish to utilize marine living resources. To qualify for the exemption, fishers must me*et al*l verification criteria and apply through locally established local co-management committees. It is illegal to engage in subsistence and small-scale fishing without a permit, and currently, subsistence and small-scale fishers are managed by fishing exemptions until the finalization of the small-scale fisheries policy. The exemption is renewable annually, and before issuing exemptions, departmental staff explain exemption conditions and bag limits. Fishers should register and apply at their local co-management committee, indicate the sector or fishery they want to engage in, and sign the list to acknowledge receipt of their exemptions. The application process can take a month or longer, depending on the volume of applications. Failure to adhere to exemption conditions may result in legal proceedings, including the suspension, cancellation, or revocation of the exemption.

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 (Figure 124). 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).

Figure 124: The University of Western Cape's PLAAS and Masifundise Development Trust organized a round table discussion on the status of small-scale fisheries in South Africa on 19 April 2018. More than 60 people, including civil society members, academics, community representatives, students, and legal practitioners, attended the event and presented their views. Image: Fishing Industry News SA

In 2013 the SSFP Implementation Plan (IP) was finalised. The IP estimated a five-year process and a total budget of R424 million. Accordingly, the Marine Living Resources Act (MLRA) had to be amended to accommodate the small-scale fishing sector. Since the Act was amended to accommodate the small-scale fishing sector, much progress has been made in rolling out the small-scale fishing sector.

Looking at the SSF sector in more detail, the majority of applicants are male, averaging 44 years in age and the majority are classified as previously disadvantaged ethnic groups. The majority of respondents in each province are mainly dependent on fishing for more than 50% of their income. Additionally, there is a large dependency on government grants (32-45%) and limited involvement in other forms of economic activity. Approximately 80% of respondents are living with an income that is under or close to the poverty line of R1 558 pm.

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. 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.

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.

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. 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. These permits are still outstanding and for now SSF operate under "exemptions".

More than 270 communities have registered an Expressions of Interest (EOI) with the Department. 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:

- In the Northern Cape, there are 103 fishers registered in the Namakwa district, comprising the Richtersveld and Kamiesberg local municipalities. These fishers form part of 2 Co-Operatives.
- 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 2 741 fishers registered in the province. The number of Co-Operatives are still under review.
- 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 5 335 fishers registered in the province. These fishers form part of 72 Co-Operatives.
- KwaZulu-Natal has 2 184 registered small-scale fishers divided by district into 1) Ugu, 2) Ethekwini Metropolitan, 3) Ilembe, 4) King Shwetshayo/Uthungula, and 5) Umkhanyakude. These fishers form part of 35 Co-Operatives.

Approximately 10 000 small-scale fishers have been identified around the coast. The licence block is situated offshore of the Namakwa and West Coast municipal districts. Between Port Nolloth and Saldanha Bay, 19 communities have been registered for small-scale fishing rights, comprising a total of 842 fishers.

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. Section 6 of the regulations covers access Management of the rights of access and includes amongst other parts. 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 handline, abalone, 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, 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 125.

Figure 125: 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.

Snoek are 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. Snoek availability coincides with peaks in the availability of other small pelagic species, notably anchovy and sardine. As shown by Crawford *et al*. (1987) snoek stay inshore on their southward migration (i.e. April through to June) and then move offshore into deeper waters to spawn 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 (*Jasus lalandii*) using hoopnets set by small “bakkies” on suitable reefs 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. The harvesting of wild abalone along the South-West Coast is expected to range to a maximum water depth of 20 m. Catches of chokka squid (*Loligo vulgaris reynaudii*) off the South Coast rarely exceed a water depth of 60 m. The collection of oysters (*Striostrea margaritacea*) along the South Coast is confined to intertidal and shallow sub-tidal areas.

The small-scale fisheries off the Northern, Western and Southern Cape coastlines are unlikely to range beyond 20 km from the coastline, thus inshore of the AOI for proposed drilling at its closest point, and inshore of the area of noise disturbance. The small-scale fishery rights cover the nearshore area (defined in section 19 of the MLRA as being within close proximity of shoreline). As, such, SSF are currently not permitted to target tuna as it is not listed in the basket of species for SSF exploitation, although they are allowed to catch up to 10 tuna per day. Based on the distance from key SSF harbours to the AOI and on vessel clarification (with Class C to E vessels not being allowed to travel beyond 28 km from the coast, tuna is caught closer to the coast by the SFF (and traditional line fish and recreational fishers) when warmer waters move closer inshore during the summer months.

This assessment is however cognisant of the ongoing issues related to the perceived areas fished and species targeted by SSF off the West Coast of South Africa e.g. that cultural practice of SSF may occur to 55 km offshore. While SSF regulations clearly specify that fishing is required to take place “nearshore” the actual differentiation between SSF and other fishing operations that might include SSF, such as the commercial “traditional linefish” and “pole and line” and the extent to which these commercial fisheries might include SSF, remains unclear. As such the offshore extent to which SSF may operate requires a precautionary approach in this assessment and consideration that the possibility exists (albeit a remote possibility that cannot be verified through the information made available on these fisheries), that SSF may have occurred historically and potentially in the future further offshore than suggested by the information made available for this assessment i.e. there is a remote possibility that some SSF may have targeted certain species (of which tuna and snoek are the main candidate species) further offshore than 20 km. The distance fished offshore by SSF and the associated risks determined in this assessment further necessarily considers practical aspects, notably that bottom fishing is impractical in waters deeper than 100 m and as such any bottom fishing, whether SSF or commercial, is highly unlikely beyond a precautionary depth being the 100 m depth contour. Further, in regard to migratory species, such as longfin tuna and snoek, economic and regulatory aspects relating to distances fished offshore is pertinent [i.e. such as the requirements of the South African Maritime Safety Authority (SAMSA)] in particular that most SSF are not likely to be “B” class certified (i.e. can operate vessels up to 40 nm offshore and are longer than 9 m) are likely limited to “C” class being mainly vessels of <9 m permitted to only operate < 15 nm offshore. It should also be noted that the AOI does not overlap with the traditional line fish (which also targets snoek and tuna) and small pelagic purse-seine (which targets sardine and anchovy) fishing grounds. Based on the above, there is no anticipated overlap with the SSF.

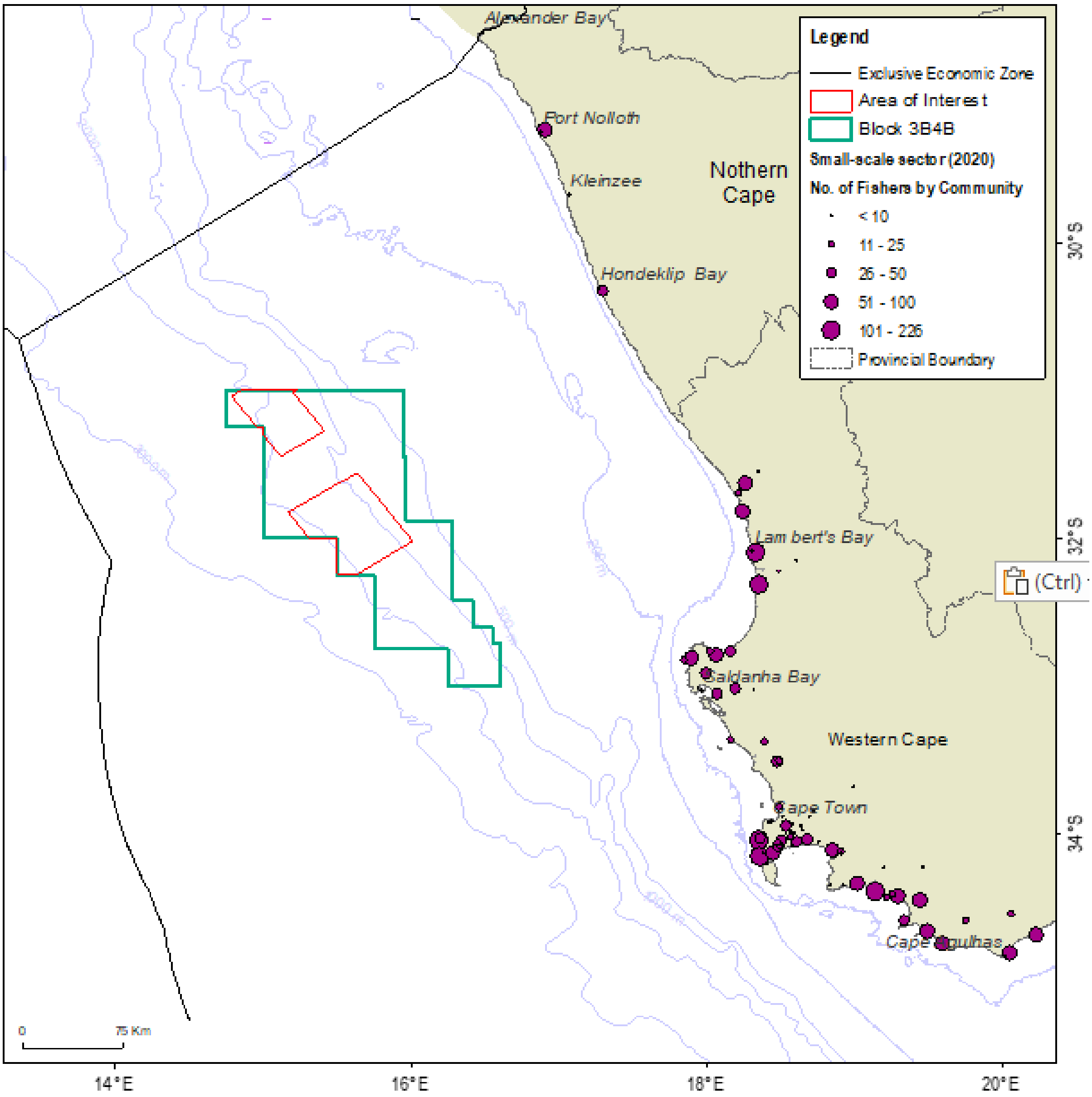


Figure 126: Block 3B/4B (Green polygon) and AOI for proposed drilling (Red polygon) in relation to the spatial distribution of small-scale fishing communities and number of participants per community along the west coast of South Africa.

8.4.6 RECREATIONAL FISHING

Recreational fishing is a non-commercial fishery in South Africa that is regulated by individual permits obtained by the public. It is estimated to have the largest number of participants of all fishery sectors in South Africa, with over 450,000 participants (DFFE, 2020). In 1996, it was estimated that there were 500,000 recreational fishers in the country (McGrath *et al*., 1997), but a more recent study by Leibold and van Zyl (2008) estimated that there were 900 000 participants in 2007.

Recreational fishing is a valuable industry in South Africa, with the tourism infrastructure, boats, vehicles, tackle, and bait making it an important economic contributor, estimated to be more than R9 billion per annum (DFFE, 2020). Recreational fishing includes subsets of numerous commercial fisheries, such as linefish, west and east coast lobster, spearfishing, squid, crabs, and many other species.

A recreational fishing permit entitles the holder to catch fish for their own use only and not for the purpose of selling or trading fish. The recreational fishery is managed by several output restrictions, such as size and bag limits, closed areas, and seasons. These restrictions are in place to ensure the sustainability of fish stocks and to minimize the impact on the marine ecosystem.

Less than 6% of anglers are affiliated to angling clubs and organizations (Mann *et al*., 2013), which suggests that the majority of recreational fishers operate independently. This could pose a challenge for monitoring and regulating the recreational fishery, as it may be difficult to ensure compliance with regulations and to collect accurate data on catches and effort.

Recreational fishing is extensive around the coast of South Africa and comprises shore based and boat-based fishing activities. Offshore recreational fishing is dependent on vessel size. Offshore small recreational or pleasure craft are limited by their certification – which varies from Category E (limited to a distance of 5 nautical mile from shore and 15 nautical miles from an approved launch site) to Category C (15 nautical miles offshore), Category B (limited to day or night passages, but within 40 nautical miles of the coastline) to Category A (allowing for extended or ocean passage). Most recreational craft are Category C certified, targeting nearshore marine species, and therefore would not technically be authorised to travel to the AOI for proposed exploration drilling.

Category A and B certified recreational vessels as well as fishing charter operation vessels targeting offshore pelagic species (tuna, dorado, marlin, etc.) with rod-and-reel are known to focus their effort on the North-eastern boundary between Cape Canyon offshore of Saldanha Bay and Hope Canyon due South of Cape Point. These anglers are unlikely to fish in the AOI for proposed drilling as they seldom fish offshore of the 1 000 m depth contour. These vessels fish seasonally in the above-mentioned areas with the majority of their effort taking place between October and May.

Overall, recreational fishing is an important and valuable industry in South Africa, with a large number of participants and significant economic impact. However, effective management and regulation are crucial to ensure the sustainability of fish stocks and the marine ecosystem, as well as to maintain the economic benefits of recreational fishing in the long term.

Landings and operational effort from this open-access recreational fishery are not reported nor recorded throughout the region.

8.4.7 ILLEGAL, UNREPORTED AND UNREGULATED FISHING

In 1977 South Africa first declared its Exclusive Economic Zone (EEZ) out for 200 nautical miles to seaward from the coastal baselines of both South Africa and its possessions in the Southern Ocean, the Marion and Prince Edward Islands. Following the coming into force of the 1982 UNCLOS Convention on 16 November 1994, South Africa passed the Maritime Zones Act 15 of 1994 affirming its rights and obligations to Fisheries, Oil and Gas Exploration and Exploitation as well as Marine Scientific Research within its EEZ.

IUU fishing may include activities conducted by national or foreign vessels in waters under the jurisdiction of a state – without that state's permission or in contravention of that state's laws and regulations. IUU fishing does not only entail the illegal catching of fish, but also relates to the storing, shipping and selling of fish caught illegally. IUU fishing is an international problem faced by many countries. South Africa is vulnerable to illegal fishing since it has a coastline of over 3 000 km and an exclusive economic zone of 1 068 659 km^2. In light of the above South Africa is one of the few countries in the region with the resources to patrol its waters in the effort to stop IUU fishing. The South African Authority strictly regulates fishing activity within its own EEZ and the area is regularly patrolled by a fleet of Offshore Environmental Protection Vessels operated by DFFE. The South African Navy also patrol offshore regions, whilst the South African Police patrols areas within their jurisdiction (within 24 nm). Legislation also requires all foreign fishing vessels entering the EEZ to apply for an EEZ permit and that all fishing gear be stowed and that the vessel switch on their AIS. This is monitored by the DFFE VMS operations room.

Whilst South Africa experiences difficulties with land-based coastal marine poaching activity, such as abalone and rock-lobster poaching, offshore areas are not considered viable for large scale illegal activity, especially in the AOI for drilling.

Considering that the Licence Block is situated offshore of the continental shelf in water depths exceeding 500 m, the risk of Illegal, Unreported and Unregulated (IUU) fishing would, most likely, be conducted by offshore

Large Scale Tuna Longline Vessels (LSTLVs). If these vessels illegally enter the EEZ, any fishing vessel that is not reporting on its AIS would be regarded with suspicion. Fishing industry operating in the area would report any illegal fishing activity if it were sighted.

8.4.8 NAMIBIAN COMMERCIAL FISHERIES

The Namibian fishing industry is a major contributor to the country's GDP, ranking among the top ten fishing countries globally. Fish resources in Namibian waters are historically abundant due to the high productivity of the Benguela upwelling ecosystem, with commercial fish stocks typically supporting intensive commercial fisheries. The main targeted species and gear types are demersal, small pelagic, large migratory pelagic fish, linefish, and crustacean resources. Mariculture is a developing industry mainly in Walvis Bay and Lüderitz Bay. The industry has only two major fishing ports, Walvis Bay and Lüderitz, and currently has 116 Namibian-registered commercial fishing vessels, mostly demersal trawlers that fish year-round with the exception of a one month closed season in October. The midwater trawlers that target horse mackerel and the large pelagic tuna longline vessels are also significant. Licensed foreign fishing vessels in Namibian waters are limited, and licensed fishers must reflag under Namibia. The license block and AOI for drilling fall within South Africa, but for the purpose of understanding the potential impacts under worst-case scenarios summary information will be provided for Namibia’s commercial fisheries, with particular focus on Hake and Tuna-based fisheries.

8.4.8.1 **MANAGEMENT AND RESEARCH**

The management of fish stocks for commercial purposes is overseen by the Ministry of Fisheries and Marine Resources (MFMR), which receives guidance from the National Marine Information and Research Centre (NatMIRC) in Swakopmund under the Ministry. TACs are set every year by the Minister based on recommendations from an advisory council. The Confederation of Namibian Fishing Industries represents commercial fisheries at the industry level, while sector-specific associations, such as the Namibian Hake Association and the Pelagic Fishing Association of Namibia, represent different fish species. MFMR conducts regular research surveys to determine the biomass of demersal, midwater, and small pelagic species, covering the entire continental shelf from the Angolan to South African maritime borders. These surveys typically follow fixed transects, are spaced 20-25 nm apart, and are designed to statistically optimize the number of stations. Demersal trawl surveys, for example, take place between January and February over a one-month period, with most of the sampling trawls occurring during daylight hours. Occasionally, "transboundary" surveys may be conducted by the Benguela Current Commission.

8.4.8.2 **STOCK DISTRIBUTION AND SPAWNING**

Commercial species spawning and distribution in Namibian waters are crucial to the country's fishing industry. The sardine population, which historically spawned continuously from September to April, collapsed in the 1960s and has remained overexploited. The southern border of this species' range is demarcated by the Lüderitz upwelling front, and it currently remains closed due to a significant population reduction. Cape horse mackerel, whose concentrations are dense between Cape Cross and the Kunene River, spawns during both summer and winter, with peak activity between January and April. Albacore and bigeye tuna are the most important to fisheries, with the availability of these species increasing in different periods. Albacore tuna is most abundant in southern Namibia in the first trimester (January to March), while bigeye tuna is available during the second and third trimesters. Hake, the most commercially important fishery in Namibia, displays seasonal variation in spawning, with spawning peaks occurring between July and September along the shelf break off central Namibia. Monkfish is found along the entire extent of the Namibian coast, with the fishery concentrated between 17°15'S and 29°30'S on the deeper continental shelf and upper slope depths at 200 m to 500 m). The abundance of these species has a strong seasonal signal resulting in increased availability to the fisheries targeting them at different periods. It is important to note that weather conditions play an important role in operations within the tuna fisheries (pole-and-line and longline).

The migration patterns of key commercial fish species in Namibia are crucial to sustain the small pelagic and hake fisheries. Hake spawns north of the Lüderitz upwelling centre, while sardines and horse mackerel spawn between Lüderitz and the Angola–Benguela Front. Complex eddying and southward transport occur beneath the surface drift. Larval settlement happens in inshore areas, and sardine spawning peaks offshore during

September and October. Warm water from the Angolan Current pushes southwards in late summer, transporting pelagic spawning products to the nursery grounds off central Namibia.

8.4.8.3 **HAKE SPECIES**

Namibia's fishing industry is largely driven by the shallow-water hake (Merluccius capensis) and the deep-water hake (Merluccius paradoxus), which are managed as a single. At the peak of exploitation in the mid-1970s, catches of hake in Namibian waters reached almost 1 million tons, although some believe that this figure was underestimated. The fishery is currently managed through a total allowable catch (TAC) system, which varies from year to year but is around 150 000 tons.

The shallow-water hake is the predominant species, but the deep-water hake is also important. The fleet of 71 demersal trawlers licensed to operate within the fishery primarily targets hake, caught in deeper waters, while smaller trawlers fish inshore for monkfish, sole, and kingklip. Eighteen demersal longliners also target hake, as well as smaller quantities of kingklip and snoek. The directed hake trawl fishery is Namibia's most valuable fishery, with a current annual hake TAC of 154 000 tons.

The deep-sea fleet is divided into wetfish and freezer vessels, with a prescribed 70:30 ratio. Freezer vessels process fish offshore, while wetfish vessels land fish at factories ashore for processing. Wetfish vessels are smaller, with an average length of 45 m, and can only remain in an area for about a week before returning to port, whereas freezer vessels can work in an area for up to a month at a time. Most trawlers operate from the port of Walvis Bay, with fewer vessels operating from Lüderitz.

Spawning by M. capensis has been recorded along most of the Namibian coast, from about 27°S to 18°S, although areas of localized spawning appear to be focused off central Namibia (25°S to 20°S), and the exact location varies between years. Fishing effort is relatively constant throughout the year, except for a closure in October and relatively lower levels of effort in November and December.

The target species of the demersal longline fishery is the Cape hakes, with a small non-targeted commercial by-catch that includes kingklip. The catch is packed unfrozen, on ice, and landed as either prime quality or headed and gutted. A total hake TAC of 154,000 tons was set for 2021/2022, but less than 10 000 tons of this was caught by longline vessels.

8.4.8.4 **TUNA-BASED FISHERIES**

Namibia has two major tuna fisheries: the Large Pelagic Longline fishery and the Tuna-Pole fishery. The Large Pelagic Longline fishery utilizes surface long-lines to target migratory pelagic species, including yellowfin tuna, bigeye tuna, swordfish, and various pelagic shark species. The fishery has provisions for up to 26 fishing rights and 40 vessels. Yellowfin tuna is distributed between 10°S and 40°S in the south Atlantic and spawns in the central Atlantic off Brazil in the austral summer. Immature yellowfin tuna can be found throughout the year in the Benguela system. After reaching sexual maturity, they migrate in summer from feeding grounds off the West Coast of southern Africa to the spawning grounds in the central Atlantic. Bigeye tuna occurs in the Atlantic between 45°N and 45°S, and it is believed that they migrate to the Benguela system to feed. Swordfish spawn in warm tropical and subtropical waters and migrate to colder temperate waters during summer and autumn months. The tuna are targeted at thermocline fronts, predominantly along and offshore of the shelf break. The spatial distribution of fishing effort is widespread and may be expected predominantly along the shelf break (approximately along the 500 m isobath) and into deeper waters (2 000 m). Effort occurs year-round with a slight peak over the period March to May. Longline vessels targeting pelagic tuna species and swordfish operate extensively around the entire Namibian coast.

The Tuna-Pole fishery is predominantly based on the southern Atlantic albacore stock and a very small amount of skipjack tuna, yellowfin tuna, and bigeye tuna. Namibia’s quota for tuna and swordfish is allocated by the International Commission for Conservation of Atlantic Tunas (ICCAT), of which Namibia is a member. Albacore tuna is a temperate species that prefers subtropical ocean waters of 16° – 20°C but appears to be differentially distributed depending on their life-history stage. Spawning occurs in equatorial regions where water temperatures exceed 24°C. The Tuna-Pole fishery catches albacore using long poles that have lines attached to them, with hooks and bait at the end. The poles are manually lowered into the water and raised to retrieve the catch.

One of the key features of the Namibian tuna pole fishery is the fact that it is certified as sustainable by the Marine Stewardship Council (MSC), an international non-profit organization that sets standards for sustainable fishing. The certification recognizes that the fishery is well-managed, operates in an environmentally responsible manner, and meets rigorous standards for sustainability.

8.4.9 SUMMARY TABLE OF SEASONALITY OF CATCHES

The seasonality of each of the main commercial fishing sectors that operate off the west coast (west of 20°E) of South Africa is indicated in Table 26 – also presented is the relative intensity of fishing effort on a month-by-month basis.

Table 26: Summary table showing seasonal variation in fishing effort expended by each of the main commercial fisheries sectors operating in West Coast South African waters.

Sector	Targeted Species	Fishing Intensity by Month within South African Exclusive Economic Zone (EEZ) H = high; M = Low to Moderate; N = None											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Demersal Trawl	Deepwater hake and shallow-water hake	H	H	H	H	H	H	H	H	H	H	H	H
Midwater Trawl	Horse mackerel	H	H	H	H	H	H	H	H	H	H	H	H
Demersal Longline	Shallow-water hake	M	M	M	H	H	H	H	H	H	H	H	H
Small Pelagic Purse-Seine	Anchovy, sardine, Red-eye round herring	M	H	H	H	H	H	H	H	H	H	H	M
Pelagic Longline	Yellowfin tuna, big eye tuna, Swordfish, southern bluefin	M	M	M	H	H	H	H	H	H	H	H	H
Tuna Pole	Albacore	H	H	H	H	H	M	M	M	M	M	H	H
Traditional Linefish	Snoek, Cape bream, geelbek, kob, yellowtail, Sparidae, Serranidae, etc	H	M	M	M	M	M	M	M	M	M	M	H
West Coast Rock Lobster	*Jasus lalandii*	M	M	M	M	M	M	M	M	M	N	M	M

Sector	Targeted Species	Fishing Intensity by Month within South African Exclusive Economic Zone (EEZ) H = high; M = Low to Moderate; N = None											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Research survey (trawl)	Demersal spp.	N	N	N	M	M	N	N	N	M	M	N	N
Research survey (acoustic)	Pelagic spp.	N	N	M	M	M	N	N	N	N	N	N	N

8.5 OTHER USES OF THE AREA

This section provides a description of the other characteristics of the application area. The information has been sourced from the Marine Ecological Baseline Study undertaken by Pisces Environmental Services (Pty) Ltd.

8.5.1 BENEFICIAL USES

Block 3B/4B is located well offshore beyond the 300 m depth contour. Other users of the offshore areas include the commercial fishing industry (see CapFish 2021 – Fisheries Specialist Study), with marine diamond mining concessions being located inshore of the eastern portion of Block 3B/4B (Figure 127). Recreational activities along the coastline north of St Helena Bay are limited to the area around Lambert's Bay, Hondeklip Bay and Port Nolloth.

On the Namaqualand coast marine diamond mining activity is restricted to nearshore, diver-assisted operations from small, converted fishing vessels working in the a-concessions, which extend to 1 000 m offshore of the high water mark. No deep-water diamond mining is currently underway in the South African offshore concession areas, although prospecting activities are ongoing. In Namibian waters, deep-water diamond mining by De Beers Marine Namibia is currently operational in the Atlantic 1 Mining Licence Area, to the northeast of Block 3B/4B.

These mining operations are typically conducted to depths of 150 m from fully self-contained mining vessels with on board processing facilities, using either large-diameter drill or seabed crawler technology. The vessels operate as semi-mobile mining platforms, anchored by a dynamic positioning system, commonly on a three to four anchor spread. Computer-controlled positioning winches enable the vessels to locate themselves precisely over a mining block of up to 400 m x 400 m. These mining vessels thus have limited manoeuvrability and other vessels should remain at a safe distance.


Figure 127: Typical crawler-vessel (left) and drillship (right) operating in the Atlantic 1 Mining Licence Area (Photos: De Beers Marine).

Other industrial uses of the marine environment include the intake of feed-water for mariculture, or diamond-gravel treatment, submarine telecommunications cables, ammunition dumps and hydrocarbon wellheads (Figure 128). None of these activities should in any way be affected by exploration drilling activities offshore.

There are a number of existing and proposed subsea fibreoptics cables that make landfall between Cape Town and Saldanha Bay (Figure 128), most of which pass to the west of Block 3B/4B. Of the ammunition dump sites off the West Coast, none fall within Block 3B/4B.

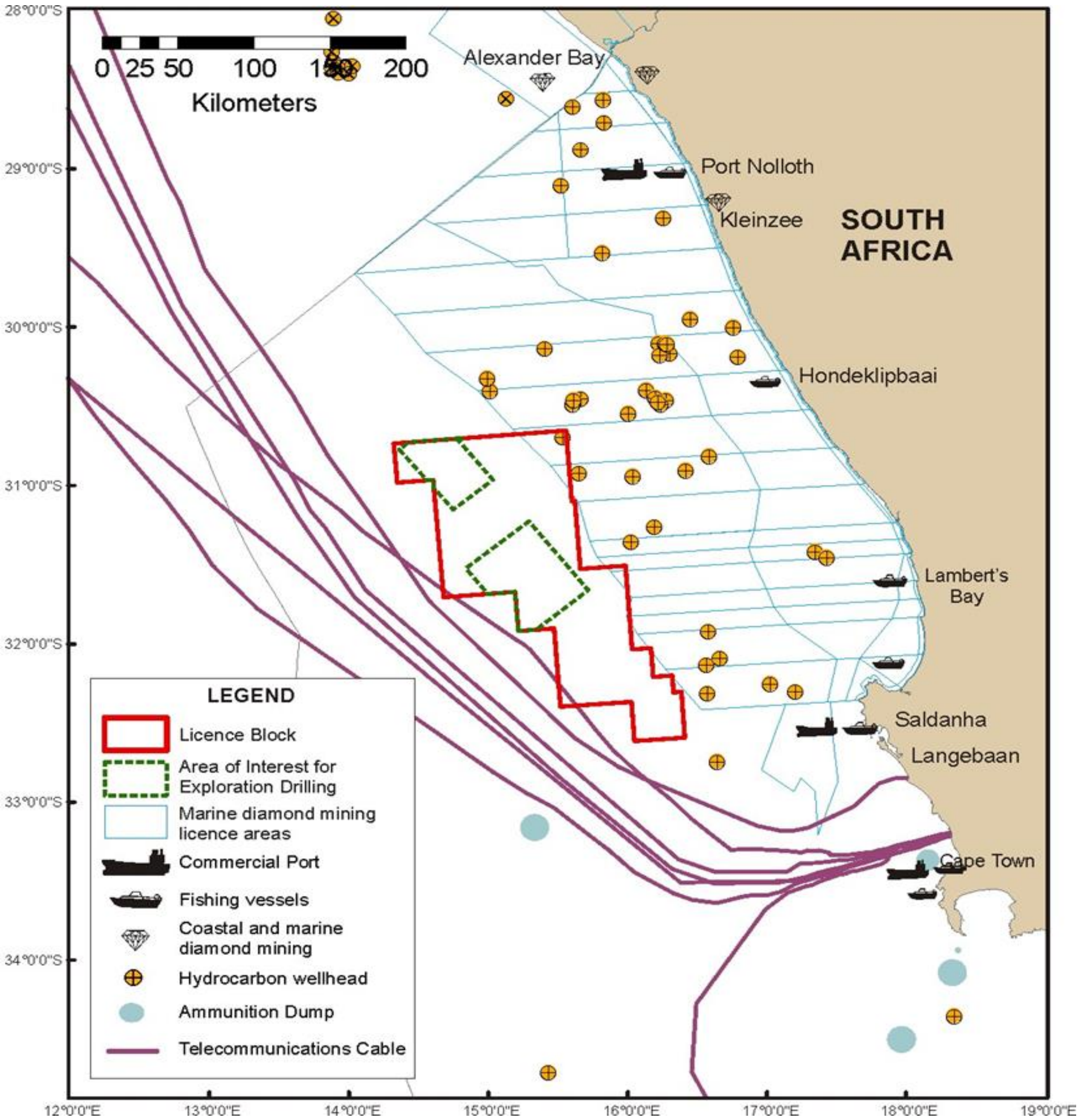


Figure 128: Block 3B/4B (red polygon) in relation to other marine infrastructure on the West Coast, illustrating the location of well heads, diamond mining concessions, submarine telecommunications cables and ammunition dumps.

8.5.2 SANCTUARIES, MARINE PROTECTED AREAS AND OTHER SENSITIVE AREAS

Numerous conservation areas and a coastal marine protected area (MPA) exist along the coastline of the Western Cape, although none overlap with Block 3B/4B.

8.5.2.1 SANCTUARIES

Sanctuaries are considered a type of management area within South Africa's multi-purpose expanded MPA network in which access and/or resource use is prohibited. Sanctuaries in the vicinity of the project area in which restrictions apply are the McDougall's Bay, Stompneusbaai, Saldanha Bay, Table Bay and Hout Bay rock lobster sanctuaries, which are closed to commercial exploitation of rock lobsters. These sanctuaries were originally proclaimed early in the 20th century under the Sea Fisheries Act of 1988 as a management tool for the protection of the West Coast rock lobster (Mayfield *et al.* 2005). They lie well inshore or to the south of Block 3B/4B.

8.5.2.2 MARINE PROTECTED AREAS

No-take MPAs offering protection of the Namaqua biozones (sub-photic, deep-photic, shallow-photic, intertidal and supratidal zones) are absent northwards from Cape Columbine (Emanuel *et al*. 1992; Lombard *et al*. 2004). This resulted in substantial portions of the coastal and shelf-edge marine biodiversity in the area being assigned a threat status of 'Critically Endangered', 'Endangered' or 'Vulnerable' in the 2011 National Biodiversity Assessment (NBA) (Lombard *et al*. 2004; Sink *et al*. 2012). Using biodiversity data mapped for the 2004 and 2011 NBAs a systematic biodiversity plan was developed for the West Coast (Majiedt *et al*. 2013) with the objective of identifying both coastal and offshore priority areas for MPA expansion. Potentially vulnerable marine ecosystems (VMEs) that were explicitly considered during the planning included the shelf break, seamounts, submarine canyons, hard grounds, submarine banks, deep reefs and cold water coral reefs. To this end, nine focus areas were identified for protection on the West Coast between Cape Agulhas and the South African – Namibian border. These focus areas were carried forward during Operation Phakisa, which identified potential offshore MPAs. A network of 20 MPAs was gazetted on 23 May 2019, thereby increasing the ocean protection within the South African Exclusive Economic Zone (EEZ) to 5%. There is no overlap with Block 3B/4B and any of these offshore MPAs, but the northern boundary of Block 3B/4B lies adjacent to the Child's Bank MPA and the Benguela Muds MPA lies ~12 km east of the southeastern boundary of Block 3B/4B. The AOI for drilling specifically avoids both this MPA and the associated EBSA (see later). These are described briefly below.

8.5.2.3 COASTAL MARINE PROTECTED AREAS

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

The **Rocher Pan MPA**, which stretches 500 m offshore of the high water mark of the adjacent Rocher Pan Nature Reserve, was declared in 1966. The MPA primarily protects a stretch of beach important as a breeding area to numerous waders. It is located in St Helena Bay inshore of Block 3B/4B.

The **West Coast National Park**, which was established in 1985 incorporates the Langebaan Lagoon and Sixteen Mile Beach MPAs, as well the islands Schaapen (29 ha), Marcus (17 ha), Malgas (18 ha) and Jutten (43 ha). Langebaan Lagoon was designated as a Ramsar site in April 1988 under the Convention on Wetlands of International Importance especially as Waterfowl Habitat. The lagoon is divided into three different utilization zones namely: wilderness, limited recreational and multi-purpose recreational areas. The wilderness zone has restricted access and includes the southern end of the lagoon and the inshore islands, which are the key refuge sites of the waders and breeding seabird populations respectively. The limited recreation zone includes the middle reaches of the lagoon, where activities such as sailing and canoeing are permitted. The mouth region is a multi-purpose recreation zone for power boats, yachts, water-skiers and fishermen. However, no collecting or removal of abalone and rock lobster is allowed. The length of the combined shorelines of Langebaan Lagoon MPA and Sixteen Mile Beach is 66 km. The uniqueness of Langebaan lies in its being a warm oligotrophic lagoon, along the cold, nutrient-rich and wave exposed West Coast.

The **Table Mountain National Park (TMNP) MPA** was declared in 2004 and includes 996 km^2 of the sea area and 137 km of coastline around the Cape Peninsula from Moullie Point in the North to Muizenberg in the south. Although fishing is allowed in the majority of the MPA (subject to Department of Agriculture, Forestry and Fisheries (DAFF) permits, regulations and seasons), the MPA includes six 'no-take' zones where no fishing or extractive activities are allowed. These 'no-take' zones are important breeding and nursery areas for a wide variety of marine species thereby providing threatened species with a chance to recover form over-exploitation.

8.5.2.4 OFFSHORE MARINE PROTECTED AREAS

The **Orange Shelf Edge MPA** covers depths of between 250 m and 1 500 m and is unique as it has to date never been trawled. Proclaimed in 2019, this MPA provides a glimpse into what a healthy seabed should look like, what animals live there and how the complex relationships between them support important commercial fish species such as hake, thereby contributing fundamentally towards sustainable fisheries development. This MPA also protects the pelagic habitats that are home to predators such as blue sharks, as well as surface waters where thousands of seabirds such as Atlantic, yellow-nosed albatrosses feed.

The 1 335 km^2 **Child's Bank MPA**, located on the northern boundary of Block 3B/4B at its closest point, supports seabed habitats inhabited by a diversity of starfish, brittle stars and basket stars, many of which feed in the currents passing the bank's steep walls. Although trawling has damaged coral in the area, some pristine coral gardens remain on the steepest slopes. The Child's Bank area was first proposed for protection in 2004 but was only proclaimed in 2019, after reducing its size to avoid petroleum wellheads and mining areas. The MPA provides critical protection to these deep sea habitats (180 - 450 m) as they allow for the recovery of important nursery areas for young fish. Located on the northern edge of the licence block, this MPA is 38 km east of the northern AOI at its closest point.

The **Benguela Muds MPA**, is the smallest of the South African offshore MPAs. At only 72 km^2 the muddy habitats located in this area are created by sediment washed down the Orange River and out to sea. These mud habitats are of limited extent and were considered 'critically endangered' on South Africa's deep continental margin of the west coast (Sink *et al.* 2014). The MPA represents the least trawled stretch of muddy seabed on the west coast. It lies ~ 12 km east of the southeastern boundary of Block 3B/4B and ~90 km southeast of the southern AOI.

The **Namaqua Fossil Forest MPA,** which lies ~165 km northeast of Block 3B/4B, provides evidence of age-old temperate yellowwood forests from a hundred million years ago when the sea-level was more than 200 m below what it is today; trunks of fossilized yellowwood trees covered in delicate corals. These unique features stand out against surrounding mud, silt and gravel habitats. The fossilized trees are not known to be found anywhere else in our oceans and are valuable for research into past climates. In 2014 this area was recognised as globally important and declared as an Ecologically and Biologically Significant Area (EBSA). The 1 200 km^2 MPA protects the unique fossil forests and the surrounding seabed ecosystems and including a new species of sponge previously unknown to science.

The **Cape Canyon** is a deep and dramatic submarine canyon carved into the continental shelf and extending to a maximum depth of 3,600 m. The 580 km^2 MPA was proclaimed in 2019 and protects the upper part of the canyon where depths range from 180 to 500 m. Underwater footage has revealed a rich diversity of seafans, hermit crabs and mantis shrimps, with hake, monk and john dory resident on the soft canyon floor. Rocky areas in the west of the canyon support fragile rocky habitat, but the area also includes sandy and muddy habitats, which have been trawled in the past. Interaction of nutrient-rich bottom water with a complex seascape results in upwelling, which in turn provides productive surface waters in which seabirds, humpback whales and Cape fur seals feed. The MPA lies ~75 km east of the southeastern boundary of Block 3B/4B and, approximately 155 km southeast of the southern AOI.

The 612 km^2 **Robben Island MPA** was proclaimed in 2019 to protect the surrounding kelp forests - one of the few areas that still supports viable stocks of abalone. The island harbours the 3rd largest penguin colony, with the breeding population peaking in 2004 at 8 524, but declining since. The island also holds the largest numbers of breeding Bank Cormorant in the Western Cape (120 pairs in 2000) and significant populations of Crowned Cormorant, African Black Oystercatcher (35 breeding pairs in 2000), Hartlaub's Gull and Swift Tern.

8.5.2.5 SENSITIVE AREAS

Despite the current lack of knowledge of the community structure and endemicity of South African macro-infauna off the edge of the continental shelf, the marine component of the 2018 National Biodiversity Assessment (Sink *et al.* 2019), rated the South Atlantic bathyal and abyssal unconsolidated habitat types that characterise depths beyond 500 m, as being of 'Least concern' (see Figure 129), reflecting the great extent of these habitats in the South African Exclusive Economic Zone (EEZ). However, those ecosystem types occurring along the shelf edge (-500 m) and Cape Canyon are considered 'Vulnerable', with isolated portions being rates as 'Endangered' (Cape Upper Canyon and Southern Benguela Muddy Shelf Edge), and 'Critically Endangered' (Brown's Bank Rocky Shelf Edge). Block 3B/4B and the AOI for drilling is dominated by ecosystems rated as 'Least Concern' by the 2018 National Biodiversity Assessment.

Despite the development of the offshore MPA network, most of the ecosystem types in Block 3B/4B (i.e. Southeast Atlantic Upper, Mid and Lower Slopes, Cape Basin Abyss) are currently considered 'not protected' or 'poorly protected' and further effort is needed to improve protection of these threatened ecosystem types (Sink *et al.* 2019). Ideally, all highly threatened ('Critically Endangered' and 'Endangered') ecosystem types should be well protected. Currently, however, most of the Southeast Atlantic Upper- and Mid-Slope are poorly protected receiving only 0.2-10% protection, whereas the Southeast Atlantic Lower Slope receives no protection at all (Sink *et al.* 2019). Expanding the size of the Orange Shelf Edge MPA to form a single MPA along the South African Border could improve protection of these threatened habitats.

8.5.2.6 ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT AREAS

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

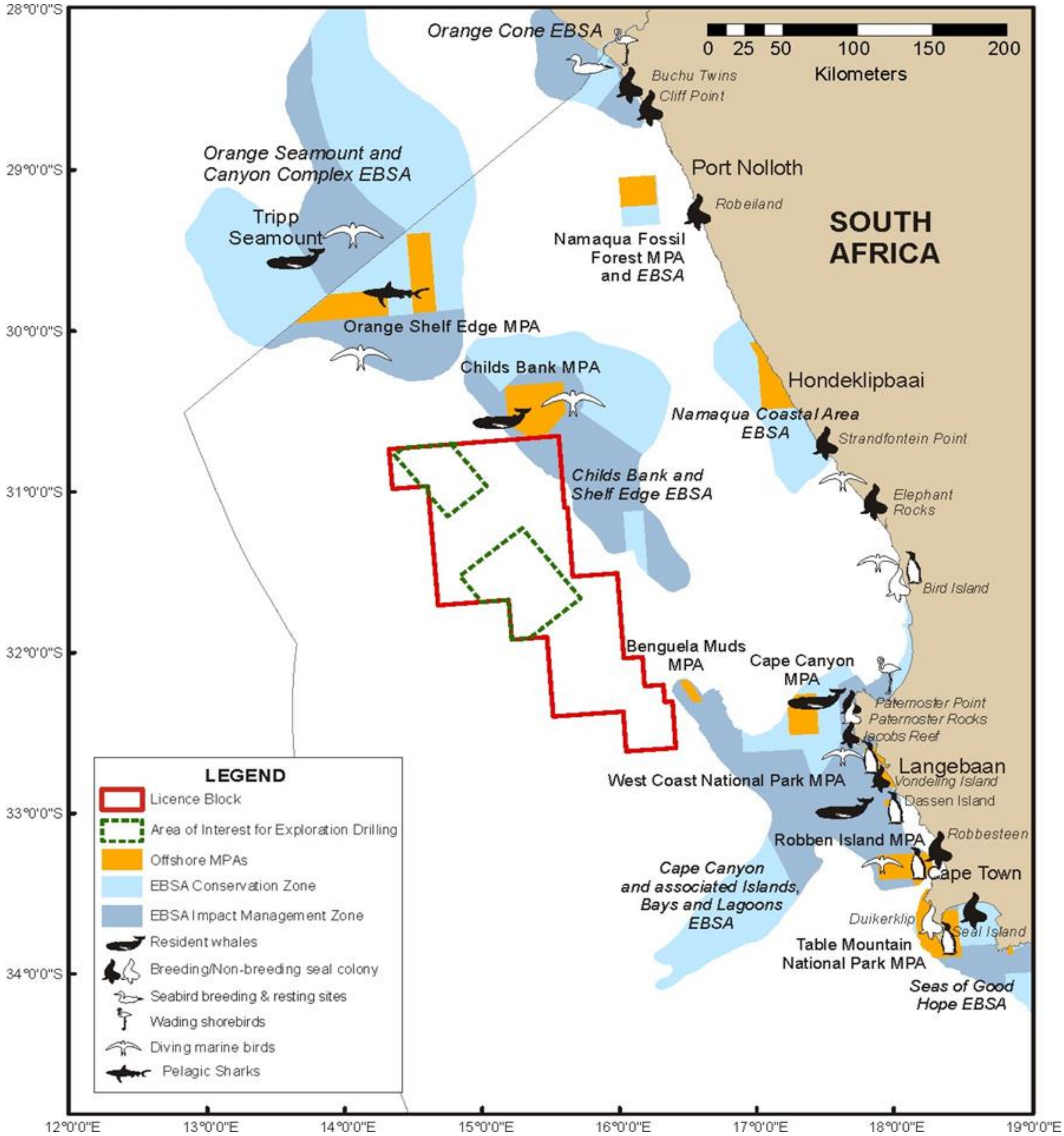


Figure 129: Block 3B/4B (red polygon) in relation to project - environment interaction points on the West Coast, illustrating the location of seabird and seal colonies and resident whale populations, Marine Protected Areas (MPAs) and Ecologically and Biologically Significant Areas (EBSAs) (Adapted from MARISMA Project 2020).

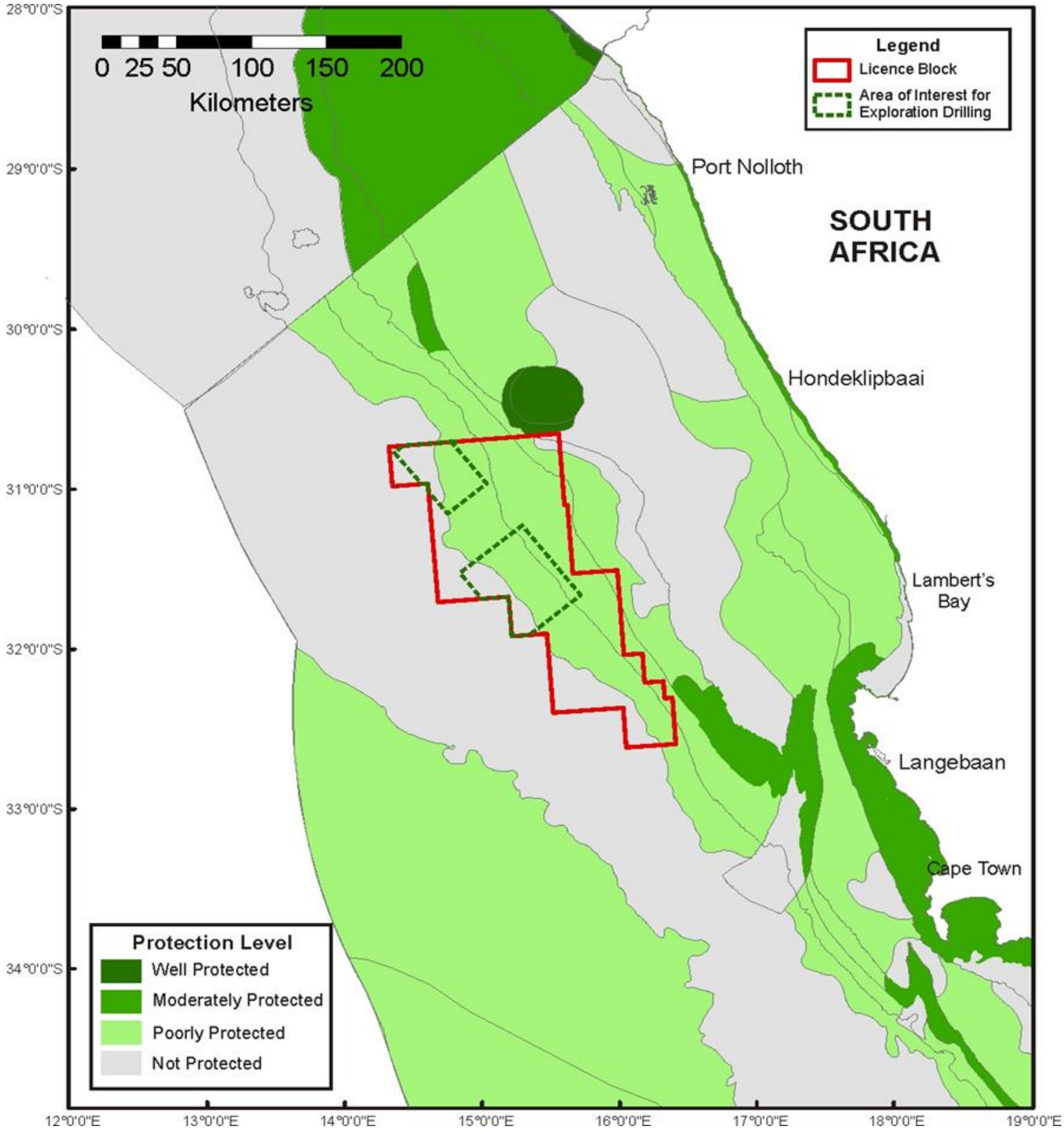


Figure 130: Block 3B/4B (red polygon) in relation to protection levels of 150 marine ecosystem types as assessed by Sink *et al.* (2019). The adjacent Namibian protection levels (adapted fom Holness *et al.* 2019) are also shown.

The following summaries of the EBSAs in the project area are adapted from http://cmr.mandela.ac.za/EBSA-Portal/Namibia/. Although Block 3B/4B overlaps to some extent with the Child's Bank EBSA, the AOI for exploration drilling avoids all EBSAs. The text and figures below are based on the EBSA status as of October 2020.

The **Childs Bank and Shelf Edge** EBSA is a unique submarine bank feature rising from -400 m to -180 m on the western continental margin on South Africa (approximately 300 km north-west of the AOI). This area includes five benthic habitat types, including the bank itself, the outer shelf and the shelf edge, supporting hard and unconsolidated habitat types. Childs Bank and associated habitats are known to support structurally complex cold-water corals, hydrocorals, gorgonians and glass sponges; species that are particularly fragile, sensitive and vulnerable to disturbance, and recover slowly. This EBSA overlaps to some extent with Block 3B/4B.

There are also a number of EBSAs in the indirect area of influence to the north, south and east of Block 3B/4B. These are described briefly below.

The **Orange Cone** transboundary EBSA is a transboundary EBSA, spanning the mouth of the Orange River (approximately 610 km north of the AOI). The estuary is biodiversity-rich but modified, and the coastal area includes many 'Critically Endangered', 'Endangered' and 'Vulnerable' habitat types (with the area being particularly important for the 'Critically Endangered' Namaqua Sandy Inshore, Namaqua Inshore Reef and Hard Grounds and Namaqua Intermediate and Reflective Sandy Beach habitat types). The marine environment experiences slow, but variable currents and weaker winds, making it potentially favourable for reproduction of pelagic species. An ecological dependence of river outflow for fish recruitment on the inshore Orange Cone is also likely. The Orange River Mouth is a transboundary Ramsar site and falls within the Tsau//Khaeb (Sperrgebiet) National Park. It is also under consideration as a protected area (RAMSAR site) by South Africa and is an Important Bird and Biodiversity Area. This EBSA lies ~220 km to the northeast of Block 3B/4B at its closest point.

The **Orange Seamount and Canyon Complex EBSA**, occurs at the western continental margin of southern Africa, spanning the border between South Africa and Namibia (approximately 500 km north-west of the AOI). On the Namibian side, it includes Tripp Seamount and a shelf-indenting canyon. The EBSA comprises shelf and shelf-edge habitat with hard and unconsolidated substrates, including at least eleven offshore benthic habitat types of which four habitat types are 'Threatened', one is 'Critically endangered' and one 'Endangered'. The Orange Shelf Edge EBSA is one of few places where these threatened habitat types are in relatively natural/pristine condition. The local habitat heterogeneity is also thought to contribute to the Orange Shelf Edge being a persistent hotspot of species richness for demersal fish species. Although focussed primarily on the conservation of benthic biodiversity and threatened benthic habitats, the EBSA also considers the pelagic habitat, which is characterized by medium productivity, cold to moderate Atlantic temperatures (SST mean = 18.3°C) and moderate chlorophyll levels related to the eastern limit of the Benguela upwelling on the outer shelf. This EBSA lies ~45 km to the north of Block 3B/4B at its closest point.

The **Namaqua Fossil Forest** EBSA is a small seabed outcrop composed of fossilized yellowwood trees at 136-140 m depth, approximately 30 km offshore on the west coast of South Africa approximately 545 km north of the AOI). A portion of the EBSA comprised the Namaqua Fossil Forest MPA. The fossilized tree trunks form outcrops of laterally extensive slabs of rock have been colonized by fragile, habitat-forming scleractinian corals and a newly described habitat-forming sponge species. The EBSA thus encompasses a unique feature with substantial structural complexity that is highly vulnerable to benthic impacts. This EBSA lies ~150 km to the northeast of Block 3B/4B at its closest point.

The **Namaqua Coastal Area** EBSA encompasses the Namaqua Coastal Area MPA and is characterized by high productivity and community biomass along its shores (approximately 345 km north of the AOI). The area is important for several threatened ecosystem types represented there, including two 'Endangered' and four 'Vulnerable' ecosystem types, and is important for conservation of estuarine areas and coastal fish species. This EBSA lies ~115 km to the east of Block 3B/4B at its closest point.

The **Cape Canyon and Associated Islands** EBSA includes the Benguela Muds MPA and the Cape Canyon, which is thought to hosts fragile habitat-forming species. The area is considered important for pelagic fish, foraging marine mammals and several threatened seabird species and serves to protect nine 'Endangered' and 12 'Vulnerable' ecosystem types, and two that are 'Near Threatened'. There are several small coastal MPAs within the EBSA. Block 3B/4B lies approximately 4 km westward of this EBSA at its closest point.

The proposed **Seas of Good Hope EBSA** is located at the coastal tip of Africa, wrapping around Cape Point and Cape Agulhas. It extends from the coast to the inner shelf, and includes key islands (Seal Island, Dyer Island and Geyser Rocks), two major bays (False Bay and Walker Bay), and is of key importance for threatened species and habitats. The threatened habitats include coastal, inshore and inner shelf ecosystem types. The important life-history stages supported by the area are breeding and/or foraging grounds for a myriad of top predators, including sharks, whales, and seabirds, some of which are threatened species. This EBSA is also the place where the Benguela and Agulhas Currents meet. This EBSA lies over 200 km to the southeast of Block 3B/4B at its closest point.

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

8.5.2.7 **BIODIVERSITY PRIORITY AREAS**

The National Coastal and Marine Spatial Biodiversity Plan[3] comprises a map of Critical Biodiversity Areas (CBAs), Ecological Support Area (ESAs) and accompanying sea-use guidelines. The CBA Map presents a spatial plan for the marine environment, designed to inform planning and decision-making in support of sustainable development. The sea-use guidelines enhance the use of the CBA Map in a range of planning and decision-making processes by indicating the compatibility of various activities with the different biodiversity priority areas so that the broad management objective of each can be maintained. The intention is that the CBA Map (CBAs and ESAs) and sea-use guidelines inform the MSP Conservation Zones and management regulations, respectively.

Block 3B/4B overlaps with areas mapped as Critical Biodiversity Area 1 (CBA 1) Natural, CBA 1 Restore, Critical Biodiversity Area 2 (CBA 2) Natural, CBA 2 Restore and Ecological Support Area (ESA). There is minima1 overlap of the northern AOI for proposed exploration drilling with CBA 1 Natural (2.6 km^2) and CBA 2 Natural (35.9 km^2) areas but for the southern AOI, the overlap with CBA 1 Natural and CBA2 Natural, amounts to 520.1 km^2 and 251.2 km^2, respectively (Figure 131). CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 are "best design sites" and there are often alternative areas where feature targets can be met; however, these will be of higher cost to other sectors and / or will be larger areas.

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

Activities within these management zones are classified into those that are "compatible", those that are "not compatible", and those that have "restricted compatibility". Non-invasive (e.g. seismic surveys) and invasive (e.g. exploration wells) exploration activities are classified as having "restricted compatibility". Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. Harris *et al.* (2022) states that as part of the site-specific, context-specific assessment "*particularly careful attention would need to be paid in areas containing irreplaceable to near-irreplaceable features where the activity may be more appropriately evaluated as not permitted. The ecosystem types in which the activities take place may also be a consideration as to whether or not the activity should be permitted, for example. Where it is permitted to take place, strict regulations and controls over and above the current general rules and legislation would be required to be put in place to avoid unacceptable impacts on biodiversity features. Examples of such regulations and controls include exclusions of activities in portions of the zone; avoiding intensification or expansion of current impact footprints; additional gear restrictions; and temporal closures of activities during sensitive periods for biodiversity features.*" Petroleum production is, however, classified as "not compatible" in CBAs, but may be compatible, subject to certain conditions, in ESAs (Harris *et.al*. 2022).

3

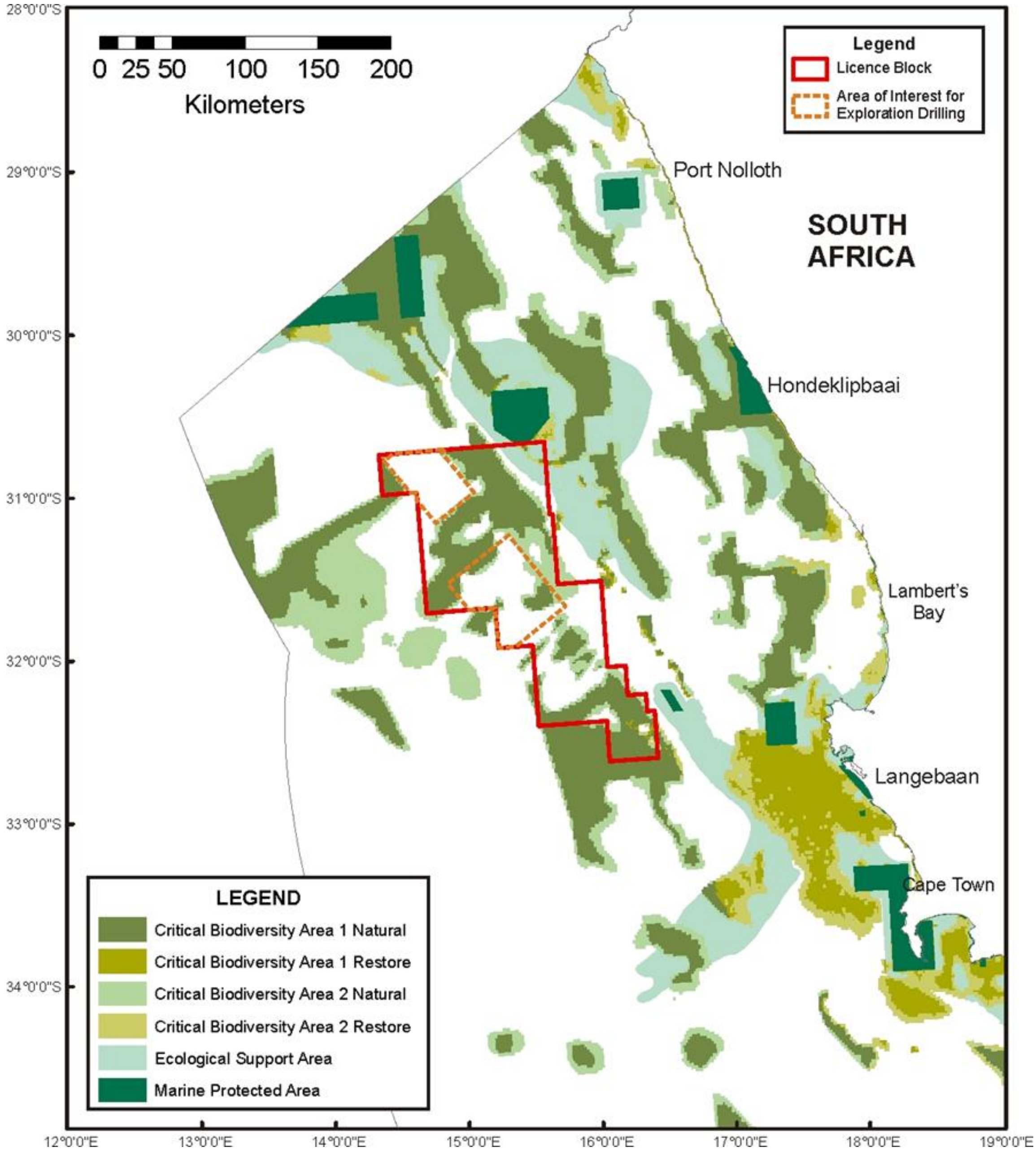


Figure 131: Block 3B/4B (red polygon) and the AOI for exploration drilling (orange dashed polygons) in relation to Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Version 1.2) (Harris *et al.* 2022).

8.5.2.8 **IMPORTANT BIRD AREAS (IBAS) AND RAMSAR SITES**

There are numerous coastal Important Bird Areas (IBAs) in the general project area (Table 27) (https://maps.birdlife.org/marineIBAs). These are all located well inshore of Block 3B/4B.

Table 27: List of confirmed coastal Important Bird Areas (IBAs) and their criteria listings. (www.BirdLife.org.za). Those incorporating or listed as RAMSAR sites are shaded.

Site Name	IBA Criteria[4]
Orange River Mouth Wetlands (ZA023)	A1, A3, A4i, A4iii
Olifants River Estuary (ZA078)	A3, A4i
Verlorenvlei Estuary (ZA082)	A4i
Berg River Estuary (ZA083)	A4i
West Coast National Park and Saldanha Bay Islands (ZA 084) (incorporating Langebaan RAMSAR site)	A1, A4i, A4ii, A4iii
Dassen Island (ZA088)	A1, A4i, A4ii, A4iii
Robben Island (ZA089)	A1, A4i, A4ii, A4iii
Rietvlei Wetland: Table Bay Nature Reserve (ZA090)	A1, A4i
Boulders Beach (ZA096)	A1
False Bay Nature Reserve (ZA095)	A1, A4i, A4iii

Various marine IBAs have also been proposed in South African territorial waters, with a candidate marine IBA suggested off the Orange River mouth and a further candidate marine IBA suggested in international waters west of the Cape Peninsula (). Block 3B/4B does not overlap with any of these proposed marine IBAs.

A Ramsar site is considered wetland designated to be of international importance under the Ramsar Convention, also known as "The Convention on Wetlands", an intergovernmental environmental treaty established by UNESCO in 1971. The convention entered into force in South Africa on 21 December 1975.It provides for national action and international cooperation regarding the conservation of wetlands, and wise sustainable use of their resources. South Africa currently has 27 sites designated as Ramsar Sites, with a surface area of 571 089 hectares. The coastal RAMSAR sites in the area of indirect influence are provided in Table 28 below.

[4] **A1**. Globally threatened species; **A2**. Restricted-range species; **A3**. Biome-restricted species; **A4**. Congregations; **i**. applies to 'waterbird' species; **ii**. This includes those seabird species not covered under i.; **iii**. modelled on criterion 5 of the Ramsar Convention for identifying wetlands of international importance. The use of this criterion is discouraged where quantitative data are good enough to permit the application of A4i and A4ii.

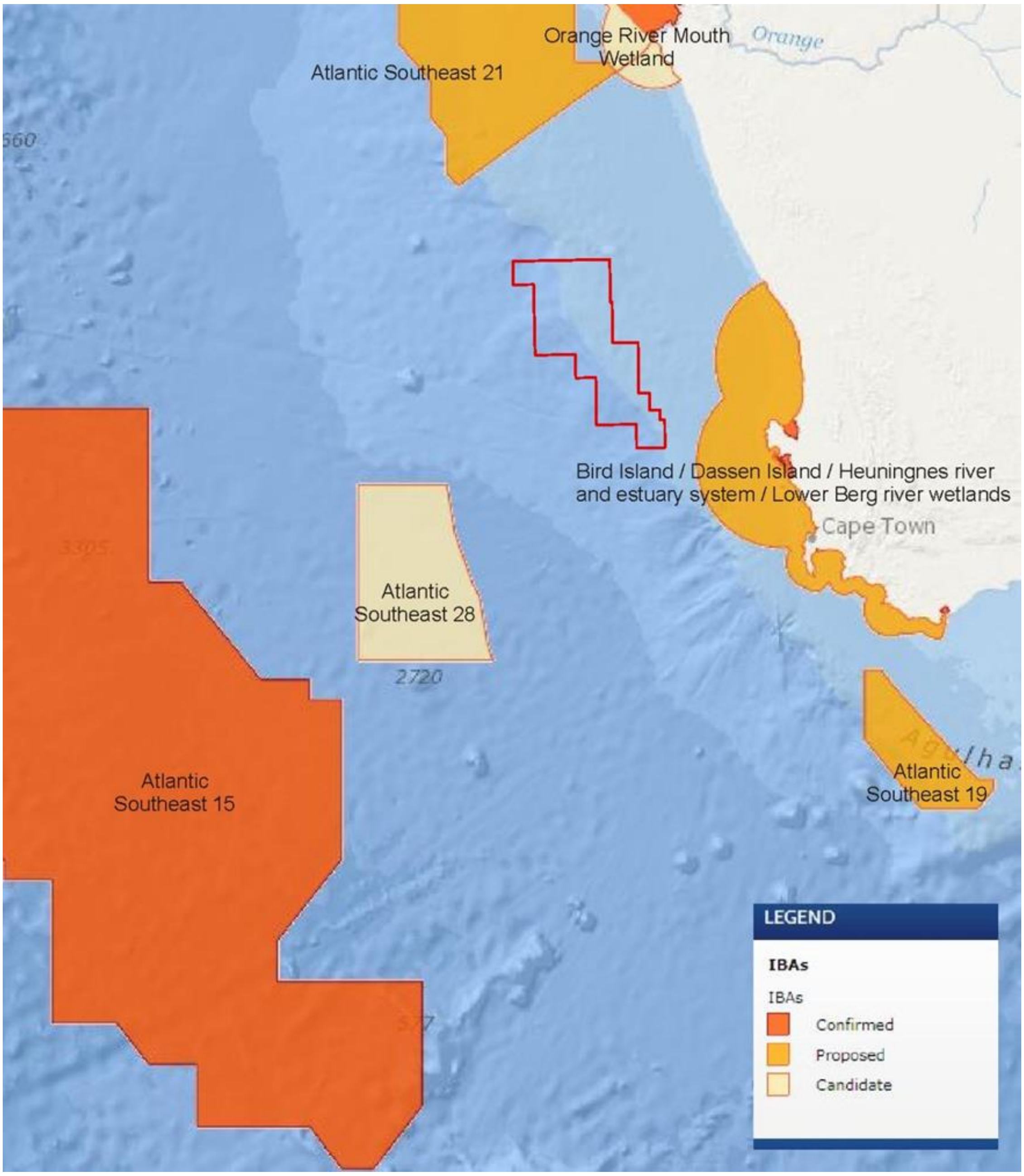


Figure 132: Block 3B/4B (red polygon) in relation to coastal and marine IBAs (Source: https://maps.birdlife.org/marineIBAs).

Table 28: List of coastal RAMSAR sites in the area of influence of Block 3B/4B.

Name	Size (ha)	Province	Description
Orange River Mouth	2 000	Northern Cape	Ramsar site no. 526. Transboundary area of extensive saltmarshes, freshwater lagoons and marshes, sand banks, and reedbeds shared by South Africa and Namibia. Important for resident birds and for staging locally migrant waterbirds. Following the collapse of the saltmarsh component of the estuary, the site was placed on the Montreux Record in 1995.

Name	Size (ha)	Province	Description
Verlorenvlei	1 500	Western Cape	Ramsar site no. 525. One of the largest lakes (and one of South Africa's few coastal freshwater lakes), with associated scrub, shrubland, dune systems, marshland and reedbeds representing a transition zone between two plant communities. The site is an important feeding area for rare pelicans and fish, for moulting and breeding birds, as well as for staging wading birds.
Langebaan	6 000	Western Cape	Ramsar site no. 398. National Park. A large, shallow marine lagoon includes islands, reedbeds, sand flats, saltmarshes and dwarf shrubland. The lagoon is an important nursery area for a number of fish species and supports a diverse and ecologically important algal and shoreline biota. Important for wintering and staging wading birds, and the numerous breeding birds include the largest colony of gulls in South Africa.
Dassen Island Nature Reserve	737	Western Cape	Ramsar site no. 2 383. The Dassen Island Nature Reserve, lying off the Western Cape Province, is the second-largest coastal island on the South African continental shelf. It is within the Benguela upwelling ecosystem, which lifts cold, nutrient-rich water to the surface. Sandy inner shelf, rocky mid-shelf mosaic, island shore and kelp forest are the main habitat types. Dassen Island is covered by Cape seashore vegetation and a number of cetacean species are found in the surrounding seas. The Site is an Important Bird Area providing habitat for significant numbers of seabird and shorebird species, including 10 of the 15 seabirds endemic to southern Africa, and numerous Palearctic and sub-Antarctic migrants. It provides safe breeding refuge for threatened species such as the African penguin and Cape cormorant and other coastal birds.
False Bay Nature Reserve	1 542	Western Cape	Ramsar site no. 2 219. The False Bay Nature Reserve is a unique area on the Cape Flats, situated between False Bay and Table Bay, consisting of about 50% permanent wetland and 49% terrestrial vegetation including the critically endangered Cape Flats Sand Fynbos and Cape Flats Dune Strandveld and some sand beaches. The False Bay Nature Reserve contains two lakes, Rondevlei (protected area reserve) and Zeekoevlei. Serving as a reservoir of biodiversity, the False Bay Nature Reserve supports important populations of mammals and is home to over 60% of the bird species in the South-western Cape (228 species). About 256 species of indigenous plants grow on the site.

8.5.2.9 IMPORTANT MARINE MAMMAL AREAS (IMMAS)

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

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

- Criterion A – Species or Population Vulnerability
    - Areas containing habitat important for the survival and recovery of threatened and declining species.
- Criterion B – Distribution and Abundance
    - Sub-criterion B1 – Small and Resident Populations: Areas supporting at least one resident population, containing an important proportion of that species or population, that are occupied consistently.
    - Sub-criterion B2 – Aggregations: Areas with underlying qualities that support important concentrations of a species or population.
- Criterion C – Key Life Cycle Activities
    - Sub-criterion C1 – Reproductive Areas: Areas that are important for a species or population to mate, give birth, and/or care for young until weaning.
    - Sub-criterion C2 – Feeding Areas: Areas and conditions that provide an important nutritional base on which a species or population depends.
    - Sub-criterion C3 – Migration Routes: Areas used for important migration or other movements, often connecting distinct life-cycle areas or the different parts of the year-round range of a non-migratory population.
- Criterion D – Special Attributes
    - Sub-criterion D1 – Distinctiveness: Areas which sustain populations with important genetic, behavioural or ecologically distinctive characteristics.
    - Sub-criterion D2 – Diversity: Areas containing habitat that supports an important diversity of marine mammal species
    - Although much of the West Coast of South Africa has not yet been assessed with respect to its relevance as an IMMA, the coastline from the Olifants River mouth on the West Coast to the Mozambiquan border overlaps with three declared IMMAs (Figure 133) namely the
    - Southern Coastal and Shelf Waters of South Africa IMMA (166 700 km^2),
    - Cape Coastal Waters IMMA (6 359 km^2), and
    - South East African Coastal Migration Corridor IMMA (47 060 km^2).
    - These are described briefly below based on information provided in IUCN-Marine Mammal Protected Areas Task Force (2021) (www.marinemammalhabitat.org).

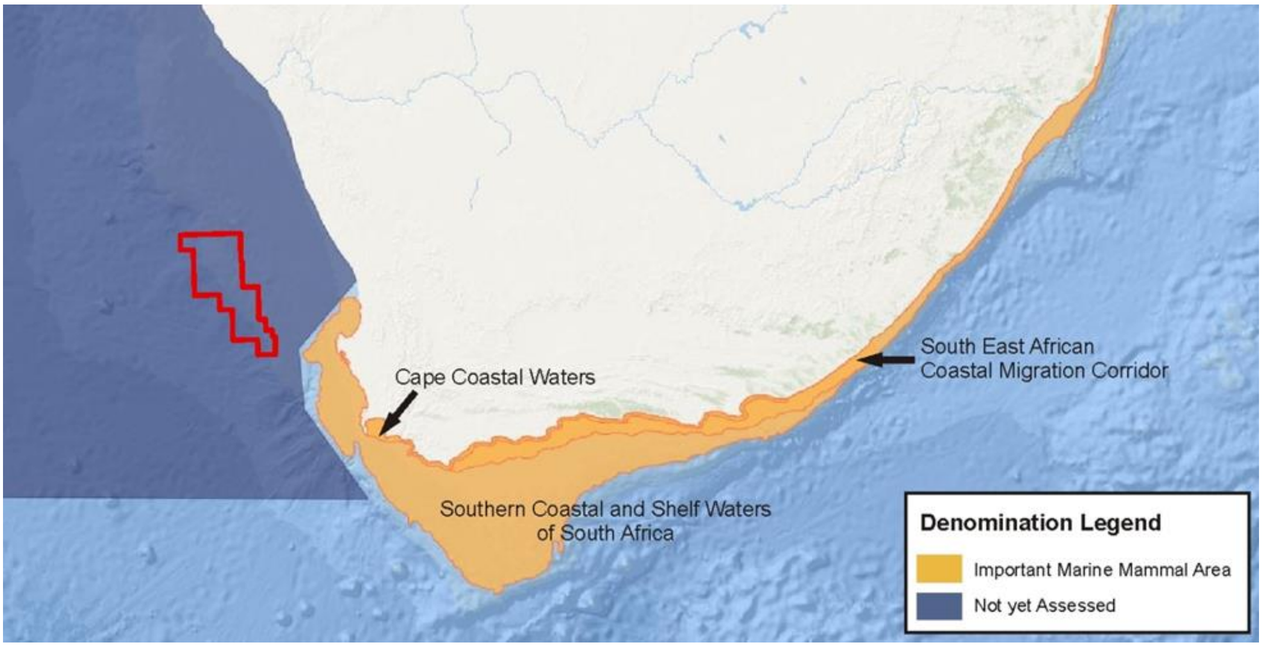


Figure 133: Block 3B/4B (red polygon) in relation to coastal and marine IMMAs (Source: www.marinemammalhabitat.org/imma-eatlas/).

The 166 700 km^2 **Southern Coastal and Shelf Waters of South Africa IMMA** extends from the Olifants River mouth to the mouth of the Cintsa River on the Wild Coast. Qualifying species are the Indian Ocean Humpback dolphin (Criterion A, B1), Bryde's whale (Criterion C2), Indo-Pacific bottlenose dolphin (Criterion B1, C3, D1), Common dolphin (Criterion C2) and Cape fur seal (criterion C2). The IMMA covers the area supporting the important 'sardine run' and the marine predators that follow and feed on the migrating schools (Criterion C2) as well as containing habitat that supports an important diversity of marine mammal species (Criterion D2) including the Indian Ocean humpback dolphin, the inshore form of Bryde's whale, Indo-Pacific bottlenose dolphin, common dolphin, Cape fur seal, humpback whales, killer whales and southern right whales.

The **Cape Coastal Waters IMMA** extends from Cape Point to Woody Cape at Algoa Bay and extends over some 6 359 km^2. It serves as one of the world's three most important calving and nursery grounds for southern right whales, which occur in the extreme nearshore waters (within 3 km of the coast) from Cape Agulhas to St. Sebastian Bay between June and November (Criterion B2, C1). Highest densities of cow-calf pairs occur between Cape Agulhas and the Duivenhoks River mouth (Struisbaai, De Hoop, St Sebastian Bay), while unaccompanied adult densities peak in Walker Bay and False Bay. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin and Indo-Pacific bottlenose dolphin.

The South East African Coastal Migration Corridor IMMA extends some 47 060 km^2 from Cape Agulhas to the Mozambiquan border and serves as the primary migration route for C1 substock of Southern Hemisphere humpback whales (Criterion C3). On their northward migration between June and August, they are driven closer to shore due to the orientation of the coast with the Agulhas Current, whereas during the southward migration from September to November, they remain further offshore (but generally within 15 km of the coast) utilising the southward flowing Agulhas Current as far west as Knysna. The IMMA also contains habitat that supports an important diversity of marine mammal species including the Indian Ocean humpback dolphin, Common dolphin, Indo-Pacific bottlenose dolphin, Spinner dolphin, Southern Right whale, and killer whale.

There is no overlap of Block 3B/4B with the IMMA.

8.6 SOCIO-ECONOMIC

This section provides and overview of the socio-economic environment for the study area from publicly available sources (e.g. the Namakwa District Municipality (NDM) Integrated Development Plan (IDP) 2020-21).

The proposed project area for the African Energy Block project is located on the edge of the South African exclusive economic zone in the Atlantic Ocean. The people potentially affected by the proposed project are those living in the areas adjacent to the ocean whose activities could potentially be affected. The following areas are included in the baseline description of the social environment:

- Northern Cape Province
    - Namakwa District Municipality
    - Richtersveld Local Municipality (Wards 2, 3, 4)
    - Nama Khoi Local Municipality (Ward 8)
    - Kamiesberg Local Municipality (Wards 1, 2)
- Western Cape Province
    - West Coast District Municipality
    - Matzikama Local Municipality (Wards 2, 5, 8)
    - Cederberg Local Municipality (Ward 5)
    - Bergrivier Local Municipality (Wards 6, 7)
    - Saldanha Bay Local Municipality (Wards 1, 3, 5, 6, 11, 12, 14)
    - Swartland Local Municipality (Ward 5)
    - City of Cape Town Metropolitan Municipality (Wards 4, 23, 29, 32, 54, 55, 74, 107, 113, 115)

8.6.1 NORTHERN CAPE PROVINCE

The Northern Cape Province is South Africa's largest province. It takes up almost a third of the country and covers an area of 372 889 km^2 (www.municipalities.co.za). It is bordered by the provinces of North West, Free State, Eastern Cape and Western Cape as well as the countries of Namibia and Botswana and the Atlantic Ocean. It consists of the Frances Baard, John Taolo Gaetsewe, Namakwa, Pixley Ka Seme and ZF Mgcawu District Municipalities.

The capital of the province is Kimberley and other towns in the province include Springbok, Kuruman, De Aar, Sutherland, Alexander Bay, Port Nolloth, Kathu, Okiep, Springbok, Aggeneys, Upington, Kakamas, Keimoes and Warrenton.

The economy of the province relies mainly on mining and agriculture. Commodities being mined include iron ore, copper, asbestos, manganese, fluorspar, semi-precious stones, and marble. Alluvial diamonds are being extracted from the beaches and sea in the area around Alexander Bay and Port Nolloth. Agricultural products include sheep, wheat, fruit, grapes, wheat, peanuts, maize, and cotton. The province is known for its dried fruit, wine, and karakul pelt.

The spring-flowers in Namakwaland is a popular tourist attraction. The province also houses the southern hemisphere's largest astronomical observatory at Sutherland.

8.6.1.1 NAMAKWA DISTRICT MUNICIPALITY

The Namakwa District Municipality is the largest district municipality in the province and covers an area of 126 836 km^2 (www.municipalities.co.za). It is bordered by the ZF Mgcawu Local Municipality, the Cape Winelands, West Coast, Pixley Ka Seme and Central Karoo District Municipalities, the country of Namibia and the Atlantic Ocean. It is the largest district in the province, making up almost a third of the province.

The district consists of six local municipalities, namely the Hantam, Kamiesberg, Karoo Hoogland, Khai-Ma, Nama Khoi, and Richtersveld Local municipalities. The capital of the province is Springbok and other towns include Aggeneys, Alexander Bay, Brandvlei, Bulletrap, Calvinia, Carolusberg, Concordia, Eksteensfontein, Frasersburg, Garies, Hondeklip Bay, Kamieskroon, Kleinzee, Koingnaas, Komaggas, Kuboes, Leliefontein/Kamiesberg, Loeriesfontein, Middelpos, Nababeep, Nieuwoudtville, O'Kiep, Onderste Doorns, Pella, Pofadder, Port Nolloth, Richtersveld, Sanddrift, Springbok, Steinkopf, Sutherland, and Williston.

The main economic sectors are tourism and agriculture.

8.6.1.2 RICHTERSVELD LOCAL MUNICIPALITY

The Richtersveld municipality is the smallest municipality in the district and covers an area of 9 608 km^2 (www.municipalities.co.za). The municipality borders the Atlantic Ocean and the main towns are Alexander Bay, Eksteensfontein, Kuboes, Port Nolloth, Richtersveld and Sanddrift. Port Nolloth is the main economic centre of the municipality.The main economic sectors are mining, agriculture, fishing and tourism0 Richtersveld Local Municipality IDP 2022/2027).

The main challenges that municipality faces relate to infrastructure, and socio-economic, spatial and housing issues, as well as issues relative to social facilities and services. The Richtersveld Municipal area is earmarked for a massive harbour development at Boegoebaai (about 60 km north of Port Nolloth and 20 km south of the border between Namibia and South Africa). This project is currently in its initial phase, and it is envisaged that this development will serve as an enabler of further development in the Northern Cape (Namakwa District Municipality IDP 2022-2027).

The Boegoebaai port is closely linked to the Northern Cape Green Hydrogen Strategy which was launched to the global community at the COP26 summit in Glasgow in November 2021 (www.globalafricanetwork.com). Green hydrogen refers to the production of hydrogen using renewable energy sources (www.un.org). Black/brown hydrogen is produced using coal and grey/blue hydrogen is derived from methane. Being an energy carrier, green hydrogen would act like a battery that allows the storage of excess energy created by renewable sources and would reduce the intermittency of renewables that cannot generate power all hours of the day, ensuring a sufficient and continuous supply of power for the grid.

8.6.1.3 NAMA KHOI LOCAL MUNICIPALITY

The Nama Khoi Local Municipality covers an area of 17 990 km^2 (www.municipalities.co.za). It is home to Nama, Khoe and San people who have occupied the area for hundreds of years. The municipality borders the Atlantic Ocean, and the main towns are Bulletrap, Carolusberg, Concordia, Kleinzee, Komaggas, Nababeep, O'Kiep, Springbok, Steinkopf. The main economic activities are mining and tourism, but there are also some government departments. This region is known as the land of the Nama people.

8.6.1.4 KAMIESBERG LOCAL MUNICIPALITY

The Kamiesberg Local Municipality covers an area of 14 208 km^2 (www.municipalities.co.za). The municipality borders the Atlantic Ocean and the main towns are Garies, Hondeklip Bay, Kamieskroon, Koingnaas, and Leliefontein/Kamiesberg. Hondeklip Bay has a harbor that serves fishing and diamond boats (Namakwa District Municipality IDP 2022-2027). It is also a mariculture centre and popular with tourists for scenic drives and 4x4 routes. Garies and Kamieskroon are known for wildflowers in spring, while Koingnaas is a mining town for alluvial diamonds.

8.6.2 WESTERN CAPE PROVINCE

The Western Cape Province is located on the southern tip of Africa between the Atlantic and Indian Oceans and is bordered by the Northern Cape and Eastern Cape Provinces. It covers an area of 129 462 km^2 (www.municipalities.co.za). The province is divided into one metropolitan municipality and five district municipalities. The capital of the province is the city of Cape Town and other major cities and towns include George, Knysna, Paarl, Swellendam, Oudtshoorn, Stellenbosch, Worcester, Mossel Bay and Strand.

The province has a well-established industrial and business base. Main economic activities include finance, real estate, ICT, retail, and tourism. Fishing is the most important industry along the west coast and sheep farming in the Karoo. In terms of agriculture main produce include grapes, fruit, vegetables, and wheat. A number of vineyards are located in the Western Cape Province.

8.6.2.1 WEST COAST DISTRICT MUNICIPALITY

The West Coast District Municipality covers an area of 31 118 km^2 (www.municipalities.co.za) and is bordered by the Namakwa and Cape Winelands District Municipalities, the City of Cape Town, and the Atlantic Ocean. The municipality consists of five local municipalities, namely the Swartland, Bergrivier, Matzikama, Cederberg and Saldanha Bay Local Municipalities.

The capital of the district is Moorreesburg and other main towns include Abbotsdale, Aurora, Bitterfontein, Chatsworth, Citrusdal, Clanwilliam, Darling, Doring Bay, Ebenhaezer, Eendekuil, Elands Bay, Graafwater, Grotto Bay, Hopefield, Jacobs Bay, Kalbaskraal, Klawer, Kliprand, Koekenaa, Koringberg, Lamberts Bay, Langebaan, Leipoldtville, Lutzville, Malmesbury, Molsvlei, Moorreesburg, Nuwerus, Paternoster, Piketberg, Porterville, Putsekloof, Redelinghuys, Riebeeck Kasteel, Riebeeck West, Rietpoort, Riverlands, Saldanha, St Helena Bay, Stofkraal, Strandfontein, Vanrhynsdorp, Velddrif, Vredenburg, Vredendal, Wupperthal, and Yzerfontein.

Despite lively economic activity in the Swartland, Saldanha and Bergrivier areas, large parts of the district remain impoverished. The district has the second lowest GDPR in the Western Cape Province and income inequality has worsened over the years (West Coast District Municipality IDP 2022-2027). The economic activities are mainly driven by activities within the manufacturing; agriculture, forestry and fishing; as well as wholesale and retail trade sector. The recent drought has had a significant impact on the agriculture, forestry and fishery sectors within the district.

8.6.2.2 MATZIKAMA LOCAL MUNICIPALITY

The Matzikama Local Municipality borders the Northern Cape Province and the Atlantic Ocean. It is the largest of the five municipalities in the district, making up almost half of the district. It covers an area of 12 981 km^2 (www.municipalities.co.za). There are 18 towns and villages in the municipal area with most of the population being concentrated along the Olifants River and its canal system. The main towns and villages include Bitterfontein, Doring Bay, Ebenhaezer, Klawer, Kliprand, Koekenaa, Lutzville, Molsvlei, Nuwerus, Putsekloof, Rietpoort, Stofkraal, Strandfontein, Vanrhynsdorp,aand Vredendal.

The agriculture, forestry and fishery sector was the main driver of the municipality’s economy, followed by the wholesale and retail trade, catering and accommodation sector (Matzikama Local Municipality IDP, May 2022). The municipality is under severe strain with regards to coastal resource use (mining pressure, marine living resources), exploitation of estuarine resources and coastal vulnerabilities (illegal off-road vehicles, illegal camping and coastal erosion). Due to the dwindling fishing stocks the capture fisheries industry closed down more than 10 years ago and the likeliness of it being restored to its original form is unlikely. The only remaining activity of this industry is subsistence and small scale fishing.

Operation Phakisa – Oceans Economy forms part of the Matzikama Coastal Management Plan, also in terms of the socio-economic development of the coastal zones (Matzikama Local Municipality IDP, May 2022). Operation Phakisa – Oceans Economy was launched in July 2014 as a priority programme of the South African Government with the aim to considerably grow the Ocean Economy’s contribution to the country’s GDP by 2033. It is a results-driven approach that involves clear plans and targets, ongoing monitoring of progress and making these results public. It focuses on bringing key stakeholders from the public and private sectors, academia as well as civil society organisations together to collaborate in (www.dffe.gov.za):

- Detailed problem analysis;
- Priority setting;
- Intervention planning; and
- Delivery.

The project focuses on six growth areas, namely:

- Marine transport and manufacturing;
- Offshore oil and gas exploration;

- Aquaculture;
- Marine protection services and ocean governance;
- Small harbours; and
- Marine tourism.
- The six growth areas are supported by two enablers, namely:
- Skills and capacity building; and
- Research, technology and innovation.

8.6.2.3 **CEDERBERG LOCAL MUNICIPALITY**

The Cederberg Local Municipality covers an area of 8 007 km^2 (www.municipalities.co.za). It is bordered by the Atlantic Ocean and the Cederberg Mountains and is located on the Cape-Namibia corridor. The main towns in the area include Citrusdal, Clanwilliam, Elands Bay, Graafwater, Lamberts Bay, Leipoldtville, and Wupperthal.

The economic activities in the Cederberg Local Municipality are dominated by agriculture and fishing, manufacturing, wholesale and retail trade, catering and accommodation, and transport, storage and accommodation (Cederberg Local Municipality IDP 2022-23). The area consists of a mix of sparsely and densely populated towns with Clanwilliam and Citrusdal serving as the main agricultural centres. The area is characterised by high levels of unemployment, poverty and social grant dependence. The road network is diverse with national, trunk, main and divisional roads of varying quality.

8.6.2.4 **BERGRIVIER LOCAL MUNICIPALITY**

The Bergrivier Local Municipality covers an area of 4 407 km^2 (www.municipalities.co.za). The main towns in the area include Aurora, Eendekuil, Piketberg, Porterville, Redelinghuys, and Velddrif. The agriculture sector is the largest employer in the municipal area with a contribution of 50.4% to total employment (Bergrivier Local Municipality IDP, May 2022). The four pillars for economic development in the municipal area are agriculture and agro processing; tourism; manufacturing; and the development of small and medium enterprises.

8.6.2.5 **SALDANHA BAY LOCAL MUNICIPALITY**

The Saldanha Bay Local Municipality is the smallest of the five municipalities in the district and covers an area of 2 015 km^2 (www.municipalities.co.za). The main towns in the area are Hopefield, Jacobs Bay, Langebaan, Paternoster, Saldanha, St Helena Bay, Vredenburg.

The Saldanha Bay area plays an important role in the broader strategic framework of the South African Government as driven by the National Development Plan and National Growth Plan. It was identified as a special intervention area, attributed to the natural deep-water harbour and industrial development prospects that warrants its designation as a national growth management zone. The Saldanha Bay Industrial Development Zone (IDZ) was launched in October 2013 with the aim of serving as an important mechanism to achieve the government’s aim of sustainable economic development and job creation in the localised economy. Diversification, and transformation of the historically under-developed and under-supported industrial maritime and energy sectors and broadening of the regional and national economic base through industrialisation (Saldanha Bat Local Municipality IDP, May 2022).

St Helena Bay is one of the world’s principal fishing centres. Huge shoals of anchovies and pilchards fed in the area before they were depleted by overfishing. Twelve fish-processing factories were established along the 21 km curve of the shore from West Point to Sandy Point and Stompneus. The bay is also well known for its snoek, especially during the winter months.

Saldanha Bay is the largest natural bay in South Africa and has a huge iron ore quay and is home to a large variety of fishing vessels. The town is not only important for export, but also hosts a number of other industries, such as crayfish, fish, mussels, oysters, seaweed and many more. It is also home to the South African Military Academy as well as SAS SALDANHA, a naval training unit.

The largest economic sectors in the municipal area are manufacturing, trade, and finance, while the agricultural sector is the largest contributor to employment. The fishing industry and fish processing are the largest primary and secondary industries in the municipality.

8.6.2.6 SWARTLAND LOCAL MUNICIPALITY

The Swartland Local Municipality covers an area of 3 708 km^2 (www.municipalities.co.za). Main towns in the area include Abbotsdale, Chatsworth, Darling, Grotto Bay, Kalbaskraal, Koringberg, Malmesbury, Moorreesburg, Riebeeck Kasteel, Riebeeck West, Riverlands, and Yzerfontein.

The town of Malmesbury fulfils an important niche in the region due to its high development potential that can be attributed to factors like its relative accessibility along the N7 road/rail corridor; proximity to Cape Town; a diversified economic base that not only accommodates agriculture, but also well-developed industrial and commercial sectors; and supportive infrastructure. A number of people moved here and commute to jobs in Cape Town because of the high property rates in the Cape Town Metropolitan area and the tranquil environment that it offers.

Commercial services; Manufacturing; and Agriculture are the biggest contributors to the economy of the municipal area, with Agriculture being the second highest contributor to employment.

8.6.2.7 CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY

The City of Cape Town Metropolitan Municipality is situated in the southern peninsula of the Western Cape Province and covers an area of 2 441 km^2 (www.municipality.co.za). It is South Africa’s second largest economic centre and the second most populous city after Johannesburg. It is the provincial capital as well as the legislative capital of South Africa. The city is known for its harbour, floral kingdom and well-known landmarks like Table Mountain and Cape Point.

Main towns and cities in the area include Athlone, Atlantis, Belhar, Bellville, Blackheath, Blouberg, Blue Downs, Brackenfell, Cape Point, Cape Town, Delft, Durbanville, Elsies Rivier, Fish Hoek, Goodwood, Gordon's Bay, Grassy Park, Guguletu, Hout Bay, Khayelitsha, Kommetjie, Kraaifontein, Kuils River, Langa, Macassar, Matroosfontein, Melkbosstrand, Milnerton, Mitchells Plain, Muizenberg, Noordhoek, Nyanga, Parow, Philadelphia, Philippi, Robben Island, Scarborough, Simon's Town, Sir Lowry's Pass, Somerset West, Southern Suburbs, Strand, and Table View.

8.6.3 DESCRIPTION OF THE POPULATION

The baseline description of the population will take place on three levels, namely provincial, district and local. Impacts can only truly be comprehended by understanding the differences and similarities between the different levels. The baseline description will focus on the municipal areas along the west coast that are most likely to be affected by the proposed project. Where possible, the data will be reviewed on a ward level. The data used for the socio-economic description was sourced from Census 2011. Census 2011 was a de facto census (a census in which people are enumerated according to where they stay on census night) where the reference night was 9-10 October 2011. The results should be viewed as indicative of the population characteristics in the area and should not be interpreted as absolute.

Although a Census was conducted in 2022, StatsSA could to date upon query not indicate when the results would be released. It is acknowledged that the Census 2011 data is very outdated and as such should be interpreted with care. Where possible, data will be supplemented by data from Community Survey 2016, which is a bit more recent.

The following points regarding Census 2011 must be kept in mind (www.statssa.co.za):

- Comparisons of the results of labour market indicators in the post-apartheid population censuses over time have been a cause for concern. Improvements to key questions over the years mean that the labour market outcomes based on the post-apartheid censuses must be analysed with caution. The differences in the results over the years may be partly attributable to improvements in the questionnaire since 1996 rather than to actual developments in the labour market. The numbers published for the 1996, 2001, and 2011 censuses are therefore not comparable over time and are different from those published by Statistics South Africa in the surveys designed specifically for capturing official labour market results.

- For purposes of comparison over the period 1996–2011, certain categories of answers to questions in the censuses of 1996, 2001 and 2011, have either been merged or separated.
- The tenure status question for 1996 has been dropped since the question asked was totally unrelated to that asked thereafter. Comparisons for 2001 and 2011 do however remain.
- All household variables are controlled for housing units only and hence exclude all collective living arrangements as well as transient populations.
- When making comparisons of any indicator it must be considered that the time period between the first two censuses is five years and that between the second and third census is ten years. Although Census captures information at one given point in time, the period available for an indicator to change is different.

8.6.4 POPULATION AND HOUSEHOLD SIZES

According to the Community Survey 2016, the population of South Africa is approximately 55,7 million and has shown an increase of about 7.5% since 2011. The household density for the country is estimated on approximately 3.29 people per household, indicating an average household size of 3-4 people (leaning towards 3) for most households, which is down from the 2011 average household size of 3.58 people per household. Smaller household sizes are in general associated with higher levels of urbanisation.

The greatest increase in population since 2011 has been in the Swartland and Saldanha Bay Local Municipalities (Table 29) and the increases were well above the national average. The Richtersveld Local Municipality where Port Nolloth is located is the only one of the coastal municipalities in the Northern Cape that showed an increase in population. The Kamiesberg Local Municipality where Hondeklip Bay is located, saw the greatest decrease in population between 2011 and 2016. Population density refers to the number of people per square kilometre and the population density on a national level has increased from 42.45 people per km^2 in 2011 to 45.63 people per km^2 in 2016. The City of Cape Town had the highest population density in 2016, and the Kamiesberg Local Municipality the lowest. Figure 134 gives a comparison of the population density. The municipalities in the rural areas in the Northern Cape are the least densely populated, while the metropolitan areas in Cape Town have the highest population density. Figure 135 shows the number of people per ward. The wards in the rural areas tend to have less people spread over a greater area, while in the urban areas there are more people in a much smaller area.

Table 29: Population density and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Size in km^2	Population 2011	Population 2016	Population density 2011	Population density 2016	Growth in population (%)
Northern Cape	372,889	1,145,861	1,193,780	3.07	3.20	4.18
Namakwa DM	126,836	115,842	115,488	0.91	0.91	-0.31
Richtersveld LM	9,608	11,982	12,487	1.25	1.30	4.21
Nama Khoi LM	17,990	47,041	46,512	2.61	2.59	-1.12
Kamiesberg LM	14,208	10,187	9,605	0.72	0.68	-5.71
Western Cape	129,462	5,822,734	6,279,730	44.98	48.51	7.85

Area	Size in km²	Population 2011	Population 2016	Population density 2011	Population density 2016	Growth in population (%)
West Coast DM	*31,118*	*391766*	*436,403*	*12.59*	*14.02*	*11.39*
Matzikama LM	12,981	67147	71,045	5.17	5.47	5.81
Cederberg LM	8,007	49,768	52,949	6.22	6.61	6.39
Bergrivier LM	4,407	61,897	67,474	14.05	15.31	9.01
Saldanha Bay LM	2,015	99,193	111,173	49.23	55.17	12.08
Swartland LM	3,708	113,762	133,762	30.68	36.07	17.58
City of Cape Town Metropolitan	*2,441*	*3,740,026*	*4,004,793*	*1,532.17*	*1,640.64*	*7.08*

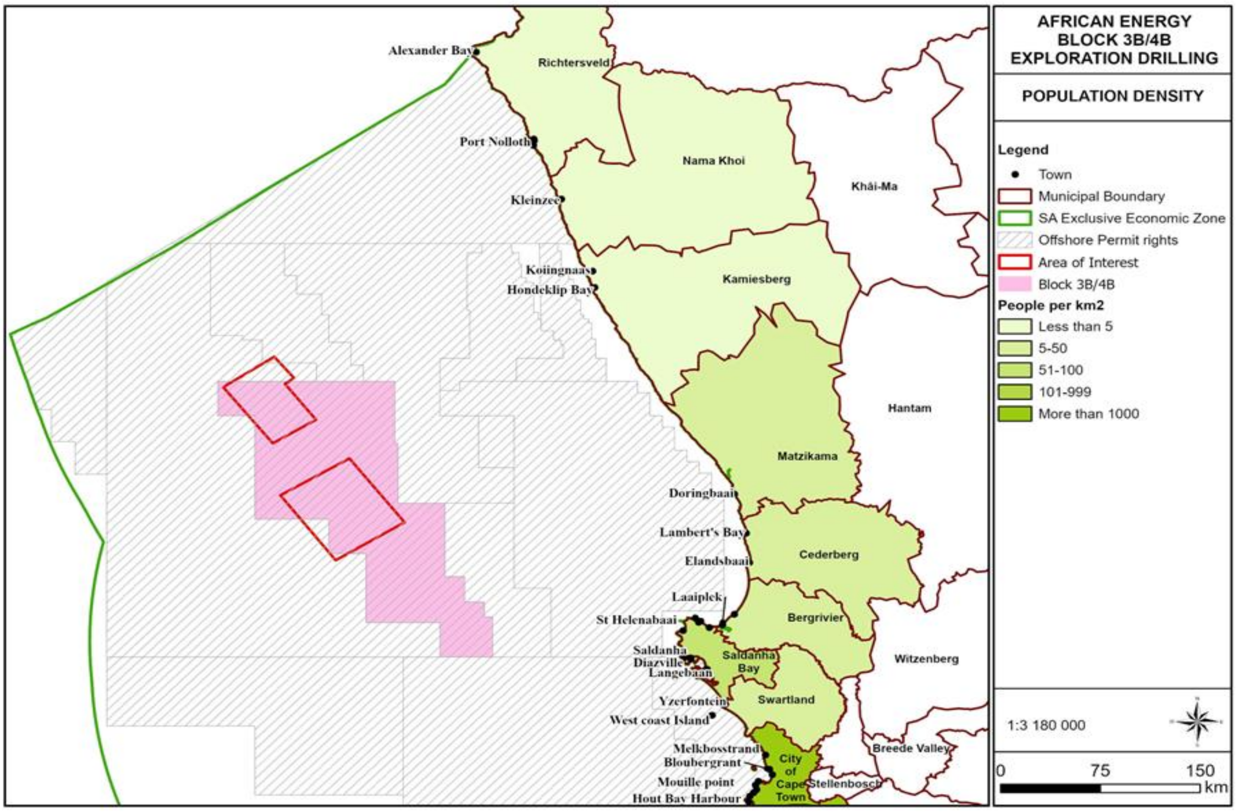


Figure 134: Population density (source: Community Survey 2016)

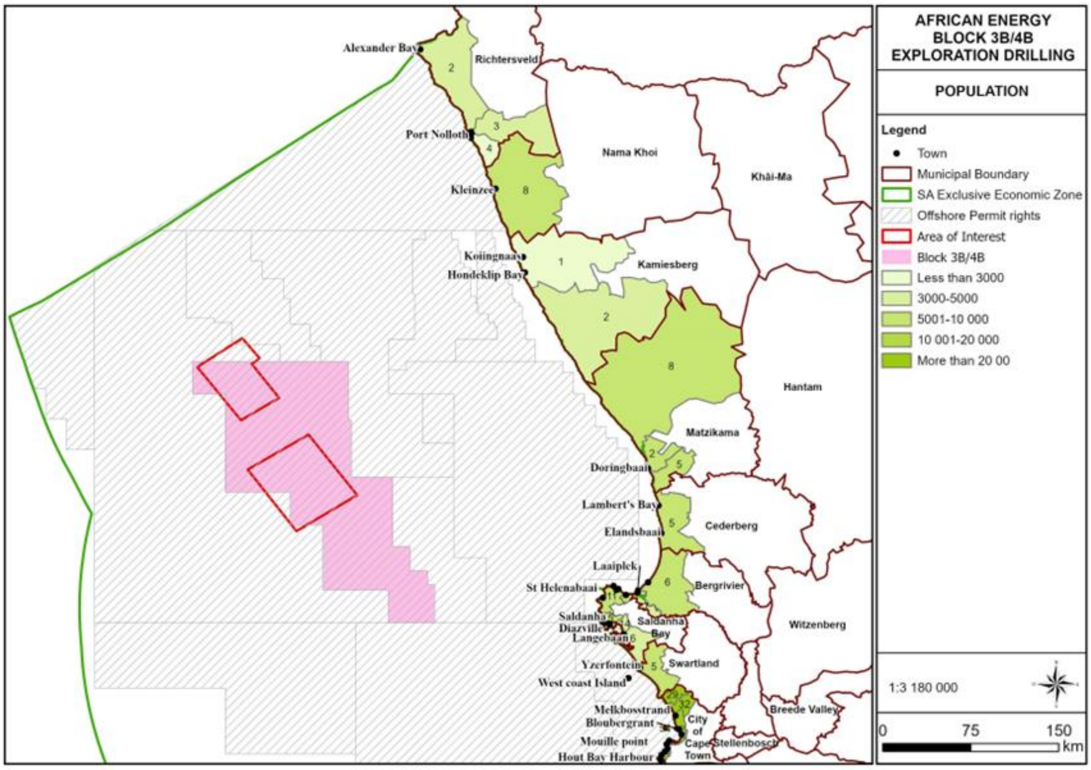


Figure 135: People per ward (source: Census 2011)

The number of households in the study area has increased on all levels (Table 30) The proportionate increase in households were greater than the increase in population on all levels. The greatest proportional increases in households were in the Swartland and Saldanha Bay Local Municipalities. The average household size has shown a decrease on all levels, which means there are more households, but with less members.

Table 30: Household sizes and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Households 2011	Households 2016	Average household size 2011	Average household size 2016	Growth in households (%)
Northern Cape	301,405	353,709	3.80	3.38	17.35
Namakwa DM	*33,856*	*37,669*	*3.42*	*3.07*	*11.26*
Richtersveld LM	3,543	4,211	3.38	2.97	18.85
Nama Khoi LM	13,193	14,546	3.57	3.20	10.26
Kamiesberg LM	3,143	3,319	3.24	2.89	5.60
Western Cape	1,634,000	1,933,876	3.56	3.25	18.35
West Coast DM	*106,781*	*129,862*	*3.67*	*3.36*	*21.62*
Matzikama LM	18,835	20,821	3.57	3.41	10.54
Cederberg LM	13,513	15,279	3.68	3.47	13.07

Area	Households 2011	Households 2016	Average household size 2011	Average household size 2016	Growth in households (%)
Bergrivier LM	16,275	19,072	3.80	3.54	17.19
Saldanha Bay LM	28,835	35,550	3.44	3.13	23.29
Swartland LM	29,324	39,139	3.88	3.42	33.47
City of Cape Town Metropolitan	*1,068,573*	*1,264,849*	*3.50*	*3.17*	*18.37*

Figure 136 shows the number of households per ward. The wards in the Kamiesberg Local Municipality have the fewest people per ward.

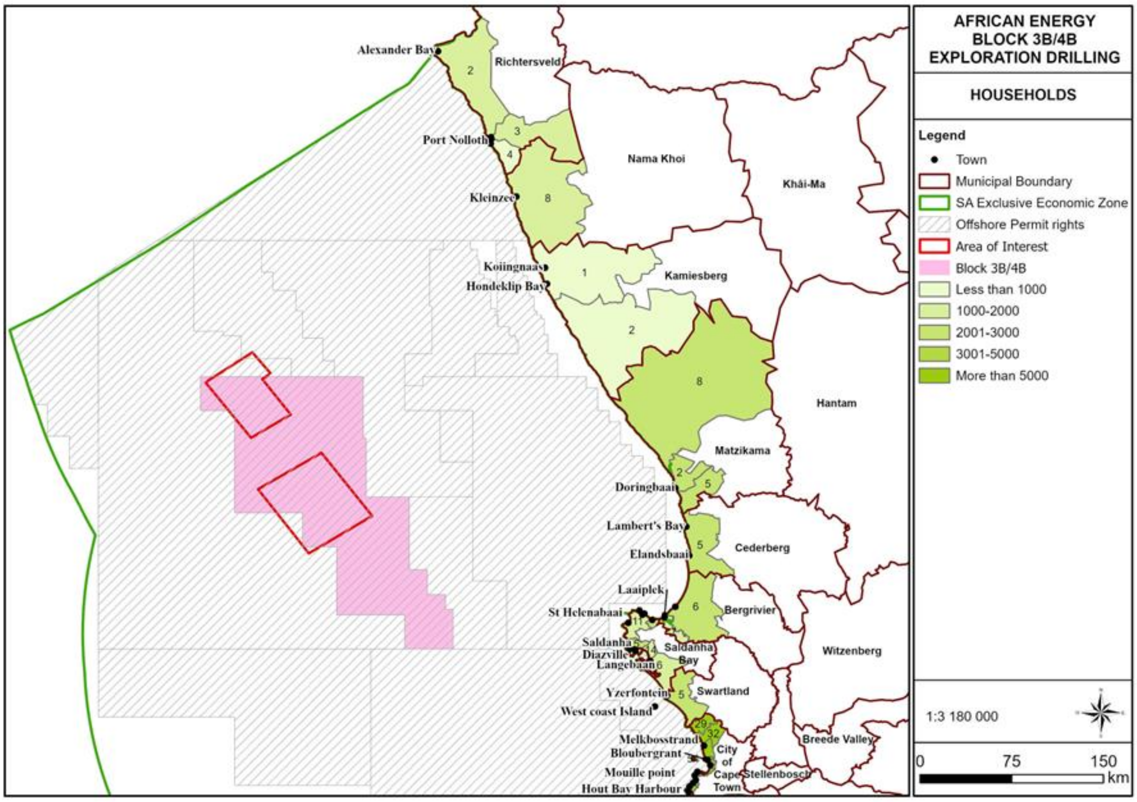


Figure 136: Households per ward (source: Census 2011)

The total dependency ratio is used to measure the pressure on the productive population and refer to the proportion of dependents per 100 working-age population. As the ratio increases, there may be an increased burden on the productive part of the population to maintain the upbringing and pensions of the economically dependent. A high dependency ratio can cause serious problems for a country as the largest proportion of a government's expenditure is on health, social grants and education that are most used by the old and young population.

The Kamiesberg Local Municipality has the highest total dependency ratio (Table 31), while in the Richtersveld Local Municipality have the lowest. Employed dependency ratio refers to the proportion of people dependent on the people who are employed, and not only those of working age. The employed dependency ratio for the Kamiesberg and Nama Khoi Local Municipalities are the highest. This suggests high levels of poverty in these areas. Figure 137 and Figure 138 show the total and employed dependency ratios on a ward level.

Table 31: Total dependency ratios (source: Census 2011).

Area	Total dependency	Youth dependency	Aged dependency	Employed dependency
Northern Cape	55.75	46.94	8.80	75.32
Namakwa DM	*51.23*	*39.01*	*12.22*	*70.92*
Richtersveld LM	*42.51*	*33.96*	*8.55*	*61.38*
Ward 2	36.82	32.89	3.93	56.70
Ward 3	39.54	32.95	6.59	64.57
Ward 4	48.60	35.93	12.67	63.98
Nama Khoi LM	*49.45*	*37.16*	*12.29*	*73.74*
Ward 8	45.05	35.42	9.63	76.99
Kamiesberg LM	*57.89*	*41.84*	*16.05*	*78.37*
Ward 1	54.81	40.19	14.62	79.04
Ward 2	48.90	33.04	15.86	69.06
Western Cape	44.96	36.44	8.52	65.47
West Coast DM	*45.92*	*37.14*	*8.78*	*63.98*
Matzikama LM	*49.39*	*40.05*	*9.34*	*64.55*
Ward 2	48.60	38.35	10.24	67.26
Ward 5	46.38	33.96	12.41	53.32
Ward 8	53.71	41.14	12.57	71.99
Cederberg LM	*46.99*	*37.59*	*9.40*	*62.75*
Ward 5	51.76	38.06	13.70	69.48
Bergrivier LM	*46.89*	*36.62*	*10.27*	*61.61*
Ward 6	46.60	37.11	9.49	65.08
Ward 7	55.44	23.94	31.50	68.70
Saldanha Bay LM	*43.96*	*36.41*	*7.54*	*65.36*
Ward 1	39.71	36.79	2.91	68.76
Ward 3	29.02	23.68	5.35	74.04

Area	Total dependency	Youth dependency	Aged dependency	Employed dependency
Ward 5	39.28	27.63	11.66	54.39
Ward 6	59.99	25.93	34.06	61.44
Ward 11	44.91	32.19	12.73	63.50
Ward 12	45.16	41.60	3.56	67.57
Ward 14	42.82	34.92	7.90	54.68
Swartland LM	*44.68*	*36.21*	*8.47*	*64.27*
Ward 5	50.76	33.31	17.44	58.03
City of Cape Town Metropolitan	*43.61*	*35.65*	*7.97*	*65.39*
Ward 4	35.95	31.80	4.16	52.38
Ward 23	38.49	26.83	11.66	47.23
Ward 29	47.25	40.95	6.30	69.98
Ward 32	44.89	41.04	3.85	68.39
Ward 54	39.01	16.17	22.84	51.04
Ward 55	41.63	26.22	15.41	56.16
Ward 74	40.68	33.04	7.63	58.62
Ward 107	40.60	28.96	11.64	46.30
Ward 113	36.71	26.07	10.64	47.93
Ward 115	26.32	14.33	12.00	60.94

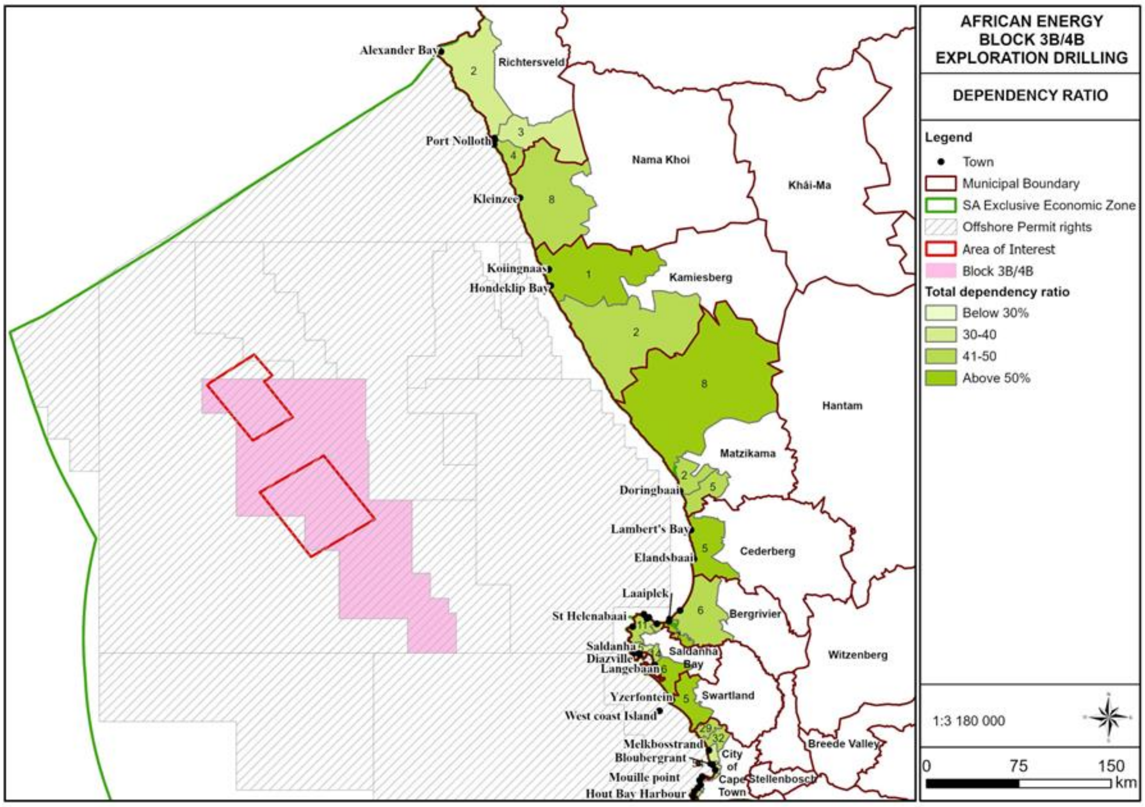


Figure 137: Total dependency ratios (source: Census 2011)

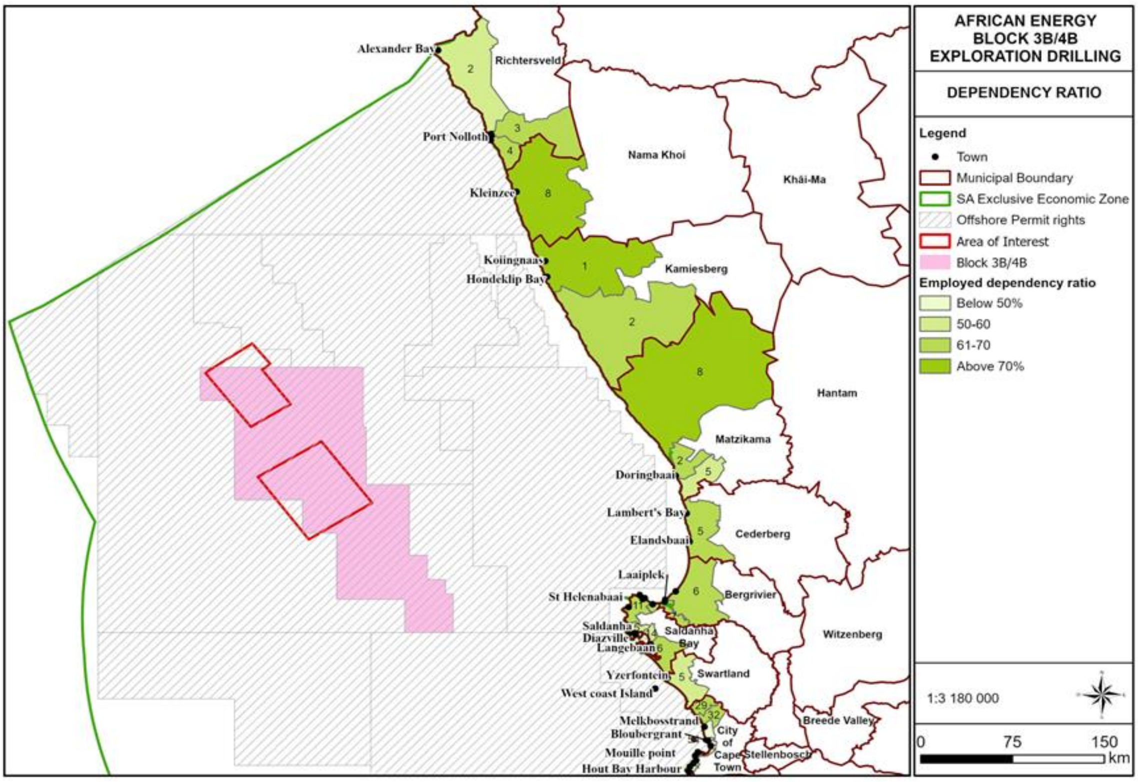


Figure 138: Employed dependency ratio (source: Census 2011).

Poverty is a complex issue that manifests itself in economic, social, and political ways and to define poverty by a unidimensional measure such as income or expenditure would be an oversimplification of the matter. Poor people themselves describe their experience of poverty as multidimensional. The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting, and cooking, water access, sanitation, dwelling type, asset ownership and unemployment.

The poverty headcount refers to the proportion of households that can be defined as multi-dimensionally poor by using the SAMPI's poverty cut-offs (Statistics South Africa, 2014). The poverty headcount has increased on all levels since 2011 indicating an increase in the number of multi-dimensionally poor households.

The intensity of poverty experienced refers to the average proportion of indicators in which poor households are deprived (Statistics South Africa, 2014). The intensity of poverty has increased slightly on all levels. The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. The SAMPI score has decreased in the Northern Cape as well as the Northern Cape municipalities included in the study. In the Nama Khoi Local Municipality, the score remained the same although there was a slight increase in the intensity of the poverty. In the Western Cape the SAMPI score decreased on a provincial level, but in the West Coast District Municipality it has increased.

8.6.5 POPULATION COMPOSITION, AGE, GENDER AND HOME LANGUAGE

The majority of the people living in wards adjacent to the ocean are classified as belonging to the Coloured population group (Figure 139). The Coloured population group include Khoe and San people who in general find this classification offensive and they do not identify as such.

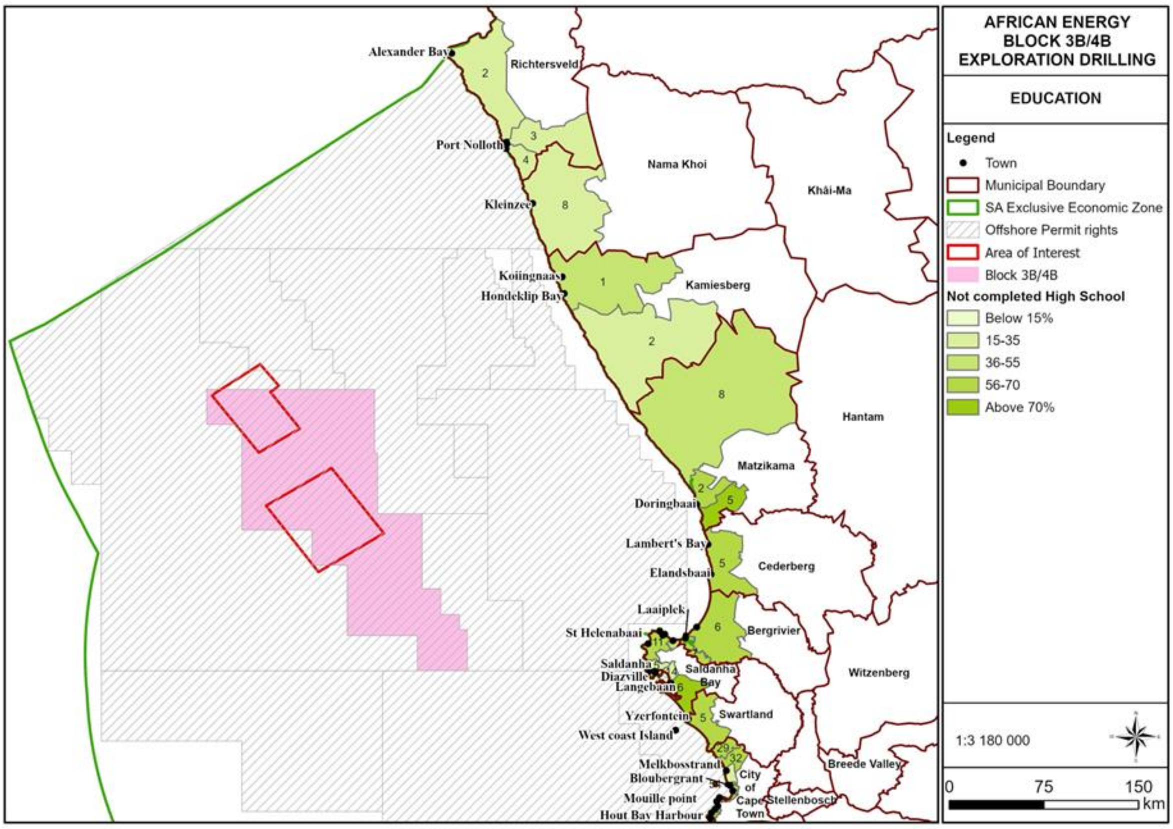


Figure 139: Classified as Coloured (shown in percentage, source: Census 2011)

The Kamiesberg Local Municipality has the highest average age (33.17 years) while the Saldanha Bay Local Municipality has the lowest (29.86 years). Average age varies on a ward level.

The gender distribution is more or less equal in most municipal areas, except for the Richtersveld Local Municipality where there is a bias towards males. This is most likely due to mining activities that are taking place in the area. On a ward level, most people have Afrikaans as home language (Figure 140).

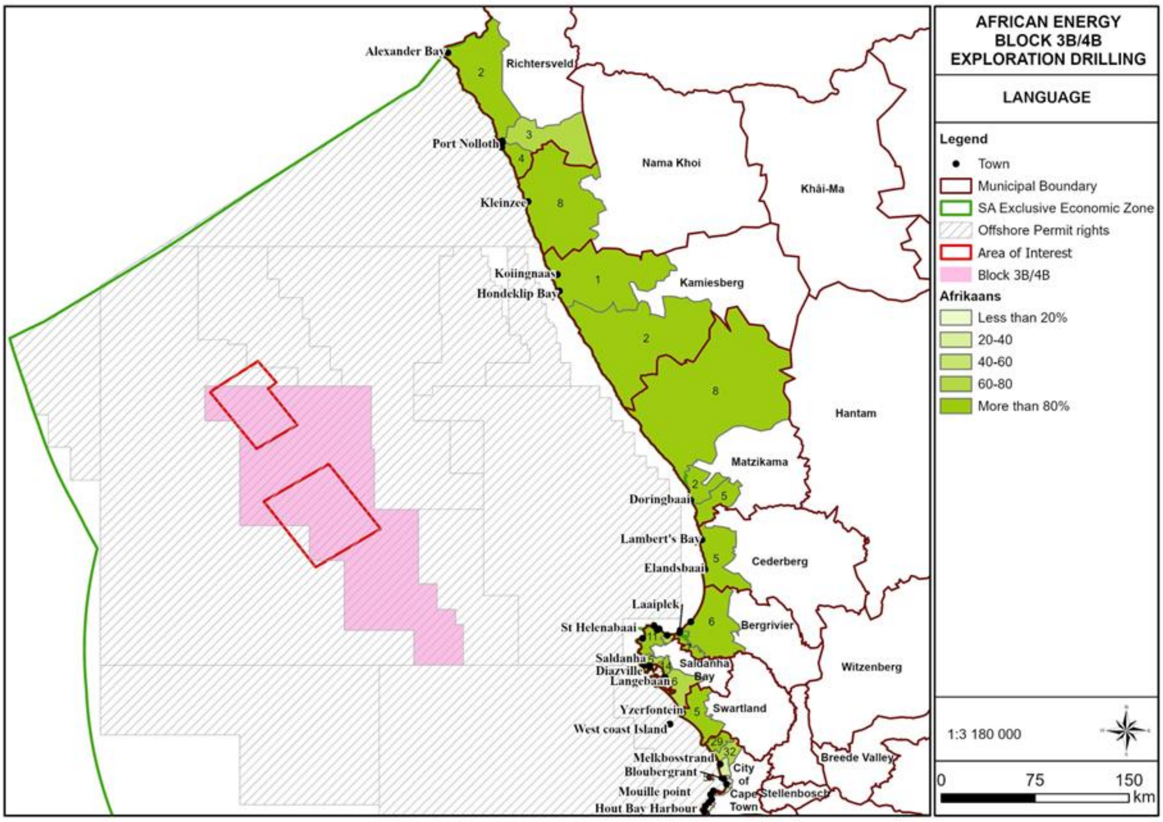


Figure 140: Home language Afrikaans (shown in percentage, source; Census 2011)

8.6.6 EDUCATION

The highest proportion of people who did not complete high school is in the Saldanha Bay (73.59%) and the Swartland (72.83%) Local Municipalities while the Matzikama (32.7%) and Nama Khoi (37.37%) Local Municipalities have the lowest proportion of people that did not complete high school (Figure 141).

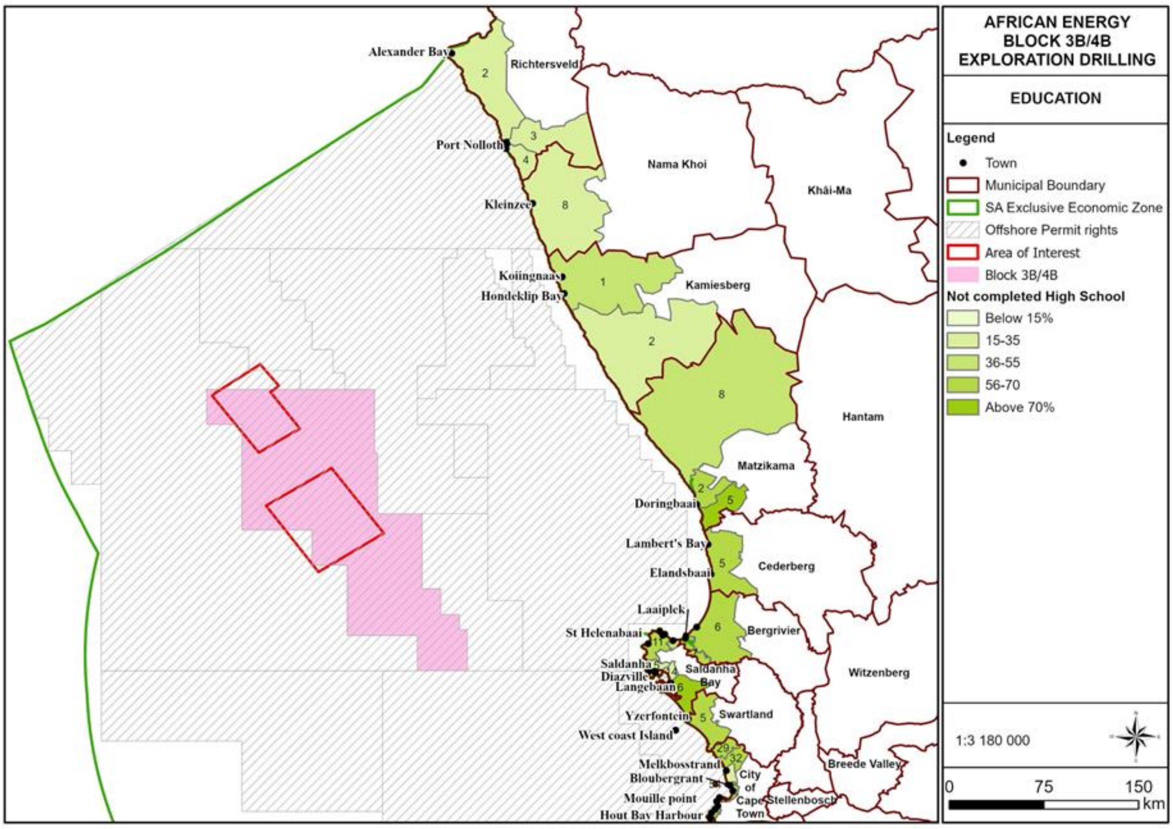


Figure 141: Proportion of people that did not complete secondary school (shown in percentage, source: Census 2011).

8.6.7 EMPLOYMENT

In 2011 the area with the highest proportion of unemployed people was ward 1 in the Kamiesberg Local Municipality where Hondeklip Bay is located (Figure 142). The proportion of unemployed people include those actively seeking for work as well as discouraged work seekers. The majority of people who are working, is employed in the formal sector.

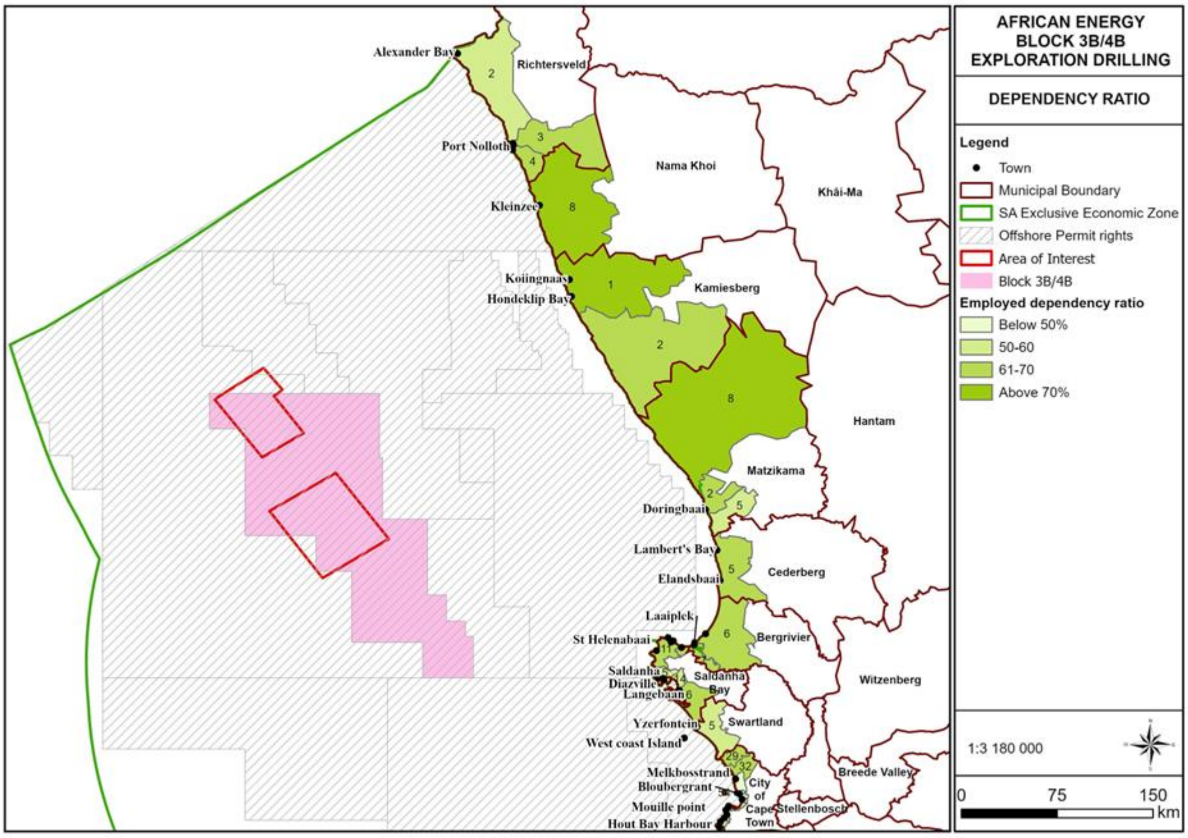


Figure 142: Proportion of adults that are unemployed (shown in percentage, source: Census 2011).

8.6.8 HOUSEHOLD INCOME

In 2011 almost a third of households on municipal level had an annual household income of R19 600 or less, with great variation between wards (Figure 143). Statistics South Africa (2015) has calculated the Food Poverty Line (FPL) for the Northern Cape Province as R310 per capita per month for 2011 where the FPL is the Rand value below which individuals are unable to purchase or consume enough food to supply them with the minimum per-capita-per-day energy requirement for good health. The FPL is one of three poverty lines, the others being the upper bound poverty line (UBPL) and the lower bound poverty line (LBPL). The LBPL and UBPL both include a non-food component. Individuals at the LBPL do not have enough resources to consumer or purchase both adequate food and non-food items and are forced to sacrifice food to obtain essential non-food items, while individuals at the UBPL can purchase both adequate food and non-food items. The LBPL for the Northern Cape Province was R457 per capita per month in 2011 and the UBPL R705 per capita per month respectively. The FPL for Western Cape was R352 per capita per month, the LBPL was R545 and the UPL was R804. Based on this, a household with four members needed an annual household income of approximately R17 000 in 2011 to be just above the FPL. When comparing this with the SAMPI data it seems as if there are more households below the poverty lines in the area than who are multi-dimensionally poor. This is due to the poverty lines using a financial measure and do not take into consideration payment in kind and livelihood strategies such as subsistence farming. If these were to be converted into a Rand value, the poverty line picture may have a closer resemblance to the SAMPI data.

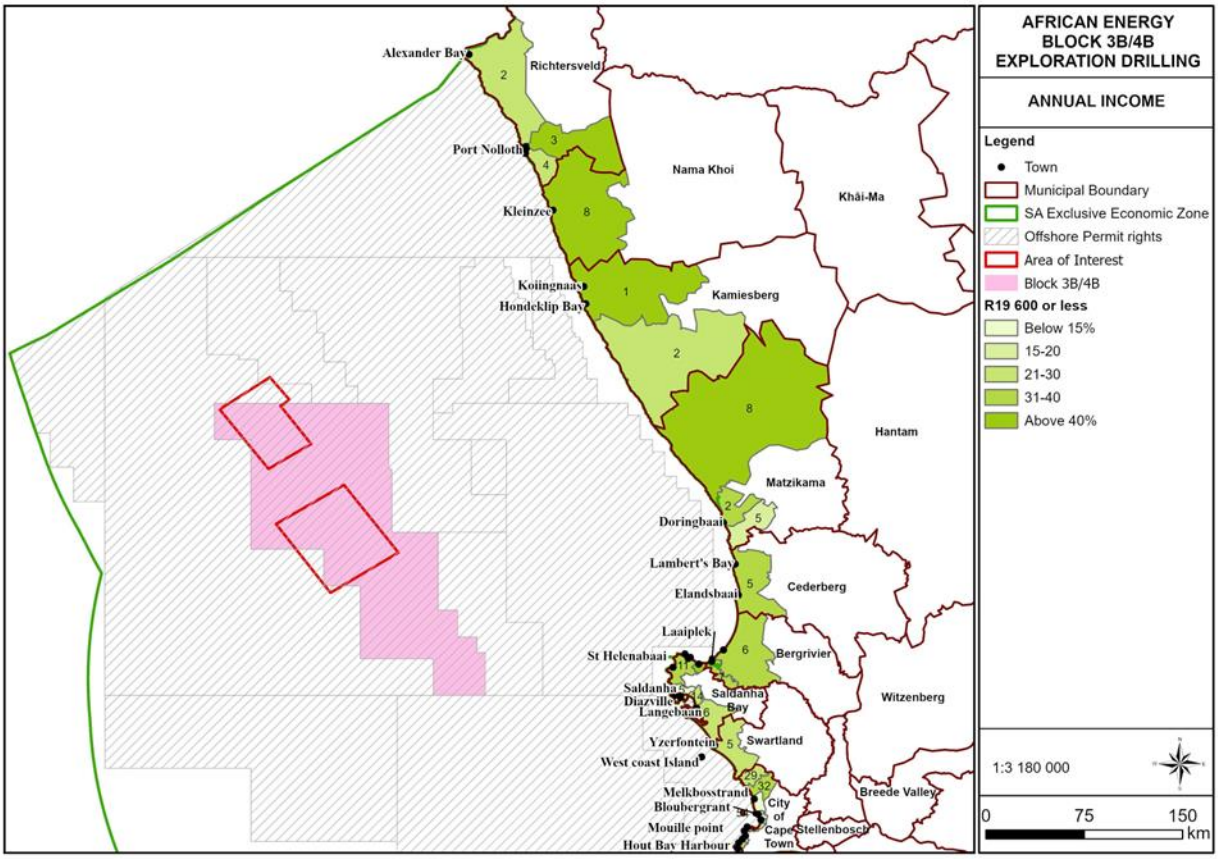


Figure 143: Proportion of households with an annual income of R19 600 or less in 2011 (shown in percentage, source: Census 2011).

8.6.9 HOUSING

The majority of households live in areas that are classified as urban, except in the Matzikama Local Municipality (Figure 144). The majority of people live in formal dwellings that that are houses or structures that are on a separate stand or yard. The incidence of informal dwellings is relatively low (Figure 145), except for Ward 1 of the Saldanha Bay Local Municipality where the majority of people live in informal dwellings. Wards 32 and 74 also have a relatively large proportion of households living in informal dwellings.

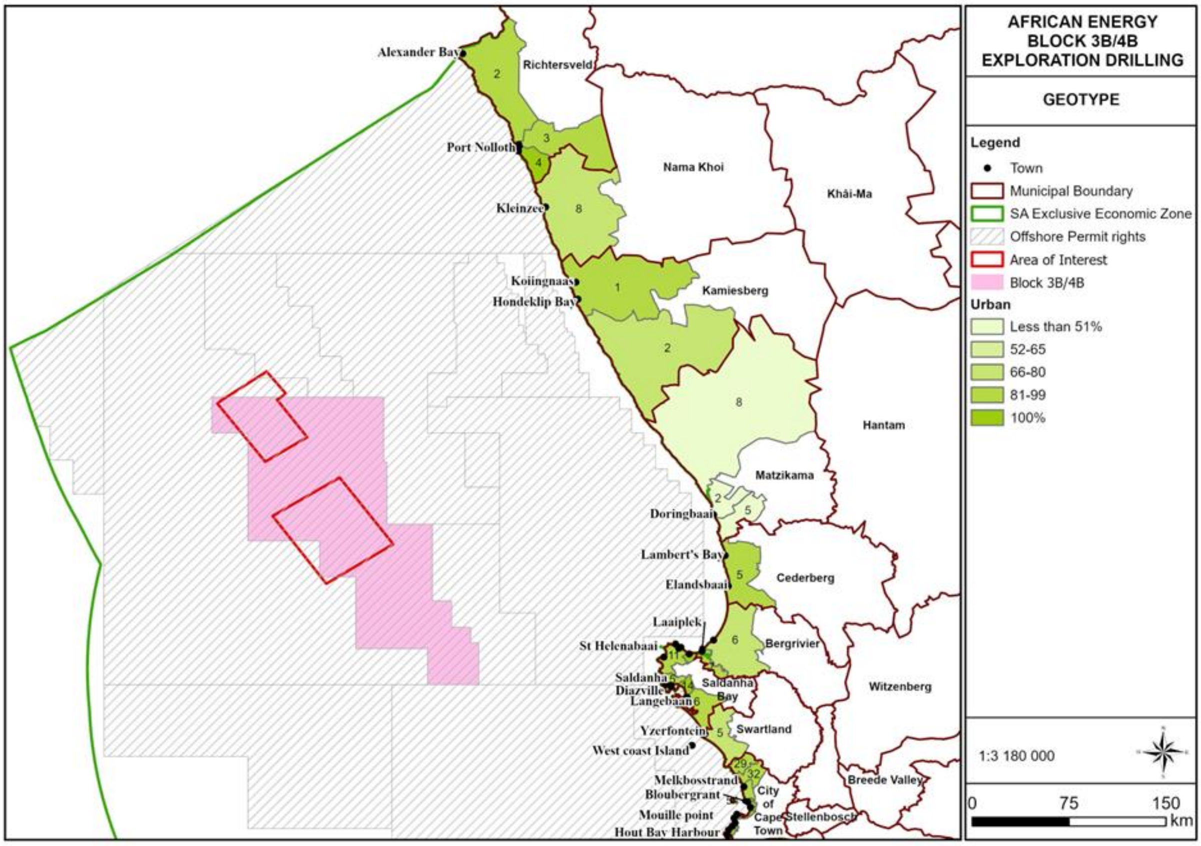


Figure 144: Proportion of households that live in urban areas (shown in percentage, source: Census 2011).

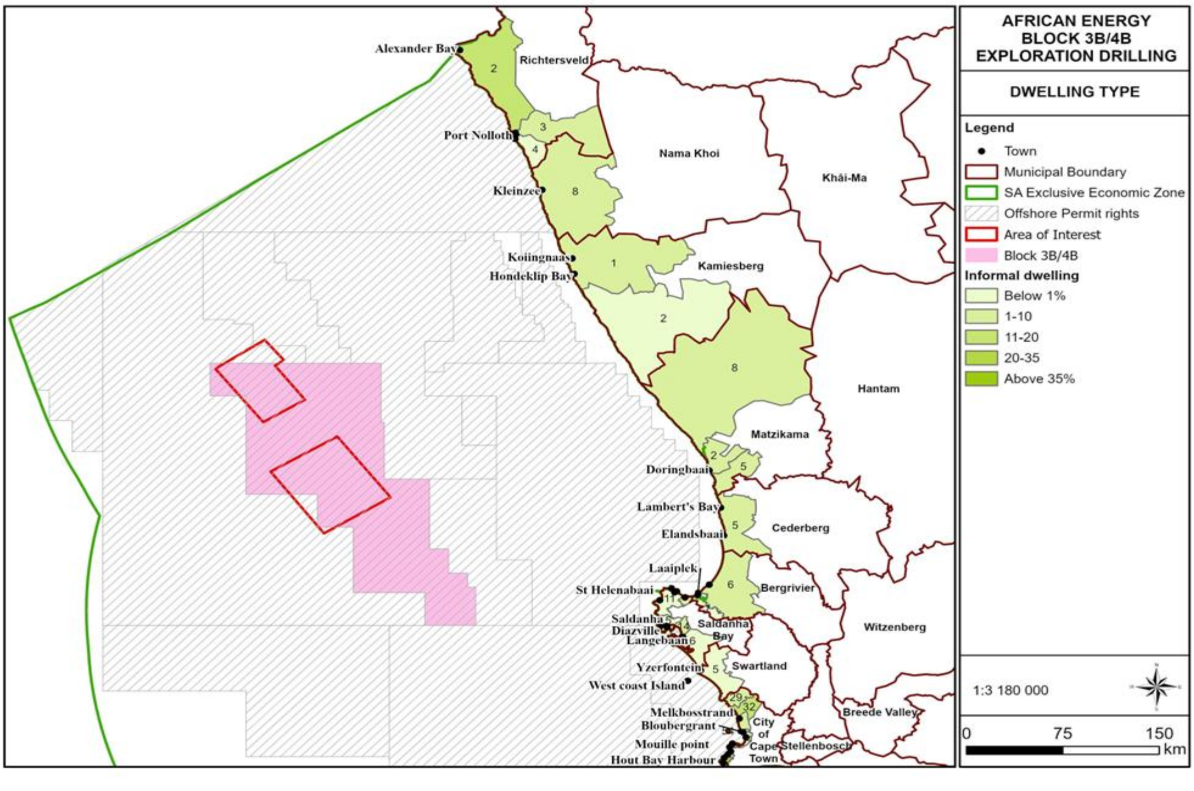


Figure 145: Proportion of households that live in informal dwellings (shown in percentage, source: Census 2011).

8.6.10 HOUSEHOLD SIZE

The average household size in the wards vary between 1.96 people per household and 4.86 people per household (Figure 146).

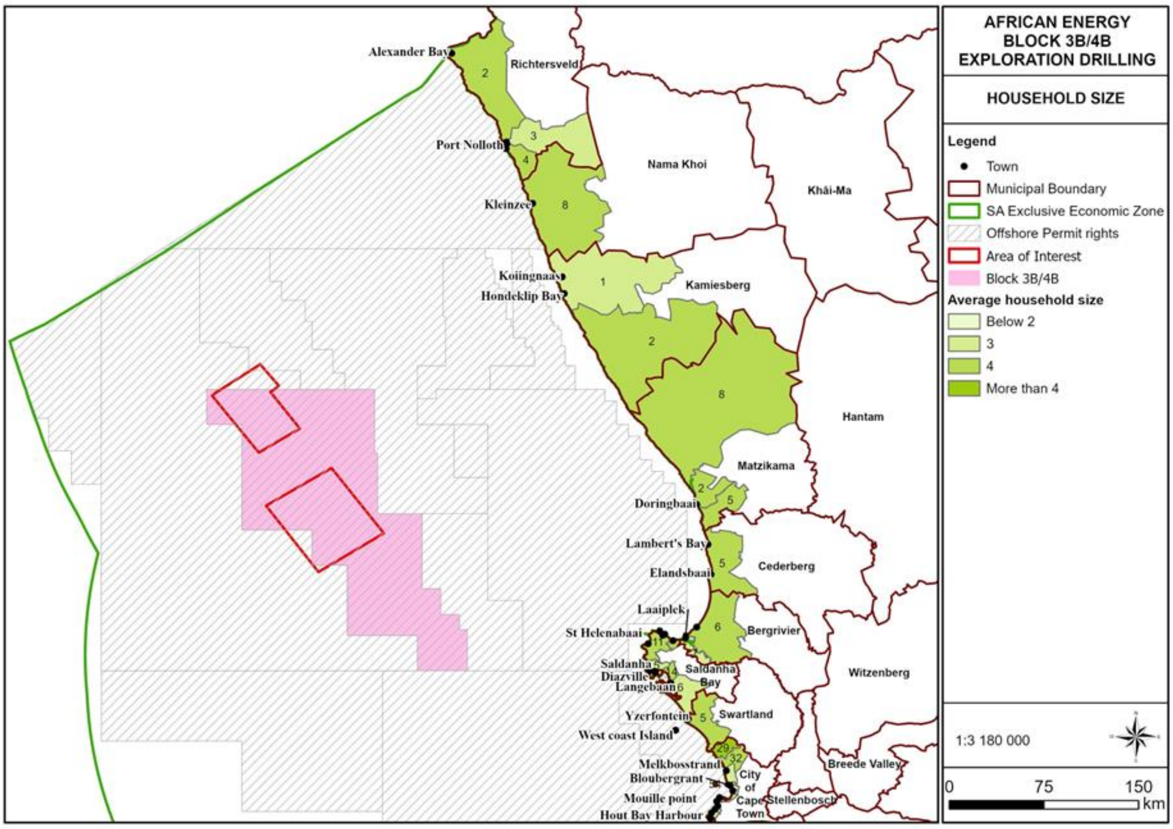


Figure 146: Average household sizes (source: Census 2011).

8.6.11 ACCESS TO WATER AND SANITATION

Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble *et al* (2006). Most households get their water from a regional or local water scheme, with the lowest incidence in Ward 1 of the Kamieskroon Local Municipality where Hondeklip Bay is located (Figure 147).

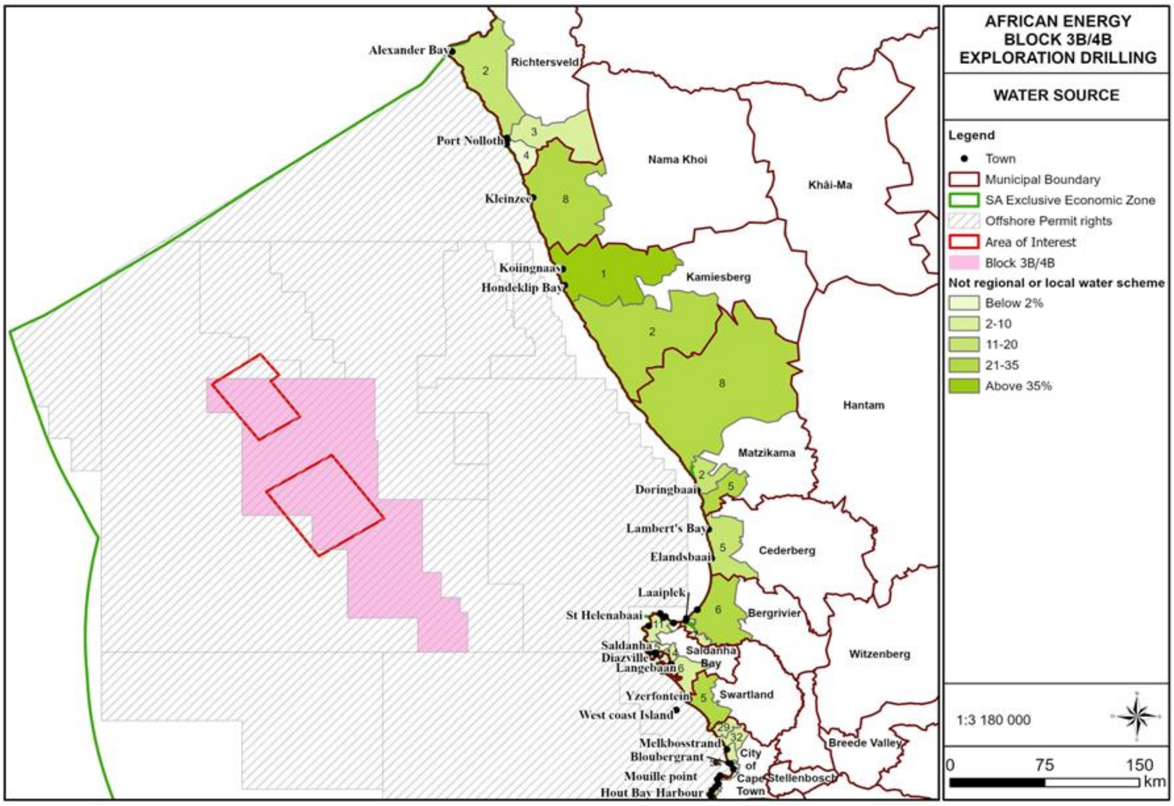


Figure 147: Proportion of households that does not get water from a regional or local water scheme (shown in percentage, source: Census 2011).

The incidence of access to piped water inside the dwelling varies and tend to be lower in the Northern Cape municipalities (Figure 148).

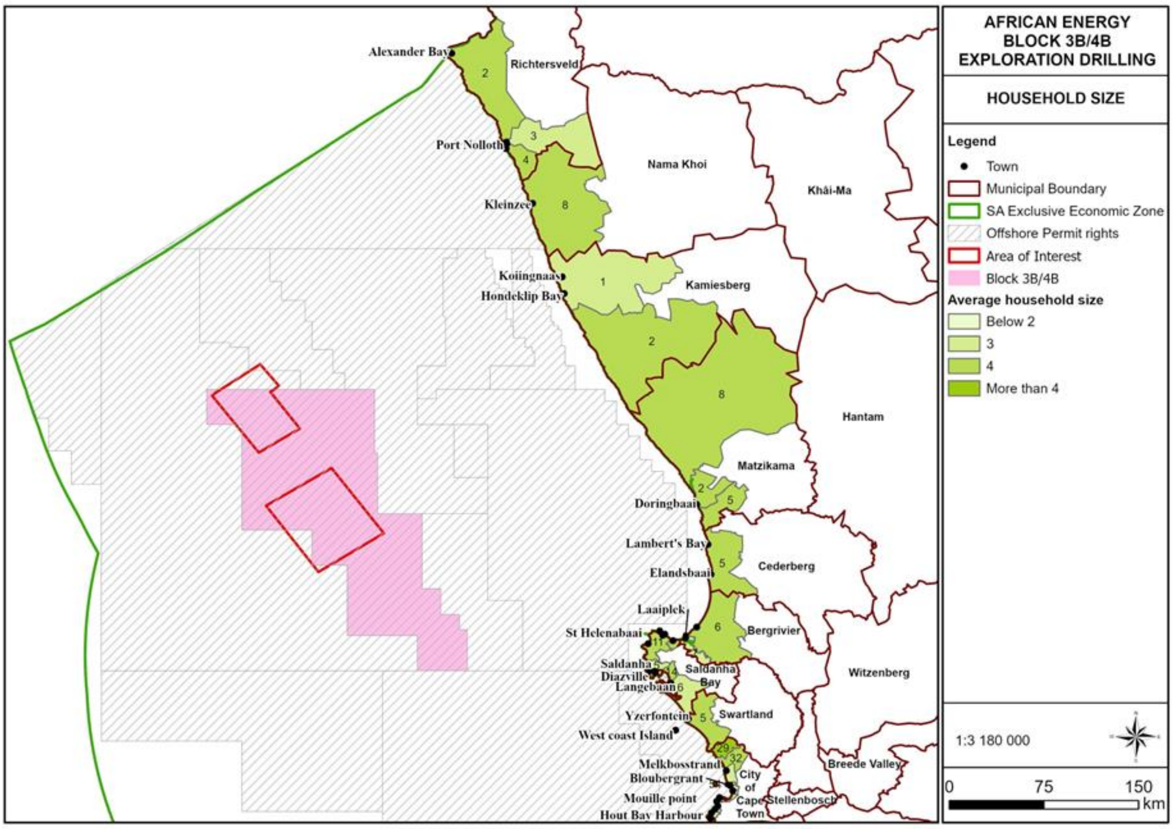


Figure 148: Proportion of households that does not have piped water in the dwelling (shown in percentage, source: Census 2011).

Access to a flush toilet is in general lower in the Northern Cape Municipalities (Figure 149).

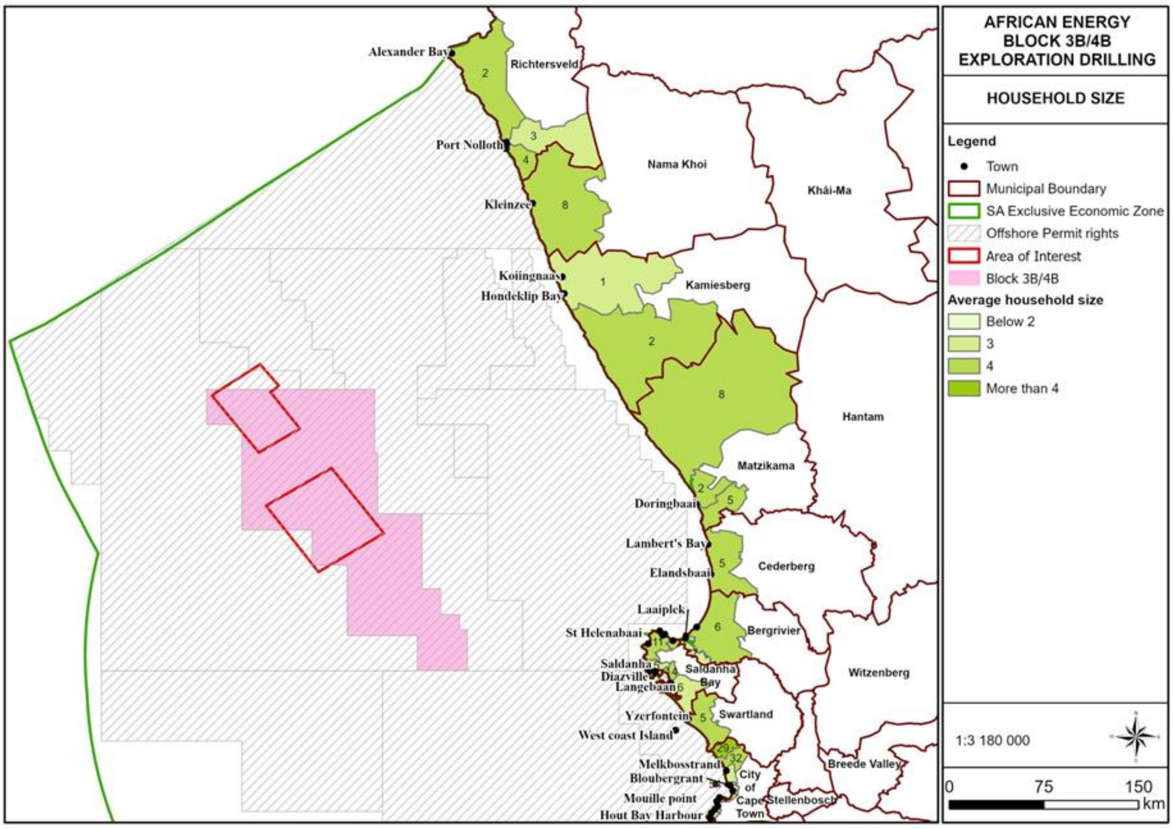


Figure 149: Proportion of households that does not have a flush toilet (shown in percentage, source: Census 2011).

8.6.12 ENERGY

Electricity is seen as the preferred lighting source (Noble *et al*, 2006) and the lack thereof should thus be considered a deprivation. Even though electricity as an energy source may be available, the choice of energy for cooking may be dependent on other factors such as cost. The majority of households have access to electricity for lighting purposes (Figure 150) but a lower proportion use electricity for heating (Figure 151) and cooking (Figure 152) purposes.

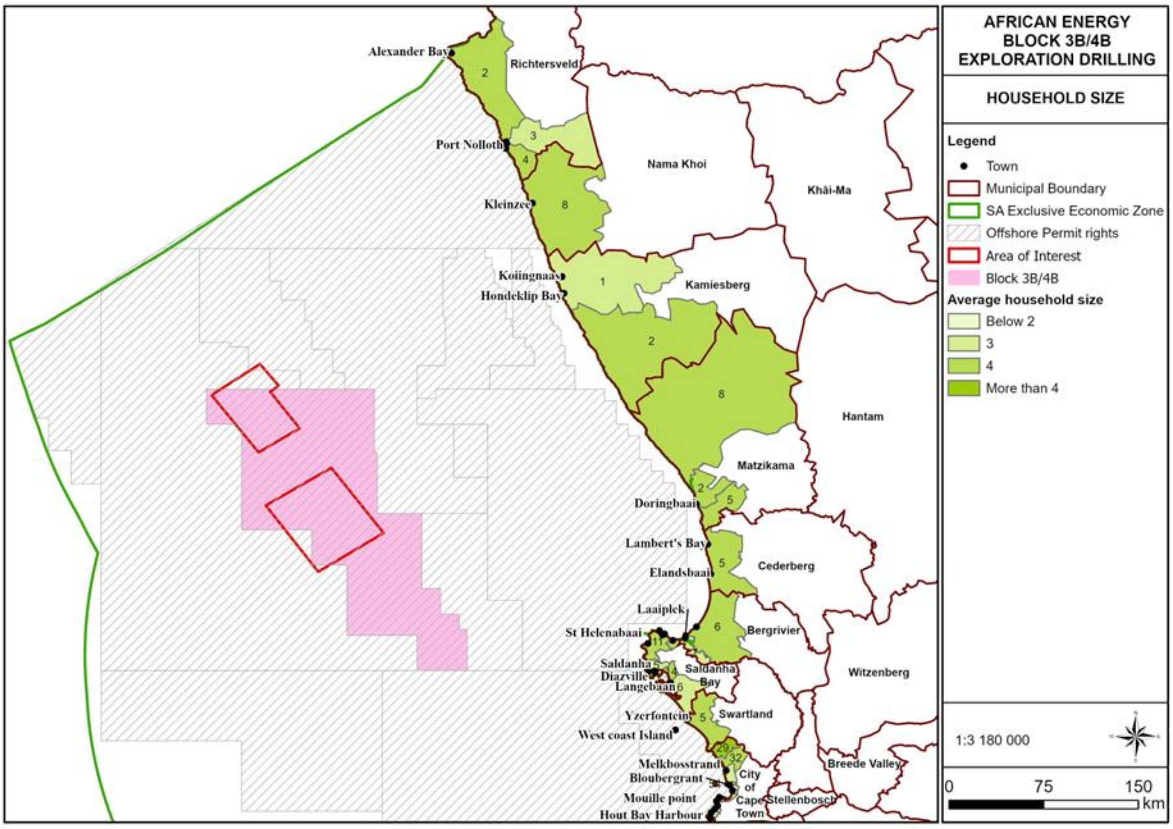


Figure 150: Proportion of households that use paraffin, candles, wood or nothing for lighting purposes (shown in percentage, source: Census 2011).

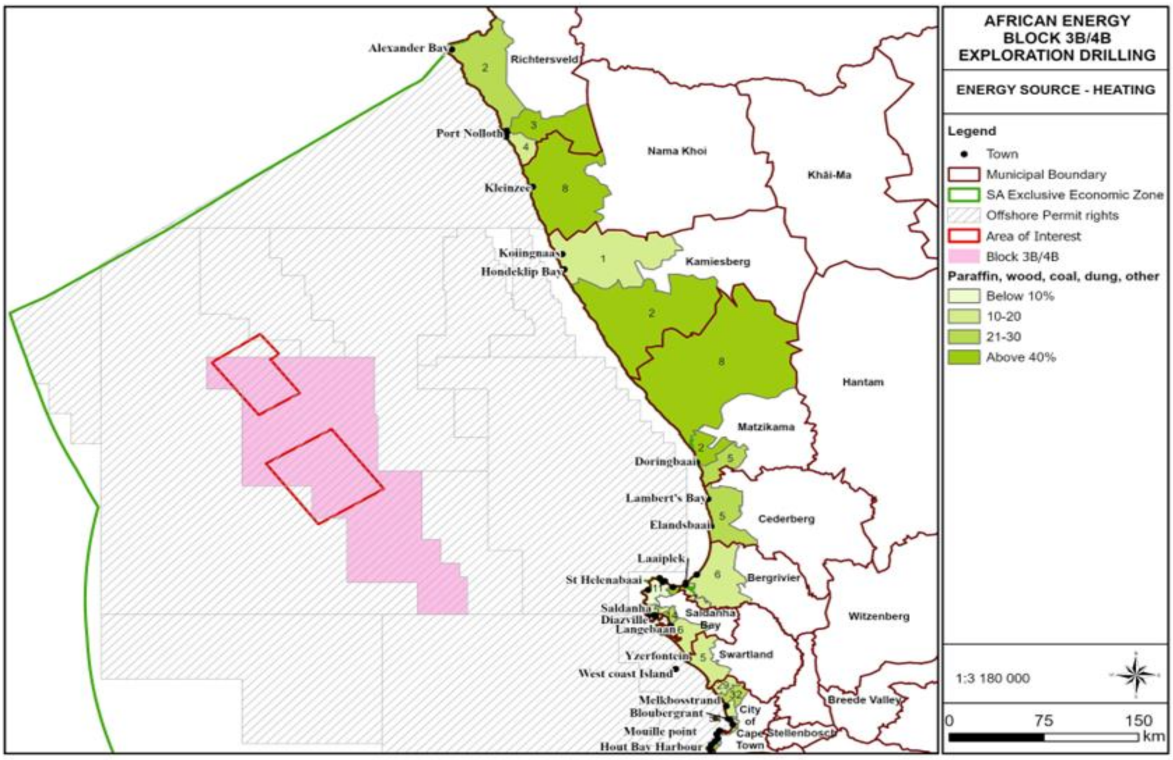


Figure 151: Proportion of households that use paraffin, wood, coal, dung or something else for heating purposes (shown in percentage, source: Census 2011).

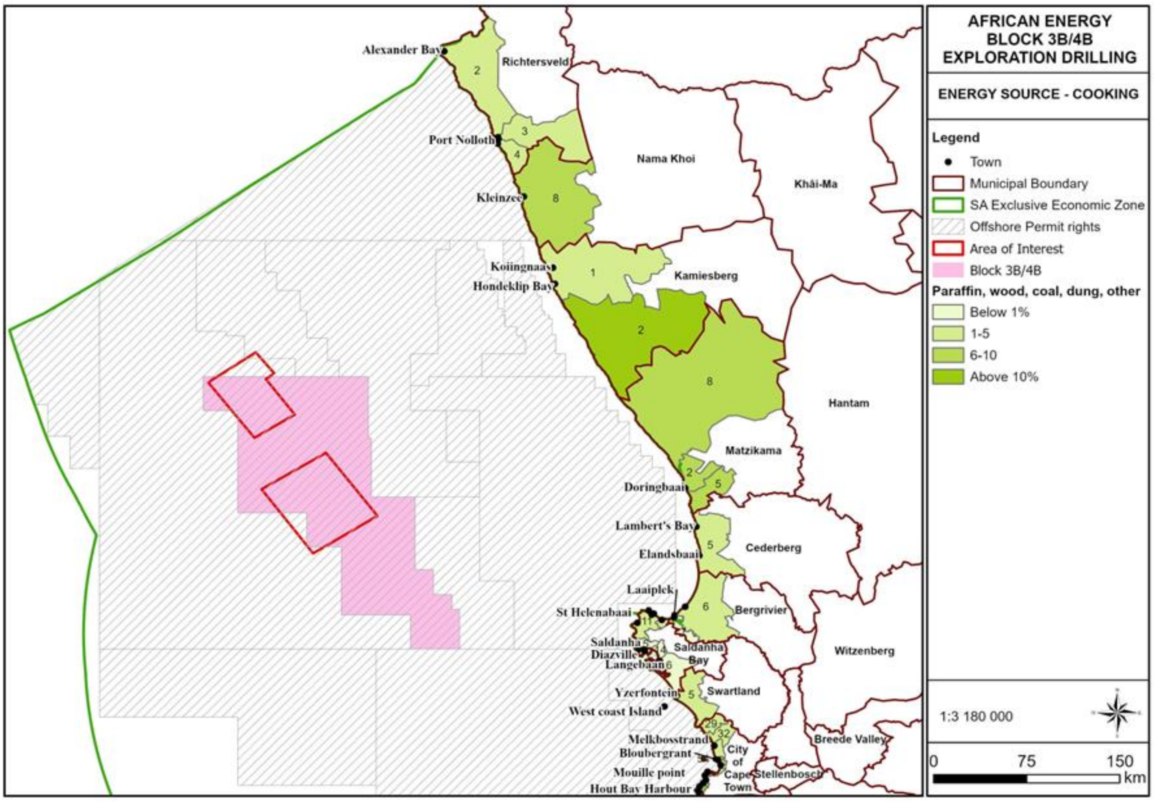


Figure 152: Proportion of households that use paraffin, wood, coal, dung or something else for cooking purposes (shown in percentage, source: Census 2011).

8.7 CULTURAL AND HERITAGE RESOURCES

This section provides and overview of the cultural and heritage environment for the study area. The information has been sourced from previous heritage studies undertaken which provide coverage of the study area.

Marine resources have a long history of human exploitation. Evidence from archaeological sites suggest that the West Coast region was occupied from the Early Stone Age (ESA) through to the Middle Stone Age (MSA) and Later Stone Age (LSA), up until the arrival of early European settlers from the 18th century onwards. There are numerous sites (including shell middens, stratified cave deposits, rock art, stone tools, and fish traps) recorded along the coast that demonstrate that the rocky shorelines were attractive to hunter-gatherers through time. Much of what we know about settlement, subsistence strategies and di*et al*ong the coast is linked to these shorelines. Whilst gorges and stone sinkers are probably the best evidence for technical fishing equipment in the LSA, marine shell middens also demonstrate that the coastal zone was particularly favoured by LSA people (Deacon, 1995).

8.7.1 SHELL MIDDENS

Marine shell middens have been identified within 1 km of the coastline, near estuaries and in dune fields which lie adjacent to rock shores. While pre-historic people likely favoured the rocky shorelines for ease of access to marine resources, middens have also been found further inland, where people would have been able to exploit additional resources such as game life and fresh water.

In some instances, these shell middens are associated with domestic artefactual debris which suggests that they in fact represent occupation sites of long duration. Whilst the opposite can be said for midden sites that do not contain a formal stone artefact component, and instead may represent visits of short duration. These pre-historic people were the ancestors of the San and Khoikhoi. According to archaeologists, several shell middens in the Vredenburg Peninsula are associated with both San and Khoikhoi groups who were harvesting the shorelines and estuaries of the West Coast in a sustainable and patterned manner.

8.7.2 STONE FISH TRAPS

The remains of fish traps (visvywers; stone-walled tidal fish traps) have been recorded along the South African coastline from St Helena Bay to Mossel Bay. Along the south-western coastline, these traps, which use "the tidal range to allow fish to enter pre-built enclosures and be trapped at low tide", provide evidence of early fishing techniques. The preserved fish traps vary in shape, size, and spatial complexity. Identifying the architects of these traps is, however, a contentious issue.

Initially, researchers believed that the fish traps on the south coast were ancient maritime resource systems that originated among LSA people after 2000 years ago with the arrival of Khoikhoi herders. More recent research suggests that the development of fish traps along the southern and western coasts dates to the 19th century. Furthermore, these structures may have been introduced by European farmers as part of the farming-fishing system when intensive exploitation of inshore fish by local farmers occurred. In 1987, Graham Avery recorded a tidal fish trap in Mauritzbaai, south of Jacobsbaai. Hart and Halkett (1992) have also identified the remains of at least six traps in the intertidal zone at Wilde Varkens Valley, St Helena Bay.

8.7.3 INDIGENOUS PEOPLES

Before the colonial era, there were several diverse ancient tribes who traversed the valleys and plains of the present-day West Coast region of South Africa. The origins of the West Coast fishing communities can be traced back to the San and Khoikhoi peoples who lived within this region. Together, the Khoi and the San are the First Peoples of South Africa. In 1928, a German physical anthropologist Leonard Schultze, created the term 'Khoisan', to stress the similarities between the Khoikhoi and the San.

The settlers used the term 'Bushmen' when referring to the San, and many of whom the colonists' called 'Bushmen' were, in fact, Khoikhoi or former Hottentot. Today, this term is considered derogatory, and instead, scholars would rather refer to hunters and herders together as 'Khoisan'. It should be noted that although Khoi and San Peoples may share some experiences, culturally, they remain two distinct groups, and the general preference amongst both Khoi and San people is to be called by their clan names.

8.7.3.1 **THE SAN**

During almost the entire Holocene period, small groups of San hunter-gatherers were present in southern Africa. The San are the direct descendants of the first peoples of southern Africa. It should be noted that the term "San" is used to cover over a dozen distinct hunter-gatherer groups who speak distinctive "click" languages (incl. the Khwe, !Xun, Ju'hoansi, Naro, !nuu and other groups). These groups lived across Namibia, South Africa, Botswana, and Zimbabwe. The San were small groups of nomadic people who lived by the ethos of "all people are equal". They hunted and gathered resources and did not keep livestock.

It is generally agreed amongst academics that the San were the first inhabitants of the Cape region. During the latter part of the Holocene, there were hunter-gatherers living on the West Coast who made seasonal use of the coastal resources. Several archaeological sites, including Duyker Eiland, which is in Britannia Bay, confirmed the importance of shellfish, seals, marine birds, crayfish, and beached whales as a food source for the local inhabitants during this time.

8.7.3.1.1 THE INTRODUCTION OF THE KHOIKHOI

For thousands of years, the Khoikhoi people have occupied and moved around Southern Africa as nomadic herders. The Khoikhoi were large groups of nomadic herders who owned substantial herds (incl. cattle and sheep) and migrated for pasture, water, and food resources. It is understood that Khoikhoi peoples have a spiritual connection to land, where land is perceived as a gift from nature to be cared for.

Note that the Khoikhoi term is an umbrella term which refers to different tribes. The Khoikhoi people comprise four historical groupings: the Griqua, Nama, Koranna and Cape Khoi (incl. further subgroupings). Today, the Nama people are primarily located in the Northern Cape. The Griqua are in the Western Cape, Eastern Cape, Kwazulu Natal and Gauteng, and various other parts of the country. The Korana people, live primarily in Kimberly and the Free State. The Cape Khoi are in the Western and Eastern Cape.

Evidence suggests that around 2000 years ago, the pastoralist Khoikhoi entered South Africa along the West Coast into the Cape region. They brought a new way of life, from its northern origins to South Africa. The Khoikhoi introduced domesticated livestock and new material culture (incl. pottery) into the region. They relied more on sheep as a meat resource and hunted and gathered. Groups living close to the coast would also exploit shellfish, seals, and other marine resources. The St Helena Bay (Slipper Bay) region appears to have provided the Khoikhoi with invaluable resources, including whale meat obtained via 'cetacean traps.

One of the most important West Coast pastoralist sites, Kasteelberg, is an open-air archaeological site located 4 km from the coast. It provides evidence of occupation by herders between 1800 and 1600 years ago (Klein, 1986). The occupants of the site focused on harvesting seals and the presence of sheep bones also indicated that the inhabitants were most likely herding domestic stock.

It is thought that the indigenous people in the Cape populated a region from Northern Namibia to the Cape of Good Hope and from the Atlantic Ocean to the Fish River in the East. The area between Saldanha and Vredenburg was occupied by the CochoQua and the ChariGuriQua (GuriQua) group occupied the lower Berg River area which included St Helena Bay and regions around Picketberg. Some researchers choose to use the term Peninsular Khoikhoi" when referring to the Gorachoquas, Goringhaiquas and the Goringhaiconas ("strandlopers") and "Surrounding Khoikhoi" for the Cochoqua, Chainouqua and Hessequa.

In the pre-colonial era, the relations between the Khoikhoi and the San were relatively stable due to a mutual acknowledgement of territories. Although the San and Khoikhoi seemed to have co-existed for a period, it appears that, to some degree, the San groups were displaced. It's assumed that the Khoikhoi moved into areas that had previously been utilised by the San, thus forcing the San to move into more isolated coastal regions. The San's settlement and subsistence strategy changed from one based on the large-band occupation of open areas and the hunting of large game towards the more intensive utilisation of rock shelters, in small groups and a foraging-based economy. Unfortunately, indigenous groups who lived on the coast were the first people to be severely impacted by colonial oppression.

8.7.3.2 COLONIAL DISPOSSESSION

First contact between indigenous pastoralist groups and Europeans occurred during the 15th and 16th centuries when Portuguese mariners would sail down the coast. Before the Dutch East India Company's ('VOC') governance over the southernmost tip of Africa, European merchants and travellers en route to or from Asia would call in at the natural harbour of Saldanha Bay for refreshment. Encampments were also set up along the coast by survivors of shipwrecks, and in their journals, they would recall how they met and traded with indigenous groups. Written records reveal that in 1497, the GuriQua and the San (SonQua) witnessed the arrival and departure of Vasco da Gama in St Helena Bay. Although the Saldanha Bay harbour was more sheltered than Table Bay and allowed for the crews to trade livestock from the Khoikhoi in the area there was not enough fresh water available to allow for the establishment of large permanent settlements.

It was only in 1652 that the VOC decided to occupy the Cape and establish the first permanent European settlement in South Africa. The VOC established a station at Table Bay to supply Company fleets travelling between Europe and the Indies with refreshments (i.e., meat, wheat, vegetables, and freshwater) (Ward, 2009). When the Dutch colonists arrived, they encountered several Khoikhoi groups. The largest concentration of Khoikhoi lived in the lush pasture lands of the south-western Cape region.

Initially, the relationship between the Dutch and the Khoikhoi was one of cooperation, and the VOC established trading agreements with local chiefs to get regular supplies of fresh meat (Elphick, 1977). As the colony grew, the VOC decided to decrease their dependency on local trade with the Khoikhoi. Their alternative plan was to give land to free burghers to supply meat and grain to the Company.

Khoikhoi and San lives were impacted upon by both internal strife and direct conflict with the Europeans over the disregard of traditional customs, the privatisation of land, and exhausting indigenous resources (i.e., overfishing and farming). As the Dutch took over more of the Khoikhoi's grazing land for farms, much of the Khoikhoi and San peoples' traditional lands were dispossessed. In 1657, the Goringhaiqua tribe were ordered to move to the east of the Liesbeeck boundary and this 'eviction' event would be instrumental for the first war against colonial intrusion (Bredekamp and Newton-King, 1984). The First Khoikhoi-Dutch War lasted the whole of 1659.

According to Sleigh (1993: 148), "In 1672, two sons of the weakened Peninsular Khoisan chiefs signed a contract, which they probably did not fully understand, and sold huge tracts of land from Table Bay to Saldanha Bay in the North and to the Hottentots Hollands mountains in the East to the VOC for an incredible low price (which they did not even fully receive)".

After a few more instances of territories being ignored and further land appropriation, another war of resistance was initiated by the Cochoqua, and the Second Khoikhoi-Dutch War commenced (1673-1677). This led to more

Khoikhoi groups being forced to relocate to areas further up the coast. According to writings of early settlers, it appears that some San groups, who pursued a hunting and foraging lifestyle, may have still resided in the mountainous regions of the Cape where they were less likely to clash with the Khoi or Dutch settlers. Regions that were less desirable for the colonists, such as Namaqualand, became places of refuge for the San and Khoikhoi who were able to continue many aspects of their traditional ways of life in this area for some time.

In 1713, the small-pox epidemic led to the death of many Khoikhoi people living in the south-western Cape. The surviving Khoisan became assimilated as domestic/farm workers due to the high demand for labour by the Dutch. In rural areas, the Khoisan were forced into what was referred to as semi-bonded labour. By the late 18th century, the Cape settler colony's territories incorporated the Berg (c. 1700), Olifants (1750), and Buffels (1798) rivers.

8.7.3.3 THE HISTORY OF FISHING ON THE WEST COAST

This section describes the history of fishing along the West Coast of South Africa.

8.7.3.3.1 17TH CENTURY

During the 17th century, the VOC established an outpost at St Helena Bay. From 1670, free burgers started to fish regularly in St Helena Bay. They introduced methods to the region that were not previously available to indigenous fishermen, such as metal hooks, boats, nets and bulk processing and storage.

8.7.3.3.2 18TH CENTURY

During the 18th century, the Cape settler's economy was primarily based on slave labour which was imported from Asia and East Africa. The agricultural sector which was maintained by free burghers (freed from Company service) was not stable and due to the trade of the Khoikhoi's livestock being intermittent, the settlers had to make alternative arrangements for food resources. This led to Robben Island being exploited for seals, penguins, and seabirds. Large rural landowners established private coastal fishing posts to supply marine resources to the Company; the local region; passing ships and for export. Soon, Dassen Island, Saldanha Bay and St Helena Bay developed as significant centres to supply the VOC with additional resources to sustain the growing number of people in the Cape colony, including the substantial number of slaves kept by the Company. According to Sleigh (1993), the slaves were given salted fish, seal meat, penguin, and bird eggs whilst the rest of the colony preferred to consume meat.

According to Marincowitz (1985: 40–46) "With exclusive land grants closing the north-western frontier, from the 1740s growing numbers of ex-slaves, dispossessed Khoekhoe, failed farmers, evicted tenants and bywoners (tenant farmers), new immigrants and fugitives from colonial and military justice moved onto the beaches of the west coast". Early fishing, sealing and whaling activities, by European and American whalers, around Saldanha Bay, especially near Marcus Island/Outer Bay and at Salamander Point, have been extensively documented in the archival/historical record. Although the inshore whale population declined after 1830, processing continued at Donkergat in Saldanha Bay.

8.7.3.3.3 19TH CENTURY

By the mid-19th century, scattered subsistence communities had emerged along the West Coast. Before the arrival of industrial fisheries, residents in St Helena Bay employed basic fishing technology (small-scale line fishing, beach seine nets and rowing boats) and fishing activities were informally organized by boat and net owners.

Malay slaves and other residents moved into the region to work as farm labourers. Over time, the unique fishing skills of enslaved Malay people intermingled with the fishing skills of the indigenous people. This led to the establishment of small fishing villages along the West Coast (incl. Saldanha, Langebaan and St Helena Bay).

After the emancipation of slaves, new laws were introduced to control both the freedom of movement and independent livelihoods of people who did not own land. This forced fishermen on the West Coast "to either develop artisanal skills, become wage labourers or squat on coastal government land to eke out a living from small-scale production and seasonal work".

Using business capital in both the local and international markets, entrepreneurs were able to lease Crown land and establish coastal industries along the West Coast. By the 1880s, a Cape Town-based trading company, Stephan Brothers, was able to monopolise the West Coast trade. The company bought the main grain shipping points along the West Coast, including the southern shore of St Helena Bay, where they established Laaiplek (translates to 'loading place') at the mouth of the Berg River.

8.7.3.3.4 20TH CENTURY

Although the local fishing industry on the West Coast employed a substantial number of locals at the start of the 20th century, the industry is associated with a history of hardship. The industry's collapse in the mid-20th century left numerous West Coast communities impoverished. Despite all the obstacles thrown at them, the West Coast fishing communities were resilient and continued their fishing tradition throughout the 20th century.

Historically, small-scale fishers have constantly had to compete against big scale fisheries. For example, Piketberg coastal fisheries used a method of fishing called beach seining to supply inland farmers with cheap ration fish. When there was a decline in snoek sources further south, Italian immigrant fishermen from Cape Town travelled up the West Coast on boats with set nets. Ultimately, their method of fishing impacted the supply of fish for the sedentary fishermen.

By 1900, the Stephan Brothers company were in control of nearly every suitable bay from Saldanha Bay to Lamberts Bay. They also owned numerous farms which were often acquired in exchange for debt. In 1909, the company negotiated an agreement with the State to establish an Exclusive Trek Seine Fishing Zone along the Malmesbury coast. This move meant that the company was able to dominate a new manufacturing industry which further exacerbated resource owners and local fishermen.

During World War One, there was a crayfish canning boom in the Cape. The sourcing of crayfish moved rapidly up the West Coast during this period. By the early 1920s, the overexploitation of crayfish resulted in an exhaustion of crayfish stocks and West Coast factories were forced to close. This meant that the small-scale seine fishermen, and fishermen who netted in the backwaters, were left even more vulnerable to the financial depression of the 1930s.

Then, in 1934, in an act of retaliation, "Saldanha Bay fishermen invaded the Piketberg area on motorboats carrying Italian lampara nets and, with the support of Government, wiped out the non-motorised Berg River inshore fisheries run by consortiums of farmers, fishery owners and canners". In 1951, increasing catches along the West Coast, meant that both skippers and fishermen yielded good financial returns. By 1955, South Africa had the largest fishing industry in the southern hemisphere.

With the Apartheid system arriving, the indigenous identity of the Khoisan was further disrupted through the Race Classification Act and the Populations Registration Act. The Khoisan were forcibly categorised as "Coloured". This label further dispossessed the people from their heritage. Under the Group Areas Act (1950) the towns of the West Coast were divided into segregated residential and business areas. The forced removals marked yet another era of forced removals from areas that indigenous people occupied. Despite the discrimination, the communities continued their tradition of fishing that had been passed on through the generations of fisher families.

8.7.3.3.5 MARITIME HERITAGE RESOURCES

The following section was developed by maritime archaeologist Vanessa Maitland.

The first recorded European voyages down the west coast of Africa were by the Portuguese. When the first Portuguese explorers travelled down the west African coast, they stuck close to the coastline, to map the land. However, occasionally they were swept towards the Americas, as is evident by the fate of the fleet of Pedro Alvares Cabral, in 1500. This was first Portuguese fleet which was to sail annually to the Indies. Twenty days after the fleet left Brazil, which they had "discovered", it was struck by storms and four ships, including the one under command of Bartolomeu Dias, foundered somewhere in the southern Atlantic. Different researchers put them anywhere between Tristan da Cunha and the Cape.

Bartolomeu Dias and his fleet passed the Orange River Mouth in 1487/1488 (Axelson, 1973). Thereafter, the rate of exploration and trade increased exponentially, as is evidenced by the increase in shipwrecks over the centuries. These early voyages were not well documented, and the archives often merely report that a fleet of a certain number of vessels left and only a certain amount returned, with only vague references to their place and manner of loss. Therefore, there are many undocumented wrecks, along the coastline and even more offshore.

There is some anecdotal evidence that the Phoenicians circumnavigated Africa (Herodotus, 1954). If this is true, these ships had to stick right to the coastline and therefore are likely to be inshore. There's increasing evidence that the Chinese voyages of the 1400s explored parts, if not all, of the African coast (Paine, 2013). However, once again the archival evidence to date, and availability to Western researchers, limits this knowledge.

There are many ships that are only recorded as having disappeared between Europe and the Far East and Americas. As well as between local ports. The mechanics of sailing vessels and winds meant that for a ship to get from Europe to the Cape, they often sailed via South America. There are also numerous missing U-boats and other war vessels from WW1 and WW2 that may be found.

Thousands of ships have disappeared in the southern Atlantic Ocean, a portion of these can be seen in Figure 153. There are numerous historical reports of abandoned vessels being seen by other ships (Figure 154).

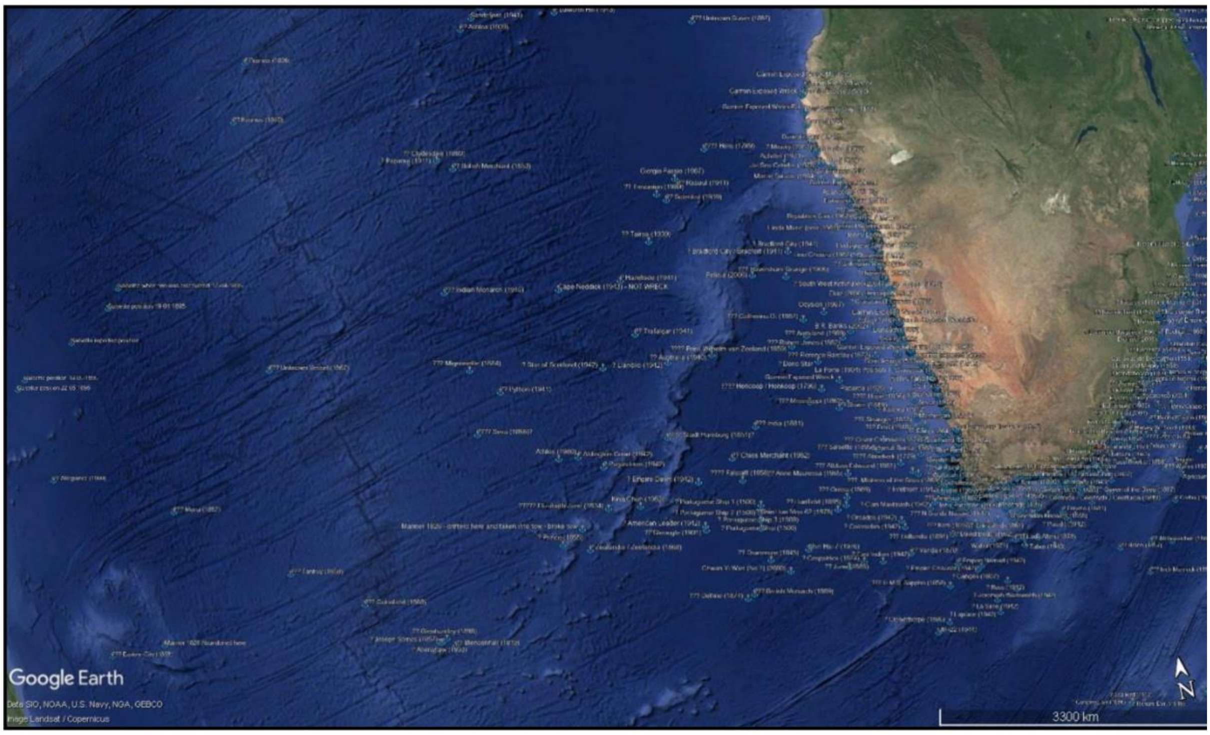
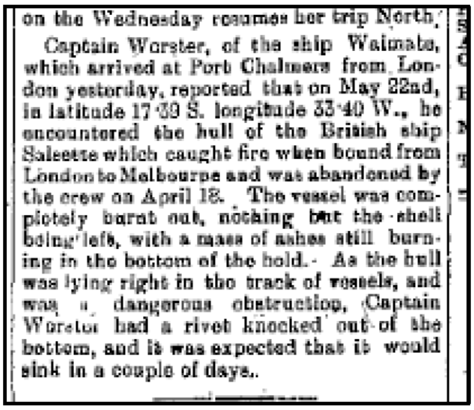


Figure 153: A portion of the ships wrecked off South Africa and in the southern Atlantic.



on the Wednesday resumes her trip North.

Captain Worster, of the ship Waimate, which arrived at Port Chalmers from London yesterday, reported that on May 22nd, in latitude 17·39 S. longitude 33·40 W., he encountered the hull of the British ship Salsette which caught fire when bound from London to Melbourne and was abandoned by the crew on April 18. The vessel was completely burnt out, nothing but the shell being left, with a mass of ashes still burning in the bottom of the hold. As the hull was lying right in the track of vessels, and was a dangerous obstruction, Captain Worster had a rivet knocked out of the bottom, and it was expected that it would sink in a couple of days.

Figure 154: Report in The Auckland Star 26-07-1895, by the Walmate on the drifting hulk of the Salsette.

8.7.4 INTANGIBLE HERITAGE

Intangible heritage' (also referred to as 'Living Heritage') is a term which is used to describe "aesthetic, spiritual, symbolic or other social values people may associate with a site, as well as rituals, music, language, know-how, oral traditions and the cultural spaces in which these 'living heritage' traditions are played out." Through its efforts to safeguard Intangible heritage UNESCO and its member states developed the Convention for the Safeguarding of the Intangible Cultural Heritage (ICHC). The following section is extracted from a UNESCO webpage that explains the importance of Intangible Heritage:

"While fragile, intangible cultural heritage is an important factor in maintaining cultural diversity in the face of growing globalization. An understanding of the intangible cultural heritage of different communities helps with intercultural dialogue and encourages mutual respect for other ways of life.

The importance of intangible cultural heritage is not the cultural manifestation itself but rather the wealth of knowledge and skills that is transmitted through it from one generation to the next. The social and economic value of this transmission of knowledge is relevant for minority groups and for mainstream social groups within a State and is as important for developing States as for developed ones.

Intangible heritage is:

- Traditional, contemporary, and living at the same time: intangible cultural heritage does not only represent inherited traditions from the past but also contemporary rural and urban practices in which diverse cultural groups take part.
- Inclusive: we may share expressions of intangible cultural heritage that are similar to those practised by others. Whether they are from the neighbouring village, from a city on the opposite side of the world or have been adapted by peoples who have migrated and settled in a different region, they all are intangible cultural heritage. They have been passed from one generation to another, have evolved in response to their environments and they contribute to giving us a sense of identity and continuity, providing a link from our past, through the present, and into our future. Intangible cultural heritage does not give rise to questions of whether or not certain practices are specific to a culture. It contributes to social cohesion, encouraging a sense of identity and responsibility which helps individuals to feel part of one or different communities and to feel part of society at large.
- Representative: intangible cultural heritage is not merely valued as a cultural good, on a comparative basis, for its exclusivity or its exceptional value. It thrives on its basis in communities and depends on those whose knowledge of traditions, skills and customs are passed on to the rest of the community, from generation to generation, or to other communities.
- Community-based: intangible cultural heritage can only be heritage when it is recognized as such by the communities, groups or individuals that create, maintain and transmit it – without their recognition, nobody else can decide for them that a given expression or practice is their heritage."

Intangible Cultural Heritage (ICH) consists of the folklore, ritual practice, beliefs, symbolism, social attachment, as well as associated human sensory engagement with the coast and sea. ICH is also found underwater, as part of the tangible heritage associated with maritime artefacts that remain on the sea floor after a shipwreck for example.

In this regard to Block 3b/4b, there is need to consider the potential impacts on Areas Beyond National Jurisdiction (ABNJ), which 3b/4b will 'touch' on as its potential impacts can go beyond the South African EEZ. South Africa has several World Heritage Sites (WHS) in which the tangible natural and intangible cultural elements are recognised and valued. The government also recognises ICH in its reference to living heritage in the National Heritage Resources Act 25 of 1999. The recognition of ICH is also evident in the SA Constitution. ICH is diversely considered by stakeholder groups situated at the coast, in the different provinces of South Africa. The ICH maintained reflects the cultural diversity of South Africa.

ICH and Tangible Heritage (TH) are contested by stakeholder groups because the practices associated with both reflect the specific cultural interests and values of each group. Despite contestation however, the anthropological research (henceforth referred to as the 'research') revealed that there are shared and often converging values regarding the conservation of the ocean and coasts.

ICH is recognized by the First Peoples of South Africa, the various groups defined within the Khoisan collective. This includes the Nama, Griqua/Guriqua, Gamtkwa, Korana and other Khoisan peoples. It is also expressed by Nguni descendants the majority population in South Africa, as well as the descendant groups of Europeans and Asians in the country.

8.7.4.1 **LOCATION OF COASTAL TANGIBLE AND INTANGIBLE CULTURAL HERITAGES**

The research undertaken as part of this EIA, found that ICH related to the coast and sea overlaps with immigrant (specifically southern African and Central African) beliefs and ritual practices at the coast. The research also revealed that coastal and oceanic ICH is holistic. It includes a variety of waterways that ultimately lead to the sea, these include streams, rivers, pools, lakes and estuaries. These waterways are described as 'living' waters and are believed to play a critical role in spiritual and health management in indigenous (First Nations and Nguni) groups specifically.

The specific beliefs concerning these 'living' waters can be summarized as follows:

- That the waters contain the ancestral spirits of the cultural communities noted;
- That the waters offer a spiritual domain to which people in the present realm can travel to (intentionally or otherwise) and from which they can return if the correct ritual activities are performed to ensure safe return;
- That while the lesser waterways such as streams, rivers and pools may contain a community's specific ancestral spirits, the ocean itself contains the ancestral spirits of the African continent and arguably the ancestral spirits of all humanity;
- That the ancestral spirits in the ocean reside on the seabed or seafloor;
- That indigenous peoples should always approach the sea and coast, as well as lesser waterways with reverence and sometimes, fear;
- That belief in the ancestral world and the place of ancestors in waterways and other ecologically sacred places does not require a relinquishing of belief in an omnipresent God. The ancestors form part of a complex genealogy of which God is the head;
- That regular, consistent and frequent interaction take place with the coast and sea in order to secure the guidance and benevolence of living communities, ancestors, as well as spirits that reside in such living waters; and
- That for First Nation peoples there is belief in the natural connection (i.e., no division) between humans and nature and that all alterations (including development) in natural settings must be preceded by rituals of respect and recognition of the divine creation and its contribution to human survival. The location of ICH for First Nations appears to exist across the territorial and aqueous domains, for example, across mountains and sea.

8.7.4.2 SUMMARY OF RESEARCH FINDINGS

The coastline considered part of the area of indirect influence, is from Port Nolloth in the Northern Cape and down the West Coast of the Western Cape Province to False Bay. These are areas with rich intangible cultural heritage. These heritages were noted and discussed by participants during fieldwork from March 2022 to May 2023. SSF and SSF families displayed high regard of the sea as well their spiritual and cultural connection with the ocean. The communities were concerned about the impact of offshore exploration including drilling in the ocean on fish stocks and on the natural environment but there were also those who desired the development that may come to South Africa as a result of these activities. Of the SSF interviewed, more than 50 percent indicated their worry about the effects of offshore oil and gas operations on fish stocks.

The team also found First Peoples' revivals of identity and remembering of coastal ICH. These stories revealed the cultural and ecological sensitivity of these coastlines, as well as their cultural value. MPA studies, the reliance of SSF families on these coastlines for subsistence, the role of the coastline in fish spawning, as well as studies of aquatic biodiversity further reveal socioeconomic reliance on coastal sites.

Secondary data to ascertain the archaeological and tangible cultural heritage at the coast indicates that, in Namaqualand (and therefore some of the Northern Cape towns selected for the fieldwork presented here), there are rich coastal and inland archaeological sites, which may be both of regional and national value (see Demset 1996, 13-14). However, these are not coastal sites, nor are they sites in the area of operation/proposed.

Secondary data analysis also revealed a similarly rich tangible (and archaeological) coastal heritage along the West Coast of the country and in the south Cape Coast. These are mainly inland sites. Indigenes' complex and holistic consideration and valuation of the sea and coast presents a different 'use' metric and valuation of the sea and coast. The ocean is not merely an asset, it is a living organism and integral part of the global ecological system. For these communities, the whole ocean forms part of a cultural complex in which local, living communities must be consulted and ancestral blessing must be obtained for development to take place. In this regard, the people interviewed consider the whole ocean to be highly sensitive regardless of industrial or other activities happening inshore.

A further finding of the May 2023 research was that for aboriginal peoples, otherwise self-describing as Khoisan, nature itself (including the ocean) is believed to have agency and is therefore deserving of specialized ritual request to the ocean itself, prior to offshore operations that involve extraction of natural resources from the sea.

In the research and engaging with people of Khoisan ancestry, it was found that, regarding ICH specifically, the are deep First Peoples' relations with the sea and nature. For the First Peoples or Khoisan, humans live in a symbiotic and holistic relationship with the sea. This is a relationship that must be conserved, and it is key to the full development of persons who are part of a larger, critically balanced ecosystem. Khoisan and Nguni peoples regularly and consistently engage with the ocean and nature, drawing on fynbos and coastal plants for healing and using the sea to commune with the ancestral world. For the Xhosa in particular, the ocean seabed is the final resting place of ancient ancestors and there is belief (even among Zimbabwean immigrants) that the sea is living water and has the possibility of healing many physical and spiritual ailments.

Under apartheid many people of mixed 'racial' descent were categorised as Coloured. This denied them expression of their Khoisan ancestry or, of any ancestry (including European ancestry) which they may have wished to publicly articulate. Since 1994, the Khoisan revival has seen many people, categorised as Coloured, taking the 'liberation walk', to reconnect with their Khoi ancestry and the spirit world denied to them in Christianity and under apartheid. The majority population of colour in the Northern Cape and Western Cape are Coloured and African Black (Nguni descendants), meaning that a majority believe in, and or engage in ritual activity that expresses a deep relationship with the ancestral world. Ancestors reside on the seabed, in flowing rivers, waterfalls, streams and estuaries. Hence the environmental conservation of all these flowing waters is perceived to be critical for the maintenance of beliefs and ritual practice. There is a substantive and valuable literature on the dynamics of Coloured and Khoisan identity in South Africa and this is succinctly assessed and presented in an annotated bibliography that clearly shows the dynamic and constructed nature of all cultural identities (Verbuyst 2022a and 2022b).

A further finding regards the twinning of diverse ecological niches in the coastal biome (sea and desert for example in the Northern Cape) and the consequent expression of dual cultural heritages that showcase the holistic nature of coastal cultural heritage. These contribute to biocultural heritage (Boswell 2022b), since they intertwine floral/faunal expressions of marine biodiversity, geological markers and human engagement with such diversity.

It is also found that in Port Nolloth, an atmospheric cultural heritage was identified in relation to the desert and coast, namely that the sea air turned to fog and mist at the coast and that this produced ideal conditions for the sustenance of coastal natural flora, as well as the requisite atmosphere for coastal leisure and sporting activity in an otherwise hot coastal setting. Although culturally interesting, it is unlikely that this aspect will be affected by drilling of the Earth's crust.

In Paternoster, Kalk Bay, Langebaan and St James, board and kite surfers, as well as SSF and swimmers spoke of the interplay of Earth/moon gravity and the tides, their impacts on surf swells and winds, as well as the abundance of fish. These comments emphasised the holistic and rhythmic/cyclical nature of cultural heritage expression and experience at the coast, as well as the physics of water, which was indicated to offer balance and wellbeing to humans.

In interviews, SSF and other community members were identified who identify as Xhosa but do not use the ocean for cultural purposes. This finding tells that it is important to consider that not all who are able to, will necessarily find cultural heritage important or more important than socioeconomic survival.

Secondary data analysis reveals ancient shell middens and caves with ancient rock art (produced by the First Peoples) in the Northern Cape coast and the Western Cape of South Africa, specifically in the area of Paternoster and St-Helena Bay. These are inshore sites of archaeological and tangible heritage significance, recently (February 2022) nominated by the South African government for World Heritage consideration. Even those sites not nominated for either national or World Heritage status are considered valuable and worthy of conservation, as noted in the principles set out in Section 5 of NHRA.

Secondary data analysis revealed the archaeological significance of the northern cape coast and the West Coast of the country. Orton, Hart and Halkett (2005) discuss the proliferation of shell middens in the areas of Kleinsee, Hondeklipbaai and further down the West Coast to Langebaan. The middens offer evidence of early coastal human occupation and thus, the earliest tangible cultural heritage of South Africa. As yet, early human history/archaeological prehistory is not fully attended to/considered for conservation by the South African

National Heritage Council (NHC) or the South African Heritage Resources Agency (SAHRA), the implementation body of the NHC. There is expressed interest however, from the Western Cape provincial government to nominate large parts of the West Coast as a site expressive of prehistorical human heritage. A close look at the 5 June Heritage Western Cape Council Committee meeting Agenda however, reveals that more than 60 percent of this Agenda concerns inshore and tangible heritages (sites, monuments and buildings) alterations. Thus, despite the call for recognition of ICH in local communities, more attention is still being given to TH and inshore heritage conservation in South Africa.

Inshore and archaeologically significant sites are also connected to coastal cultural heritages, since some rock art in these sites express the coastal activity of aquatic hunter gatherers, showing that historically, Khoisan peoples moved between inland sites and coastal sites. The sites are directly on the shore and experience to varying degrees, various existing impacts (property development, urban regeneration). The archaeological sites cannot be dismissed as mere expression of past relationships in specific ecological niches. For, the research found that present day Khoisan descendants are recently and currently remembering and re-establishing connection with this history and are reviving pilgrimages to the sea to reconnect with histories suppressed under colonial and apartheid rule. Archaeological sites are noted in Figure 7 and are worth considering for the CHIA.

Relatedly, the indigenous peoples of South Africa, who are considered Nguni descendants (i.e., Xhosa peoples), have both historical and contemporary coastal cultural heritage. As explained next, they believe that living waterways house ancestral spirits and that regular and sustained communion with such spirits and the ecological spaces noted, nourish and support benevolent relationships with the ancestral world. The ancestors are consulted for a diversity of reasons, such as explanation of ill health, a venture to be undertaken, for significant life cycle rituals (birth, marriage and circumcision for instance).

Thus, living waters (rivers, streams, pools, lakes, estuaries and seas) should be kept pristine for ease of and successful communication with the ancestors. Indigenous peoples (and some of those defined as Coloured under the apartheid regime), also imbibe sea water, as part of a complex set of ritual practices that facilitate contact with the ancestral world. Thus estuaries, rivers and streams fed by oceanic waters are sites as well. These are cultural and sacred landscapes, and their waters (as well as seawater) are used for ritual purposes.

European descendants in the research sites also cultivate a cultural relationship with ocean and coast. While the majority of responses focused on leisure pursuits at the coast, interviews on these subjects revealed that coastal sporting/leisure activities had become ICH for these communities, since the activities contained strong cultural elements (i.e. social grouping, ritual practices, commensality, unique identity, shared histories) and that these were practiced on a regular and continuing basis.

The research also revealed the role of other stakeholder groups in recognising and protecting coastal cultural heritage. These groups included municipalities and property developers who focus on the unique features of coastal towns (Tangible and Intangible cultural heritage) and leverage these features for infrastructure development and investment respectively. For instance, it was found that, the Western Cape government has produced a series of feasibility studies in 2021, including a World Heritage Site (WHS) socioeconomic study. The study has been commissioned *"… under part 3(h) of schedule 1033 of the South African World Heritage Convention Act No. 49 of 1999 (SAWHCA) Format and Procedure for The Nomination of World Heritage Sites in The Republic of South Africa. The general purpose of the Study is to identify the possible socio-economic and tourism benefits to the local community derived from the declaration of the serial nomination as World Heritage Site. More specifically, the Study should determine the potential community benefits to be derived from the serial nomination; the projected jobs to be created, as a direct and indirect result of the nomination; potential funding sources, present and future, to support the programmes at the World Heritage Site and the sustainability thereof."*

In the Socioeconomic study, the Diepkloof Rock Shelter in Langebaan and the Pinnacle Point Site Complex in the Southern Cape are noted as archaeologically significant sites (and therefore mixed tangible/intangible cultural heritage sites) worthy of world heritage status. In February 2022, the South African government approved the nomination of these sites for World Heritage consideration, as well as four other sites (including sites in the southern cape coast and in Kwazulu-Natal). The sites are already declared as national heritage sites. The South African cabinet noted that the nominated sites 'collectively contribute to the understanding of the evolution of humankind and they showcase the long sequences of human occupation over tens of thousands of years with evidence dating the period of the emergence of modern humans.' The submission of the sites for nomination is said to be 'aligned to the World Heritage Convention Act, 49 of 1999, which provides for countries to make these submissions as part of the global understanding of the evolution of humans.' In May 2023, research in the Mossel

Bay area revealed the establishment of an educational and 'identity restoration' center, the Point Discovery Centre. It is envisaged that the area behind the Centre will contain areas for activities that will enhance remembrance of Khoisan identity and cultural heritage. Interviews at the site indicated the potential for discovery of further inshore tangible cultural sites. Mossel Bay and the Pinnacle Point site complex, important to Khoi and the broader South African cultural history, are however, far from potential impacts from Block 3b/4b.

Some of the groups encountered in the area of indirect influence noted in this report, such as SSF, demonstrated greater cultural proximity to the ocean and coast. Thus, they personalised the ocean and coasts more, recognised the agency of the sea itself and the social personalities of marine life. This is also noted in Sunde's (2014) PhD Thesis. However, and as laid out in the Baseline report for Block 3b/4b, one needs to consider the dynamism of culture and the situational nature of cultural identity, as well as consider coastal cultural heritage collectively and along with other desires and needs for South Africa's coastal areas. There are competing values and plans for the advancement of the South African nation. Thus, even though the CHIA research finds the twinning of diverse ecological niches in the coastal biome and the consequent expression of dual cultural heritages that showcase the holistic nature of coastal cultural heritage – it still needs to be asked, do all coastal South Africans share this perspective and does this valuation of the coast supersede other forms of cultural valuation and cultural diversity found along the coast? There are diverse forms of biocultural heritage, since they intertwine floral/faunal expressions of marine biodiversity, geological markers and human engagement with such diversity.

In Pringle Bay, Hangklip and broader Cape Town, residents twinned the cultural heritage of the mountain with that of the sea. They spoke of the invigorating atmospheric natural heritage engendered by sea air in the coastal areas and how the mountain-sea climatic system was a holistic one leading to specific fauna and flora that formed part of the natural-cultural heritage of the coast.

In Cape Town CBD we learned of the integral part of seafood in culture and heritage. Interviewing a Malay woman from the city, she told us that, at Eid every year, families who can afford it will make a crayfish curry – this signals both the importance of Eid itself, as well as the high cultural value of crayfish in the community.

The team learned that all fish or seafood are not equal, abalone and crayfish are of much higher value and have the potential to improve the lives of those who fish for it. Interviews with SSF in Port Nolloth and St Helena Bay revealed that SSF have to now travel much further than before, because fish commonly pursued, such as sardines, are no longer readily available in the waters near these towns. The dangerous nature of fishing in open waters was also shared with the team, including beliefs that local communities have cultivated to explain miraculous situations where they were saved by mythical creatures, such as mermaids, at sea.

In Lambert's bay and in Port Nolloth, the team came across people who affirmed the existence of mermaids that saved them from drowning. These experiences strengthened belief in the other worldly nature of the sea, and of its intrinsic agency. In other words, the sea is not merely a resource, it is a living entity, containing species that are not yet known by humans.

These comments also confirmed the holistic and rhythmic/cyclical nature of cultural heritage expression and experience at the coast, as well as the physics of water, which refers to the viscosity of the sea, the regularity and shape of waves as well the regularity of marine species' shapes – which are perceived as evidence of intelligent design – of the *raison d'être* of the sea – being an integral element in a symbiotic ecologically-sound whole. The sea, to put it simply, offers physical and psychosocial balance and wellbeing to humans.

The research also found that ICH was gendered and that it had a generational dimension. Women had their own ICH with the sea and coast. For women the sea was a provider of health and healing, both physical and emotional. Women routinely and ritually took to the sea for both physical and psychological healing, engaging for example, in moon-baths at high tide. Secondly, the oceans and coasts formed part of the early socialisation of boys and young men, drawing them into the coastal ecological niche as part of a locally embedded, masculine socialisation. There are gendered cultural heritage with the oceans and coast.

Finally, the research found that coastal cultural heritages are similarly considered by indigenous South Africans and some southern African immigrant groups. An interview with a Zimbabwean woman, as well as secondary data on southern African water rituals, revealed that southern Africans share in their veneration of the ancestors and in belief regarding ancestral worlds. They also share in belief regarding living water 'housing' ancestral spirits and realms. Specifically, the secondary data analysis tells of Mami Wata – a feminine goddess, who resides in rivers and at the bottom of the ocean. Belief in Mami Wata is apparent across many African countries, not just southern Africa. An incarnation of Mami Wata is also said to be apparent in Yemanja/Lemanja, the goddess of the sea, who is revered in the African-American diaspora of Brazil, the Caribbean and the United States. Thus, heritages are not merely national or global, they are also continental and regional. Conservation of heritage therefore, may have positive implications for the restoration of African and diaspora human dignity, history and indigenous knowledge forms.

8.8 SHIPPING DENSITY

A large number of vessels navigate the major shipping lanes along the South African Coastline. Approximately 96% of the country's exports are conveyed by sea through eight commercial ports. These ports are the conduits for trade between South Africa and its southern African partners as well as hubs for traffic to and from Europe, Asia, the Americas and the east and west coasts of Africa. Figure 155 provides an indication of the shipping density along the South African Coast. It can be observed that the shipping density is generally low to medium over the majority of the proposed exploration area within Block 3B/4B.

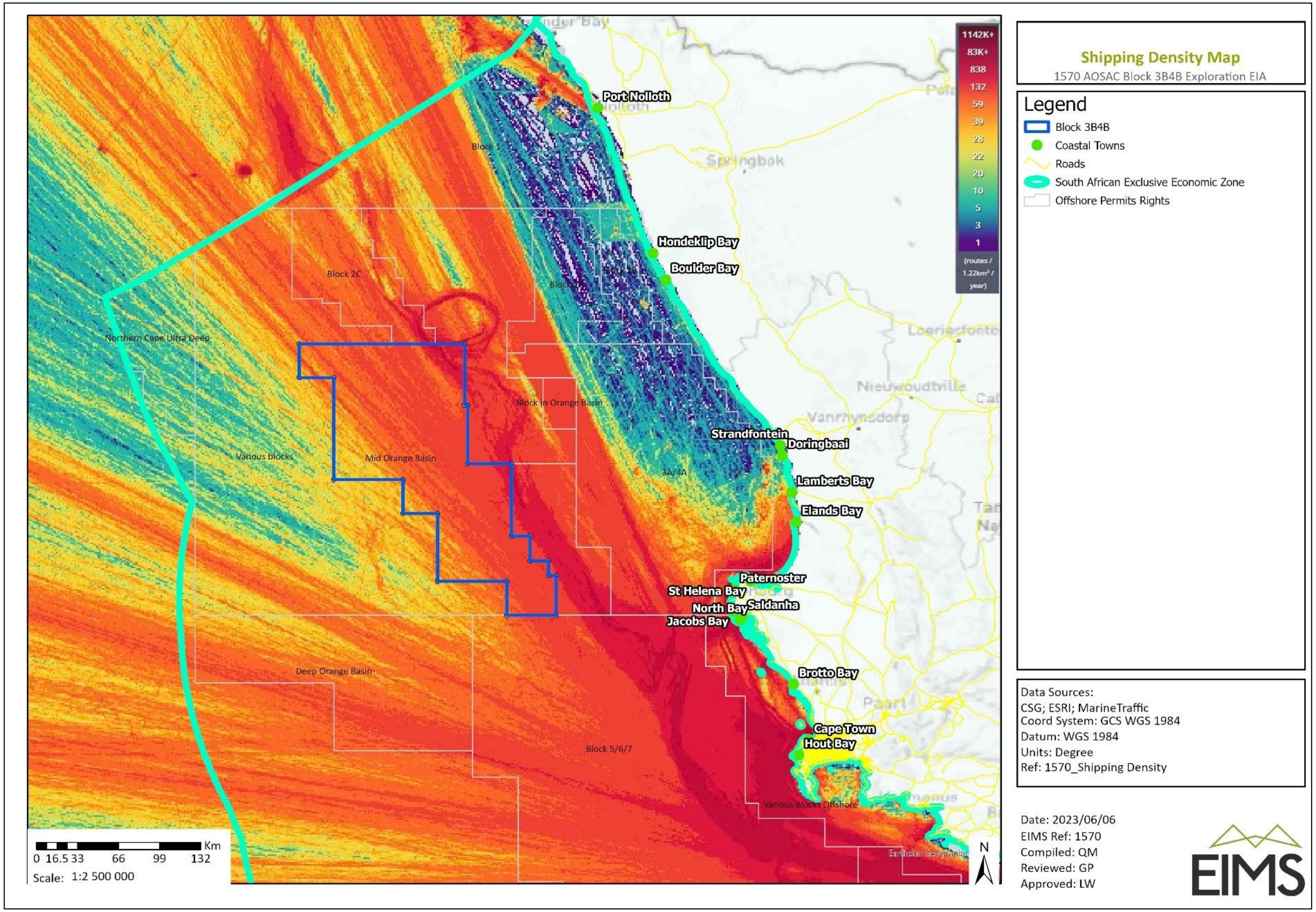


Figure 155: Shipping density along the South African Coast.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 IMPACT ASSESSMENT METHODOLOGY

The impact assessment process is broken down as follows:

- Identification of proposed activities including their nature and duration: Impacts were identified through various methods including a desktop analysis; specialist studies (Heritage and Palaeontological and Wetlands) and the public participation process;
- Screening of activities likely to result in impacts or risks;
- Utilisation of the above mentioned EIMS methodology to assess and score preliminary impacts and risks identified. Refer to section 6.11 above for the full methodology used;
- Inclusion of I&AP comments received through the public participation process regarding impact identification and assessment; and
- Finalisation of impact identification and scoring.

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations, 2014. The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

9.1.1 DETERMINATION OF ENVIRONMENTAL RISK

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\boldsymbol{C} = \frac{(\boldsymbol{E} + \boldsymbol{D} + \boldsymbol{M} + \boldsymbol{R}) * \boldsymbol{N}}{\boldsymbol{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 32 below.

Table 32: Criteria for Determining Impact Consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact

Aspect	Score	Definition
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or

Aspect	Score	Definition
		processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 33.

Table 33: Probability Scoring.

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

Table 34: Determination of Environmental Risk.

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 35.

Table 35: Significance Classes.

Risk Score	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk).
≥ 9; < 17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

9.1.2 IMPACT PRIORITISATION

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 36: Criteria for Determining Prioritisation.

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.

	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 36. The impact priority is therefore determined as follows:

Priority = CI + LR

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (Refer to Table 37).

Table 37: Determination of Prioritisation Factor.

Priority	Ranking	Prioritisation Factor
2	Low	**1**
3	Medium	**1.125**
4	Medium	**1.25**
5	Medium	**1.375**
6	High	**1.5**

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 38: Environmental Significance Rating

Value	Description
< -9	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ -9 < -17	Medium negative (i.e. where the impact could influence the decision to develop in the area).
≥ -17	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
0	No impact
< 9	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 9 < 17	Medium positive (i.e. where the impact could influence the decision to develop in the area).

≥ 17	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

9.2 PRELIMINARY IMPACTS IDENTIFIED

This Section presents the potential impacts that have been identified during the scoping phase assessment. It should be noted that this report will be made available to I&AP's for review and comment and their comments and concerns will be addressed in the final Scoping report submitted to the PASA/DMRE for adjudication. The results of the public consultation will be used to update the identified potential impacts which will be further refined during the course of the EIA assessment and consultation process.

Potential environmental impacts were identified during the scoping process. These impacts were identified by the EAP, the appointed specialists, as well as the preliminary input from the public. Table 39 provides the list of potential impacts identified.

Without proper mitigation measures and continual environmental management, most of the identified impacts may potentially become cumulative, affecting areas outside of their originally identified zone of impact. The potential cumulative impacts have been identified, evaluated, and mitigation measures suggested which will be updated during the detailed EIA level investigation.

When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the activity. The main impacts which have a cumulative effect on a regional scale are related to the transportation vectors that they act upon. For example, air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly, water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

Table 39: Identified preliminary environmental impacts.

Activity Phase	Ancillary Activity	Aspect	Geo-physical (geology, topography, air, water)	Biological	Socio-Economic	Heritage and Cultural
Planning Phase	Employment/recruitment				Employment opportunities.	
	I&AP consultations				Social unrest and community conflict Negative perceptions Uncertainty Further marginalisation of vulnerable groups Concerns about cumulative impacts on their livelihoods and sense and spirit of place Concerns about industrial accidents Impacts on sense and spirit of place Impacts on social license to operate Stakeholder fatigue and disillusionment Community expectations regarding perceived benefits of projects Potential influx of people Gender impacts	

Activity Phase	Ancillary Activity	Aspect	Geo-physical (geology, topography, air, water)	Biological	Socio-Economic	Heritage and Cultural
					Economic benefits Diversification of economic activities Impacts on mental health	
	Environmental awareness training					
	Helicopter and Vessel Movement				Noise Nuisance	
Mobilisation Phase	Transit of vessel, drilling unit and supply vessels to drill site	Increase in underwater noise levels from vessel transit		Disturbance of behaviour (foraging and anti-predator) and physiology of marine fauna	Noise Nuisance	
		Light emissions in marine environment		Disorientation and mortality of seabirds		
		Routine discharge to sea (e.g. deck and machinery space drainage, sewage and galley wastes) and local reduction in water quality		Physiological effect on marine fauna		
				Increased food source for marine fauna		
				Increased predator - prey interactions		
	Discharge of ballast water	Introduction of invasive alien species		Loss of biodiversity		
	Sonar surveys	Increased underwater noise levels from		Disturbance / behavioural changes	Impacts on the fishing sector catch rates (tuna	

Activity Phase	Ancillary Activity	Aspect	Geo-physical (geology, topography, air, water)	Biological	Socio-Economic	Heritage and Cultural
Pre-drilling surveys		multibeam echo sounders and sub-bottom profilers		to marine fauna (cetaceans, turtles, etc)	pole and large pelagic longline.	
				Physiological effect on marine fauna		
				Masking or interfering with other biologically important sounds		
Operation Phase	Presence and operation of drill unit and support vessels (including waste management, water intake, air emissions and discharges to sea)	Increase in underwater noise levels		Disturbance / behavioural changes to marine fauna (cetaceans, turtles, etc)	Impacts on the fishing sector catch rates (tuna pole and large pelagic longline.	Cultural heritage impact of drilling block
		Routine discharges to sea (e.g. deck and machinery space drainage, sewage and galley wastes) and local reduction in water quality		Physiological effect on marine fauna		
				Increased food source for marine fauna		
				Fish aggregation and increased predator - prey interactions		
	Lighting from drill unit	Light emissions in marine environment		Disorientation and mortality of seabirds		
				Attraction of plankton and increased risk to fish, turtles and cetaceans		

Activity Phase	Ancillary Activity	Aspect	Geo-physical (geology, topography, air, water)	Biological	Socio-Economic	Heritage and Cultural
	Operation of helicopters	Increase in ambient noise levels		Disturbance of coastal and marine fauna in sensitive and protected areas		
				Faunal avoidance of key breeding areas (e.g. coastal birds and cetaceans)		
				Abandonment of nests (birds) and young (birds and seals)		
	Well drilling (including ROV site selection, installation of conductor pipes; well head, BOP and riser system, well logging, and plugging)	Disturbance of sediment due to equipment installation	Disturbance of seabed and benthos			
		Increased underwater noise levels		Disturbance / behavioural changes to marine fauna		
	Discharge of cuttings and drilling fluid, and residual cement	Accumulation of cuttings and cement on seafloor and sediment disturbance		Smothering disturbance and mortality of benthic biota Toxicity and bioaccumulation or other physiological effects on marine fauna		

Activity Phase	Ancillary Activity	Aspect	Geo-physical (geology, topography, air, water)	Biological	Socio-Economic	Heritage and Cultural
				Reduced physiological functioning of marine organisms		
		Sediment plume and water column disturbance		Increased water turbidity, reduced light penetration and physiological effects on marine fauna		
	Discharge of cuttings and drilling fluid, and residual cement	Accumulation of cuttings and cement on seafloor and sediment disturbance		Smothering disturbance and mortality of benthic biota Toxicity and bioaccumulation or other physiological effects on marine fauna Reduced physiological functioning of marine organisms		
		Sediment plume and water column disturbance		Increased water turbidity, reduced light penetration and physiological effects on marine fauna		
	Well (flow) testing	Flaring of gas and liquid hydrocarbons	Air quality and Climate change impacts	Disturbance, disorientation and mortality of marine faunal due to flare lighting		

Activity Phase	Ancillary Activity	Aspect	Geo-physical (geology, topography, air, water)	Biological	Socio-Economic	Heritage and Cultural
				Effect on faunal health (toxic effects) due to hydrocarbon 'drop-out' during flaring		
		Discharge of treated produced water		Effect on marine biota health (e.g. physiological injury) or mortality (e.g. suffocation and poisoning)		
Demobilisation phase	Abandonment of well	Increased hard substrate on seafloor		Increased and modification of benthic biodiversity and biomass		
	Demobilisation of drilling unit and support vessels from drill site	Increased underwater noise levels during transit		Disturbance to marine fauna		
		Routine discharges to sea (e.g. deck and machinery space drainage, sewage and galley wastes) and local reduction in water quality during transit		Physiological effect on marine fauna Increased food source for marine fauna Increased predator - prey interactions		
		Light emissions in marine environment		Disorientation of seabirds		
Unplanned Activities	Faunal strike	Collision with marine fauna		Oiling of coastal habitats		Unplanned events cultural heritage impacts

Activity Phase	Ancillary Activity	Aspect	Geo-physical (geology, topography, air, water)	Biological	Socio-Economic	Heritage and Cultural
	Accidental hydrocarbon spills / releases (minor) (e.g. vessel accident)	Loss of hydrocarbons to sea		Effect on faunal health (e.g. respiratory damage) or mortality (e.g. suffocation and poisoning)		
	Dropped objects / Lost equipment	Increased hard substrate on seafloor on seafloor or obstruction in water column		Physical damage to and mortality of benthic species / habitats		
	Loss of well control / well blow-out	Uncontrolled release of oil / gas from well		Effect on health of marine fauna (e.g. respiratory damage) or mortality (e.g. suffocation and poisoning)		
				Physiological effect on marine fauna		

9.3 DESCRIPTION AND PRELIMINARY ASSESSMENT OF IMPACTS

The following potential impacts were identified during the scoping phase assessment and were assessed in terms of nature, significance, consequence, extent, duration and probability. These preliminary impact calculations will be subject to amendment based on the EIA phase assessment and the results of public consultation undertaken during the Scoping as well as EIA phases. Table 40 provides a description of each impact with and an indication of which impacts are to be assessed in greater detail in the EIA phase assessment.

Table 40: Preliminary impact assessment.

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
1	Routine Operational Discharges to Sea	Operation	Very Low (Negative)	Very Low (Negative)	The routine liquid and solid discharges to sea could create local reductions in water quality, both during transit to and within the Area of Interest for drilling. Deck and machinery space drainage may result in small volumes of oils, detergents, lubricants and grease, the toxicity of which varies depending on their composition, being introduced into the marine environment. Sewage and galley waste will place a small organic and bacterial loading on the marine environment, resulting in an increased biological oxygen demand. These discharges will result in a local reduction in water quality, which could impact marine fauna (indirect impact) in a number of different ways: • Physiological effects: Ingestion of hydrocarbons, detergents and other waste could have adverse effects on marine fauna, which could ultimately result in mortality. • Increased food source: The discharge of galley waste and sewage will result in an additional food source for opportunistic feeders, speciality pelagic fish species. • Increased predator - prey interactions: Predatory species, such as sharks and pelagic seabirds, may be attracted to the aggregation of pelagic fish attracted by the increased food source.	Yes
2	Discharge of Ballast Water from Vessels	Operation	Very Low (Negative)	Negligible (Negative)	Artificial structures deployed at sea serve as a substrate for a wide variety of larvae, cysts, eggs and adult marine organisms. The transportation of vessels and equipment from other regions would therefore facilitate the transfer of the associated marine organisms. Similarly, depending on where the ballast water is loaded, it may contain larvae, cysts, eggs and adult marine organisms from other regions. Thus, ballasting and de-ballasting of these vessels / drilling unit may lead to the introduction of exotic species and harmful aquatic pathogens to the marine ecosystems (Bax et al. 2003). This would be an indirect, negative impact.	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					The marine invertebrates that colonize the surface of vessels or those in discharged ballast water can easily be introduced to a new region, where they may become invasive by outcompeting and displacing native species. Marine invasive species are considered primary drivers of ecological change in that they create and modify habitat, consume and outcompete native fauna, act as disease agents or vectors, and threaten biodiversity and ecosystem function (indirect negative impact). Once established, an invasive species is likely to remain in perpetuity.	
3	Noise from Helicopters	Operation	Low (Negative)	Low (Negative)	Elevated aerial noise levels from helicopters may disturb faunal species resulting in behavioural changes or displacement from important feeding or breeding areas (direct negative impact).	Yes
4	Lighting from Drill Unit and Vessels	Operation	Very Low (Negative)	Very Low (Negative)	The strong operational lighting used to illuminate the project vessels and especially the drill rig at night increase ambient lighting in offshore areas. Increased ambient lighting may disturb and disorientate pelagic seabirds feeding in the area (direct negative impact). Operational lights may also result in physiological and behavioural effects of fish and cephalopods (direct negative impact), as these may be drawn to the lights at night where they may be more easily preyed upon by other fish and seabirds.	Yes
5	Drilling and Placement of Infrastructure on the Seafloor	Operation and Demobilisation	Negligible (Negative)	Negligible (Negative)	Any benthic biota in the footprint of the ROV skids or equipment lost to the seabed, would either be disturbed or crushed (ROV, lost equipment) or would be completely eliminated (drilling, installation of casing, wellhead and over trawlable cap) (direct negative impact). Drilling of exploration wells in the Area of Interest in the AOI would result in the direct physical disturbance and removal of sediments, with potential changes in sediment characteristics and condition. Casing of the hole and installation of the wellhead may further disturb or crush benthic biota present on the seabed and in the sediments. Physical disturbance of the seabed, through the resuspension of sediments by ROV thrusters may also occur during ROV surveys, resulting in increased turbidity near the seabed, potentially with	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					physiological effects on benthic communities (indirect negative impact). Disturbance of seabed sediments during pre-drilling ROV surveys could potentially increase turbidity of the near-bottom water layers thereby placing transient stress on sessile and mobile benthic organisms, by negatively affecting filter-feeding efficiency of suspension feeders or through disorientation of mobile species due to reduced visibility.	
6	Disturbance and/or Smothering of soft-sediment benthic communities due to drilling solids discharge	Operation	Low (Negative)	Low (Negative)	The discharge of cuttings and WBM onto the seabed from the top-hole section of the well and the discharge of treated cuttings with NADF from the drill rig during the risered drilling stage would have both direct and indirect effects on benthic communities in the vicinity of the wellhead and within the fall-out footprint of the cuttings plume discharged from the drill rig. The cuttings and WBMs from the top-hole sections of the well are discharged onto the seafloor at the wellbore where they would accumulate in a conical cuttings pile around the wellbore thereby smothering or crushing invertebrate benthic communities living on the seabed or within the sediments (direct negative impact). Cuttings and associated NADF drilling muds discharged from the drill rig would disperse and settle over a wider area around the wellhead resulting in changes in sediment structure and community composition within the fall-out footprint of the cuttings plume. The discharge of residual cement during cementing of the first string (surface casing) and plugging of the well on demobilisation would result in accumulation of cement on the seabed and on the cuttings pile, respectively. Any benthic biota present on the seabed may potentially be smothered (direct impact) by the residual cement or suffer indirect toxicity and bioaccumulation effects due to leaching of potentially toxic cement additives.	Yes
7	Disturbance and/or Smothering of hardgrounds / deep-water reef communities due to drilling solids discharge	Operation	High (Negative)	Medium (Negative)		Yes
8	Biochemical Impacts of residual WBMs, NADFs and cements additives	Operation	Low (Negative)	Negligible (Negative)	Cement: Various chemical additives are used in the cementing programme to control its properties, including setting retarders and	Yes

<table>
<tr><th>#</th><th>Preliminary Impact</th><th>Phase</th><th>Pre-mitigation Environmental Risk</th><th>Post-mitigation Environmental Risk</th><th>Description</th><th>Further Assessment</th></tr>
<tr><td></td><td>on marine organisms in unconsolidated sediments</td><td></td><td></td><td></td><td rowspan="3">accelerators, surfactants, stabilisers and defoamers. The formulations are adapted to meet the requirements of a particular well. Their concentrations, however, typically make up <10% of the overall cement used. There is potential for the leaching of the additives into the surrounding water column, where they would potentially have toxic effects on benthic communities, or the potential for bioaccumulation.

Drilling fluids and cuttings: Discharged solids will be limited to around the well bore/ blow-out preventer (BOP). Drilling fluids are proposed to be recirculated and, therefore, will only be diluted and discharged at the well end. Should oil-based mud be used, the whole fluid and solid system will be contained. The cuttings and fluids will be moved onshore for treatment and safe disposal.

The disposal of cuttings and muds at the wellbore and from the drilling unit would have various direct and indirect biochemical effects on the receiving environment (seabed sediments and water column). The direct effects are associated with the contaminants contained in the drilling muds used during drilling operations (direct negative impact). The indirect effects result from changes to water and sediment quality. Although the cuttings themselves are generally considered to be relatively inert, the drilling muds are a specially formulated mixture of natural clays, polymers, weighting agents and/or other materials suspended in a fluid medium. The constituents and additives of the discharged muds may potentially have ecotoxicological effects on the water column and sediments. The effects may be of significance in terms of:
• Chronic accumulation of persistent contaminants in the marine environment;
• Acute or chronic effects on biota, including effects on productivity; and
• Acute or chronic effects on other biota (i.e. indirect effects on biodiversity).</td><td></td></tr>
<tr><td>9</td><td>Biochemical Impacts of residual WBMs, NADFs and cements additives on marine organisms on hard grounds</td><td>Operation</td><td>High (Negative)</td><td>Medium (Negative)</td><td rowspan="2">Yes</td></tr>
<tr><td>10</td><td>Biochemical Impacts of residual WBMs, NADFs and cements additives on marine organisms in the water column</td><td>Operation</td><td>Negligible (Negative)</td><td>Negligible (Negative)</td></tr>
</table>

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
11	Increased Water Turbidity and reduced Light Penetration on marine ecology	Operation	Negligible (Negative)	Negligible (Negative)	Cuttings discharged from the drill rig would lead in increased water turbidity and reduced light penetration resulting in both direct and indirect effects on primary producers (phytoplankton) in surface waters, and direct effects on pelagic fish and invertebrate communities in the water column. The heavier cuttings and particles discharged at the seabed or from the drilling unit would settle near the wellbore where a localised smothering effect can be expected. The finer components of the surface discharge generate a plume in the upper water column, which is dispersed away from the drilling unit by prevailing currents, diluting rapidly to background levels at increasing distances from the drill unit. The finer components of discharges on the seabed would generate a plume near the seabed, which would persist for longer due to weaker bottom currents. Increased turbidity near the surface may limit light penetration thereby negatively affecting primary productivity of phytoplankton communities (indirect negative impact). In contrast, increased turbidity near the seabed may have direct physiological effects on filter-feeding organisms and/or indirect effects on predation success of demersal species.	
12	Reduced physiological functioning of marine organisms due to indirect biochemical effects in the sediments	Operation	Low (Negative)	Negligible (Negative)	An indirect impact associated with cuttings disposal is the potential development of hypoxic conditions in the near-surface sediment layers through bacterial decomposition of organic matter (indirect negative impact). Generally speaking, biodegradable organic matter in cuttings piles often has a greater effect on the structure and function of benthic communities than sediment texture, deposition rate or, in some cases, chemical toxicity (Hartley et al. 2003). Bacterial decomposition of organic matter may deplete oxygen in the near-surface sediment layers, thereby changing the chemical properties of the sediments by generating potentially toxic concentrations of sulphide and ammonia (Wang & Chapman 1999; Gray et al. 2002; Wu 2002). The rapid biodegradation of drilling solids (particularly those containing NADFs) may therefore lead indirectly yet rapidly to sediment toxicity, particularly in fine-grained sediments (Munro et al. 1998; Jensen et al. 1999; Trannum et al. 2010). Organically enriched sediments are often hypoxic or	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					anoxic, and consequently harbour markedly different benthic communities to oxygenated sediments (Pearson & Rosenberg 1978; Gray et al. 2002; Tait et al. 2016). Organic matter concentration in the sediments would decrease in response to microbial degradation, resulting in increases in oxygen concentration in the surface-sediment layers leading to succession in the benthic community structure toward a more stable state. Such biochemical effects in the sediments can have substantial effects on the structure and function of benthic communities.	
13	Disturbance, behavioural changes and avoidance of feeding and/or breeding areas in seabirds, seals, turtles and cetaceans due to drilling and vessel noise (continuous noise)	Mobilisation, Operation and Decommissioning	Very Low (Negative)	Very Low (Negative)	The cumulative impact of increased background anthropogenic noise levels in the marine environment is an ongoing and widespread issue of concern (Koper & Plön 2012). The sound level generated by drilling operations fall within the 120-190 dB re 1 µPa range at the drilling unit, with main frequencies less than 0.2 kHz. For the current project, noise would be generated by a number of sources (e.g. heavy lift vessel, drill ship in transit and operational, semi-submersible drill rig, support vessels and drill ship maintenance) with the noise levels ranging from 197 – 200 dB re 1 µPa @ 1m depending on the drill unit and support vessels used. The noise generated by vessels and well-drilling operations in general, therefore falls within the hearing range of most fish and marine mammals, and would be audible for considerable ranges before attenuating to below threshold levels. The operating frequencies of the single beam and multi-beam sonar falls into the high frequency kHz range, and is thus beyond the low frequency hearing ranges of fish species and sea turtles (from below 100 Hz to up to a few kHz). The high frequency active sonar sources, however, have energy profiles that clearly overlap with cetacean's hearing sensitivity frequency range, particularly for cetaceans of High Frequency and Very High Frequency hearing groups, and would be audible for considerable distances (in the order of tens of km) before attenuating to below threshold levels. The noise emissions from the MBES sources are highly directional, spreading as a fan from the sound source, predominantly in a cross-track direction. The noise impact would therefore be highly	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					localised for the majority of marine mammal species. The sonar survey area is expected extend over an area of approximately 50 km^2 (approximately 7 km X 7 km) over a period of approximately 15 days. Elevated noise levels could impact marine fauna by: • Causing direct physical injury to hearing or other organs (direct negative impact), including permanent (PTS) or temporary threshold shifts (TTS); • Masking or interfering with other biologically important sounds (e.g. communication, echolocation, signals and sounds produced by predators or prey) (indirect negative impact); and • Causing disturbance to the receptor resulting in behavioural changes or displacement from important feeding or breeding areas (direct negative impact).	
14	Impacts of infrastructure and residual cement on marine biodiversity	Construction	Negligible (Negative)	Negligible (Negative)	Placement of the wellheads on the seabed and subsequent removal/ abandonment provide islands of hard substrata in an otherwise uniform area of unconsolidated sediments. The availability of hard substrata on the seabed provides opportunity for colonisation by sessile benthic organisms and provides shelter for demersal fish and mobile invertebrates thereby potentially increasing the benthic biodiversity and biomass in the continental slope region. Although the impact is direct, it can be considered neutral.	Yes
15	Impacts of flare lighting on marine fauna	Operation	Very Low (Negative)	Very Low (Negative)	Flaring during well testing produces a flame of intense light and heat at the drill unit. Increased ambient lighting may disturb and disorientate pelagic seabirds feeding in the area (direct negative impact). This increase lighting may also result in indirect physiological and behavioural effects on fish and cephalopods, as these maybe drawn to the lights at night where they maybe more easily preyed upon by other fish and seabirds (indirect negative impact).	Yes
16	Impact on marine fauna from the discharge of treated produced water	Operation	Very Low (Negative)	Very Low (Negative)		Yes
17	Impact on marine fauna from hydrocarbon ‘drop-out’	Operation	Very Low (Negative)	Very Low (Negative)		Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					If water flows during well testing, the hydrocarbon component will be separated and piped to a flare boom where it would be incinerated, while the water will be treated and possibly discharged. This product water contains hydrocarbons, which if released overboard without treatment would have toxic effects on marine fauna (indirect negative impact). Inefficient combustion of hydrocarbons can result in the release of unburnt hydrocarbons, which 'drop-out' onto the sea surface and may form a visible slick of oil (indirect negative impact).	
18	Unplanned Collision of Vessels with Marine Fauna	Operation	Low (Negative)	Low (Negative)	The potential effects of vessel presence on marine fauna (especially turtles and cetaceans) include physiological injury or mortality due to the drill rig or support vessels colliding with animals basking or resting at the sea surface (direct negative impact).	Yes
19	Unplanned Loss of Equipment	Operation	Negligible (Negative)	Negligible (Negative)	The potential impacts associated with lost equipment include (direct negative impact): • Potential disturbance and damage to seabed habitats and associated fauna within the equipment footprint. • Potential physiological injury or mortality to pelagic and neritic marine fauna due to collision or entanglement in equipment drifting on the surface or in the water column. • The accidental loss of equipment onto the seafloor would provide a localised area of hard substrate for colonisation by benthic organisms.	Yes
20	Unplanned Oil release to the sea due to vessel collisions, bunkering accident and line / pipe rupture	Operation	Medium (Negative) (nearshore)	Low (Negative) (near- and offshore)	Marine diesel spilled in the marine environment would have an immediate detrimental effect on water quality, with the toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) of marine fauna or affecting faunal health (e.g. respiratory damage) (direct negative impact). Sub-lethal and long-term effects can include disruption of physiological and behavioural mechanisms, reduced tolerance to stress and incorporation of	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					carcinogens into the food chain. If the spill reaches the coast, it can result in the smothering of sensitive coastal habitats.	
21	Unplanned Well Blow-out	Operation	Very High (Negative)	Very High (Negative)	Oil spilled in the marine environment would have an immediate detrimental effect on water quality, with the toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) of marine fauna or affecting faunal health (e.g. respiratory damage). If the spill reaches the coast, it can result in the smothering of sensitive coastal habitats.	Yes
22	Social unrest and community conflict	Planning and Operation	Medium (Negative)	Medium (Negative)	Social unrest and community conflict due to dissatisfaction with or anger about project. The coastal communities are strongly opposed to any activities in the ocean that they perceive as a threat to their livelihoods, which mostly consist of small-scale fishing. The unrest could be directed against the applicant, but also against fellow community members that hold different views on the desirability of the project.	Yes
23	Negative perceptions	Planning and Operation	Medium (Negative)	Medium (Negative)	Negative perceptions regarding the use of fossil fuels and the impact thereof on climate change.	Yes
24	Uncertainty	Planning and Operation	Medium (Negative)	Medium (Negative)	Uncertainty among community members about the impact of the project on their livelihoods and perceived impacts on livelihoods. Communities making their livelihoods from the sea suspect that project activities might impact their livelihoods, but they are not sure to what extent. The necessary scientific data that could address their concerns are not currently available.	Yes
25	Further marginalisation of vulnerable groups	Planning and Operation	Medium (Negative)	Medium (Negative)	Further marginalisation of vulnerable groups. Many members of the fishing communities are indigenous people but have been excluded by the Government from activities such as land restitution. Being marginalized means they might be easily overlooked by corporate groups or businesses unfamiliar with the local history by excluding them from meaningful consultation.	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
26	Concerns about cumulative impacts on their livelihoods and sense and spirit of place	Planning and Operation	Medium (Negative)	Medium (Negative)	Concerns about cumulative impacts on their livelihoods and sense and spirit of place. The impact of one project might not be that big, but there are a number of projects in sea where the communities fish that relate to drilling, exploration, or seismic surveying.	Yes
27	Concerns about industrial accidents	Planning and Operation	Medium (Negative)	Medium (Negative)	Concerns about industrial accidents like oil spills. Communities are concerned about how this will affect the environment that is responsible for their livelihoods, as well as the impact on coastal tourism.	Yes
28	Impacts on sense and spirit of place	Planning and Operation	Medium (Negative)	Medium (Negative)	Impacts on sense and spirit of place. For the fishing communities the ocean is part of their heritage, therefore anything that is perceived as potentially harmful to the ocean would also cause harm to them and be a threat to their traditional way of life.	Yes
29	Impacts on social license to operate	Planning and Operation	Medium (Negative)	Medium (Negative)	Impacts on social license to operate. Oil and gas companies do not currently have social license to operate in the coastal communities, and a definite effort would be required to gain social license to operate. This is not something that will happen overnight, but it will take time. Not having social license to operate can lead to delays and increased costs for the project.	Yes
30	Stakeholder fatigue and disillusionment	Planning and Operation	Medium (Negative)	Medium (Negative)	Stakeholder fatigue and disillusionment due to past experiences with similar projects. Many stakeholder initiatives took place in the past as there were a number of applications for seismic surveying, exploration and mining in the area that the stakeholders were invited to.	Yes
31	Community expectations regarding perceived benefits of projects	Planning and Operation	Medium (Negative)	Medium (Negative)	Community expectations regarding perceived benefits of projects. Not everyone in the fishing communities is opposed to oil and gas exploration. Their perceptions are that the ability to make a living from the sea is already declining. It is a hard live and they want a better life for their children. Their expectations are that the oil and gas companies will invest in these communities and assist them	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					with creating alternative livelihoods and obtaining the necessary skills and experience in that regard.	
32	Potential influx of people	Planning and Operation	Medium (Negative)	Medium (Negative)	Potential influx of people. The project may attract opportunistic work seekers in some areas, especially if there is a harbour. This will put additional pressure on service delivery and resources. An influx of people is often associated with an increase of crime in the area.	Yes
33	Gender impacts	Planning and Operation	Medium (Negative)	Medium (Negative)	Gender impacts as women may receive less opportunities or lose some of their existing opportunities.	Yes
34	Economic benefits	Planning and Operation	Medium (Negative)	Medium (Negative)	Economic benefits on a national level.	Yes
35	Diversification of economic activities	Planning and Operation	Medium (Negative)	Medium (Negative)	Diversification of economic activities. The economy in the coastal towns are not currently very diverse, making them very vulnerable to changes in economic activities.	Yes
36	Impacts on mental health	Planning and Operation	Medium (Negative)	Medium (Negative)	Impacts on mental health. Continued concerns about their livelihoods is a great source of stress for community members, and some has already started to experience psycho-social distress or mental health issues.	Yes
37	Job Creation	Planning	Low (Positive)	Low (Positive)	A small amount of skilled employment will be created during the planning and operational phases related to the planning of the survey, and related exploration activities.	No further impact assessment required in the EIA phase. Mitigation measures to be included in the EMPr.
		Operation	Low (Positive)	Low (Positive)		
		Operation	Low (Negative)	Low (Negative)		
38	Disturbance of Potential Heritage Features	Operation	Low (Negative)	Low (Negative)	The potential exists for the operations to discover previously unknown heritage features. Any object or site as defined in Section	No further impact

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					3 of the NHRA is considered a heritage resource and if discovered as part of this project, must be reported to SAHRA. It is unlikely that any such features will be located within the proposed project area and the impact is therefore considered to have a low overall significance.	assessment required in the EIA phase. Mitigation measures to be included in the EMPr.
39	Cultural heritage impact of drilling	Operation	High (Negative)	Medium (Negative)	Any impact on the integrity of the coastal and marine ecosystem through disturbance, pollution, noise, etc. could impact various aspects which makes up people's intangible cultural heritage (indirect negative impact). Groups may also contest the importance of specific cultural heritages. Because of South Africa's cultural diversity there are a diversity of beliefs and religious symbolism associated with the coast. The right to culture and to cultural expression is also enshrined in the South African Constitution. Therefore, TH and ICH should be jointly and widely considered when analysing the significance of cultural heritage in a coastal context. A further consideration is that cultural heritage conservation and management occurs in a dynamic socioeconomic context, where there are competing needs, such as the need for socioeconomic growth and sustainability. These needs should be considered together.	Yes
40	Interference with Existing Uses	Planning	Low (Negative)	Very Low (Negative)	Drilling activities can result in localised interference with existing uses. The extent of the disturbance depends on the timing and duration of the activities and the number of vehicles involved. This impact will have a low overall significance as long as the mitigation measures are implemented. The survey activities have the potential to affect marine transport routes and other mining, exploration and production activities. Due to the distance from the coast and the fact that there are few other mineral right areas in the vicinity of the survey area that may be affected, this impact has a low final significance.	Yes
		Operation	Low (Negative)	Very Low (Negative)		

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
41	Impacts on the fishing sector catch rates (tuna pole and large pelagic longline.	Operation	Low (Negative)	Low (Negative)	For most fisheries sectors, the effects of acoustic disturbance on catch rates would be considered to be of overall negligible significance. However, in the case of the Tuna Pole Fishery and large pelagic longline, the spread of sound into fishing grounds may affect catch rates and therefore the overall significance of the survey impact on these sectors has been assessed to be low.	Yes
42	Exclusion from Fishing Ground Due to Temporary Safety Zone around Vessels	Operation	Low (Negative)	Low (Negative)	Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), an exploration drilling 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 seismic contractor would request a safe operational limit (that is greater than the 500 m safety zone) that it would like other vessels to stay beyond.	Yes
43	Atmospheric Emissions	Operation	Low (Negative)	Low (Negative)	Emissions to the atmosphere during the exploration drilling may include exhaust gases from the combustion of diesel in generators and motors as well as from the burning of wastes, as well as the venting and flaring of well testing Diesel exhaust comprises mainly of carbon dioxide (CO_2) and several toxic gases including nitrogen oxides (NO_x), sulphur oxides (SO_x), and carbon monoxide (CO). Diesel combustion can also result in hydrocarbons, smoke, and particulate matter by-products. Incineration of waste on board the survey vessel will result in the release of particulate matter, smoke, CO, CO2, and dioxins (depending on the composition of the waste). However, many vessels do not have an on board incinerator. In such cases all solid waste must be stored on board for later disposal onshore.	Yes

#	Preliminary Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Further Assessment
					The atmospheric emissions from the support vessels are expected to be similar to those from diesel-powered vessels of comparable tonnage (approximately 3 000 tonnes), with the addition of the emissions from the airgun compressors. The volume of solid waste incinerated on board, and hence also the volume of atmospheric emissions, would be minimal and incineration must comply with the relevant MARPOL 73/78 standards.	

9.4 CUMULATIVE IMPACTS

Cumulative effects are the combined potential impacts from different actions that result in a significant change larger than the sum of all the impacts. Consideration of 'cumulative impact' should include "past, present and reasonably foreseeable future developments or impacts". This requires a holistic view, interpretation and analysis of the biophysical, social and economic systems (DEAT 2004).

Cumulative impact assessment is limited and constrained by the method used for identifying and analysing cumulative effects. As it is not practical to analyse the cumulative effects of an action on every environmental receptor, the list of environmental effects being considered to inform decision makes and stakeholders should focus on those that can be meaningfully (DEAT 2004).

The individual and population level consequences of other exploration activities or multiple smaller and more localised stressors (see for example Booth *et al*. 2020; Derous *et al*. 2020) are difficult to assess. A significant adverse residual environmental effect is considered one that affects marine biota by causing a decline in abundance or change in distribution of a population(s) over more than one generation within an area. Natural recruitment may not re-establish the population(s) to its original level within several generations or avoidance of the area becomes permanent. For example, despite the density of exploration drilling coverage off the southern African West Coast over the past 17 years, the southern right whale population is reported to be increasing by 6.5% per year (Brandaõ *et al*. 2017), and the humpback whale by at least 5% per annum (IWC 2012;) over a time when seismic surveying frequency has increased, suggesting that, for these population at least, there is no evidence of long-term negative change to population size as a direct result of exploration activities.

Reactions to sound or other anthropogenic disturbances by marine fauna depend on a multitude of factors including species, state of maturity, experience, current activity, reproductive state, time of day (Wartzok *et al*. 2004; Southall *et al*. 2007). If a marine animal does react briefly to a disturbance by changing its behaviour or moving a small distance, the impacts of the change are unlikely to be significant to the individual, l*et al*one the population as a whole (NRC 2005). However, if a disturbance displaces a species from an important feeding or breeding area for a prolonged period, impacts at the population level could be significant. The increasing numbers of southern right and humpback whales around the Southern African coast, and their lingering on West Coast feeding grounds long into the summer, suggest that acoustic surveys and exploration activities conducted over the past 17 years have not negatively influenced the distribution patterns of these two migratory species at least. Information on the population trends of resident species of baleen and toothed whales is unfortunately lacking, and the potential effects of seismic noise on such populations remains unknown.

While it is foreseeable that further exploration (seismic and well-drilling) and future production activities could arise if the current application is granted, there is not currently sufficient information available to make reasonable assertions as to nature of such future activities. This is primarily due to the current lack of relevant geological and resource potential information, which the proposed exploration process aims to address. While there are many other rights holders in the offshore environment (e.g. marine diamonds and gemstones, heavy minerals, precious metals and ferrous and base metals), most of these are located well inshore of Block 3B/4B and are not undertaking any exploration activities at present or would be concurrently with the proposed AOSAC exploration drilling campaign. A possible exception is further proposed exploration well drilling in PEL39, in Namibia.

Thus, the possible range of the future prospecting, mining, exploration and production activities that could arise will vary significantly in scope, location, extent, and duration depending on whether a resource(s) is discovered, its size, properties and location, etc. As these cannot at this stage be reasonably defined, it is not possible to undertake a reliable assessment of the potential cumulative environmental impacts. It is also possible that the proposed, or future, exploration fails to identify an economic petroleum resource, in which case the potential impacts associated with the production phase would not be realised.

Furthermore, the assessment methodology used in the EIA by its nature already considers past and current activities and impacts. In particular, when rating the sensitivity of the receptors, the status of the receiving environment (benthic ecosystem threat status, protection level, protected areas, etc.) or threat status of individual species is taken into consideration, which is based to some degree on past and current actions and impacts (e.g. the IUCN conservation rating is determined based on criteria such as population size and rate of decline, area of geographic range / distribution, and degree of population and distribution fragmentation. Thus, past and existing offshore activities (including shipping, prospecting, mining, exploration, production, commercial fishing, etc.) have been taken into account in the assessment of potential impacts related to the proposed project.

The primary impacts associated with the drilling of exploration wells (normal drilling operations) in the Southeast Atlantic Deep Ocean Biozone, relate to physical disturbance of the seabed, discharges of drilling solids to the benthic environment, the presence of infrastructure remaining on the seabed and associated vessels and drill unit. Other marine exploration and mining activities off the West Coast are all located well inshore of the AOI, but various existing and proposed subsea fibreoptics cables pass through the block. Cumulative impacts on benthic ecosystems in Block 3B/4B are therefore expected to be minimal.

9.4.1 CUTTINGS DISCHARGE AND SEDIMENT PLUME

With respect to physical disturbance impacts, the existing cumulative impacts to the benthic environment include the development of hydrocarbon wells (see Section 4.3.4). Since 1976 approximately 40 wells have been drilled in the Southern Benguela Ecoregion. The majority of these occur in the iBhubesi Gas field in Block 2A inshore of Block 3B/4B (Eco Atlantic recently completed the drilling of the Gazania-1 well in Block 2B which was spudded on 10 October 2022). Prior to 1983, technology was not available to remove wellheads from the seafloor, thus of the approximately 40 wells drilled on the West Coast, 35 wellheads remain on the seabed. Assuming a conservative estimate of 2.64 km^2 of cumulative seabed affected per well (based on the footprint calculated for a single well, TEEPSA, pers. comm.), the total cumulative area impacted by the installation and cuttings fall-out of 40 petroleum exploration wells on the West Coast is estimated at 105.6 km^2.

In southern Namibia, oil and gas exploration and production activities have focused on the Kudu gas field, which lies inshore and to the north of Block 3B/4B. In the order of 32 wells have been drilled in the Namibian offshore environment to date, the majority of which have been drilled off southern Namibia, most of these in less than 300 m water depth. A further 2 wells have recently been drilled in Block 2913B, with a further two wells in PEL39, with a further two wells planned for PEL39 in the third quarter of 2023. Prior to 1983, technology was not available to remove wellheads from the seafloor, and most of the wells drilled off Namibia remain with wellhead on the seabed. Despite the number of wells drilled in the West Coast offshore environment, there is no evidence of long-term negative change (cumulative impacts) to faunal population sizes or irreparable harm as a direct result of these exploration drilling activities. In fact Atkinson (2009) reported that in South Africa, abandoned wellheads in the vicinity demersal trawling grounds provide some de facto “protection” to marine infaunal, epifaunal and fish assemblages (see also Wilkinson & Japp 2005). Assuming a conservative estimate of 2.64 km^2 of cumulative seabed affected per well, the total cumulative area impacted by the installation and cuttings fall-out of 32 petroleum exploration wells off southern Namibia is estimated at 84.5 km^2.

In reality the total cumulative impacted area at any one time is considerably less, due to the natural dispersion and recovery of benthic communities over the short to medium (shallow waters) and long term (deeper waters). Furthermore, as the AOI for drilling and the associated depositional footprints will avoid MPAs and EBSAs, impacts will affect mostly communities in unconsolidated habitats, which are less sensitive to disturbance and recover more quickly than those inhabiting hard grounds. In addition, AOSAC will actively avoid and reduce potential impacts on sensitive and potentially vulnerable habitats by ensuring that wells are > 1 000 m from such habitats (using ROV survey prior to drilling). Cumulative impacts are therefore less likely.

The development of the proposed exploration well(s) in this assessment would generate a risk plume of cuttings and drilling muds in the water column. The maximum instantaneous risk would correspond to a footprint in the water column that would impact a maximum cumulative volume of 0.146 km3 for a maximum duration of 14 days, which can be considered an insignificant percentage of the ecoregion as a whole.

There is no current development or production from the South African West Coast offshore. The Ibhubesi Gas Field (Block 2A) (approved production right) and Kudu Gas Field (off southern Namibia) have been identified for development. Cumulative impacts from other hydrocarbon ventures in the area are thus likely to increase in future. Other activities that may have contributed to cumulative impacts to the benthic environment in the licence area include limited historical deep water trawling along the shelf edge in the inshore portions of the licence block.

9.4.2 UNDERWATER NOISE

Noise associated with the proposed exploration programme would also have cumulative impact on marine fauna. Due to the licence area being located within the main vessel traffic routes that pass around southern Africa, ambient noise levels are naturally elevated. Sensitive receptors and faunal species (cetaceans, turtles and certain fish) are unlikely to be significantly additionally affected as faunal behaviour will not be affected beyond 34 km during drilling. Noise levels would return back to ambient after drilling is complete.

Data on behavioural reactions to noise and drill rig presence acquired over the short-term could, however, easily be misinterpreted as being less significant than the cumulative effects over the long-term and with multiple exposures, i.e. what is initially interpreted as an impact not having a detrimental effect and thus being of low significance, may turn out to result in a long-term decline in the population, particularly when combined with other acoustic and non-acoustic stressors (e.g. temperature, competition for food, climate change, shipping noise) (Przeslawski *et al*. 2015; Erbe *et al*. 2018, 2019; Booth *et al*. 2020; Derous *et al*. 2020). Physiological stress, for example, may not be easily detectable in marine fauna, but can affect reproduction, immune systems, growth, health, and other important life functions (Rolland *et al*. 2012; Lemos *et al*. 2021). Confounding effects are, however, difficult to separate from those due to exploration drilling.

Despite the density of seismic survey coverage over the past years off the South African West Coast, the number of Southern right and Humpback whales around the southern African coast have increased, suggesting that, for these species at least, there is no evidence of long-term negative change to population size or irreparable harm as a direct result of seismic survey activities. Although surveys have revealed a steady population increase since the protection of the species from commercial whaling, more recent results, however, indicate changes in the prevalence of southern rights on the South African breeding ground, including a marked decline of unaccompanied adults since 2010 and extreme fluctuations in the number of cow-calf pairs since 2015. Vermeulen *et al*. 2020, however, contribute the change in demographics to likely spatial and/or temporal displacement of prey due to climate variability, and not seismic surveys. To date no trophic cascades off the South African coast have been documented despite the completion of a number of seismic surveys having been completed.

There are a number of current reconnaissance permit applications for proposed seismic surveys off the northern West Coast of South Africa (as of December 2022), and within the Deep Water Orange Basin, although it is unlikely that all these will be undertaken as they are targeting a similar area.

9.4.3 VESSEL LIGHTING AND OPERATIONAL DISCHARGES

There are numerous light sources and operational discharges from vessels operating within and transiting through the area, although each is isolated in space and most are mobile. Given the extent of the ocean and the point source nature of the lighting, the prevalence of sensitive receptors and faunal species interactions with the light sources is expected to be very low. Light levels would return back to ambient once operations are completed. Each of the vessels (fishing, shipping, exploration) operating within the area will make routine discharges to the ocean, each with potential to cause a local reduction in water quality, which could impact marine fauna. However, each point source is isolated in time and widely distributed within the very large extent of the open ocean. At levels compliant with MARPOL conventions no detectable cumulative effects are anticipated.

10 PLAN OF STUDY FOR ENVIRONMENTAL IMPACT ASSESSMENT

The section below outlines the proposed plan of study which will be conducted for the various environmental aspects during the EIA Phase. It is also important to note that the plan of study will also be guided by comment obtained from I&AP's and other stakeholders during the initial and scoping phase PPP.

10.1 DESCRIPTION OF ALTERNATIVES TO BE CONSIDERED IN EIA PHASE

As per the description in Section 6 above, no location alternatives are applicable to the project. The layout alternative of avoiding the CBAs identified within the AOI will be further assessed in the EIA phase. The activities proposed in this application require specialised technology and skills. The most suitable technology for use will be further assessed in the EIA phase once the final rig selection has been decided upon depending on availability and final design selection. Various scheduling alternatives have also been investigated and these will be further assessed in the EIA phase.

The no go alternative would imply that no exploration activities are undertaken. As a result, the opportunity to identify potential oil and gas resources within the Block 3B/4B and proposed AOI would not exist. This will negate the potential negative and positive impacts associated with the proposed exploration activities.

10.2 DESCRIPTION OF THE ASPECTS TO BE ASSESSED AS PART OF THE EIA PROCESS

The following aspects will be assessed further during the EIA phase investigation to be undertaken:

- Impacts on existing uses;
- Marine Ecology;
- Fisheries;
- Acoustic Impacts;
- Cultural Heritage;
- Social Impacts;
- Air Quality and Climate Change;
- Drill Cutting and Oil Spill; and
- Economic Impacts.

10.3 ASPECTS TO BE ASSESSED BY SPECIALISTS

Table 41 below details the various aspects of the project to be addressed in the EIA phase through detailed specialist studies.

Table 41: Details of specialist input during the EIA phase.

Aspect	Component	Company Responsible	Consultant	Scope of Work / Terms of Reference
Marine Ecology	Marine Ecological Impact Assessment	Pisces Environmental Services	Dr Andrea Pulfrich	This study will include a detailed description of the marine ecological components within the application area and will include: • Information gathering and literature review; • Update of Baseline Description (only based on available desktop information); • Compilation of Marine Faunal Specialist Report; and • Incorporation of sound transmission loss modelling report. The terms of reference for this study are: • Provide a general description of the benthic environment on the West Coast of South Africa, based on current available literature. • Describe the habitats that are likely to be affected by the proposed exploration activities. • Identify sensitive habitats and species that may be potentially affected by the proposed seismic exploration activities. • Describe seasonal and migratory occurrences of key marine fauna. • Identify, describe and assess the significance of potential impacts of the proposed exploration drilling on the local marine fauna, focussing particularly on marine mammals, turtles, fish and penguins, but including generic effects on fish eggs and larvae, and pelagic and benthic invertebrates. • Identify practicable mitigation measures to reduce the significance of any negative impacts and indicate how these can be implemented during surveying.
Fisheries	Fisheries Impact Assessment	CapMarine	Sarah Wilkinson	The specialist fisheries report would be prepared in line with the EIA requirements and would include: • An introduction that presents 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;

Aspect	Component	Company Responsible	Consultant	Scope of Work / Terms of Reference
				• A literature review of the specific identified sensitivities of commercial fishing sectors related to of the impacts as a result of the proposed activities; • A description of the fisheries sectors operating in the South African Exclusive Economic Zone, including a spatial and temporal assessment of recent and historical fishing catch and effort; • Detailed maps delineating fishing grounds relative to the reconnaissance application area; • The potential impacts on commercial catches in terms of disruption to normal fishing activity and potential loss of catch; • Identification of any practicable mitigation measures to reduce negative impacts on the fishing industry; and • A description of any assumptions made and any uncertainties or gaps in knowledge. The terms of reference for this study are: • A description of the existing baseline fisheries characteristics within the Reconnaissance Permit area (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 the proposed survey areas on the spatial distribution of effort expended by each fishing sector. • Calculation of proportion of fishing ground that coincides with the proposed affected area. • Assessment of potential impacts on fisheries using prescribed impact rating methodology.

Aspect	Component	Company Responsible	Consultant	Scope of Work / Terms of Reference
				• A description of any assumptions made and any uncertainties or gaps in knowledge. • Recommendation of mitigation measures, where appropriate.

Acoustics	Acoustics Impact Assessment	SLR Consulting (Canada)	Dr Jonathan Vallarta	The scope of works for a detailed modelling study includes following modelling elements as detailed in the following sub sections:
				• Modelling
				  o Sonar survey sound propagation modelling. It includes model setup, two (2) scenarios (along-track and cross-track) at five (5) possible different locations.
				  o Well drilling operations (supporting vessels and drilling unit). It includes model setup, modelling computation and post-processing of modelling results of up to five (5) possible exploration wells.
				• GIS Mapping
				  o Preparation of the required GIS information as per the specifications in the Environmental Mapping Methodology.
				• Reporting & Analysis
				  o Relevant literature review and assessment criteria establishment, zones of impact assessment for temporal/permanent injury on marine mammals, fish, and sea turtles.
				The terms of reference for this study are:
				• To undertake acoustic Modelling Assessment.
				• To recommend mitigation measures and rehabilitation measures where required for inclusion in the Environmental Management Programme.
				• To provide GIS information for the features identified, clearly indicating feature sensitivity.

Aspect	Component	Company Responsible	Consultant	Scope of Work / Terms of Reference
Cultural Heritage	Cultural Heritage Impact Assessment	N/A	Prof. MJR Boswell	The terms of reference for this study are: • To conduct anthropological field research to describe, discuss, and analyse the receiving environment (as noted above, specifically the cultural, spiritual/religious uses of and reliance on the sea). And subsequently, using anthropological research methods and analytical techniques to produce an amended field baseline research report and the CHIA Report for 3B/4B. • Identify and assess the intangible cultural heritage impacts of the proposed project's activities and associated infrastructure, using the EIMS methodology. • Where evident, assess potential enhanced impacts on the indirect area of influence. This may include discussion and analysis of impacts that combine, such as socioeconomic and cultural impacts, commercial and cultural impacts or marine and coastal ecology and cultural impacts. Additional impacts, not listed in the proposed list of impacts identified in the briefing note for specialists, may be considered, such as the role of aesthetic and tourism impacts in cultural and heritage valuation of the sea and coast. The latter is important to the CHIA because South Africa has cultural heritage tourism and cultural heritage tourism sites. • Identify knowledge gaps relating to cultural, spiritual, and religious uses of the sea and coast as well as the potential impact of such gaps on the CHIA. Seek to do research on cultural heritage at the coast that maximizes the reliability and validity of the data collected and collated for the CHIA. • Identify precautionary principles required prior to the completion of the ESIA. This may include attention to/documentation of potential harms to culturally significant locales as indicated by the stakeholders interviewed. This documentation will be key as it works to anticipate how to respond to upset conditions and/or normal conditions affecting coastal ICH (intangible cultural heritage). • Identify management and practicable mitigation actions should upset conditions arise. • Assist in the determination of significance thresholds for limits of acceptable change before and after mitigation to confirm if the impact is significant based on the sensitivity of the receptor, extent, duration, and intensity of impact. That is,

Aspect	Component	Company Responsible	Consultant	Scope of Work / Terms of Reference
				determine with input from local communities the upper limit of tolerance for change to the indirect area of influence either during normal operations or in upset conditions. The impact will also need to be contextualised regarding existing uses of the sea and coast, thereby producing a holistic and cumulative heritage impact assessment. • Assist by way of qualitative assessment, the determination of prevalence, frequency, importance and commonality of cultural and spiritual uses of the oceans and coast. The qualitative assessment will include interview questions regarding frequency for example, of ritual practice, its relative importance in the overall cultural repertoire of the community, the prevalence/commonality of the practice in the selected area. • There will be close interface between EIMS and CHIA teams to ensure that project messaging is consistent. Engagement and meetings with the communities will include, contact details of key community representatives; best methods for future consultation; best methods for the dissemination of information/report and better ways of raising issues of concern, specifically regarding issues that relate to the research on cultural heritage at the coast.
Social Impacts	Social Impact Assessment	Equispectives Research and Consulting Services	Dr Ilse Aucamp San-Marie Aucamp	The terms of reference for this study are: • To undertake Social Impact Assessment. • To recommend mitigation measures and rehabilitation measures where required for inclusion in the Environmental Management Programme. • To provide GIS information for the features identified, clearly indicating feature sensitivity as per the EIMS Mapping Methodology.
Air Quality and Climate Change	Air Quality and Climate Change Impact Assessment	Dr Gilian Petzer	Airshed Planning Professionals (Pty) Ltd	The terms of reference for this study are: • To undertake Air Quality and Climate Change Impact Assessment • To recommend mitigation measures and rehabilitation measures where required for inclusion in the Environmental Management Programme. • To provide GIS information for the features identified, clearly indicating feature sensitivity as per the EIMS Mapping Methodology.

Aspect	Component	Company Responsible	Consultant	Scope of Work / Terms of Reference
Economic Impacts	Economic Impact Assessments	Dermacon Market Studies	Dr Hein du Toit	The terms of reference for this study are: • To undertake Economic Impact Assessment. • To recommend mitigation measures and rehabilitation measures where required for inclusion in the Environmental Management Programme. • To provide GIS information for the features identified, clearly indicating feature sensitivity as per the EIMS Mapping Methodology.
Oil Spill Modelling	Oil Spill and Drill Cuttings Modelling	H-Expertise Services S.A.S	Benjamin Livas	The terms of reference for this study are: • To undertake Oil Spill and Drill Cuttings Modelling Assessment. • To recommend mitigation measures and rehabilitation measures where required for inclusion in the Environmental Management Programme. • To provide GIS information for the features identified, clearly indicating feature sensitivity as per the EIMS Mapping Methodology.

10.4 PROPOSED METHOD OF ASSESSING ENVIRONMENTAL ASPECTS

The same method of assessing impact significance as was used during the Scoping phase will be applied during the EIA phase. This methodology is described in detail in Section 9.1 of this report.

10.5 PROPOSED METHOD FOR ASSESSING DURATION AND SIGNIFICANCE

The significance of environmental impacts will be rated before and after the implementation of mitigation measures. These mitigation measures may be existing measures or additional measures that may arise from the impact assessment and specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of the mitigation. The proposed method for the assessment of environmental issues is set out in the Section 9.1. This assessment methodology enables the assessment of environmental issues including: the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

The specialist studies will recommend practicable mitigation measures or management actions that effectively minimise or eliminate negative impacts, enhance beneficial impacts, and assist project design. If appropriate, the studies will differentiate between essential mitigation measures, which must be implemented and optional mitigation measures, which are recommended.

10.6 STAGES AT WHICH COMPETENT AUTHORITIES WILL BE CONSULTED

Competent authorities have been and will be consulted during the initial notification period, the scoping phase as well as during the EIA phase.

10.7 PROPOSED METHOD OF EIA PHASE PUBLIC PARTICIPATION

The proposed public participation process to be followed for the EIA phase is provided below.

- The commenting periods that will be provided to the I&AP's (and the competent authorities) will be 30 days as per the relevant legislative requirements.
- The dates of the review and commenting period for the draft EIA/EMPr will be determined at a later date and communicated to all registered I&AP's through faxes, emails, SMS's and/or registered letters.
- The location at which the hard copy of the EIA report will be made available is at the same public places in the project area that the Scoping Report was made available (refer Appendix 2), sent electronically to stakeholders who request a copy, and placed on the EIMS website: www.eims.co.za.
- The public participation will be undertaken in compliance with NEMA GNR 982 (Chapter 6).
- Public meetings will be held during the review period for the EIA report.
- All comments and issues raised during the comment periods will be incorporated into the final EIA Report.

10.8 DESCRIPTION OF TASKS THAT WILL BE UNDERTAKEN DURING THE EIA PROCESS

The plan of study detailed in the above sections and is summarised below. The following tasks will be undertaken as part of the EIA phase of the project:

- EIA-phase specialist studies.
- Public consultation:
  - Notification of the availability of the EIAR for review and comment to all registered I&AP's;
  - Public and focus group meetings.

- Authority consultation:
  - Consultation with PASA/DMRE and the commenting authorities; and
  - Authorities consultation (including meetings where necessary) to provide authorities with project related information and obtain their feedback.
- Document compilation:
  - The EIA and EMPr will be compiled in line with the requirements of Appendix 3 and 4 of the NEMA EIA Regulations.
  - The EIA and EMPr will be made available for public comment for a period of 30 days.
  - The EIA and EMPr will be finalised and submitted to the PASA/DMRE for adjudication and decision making.

10.9 MEASURES TO AVOID, REVERSE, MITIGATE, OR MANAGE IMPACTS

All comments received from I&APs during the Scoping Report review will be taken into consideration and where applicable inform the high-level mitigation measures. Detailed mitigation measures will be further developed as part of the EIA phase. The potential impacts will further be assessed in terms of the mitigation potential, taking into consideration the following:

- Reversibility of impact:
  - Reversible.
  - Partially reversible.
  - Irreversible.
- Irreplaceable loss of resources:
  - Replaceable.
  - Partially replaceable.
  - Irreplaceable.
- Potential of impacts to be mitigated:
  - High.
  - Medium.
  - Low.

This information for each identified impact will be provided in the EIA and EMPr.

11 ASSUMPTIONS AND LIMITATIONS

Certain assumptions, limitations, and uncertainties are associated with the Scoping Report. This report is based on information that is currently available and, as a result, the following limitations and assumptions are applicable:

- The project scope and descriptions are based on project information provided by the Applicant
- In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project;
- The information presented in this report is based on the information available at the time of compilation of the report;
- It is assumed that all data and information supplied by the Specialist, Applicant or any of their staff or consultants is complete, valid, and true; and
- The description of the baseline environment has been obtained from baseline analysis done by specialists.

12 REFERENCES

Department of Environment Forestry and Fisheries (DEFF). 2020. Protocols for Specialist Assessments. Published in Government Notice No. 320 Government Gazette 43110.

Fourie, W. and Van Der Walt, J. (2008), Matakoma-ARM: Archaeological Impact Assessment for the Proposed mining development for Xstrata Group - Spitzkop Mine, Breyten – Ermelo Region, Mpumalanga Province, Krugersdorp.

Pisces Environmental Services. 2023. Proposed Exploration In Block 3B/4B Off the West Coast of South Africa: Marine Faunal Specialist Assessment.

CapMarine. 2023. Specialist Fisheries Assessment: Proposed Exploration Within Licence Block 3B/4B, West Coast, South Africa.

Namakwa District Municipality (NDM). 2023. Namakwa District Municipality Integrated Development Plan (IDP) 2020-21

13 APPENDICES

Appendix 1: EAP CV

Appendix 3: Impact Assessment Matrix

Appendix 4: DFFE Screening Tool Report