7. RECEIVING ENVIRONMENT

Block 2912 is located in the deep offshore area off the southern coast of Namibia along the EEZ and close to the marine border with South Africa. This chapter provides a description of the attributes of the physical, biological, socio-economic and cultural receiving environment of the licence area and regional area surrounding the licence block. An understanding of the environmental and social context and sensitivity within which the proposed project activities would be located is important to understanding the potential impacts.

7.1 PROJECT'S AREA OF INFLUENCE

The area of influence of the proposed exploration well drilling project defines the spatial extent of the baseline information and can be separated into the area of influence for normal operations and for unplanned events, summarised below:

- **Direct area of influence (normal operations)** (see Figure 7-1) will be confirmed based on the results of the underwater noise and drilling discharge modelling, as well as the marine ecology and fisheries assessments.
  - Block 2912 and specifically the Area of Interest for proposed exploration drilling within which project activities will take place (includes a 20 km buffer around the area of interest). These include drilling operations, refuelling at sea and the maintenance of an operational safety zone during drilling;
  - The Port of Lüderitz as the location for the onshore logistics base for the supply of equipment and materials, waste management and accommodation for staff;
  - Airspace between airport and the drilling unit for helicopter-based crew changes;
  - Marine traffic routes between Lüderitz and the drilling unit; and
  - Indirect impacts on ecosystem services, such as commercial fishing areas, marine mammals, etc. due to underwater noise and safety exclusion zone which may extend beyond the Area of Interest.
- **Indirect area of influence (unplanned events)** will be confirmed based on the oil spill modelling results:
  - The coastal and nearshore region located landward of Block 2912 that could be affected in the unlikely event of a well blow-out.

7.2 GEOPHYSICAL CHARACTERISTICS

7.2.1 Bathymetry

The continental shelf off Namibia is variable in width. Off the Orange River the shelf is wide (230 km) and characterised by well-defined shelf breaks, a shallow outer shelf and the aerofoil-shaped submarine Recent River Delta on the inner shelf. It narrows to the north reaching its narrowest point (90 km) off Chameis Bay, before widening again to 130 km off Lüderitz (Rogers, 1977). The salient topographic features of the shelf include the relatively steep descent to about 100 m, the gentle decline to about 180 m, and the undulating depths to about 200 m. In the south, the Orange Banks comprise three low mounds rising to about 160 m on the outer shelf. North of Chameis Bay, the shelf becomes a stepped feature, with a low step having an elevation between roughly 400 - 450 m below mean sea level, making it one of the deepest in the world. The variable topography of the shelf is of significance for nearshore circulation and for fisheries (Shannon & O'Toole, 1998).

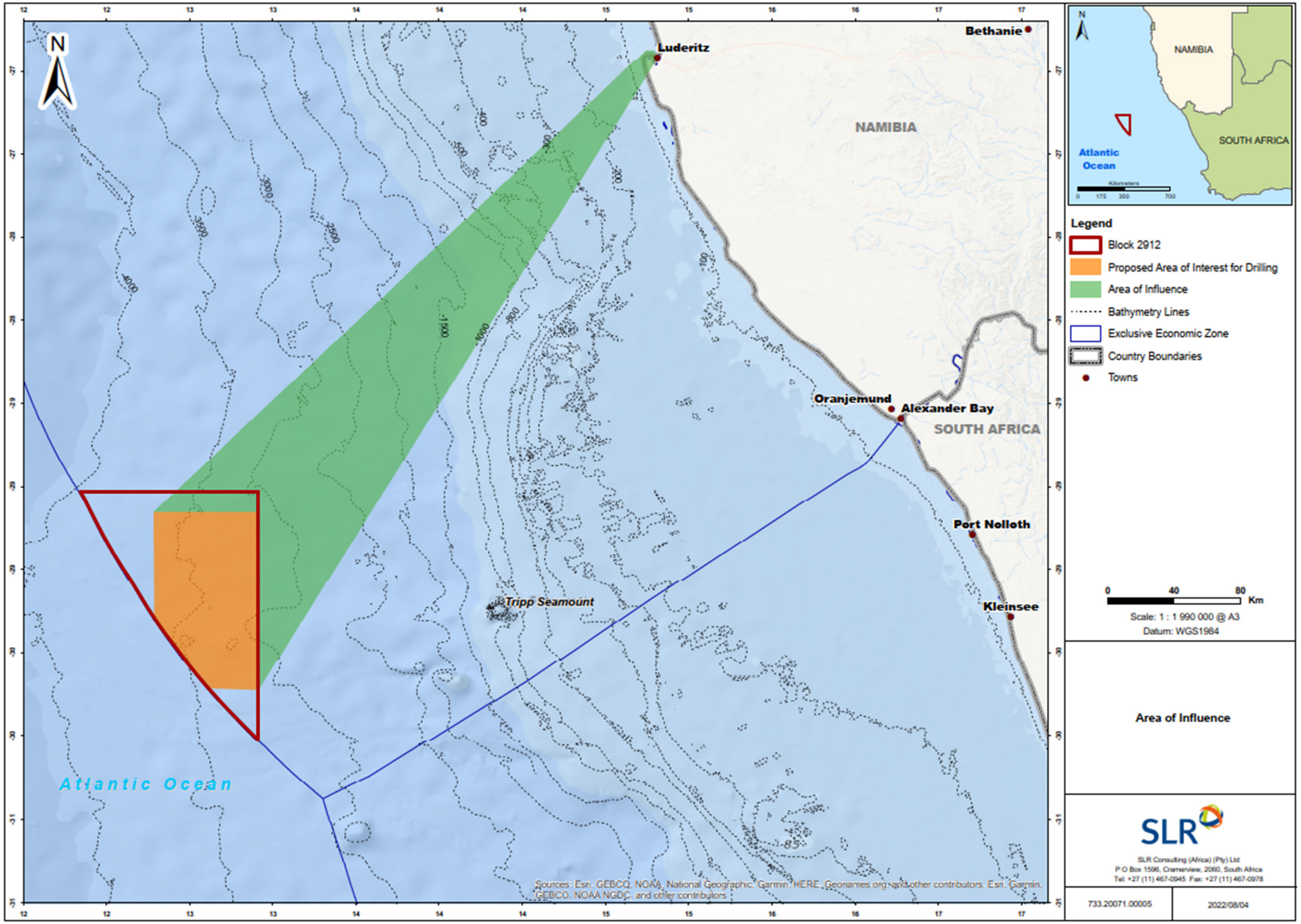

Figure 7-1: Areas of Influence during normal exploration operations

Banks on the continental shelf in the broader project area 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 Childs Bank, situated approximately 150 km offshore in South African waters at about 31°S. Tripp Seamount is a geological feature situated approximately 230 km offshore at about 29°S, which rises from the seabed at approximately 1 000 m to a depth of 150 m. Tripp Seamount is located approximately 120 km to the east of Block 2912 (see Figure 7-1).

Within the adjacent Block 2913B, previous seismic and bathymetric datasets have revealed several bathymetric features where variability in seabed erosion has resulted in defined bathymetric boundaries, which in turn are likely to affect localised habitat types. Conspicuous features include mass gravitational flow features, escarpments, eroded plateaus and sedimentary basins (AECOM, 2019).

7.2.2 Coastal and Inner-shelf Geology and Seabed Geomorphology

As part of the recent Marine Spatial Planning (MSP) process in Namibia, the marine geology of the Namibian continental shelf and geomorphic seafloor features within the EEZ were mapped (MFMR 2021). Figure 7-2 illustrates the location of geomorphic seafloor features, while Figure 7-3 illustrates the distribution of seabed surface sediment types off the southern Namibian coast.

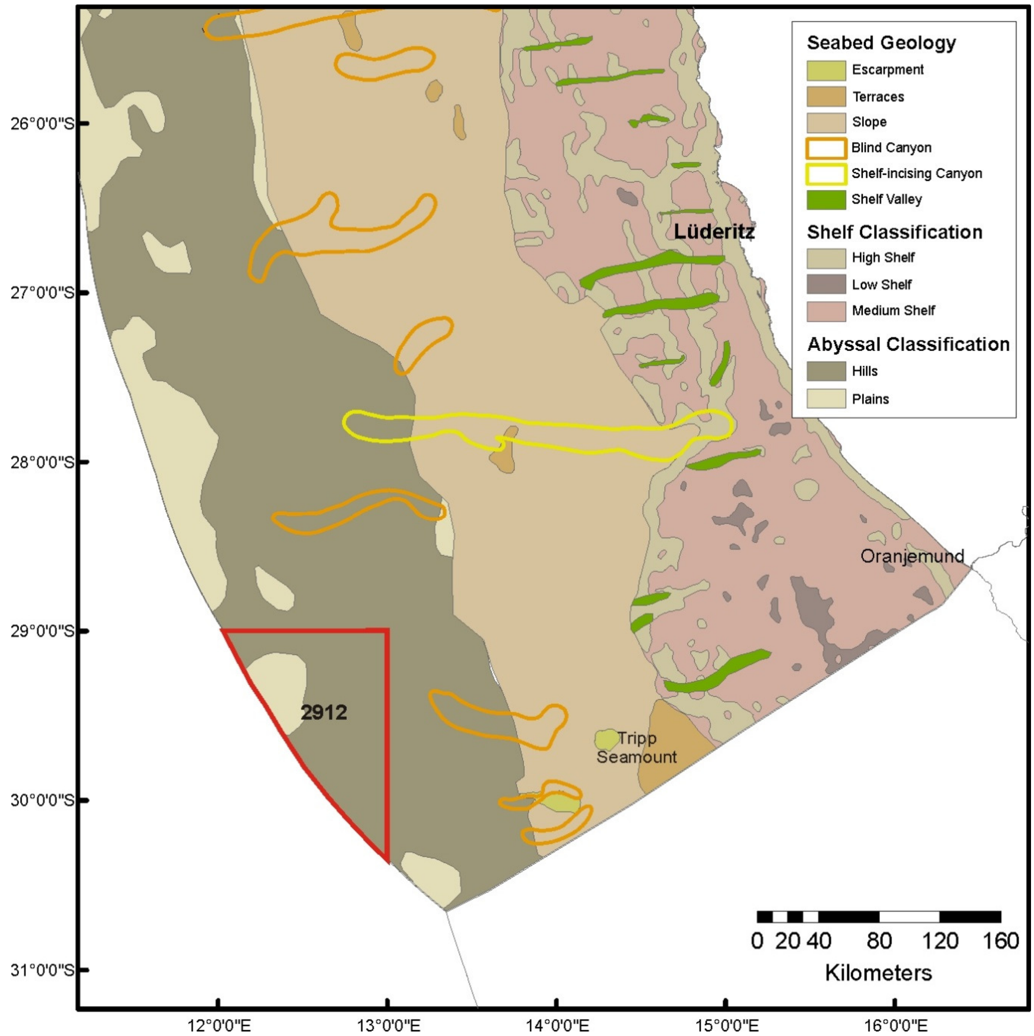

Figure 7-2: Block 2912 in relation to seabed geomorphic features off southern Namibia
Adapted from MFMR 2021

The inner shelf is underlain by Precambrian bedrock (also referred to as Pre-Mesozoic basement), whilst the middle and outer shelf areas are composed of Cretaceous and Tertiary sediments (Dingle, 1973; Birch *et al*., 1976; Rogers, 1977; Rogers & Bremner, 1991). As a result of erosion on the continental shelf, the unconsolidated 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 outer edge of the middle shelf between the Orange River and St Helena Bay in South Africa (Birch *et al*. 1976; Meadows *et al*. 1997, 2002; Herbert and Compton 2007). These biogenic muds are the main determinants of the formation of low-oxygen waters and sulphur eruptions off central and southern Namibia (see Section 7.3.5). Further offshore, sediment is dominated by muddy sands, sandy muds, mud and some sand. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous ooze.

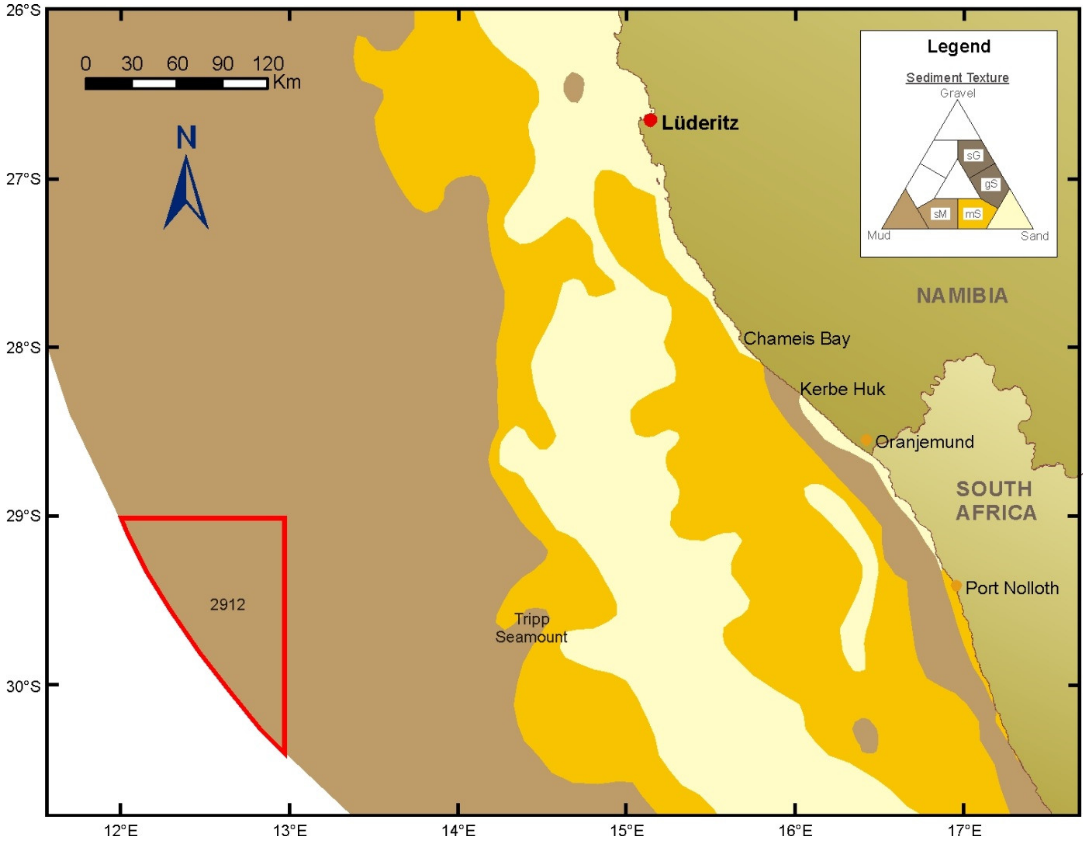

Figure 7-3: Block 2912 in relation to the sediment distribution on the continental shelf off southern Namibia
Adapted from Rogers 1977 and Holness *et al*. 2014

The baseline survey undertaken in the adjacent Block 2913B (Benthic Solutions, 2019) identified that the **seabed is characterised by homogeneous poorly to very poorly sorted fine to medium silts (muddy sands), which comprised between 81.5% and 94.4% of the sediments**. The remaining sediment is a coarser component (>500 µm) comprising predominantly relic biogenic materials from foraminifera. Gravels were absent. Video footage of the seabed throughout the area revealed evidence of bioturbation on the silt-dominated surface, although with no discernible species could be identified. The Total Organic Carbon (TOC) content of the sediments is comparatively low, suggesting that the carbon flux from near surface productivity is not strong. This would be expected from sediments in areas far offshore of the highly productive coastal upwelling.

Present day sedimentation is limited to inputs from the Orange River. This sediment is generally transported northward. In the southern portion of the study area, most of the sediment is therefore considered to be relict deposits by now ephemeral rivers active during wetter climates in the past.

7.3 BIOPHYSICAL CHARACTERISTICS

7.3.1 Climate

The climate of the Namibian coastline is classified as hyper-arid with typically low, unpredictable winter rains and strong winds predominantly south-easterly winds. 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 strongest winds occur in summer (November to April) with virtually all coming from the south-east and south-south-easterlies (see Figure 7-4). The combination of these southerly to south-easterly winds drives the massive offshore movements of surface water, and the resultant strong upwelling of nutrient-rich bottom waters, which characterise this region in summer. **Winter (May to October) remains dominated by southerly to south-easterly winds**, but the closer proximity of the winter cold-front systems results in a more significant north-westerly component (see Figure 7-4). This 'reversal' from the summer condition results in cessation of upwelling, movement of warmer mid-Atlantic water shorewards and breakdown of the strong thermoclines which typically develop in summer. There are also more calms in winter, occurring about 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.

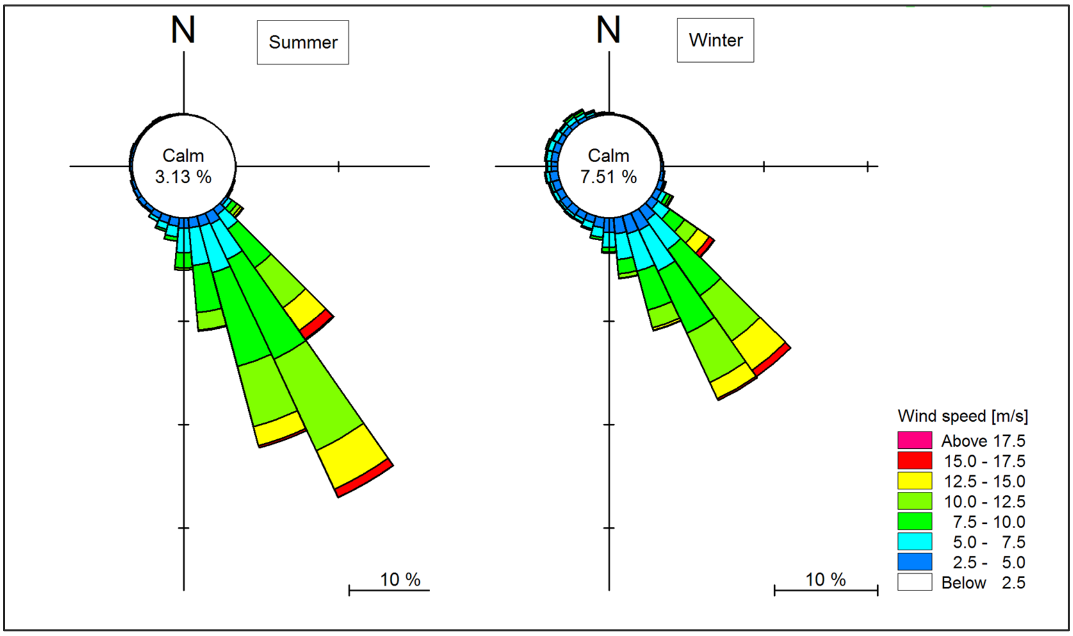

Figure 7-4: Seasonal wind roses at 14°E, 28°S in the vicinity of Block 2912
Source: PRDW 2019

Average annual precipitation ranges from 16.4 mm at Lüderitz to 51.5 mm at Oranjemund. Due to the combination of wind and cool ocean water, temperatures are mild throughout the year. Coastal temperatures average around 16°C, gradually increasing inland (Barnard, 1998). In winter, maximum diurnal shifts in temperature can occur caused by the hot easterly 'berg' winds which blow off the desert. During such occasions, temperatures up to 30°C are not uncommon.

Coastal fog is a regular occurrence; occurring on average between 50 and 75 days of the year in the south, being most frequent during the months of February through May. The fog lies close to the coast extending about 20 nautical miles (nm) (approximately 35 km) seawards (Olivier, 1992, 1995). This fog is usually quite dense, appearing as a thick bank hugging the shore and reducing visibility to <300 m. **Fog should in no way affect exploration activities in the offshore licence area. However, it may affect helicopter operations between the drill sites and the Lüderitz airport**.

7.3.2 Large-Scale Circulation, Coastal Currents and Tides

The Namibian coastline is strongly influenced by the Benguela Current. Current velocities in continental shelf areas generally range between 10–30 cm/s (Boyd & Oberholster 1994). In the south the Benguela current has a width of 200 km, widening rapidly northwards to 750 km. The flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow (Shillington *et al.* 1990; Nelson & Hutchings 1983) (see Figure 7-5). Fluctuation periods of these flows are 3 - 10 days, although the long-term mean current residual is in an approximate northwest (alongshore) direction. Near bottom shelf flow is mainly poleward (Nelson 1989) with low velocities of typically 5 cm/s. The poleward flow becomes more consistent in the southern Benguela.

Near-surface currents in the project area are primarily from the south-southeast (see Figure 7-6), with maximum speeds exceeding 60 cm/s occurring primarily during summer months (November to March). Current speeds decrease with depth to <20 cm/s near the seabed (TEEPNA, unpublished data).

The major feature of the Benguela Current is coastal upwelling and the consequent high nutrient supply to surface waters leads to high biological production and large fish stocks. The prevailing longshore, equatorward winds move nearshore surface water northwards and offshore. To balance the displaced water, cold, deeper water wells up inshore. Although the rate and intensity of upwelling fluctuates with seasonal variations in wind patterns, the most intense upwelling tends to occur where the shelf is narrowest and the wind strongest. Consequently, it is a semi-permanent feature at Lüderitz and areas to the north due to perennial southerly winds (Shannon 1985). **The Lüderitz upwelling cell is the most intense upwelling cell in the system**, with the seaward extent reaching nearly 300 km, and the upwelling water is derived from 300-400 m depth (Longhurst 2006). A detailed analysis of water mass characteristics revealed a discontinuity in the central and intermediate water layers along the shelf north and south of Lüderitz (Duncombe Rae 2005). **The Lüderitz / Orange River region (LUCORC) thus forms a major environmental barrier between the northern and southern Benguela sub-systems** (Ekau & Verheye 2005). Off central and northern Namibia, several secondary upwelling cells occur. Upwelling in these cells is perennial, with a late winter maximum (Shannon 1985).

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

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 more pronounced southerly and south-south-westerly swell component in summer. These swells tend to be wind-induced, with shorter wave periods (approximately 8 seconds), and are generally steeper than swell waves (CSIR, 1996). These wind-induced southerly waves are relatively local and, although less powerful, tend to work together with the strong southerly winds of summer to cause the northward-flowing nearshore surface currents, and result in substantial nearshore sediment mobilisation, and northwards transport, by the combined action of currents, wind and waves.

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

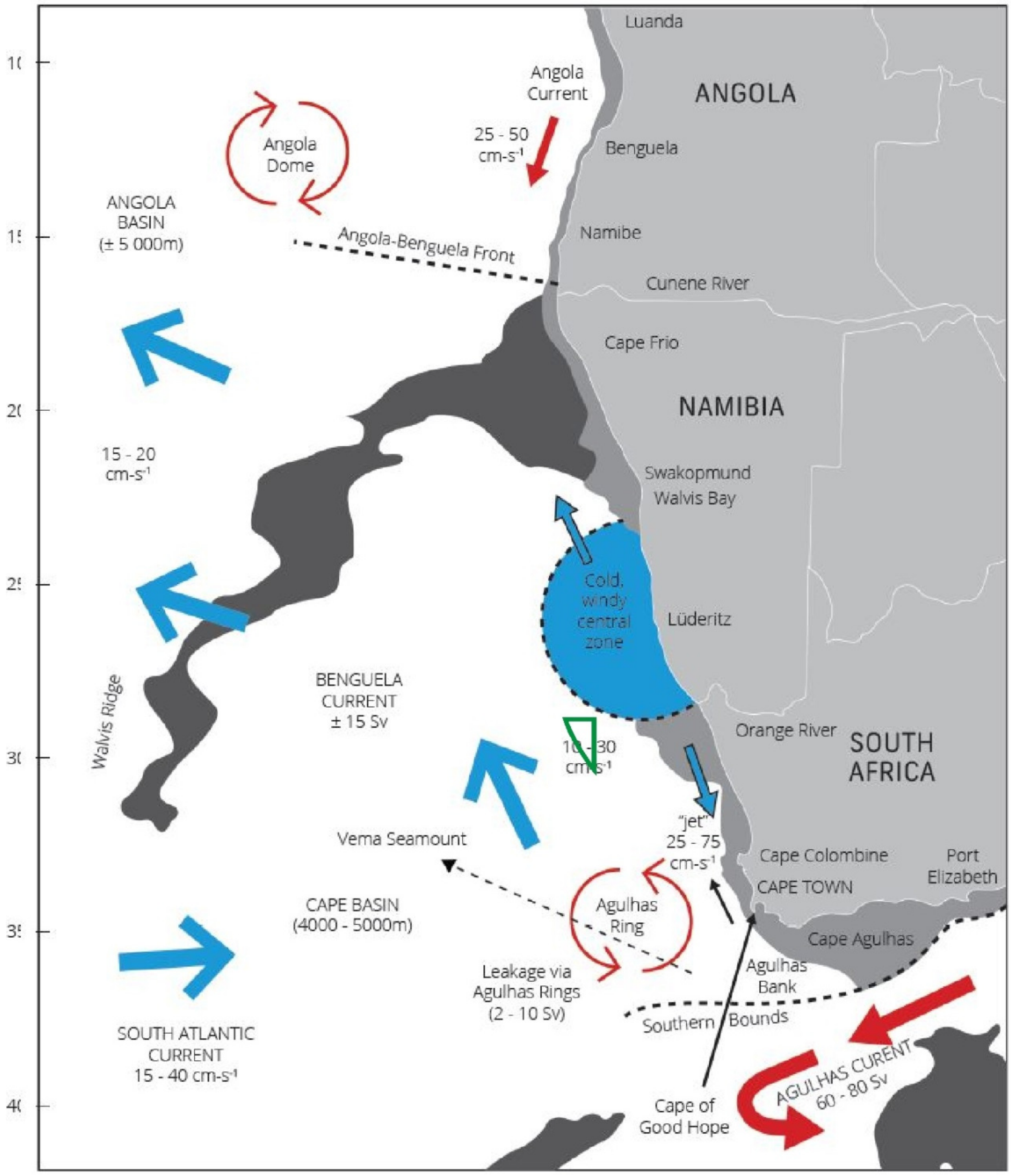

Figure 7-5: Block 2912 (green contour) in relation to major features of the predominant circulation patterns and volume flows in the Benguela System.

Adapted from Shannon *et al*. 2006

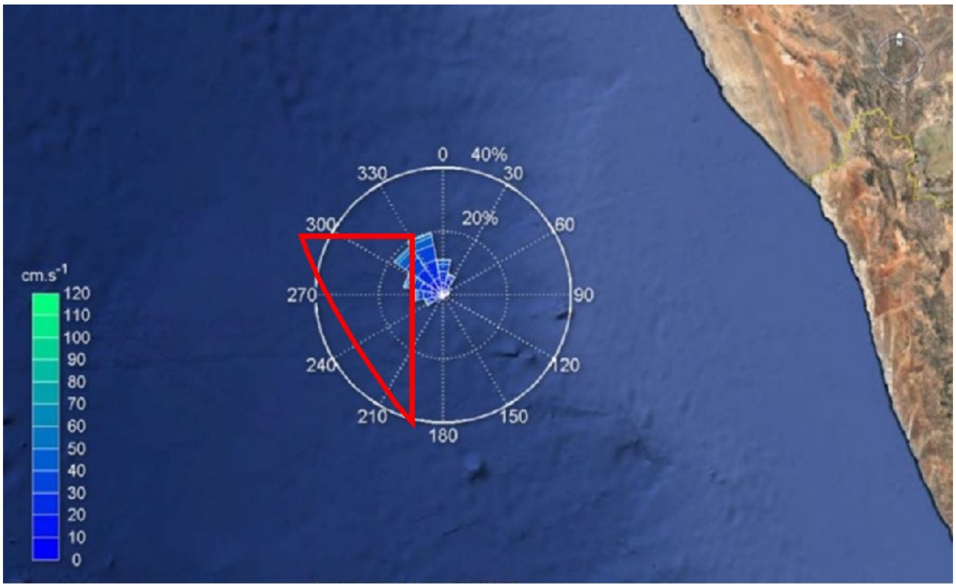

Figure 7-6: Near-surface (~ 2 m depth) current rose for Block 2912
Source: TEEPNA, 2020

7.3.3 Seawater, Upwelling and Plankton Production

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

Seawater temperatures on the continental shelf of the southern Benguela typically vary between 6°C and 16°C. Seawater profilers deployed at two stations in the adjacent Block 2913B recorded a maximum temperature of 17.5°C at the surface, declining steadily with depth to 2.3°C at the seabed (Benthic Solutions, 2019). 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 (Bailey et al., 1985; Chapman and Shannon, 1985). Oxygen minima recorded in the adjacent Block 2913B ranged from 34.3% to 43.1% (Benthic Solutions, 2019).

The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman and 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. **As Block 2912 is located well offshore of the upwelling cells, nutrient concentrations are expected to be low.** This was confirmed from water samples collected in the adjacent Block 2913B, which found that Phosphate as P and Orthophosphate (PO_4) ranged from

0.04 to 0.07 mg/l and 0.12 to 0.21 mg/l, respectively, with the highest concentrations recorded near the seabed. Nitrate and Nitrite were both below the limits of detection and ammoniacal nitrogen ranged from 0.41 to 0.44 mg/l, whilst total nitrogen remained below 2 mg/l (Benthic Solutions, 2019).

7.3.4 Turbidity

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulate matter, including both Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM). Concentrations of suspended particulate matter in shallow coastal waters can vary both spatially and temporally, typically ranging from a few mg/l to several tens of mg/l (Bricelj & Malouf, 1984; Berg & Newell, 1986; Fegley *et al*., 1992). In the offshore waters of the adjacent Block 2913B, total suspended solids (TSS) remained below 5 mg/l, being highest near the surface (2.9 mg/l) declining to around 2.6 mg/l near the seabed (Benthic Solutions, 2019).

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

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

On the inner and middle continental shelf, the ambient currents are insufficient to transport coarse sediments, and resuspension and shoreward movement of these by wave-induced currents occur primarily under storm conditions (Drake et al., 1985; Ward, 1985).

7.3.5 Organic Inputs, Hypoxia and Sulphur Eruptions

Balanced multispecies ecosystem models have estimated that 36% of the phytoplankton and 5% of the zooplankton are lost to the seabed annually (Shannon *et al*., 2003). This natural annual input of millions of tons of organic material onto the seabed has a substantial effect on the ecosystems of the Benguela region.

It provides most of the food requirements of the particulate and filter-feeding benthic communities, 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. As the mud on the shelf is distributed in discrete patches (see Figure 7-3), there are corresponding preferential areas for the formation of oxygen-poor water. The two main areas of low-oxygen water formation in the central Benguela region are in the Orange River Bight and off Walvis Bay (Chapman and Shannon, 1985; Bailey, 1991; Shannon and O'Toole, 1998; Bailey 1999; Fossing *et al*., 2000).

The spatial distribution of oxygen-poor water is subject to short- and medium-term variability. Subsequent upwelling processes can move this hypoxic water onto the inner shelf and into nearshore waters, often with devastating effects on marine communities.

Closely associated with seafloor hypoxia, is the generation of toxic hydrogen sulphide and methane within the organically-rich, anoxic muds. Under conditions of severe oxygen depletion, hydrogen sulphide (H_2S) gas is formed by anaerobic bacteria in anoxic seabed muds (Brüchert *et al*., 2003). This is periodically released from the muds as 'sulphur eruptions', causing upwelling of anoxic water and formation of surface slicks of sulphur discoloured water (Emeis *et al*., 2004). **Although these processes are common off central and southern Namibia, they are not expected in Block 2912.**

7.3.6 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). An analysis by TEEPNA of 2016 and 2021 satellite imagery detected several oil spills from boats corresponding with the orientation of the main shipping lanes along the southwestern African coast. No anomaly centre points were, however, identified in the vicinity of Block 2912 that could be considered as potential oil seeps.

7.4 BIOLOGICAL OCEANOGRAPHY

Biogeographically, the study area falls into the cold temperate Namaqua Bioregion, which extends from Sylvia Hill, north of Lüderitz in Namibia to Cape Columbine (Emanuel *et al*., 1992; Lombard *et al*., 2004). **Block 2912 is located in the offshore Namib Biozone** (De Cauwer, 2007), which extends beyond the shelf break onto the continental slope and into abyssal depths (see Figure 7-7). The coastal, wind-induced upwelling characterising the Namibian coastline, is the principle physical process which shapes the marine ecology of the central 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).

Block 2912 is located beyond the 3 000 m depth contour, the closest point to shore being approximately 290 km (approximately 330 km west of Oranjemund). The offshore marine ecosystems comprise a limited range of habitats, namely unconsolidated seabed sediments 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.

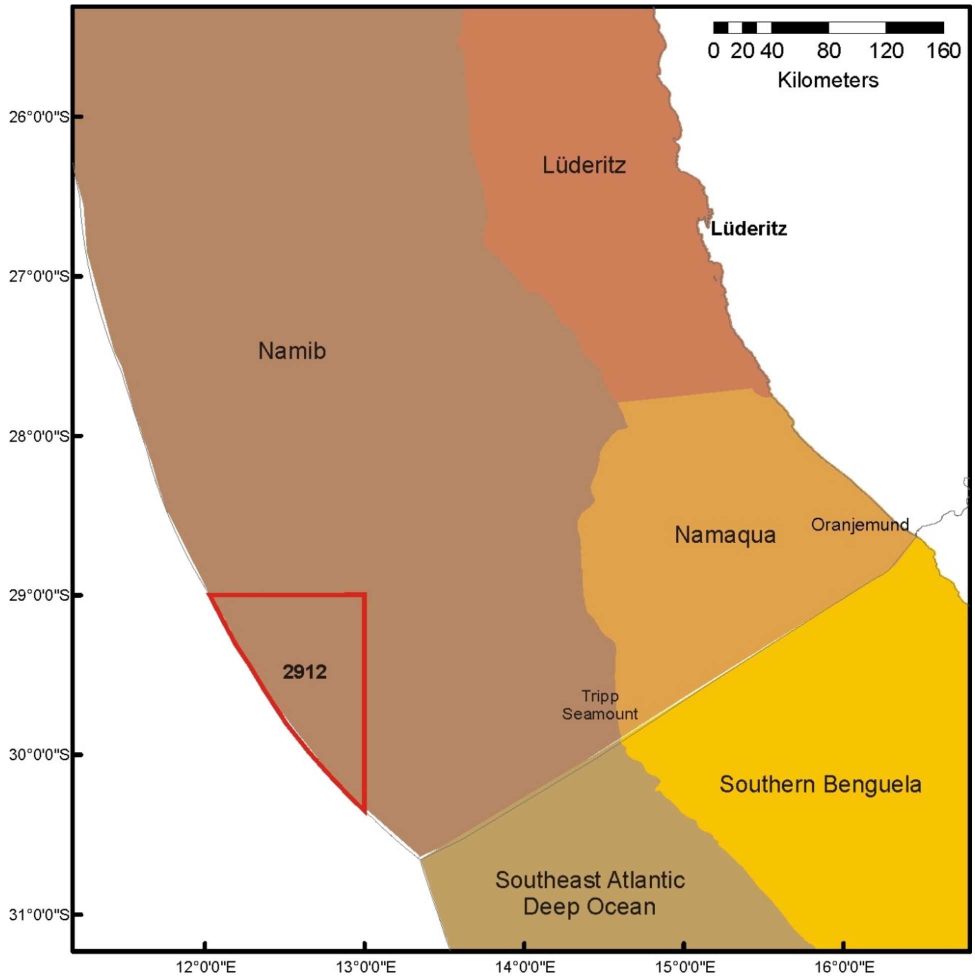

Figure 7-7: Block 2912 in relation to the Namibian biozones. The adjacent South African ecoregions are also shown.

Source: De Cauwer, 2007, MFMR, 2021 and Sink *et al*. 2019

7.4.1 Benthic Invertebrate Macrofauna Communities

The seabed communities in the Block 2912 lie within the Namaqua sub-photic and continental slope biozone, which extend from the shelf edge into the abyss. The benthic and coastal habitats of Namibia were mapped as part of the Benguela Current Commission's Spatial Biodiversity Assessment (Holness *et al.,* 2014) to develop assessments of the ecosystem threat status and ecosystem protection level (see Figure 7-8). Possible submarine canyons (with 5 km buffer) were also mapped as lines by the International Deep Ocean Project (see Figure 7-8). The benthic habitats were subsequently assigned an ecosystem threat status ('Least Threatened', 'Vulnerable', 'Endangered' or 'Critically Endangered') based on their level of protection (see Table 7-1) and mapped (see Figure 7-9).

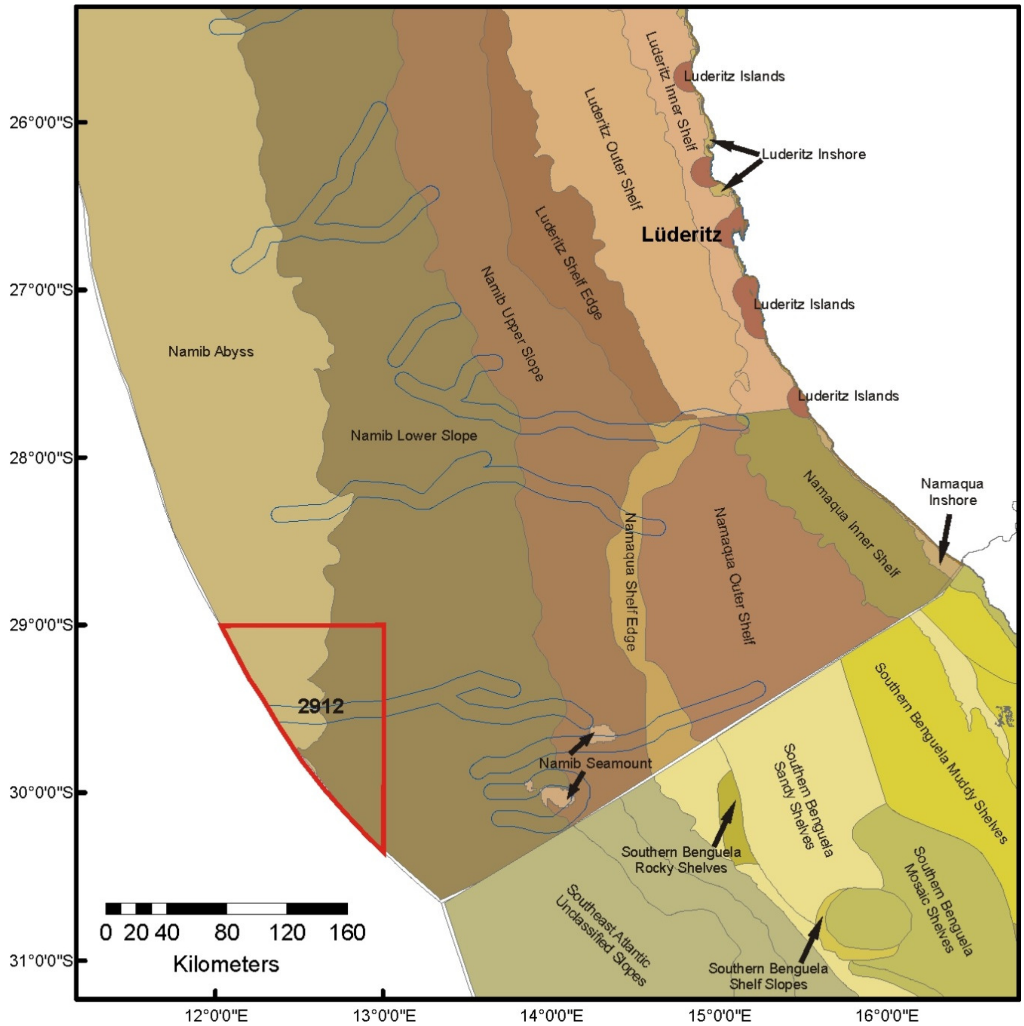

Figure 7-8: Block 2912 in relation to the Namibian benthic and coastal habitats and South African substratum types (potential submarine canyons shown in blue lines).

Source: Adapted from Holness *et al*. 2014 and Sink *et al*. 2019

Table 7-1: Ecosystem Threat Status for marine habitat types on the Namibian coast

Key	Habitat Type	Threat Status	Area (km^2)
1	**Namib Abyss**	**Least Threatened**	**800.93**
2	**Namib Lower Slope**	**Least Threatened**	**1 380.13**
3	Namib Upper Slope	Least Threatened	590.66
4	Namib Seamount	Least Threatened	26.83
5	Namaqua Shelf Edge	Endangered	44.40
6	Namaqua Outer Shelf	Least Threatened	175.29
7	Namaqua Inner Shelf	Least Threatened	69.48
8	Namaqua Inshore	Vulnerable	4.45
9	Lüderitz Shelf Edge	Critically Endangered	87.55
10	Lüderitz Outer Shelf	Vulnerable	184.70
11	Lüderitz Inner Shelf	Least Threatened	62.91
12	Lüderitz Islands	Least Threatened	13.32
13	Lüderitz Inshore	Least Threatened	3.56

Note: Those habitats potentially affected by the proposed exploration activities are shown in bold.

Source: Holness *et al*., 2014

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

Polychaetes, crustaceans and molluscs make up the largest proportion of individuals, biomass and species on the West Coast. The distribution of species within these communities are inherently patchy reflecting the high natural spatial and temporal variability associated with macro-infauna of unconsolidated sediments (Kenny *et al*., 1998; Kendall & Widdicombe, 1999; van Dalfsen *et al*., 2000; Zajac *et al*., 2000; Parry *et al*., 2003). Generally, species richness increases from the inner shelf across the mid shelf and is influenced by sediment type (Karenyi, unpublished data). The highest total abundance and species diversity has been measured in sandy sediments of the mid-shelf. Biomass is highest in the inshore (± 50 g/m^2 wet weight) and decreases across the mid-shelf averaging around 30 g/m^2 wet weight. The mid shelf mud belt, however, is a particularly rich benthic habitat where biomass can attain 60 g/m^2 dry weight (Christie, 1974; see also Steffani, 2007). The comparatively high benthic biomass in this mud belt region represents an important food source to carnivores such as the mantis shrimp, cephalopods and demersal fish species (Lane & Carter, 1999). In deeper water beyond this rich zone, biomass declines to 4.9 g/m^2 at 200 m depth and then is consistently low (<3 g/m^2) on the outer shelf (Christie, 1974).

The benthic fauna of the outer shelf and continental slope (beyond 450 m depth) are very poorly known largely due to limited opportunities for sampling, as well as the lack of access to ROVs for visual sampling of hard substrata. To date very few areas of the continental slope off the southern African West Coast have been biologically surveyed. Benthic habitats along the 500 m depth contour have been assigned a threat status of "Vulnerable", with those further inshore to the 100 m depth contour considered "Endangered" by the Benguela Current Commission (BCC) Spatial Biodiversity Assessment (Holness *et al*. 2014), but **further offshore in Block 2912, the benthic habitat type is considered 'Least Threatened'** (see Figure 7-9).

Whilst many empirical studies related community structure to sediment composition (Christie, 1974; Warwick *et al*., 1991; Yates *et al*., 1993; Desprez, 2000; van Dalfsen *et al*., 2000), other studies have illustrated the high natural variability of soft-bottom communities, both in space and time, on scales of hundreds of metres to metres (Kenny *et al*., 1998; Kendall & Widdicombe, 1999; van Dalfsen *et al*., 2000; Zajac *et al*., 2000; Parry *et al*., 2003), with evidence of mass mortalities and substantial recruitments (Steffani & Pulfrich, 2004). It is likely that the distribution of marine communities in the mixed deposits of the coastal zone is controlled by complex interactions between physical and biological factors at the sediment–water interface, rather than by the granulometric properties of the sediments alone (Snelgrove & Butman, 1994; Seiderer & Newell, 1999). For example, off central and southern Namibia it is likely that periodic intrusion of low oxygen water masses is a major cause of this variability (Monteiro & van der Plas, 2006; Pulfrich et al., 2006). Although there is a poor understanding of the responses of local continental shelf macrofauna to low oxygen conditions, it is safe to assume that in areas of frequent oxygen deficiency (i.e. Oxygen Minimum Zones - OMZs) the communities are characterised by species able to survive chronic low oxygen conditions or colonising and fast-growing species able to rapidly recruit into areas that have suffered complete oxygen depletion. Local hydrodynamic conditions, and patchy settlement of larvae, will also contribute to small-scale variability of benthic community structure.

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. As part of the Environmental Baseline Survey for the adjacent Block 2913B, however, deep-water benthic sampling was undertaken using a box corer (Benthic Solutions, 2019); thereby providing valuable information on the benthic infaunal communities in the project area.

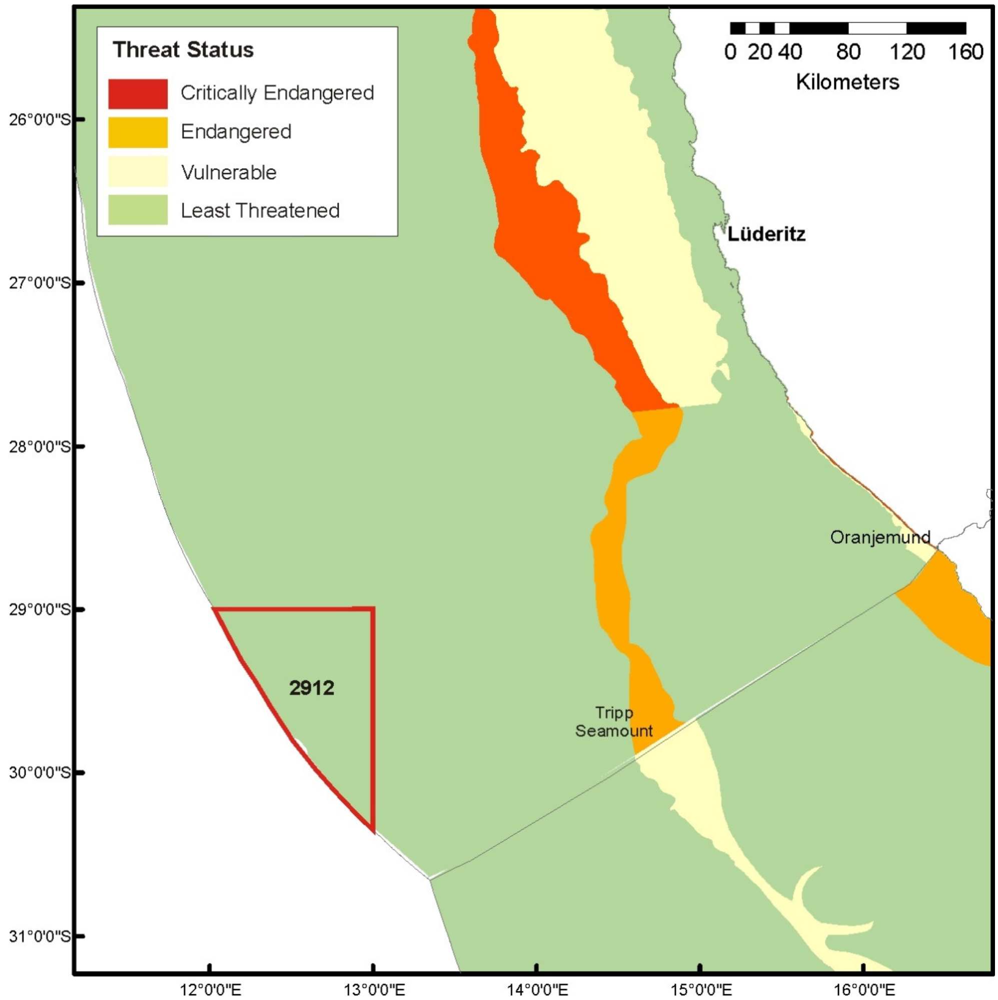

Figure 7-9: Block 2912 in relation to ecosystem threat status for offshore benthic habitat types off southern Namibia. The threat status of adjacent South African substratum types are also shown.

Source: Holness *et al*. 2014 and Sink *et al*. 2019

The macrofauna throughout the adjacent Block 2913B baseline survey area are 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 project area are illustrated in Figure 7-10.

7.4.2 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 exceeding 150 m. Some species form reefs while others are smaller and remain solitary. Corals add structural complexity to otherwise uniform seabed habitats thereby creating areas of high biological diversity (Breeze *et al*., 1997; MacIssac *et al*., 2001). Deep-water corals establish themselves below the thermocline where there is a continuous and regular supply of concentrated particulate organic matter, caused by the flow of a relatively strong current over special topographical formations which cause eddies to form. Nutrient seepage from the substratum might also promote a location for settlement (Hovland *et al*., 2002). Substantial shelf areas in the productive Benguela region should thus potentially be capable of supporting rich, cold water, benthic, filter-feeding communities. **Such communities would also be expected with topographic features such as Tripp Seamount (in Namibian waters) and Child's Bank (in South African waters), some 125 km to the east and 280 km to the south-east of Block 2912, respectively.**

7.4.3 Seamount 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 upwelling 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 influence 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 deep-water fish stocks such as orange roughy, oreos, alfonsino and Patagonian toothfish, which aggregate around these features for either spawning or feeding (Koslow, 1996).

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

Enhanced currents, steep slopes and volcanic rocky substrata, in combination with locally generated detritus, favour the development of suspension feeders in the benthic communities characterising seamounts (Rogers, 1994). Deep- and cold-water corals (including stony corals, black corals and soft corals) are a prominent component of the suspension-feeding fauna of many seamounts, accompanied by barnacles, bryozoans, polychaetes, molluscs, sponges, sea squirts, basket stars, brittle stars and crinoids (reviewed in Rogers, 2004). There is also associated mobile benthic fauna that includes echinoderms (sea urchins and sea cucumbers) and crustaceans (crabs and lobsters) (reviewed by Rogers, 1994). Some of the smaller cnidarians species remain solitary while others form reefs thereby adding structural complexity to otherwise uniform seabed habitats. The coral frameworks offer refugia for a great variety of invertebrates and fish (including commercially important species) within, or in association with, the living and dead coral framework thereby creating spatially fragmented areas of high biological diversity. Compared to the surrounding deep-sea environment, seamounts typically form biological hotspots with a distinct, abundant and diverse fauna, many species of which remain unidentified. Consequently, the fauna of seamounts is usually highly unique and may have a limited distribution restricted to a single geographic region, a seamount chain or even a single seamount location (Rogers *et al.,* 2008). Levels of endemism on seamounts are also relatively high compared to the deep sea. As a result of conservative life histories (*i.e*. very slow growing, slow to mature, high longevity, low levels of recruitment) and sensitivity to changes in environmental conditions, such biological communities have been identified as Vulnerable Marine Ecosystems (VMEs). They are recognised as being particularly sensitive to anthropogenic disturbance (primarily deep-water trawl fisheries and mining), and once damaged are very slow to recover, or may never recover (FAO, 2008).

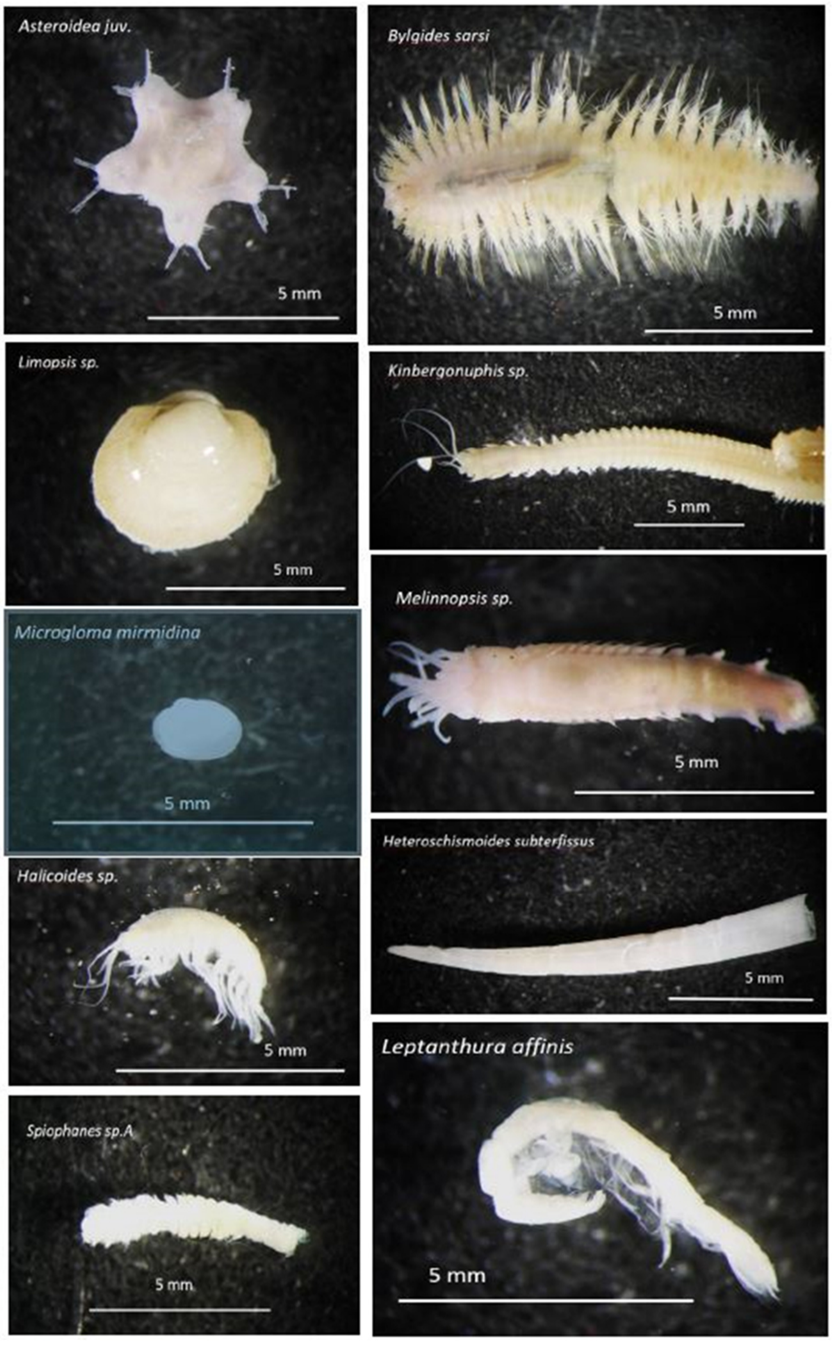

Figure 7-10: Examples of macroinvertebrates recorded in the adjacent Block 2913B
Source: Benthic Solutions Ltd, 2019a

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. There is reference to decapods crustaceans from Tripp Seamount (Kensley, 1980, 1981) and exploratory deep-water trawl fishing (Hampton, 2003), but otherwise knowledge of benthic communities characterising southern African seamounts is lacking. Evidence from video footage taken on hard-substrate habitats in 100 - 120 m depth off southern Namibia (see Figure 7-11) suggest that vulnerable communities including gorgonians, octocorals and reef-building sponges occur on the continental shelf, and similar communities may thus be expected on Tripp Seamount.

Figure 7-11: Gorgonians and bryozoans communities recorded on deep-water reefs (100-120 m) off the southern African West Coast
Source: De Beers Marine

7.4.4 Plankton

Plankton is particularly abundant in the shelf waters off Namibia, being associated with the upwelling characteristic of the region. Plankton range from single-celled bacteria to jellyfish of 2 m diameter and include bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton.

Off the Namibian coastline, phytoplankton are the principle primary producers with mean annual productivity being comparatively high at 2 g C/m^2/day (Barnard, 1998). The phytoplankton is dominated by diatoms, which are adapted to the turbulent sea conditions. Diatom blooms occur after upwelling events, whereas dinoflagellates are more common in blooms that occur during quiescent periods.

Namibian zooplankton reaches maximum abundance in a belt parallel to the coastline and offshore of the maximum phytoplankton abundance. The mesozooplankton (<2 mm body width) community includes egg, larval, juvenile and adult stages of copepods, cladocerans, euphausiids, decapods, chaetognaths, hydromedusae and salps, as well as protozoans and meroplankton larvae (Maartens, 2003; Hansen *et al.,* 2005). Copepods are the most dominant group making up 70-85 % of the zooplankton.

Ichthyoplankton constitutes the eggs and larvae of fish. As the preferred spawning grounds of numerous commercially exploited fish species are located off central and northern Namibia (see Figure 7-12), their eggs and larvae form an important contribution to the ichthyoplankton in the region. The Lüderitz upwelling cell - Orange River Cone (LUCORC) area, south of the Lüderitz upwelling cell between approximately 29°S – 31°S, is considered to be an environmental barrier to the transport of ichthyoplankton from the southern to the northern Benguela upwelling ecosystems. Areas of powerful upwelling are considered unfavourable spawning habitats, with pelagic fish species, such as anchovy, redeye round herring, horse mackerel and shallow-water hake, reported as spawning on either side of the LUCORC area, but not within it (see Figure 7-12). The area is characterised by diminished phytoplankton biomass due to high turbulence and deep mixing in the water column. A deficiency of phytoplankton results in poor feeding conditions for micro-, meso- and macrozooplankton and for ichthyoplankton, and successful survival and recruitment of these species in the area is considered unlikely (Lett *et al.*, 2007). **Due to its location far offshore and beyond the influence of upwelling, the abundance of phytoplankton, zooplankton and ichthyoplankton in Block 2912, is thus expected to be comparatively low.**

Vertical plankton hauls undertaken in the adjacent Block 2913B, however, identified that a wide diversity of copepods (39 different species) dominated the zooplankton, contributing 88.5% to the zooplankton captured, followed by Ostracods (2.6%) and Amphipods (2.3%). Chaetognathes (1.84%), Ophiuroid larvae (1.24%) and Cnidera (0.31%) were also present with decapods, mysids, euphausids, ctenopores, molluscs, polychaetes and chordates also represented (Benthic Solutions, 2019).

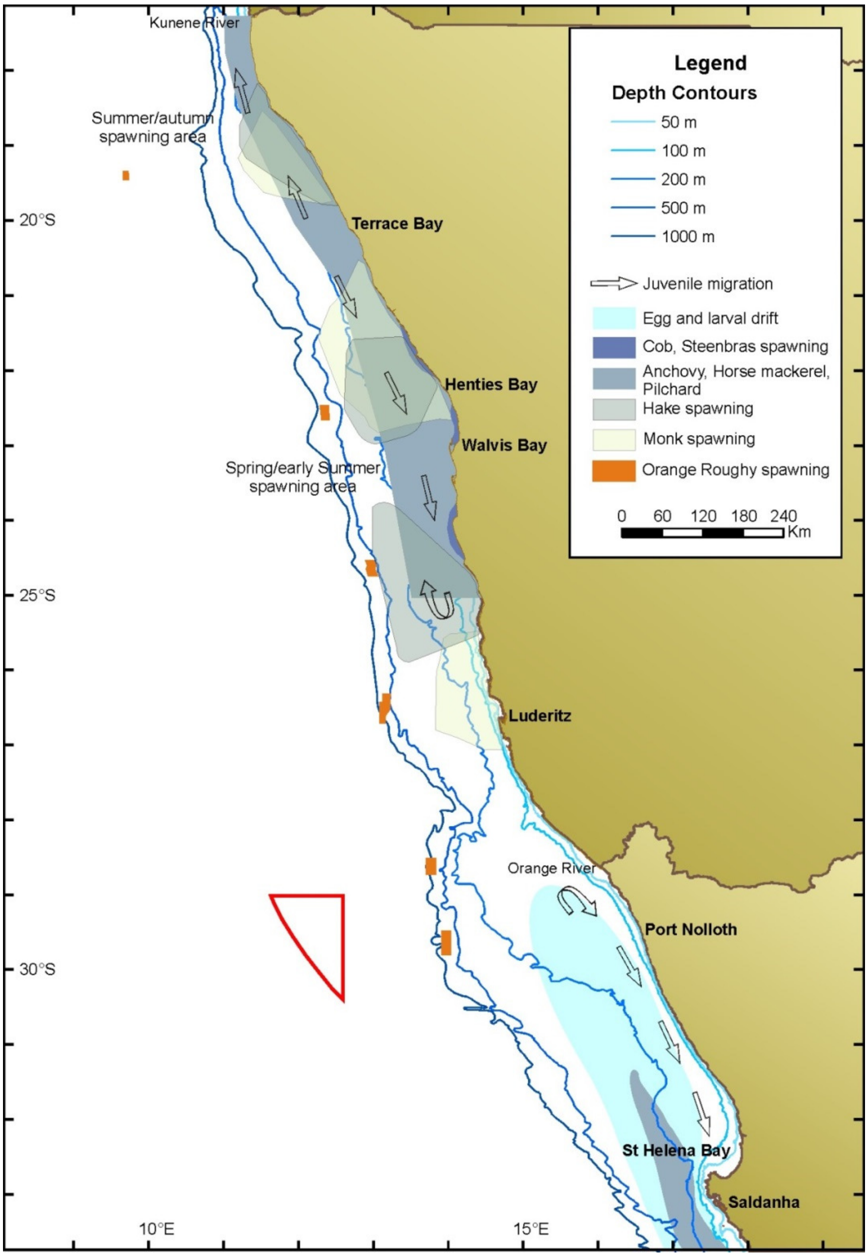

Figure 7-12: Block 2912 in relation to major spawning areas in the Benguela region
Source: Cruikshank, 1990; Hampton, 1992; MFMR, 2021

7.4.5 Cephalopods

The major cephalopod resource in the southern Benguela is cuttlefish with up to 14 species being recorded (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.

Pelagic invertebrates that may be encountered in the licence area are the colossal squid, *Mesonychoteuthis hamiltoni,* and the giant squid, *Architeuthis sp*. Both are deep dwelling species, with the colossal squid's distribution confined to the entire circum-Antarctic Southern Ocean (see Figure 7-13, top), while the giant squid is usually found near continental and island slopes all around the world's oceans (see Figure 7-13, bottom). Both species could thus potentially occur in the licence 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 to 1 000 m. They lack gas-filled swim bladders and maintain neutral buoyancy through an ammonium chloride solution occurring throughout their bodies.

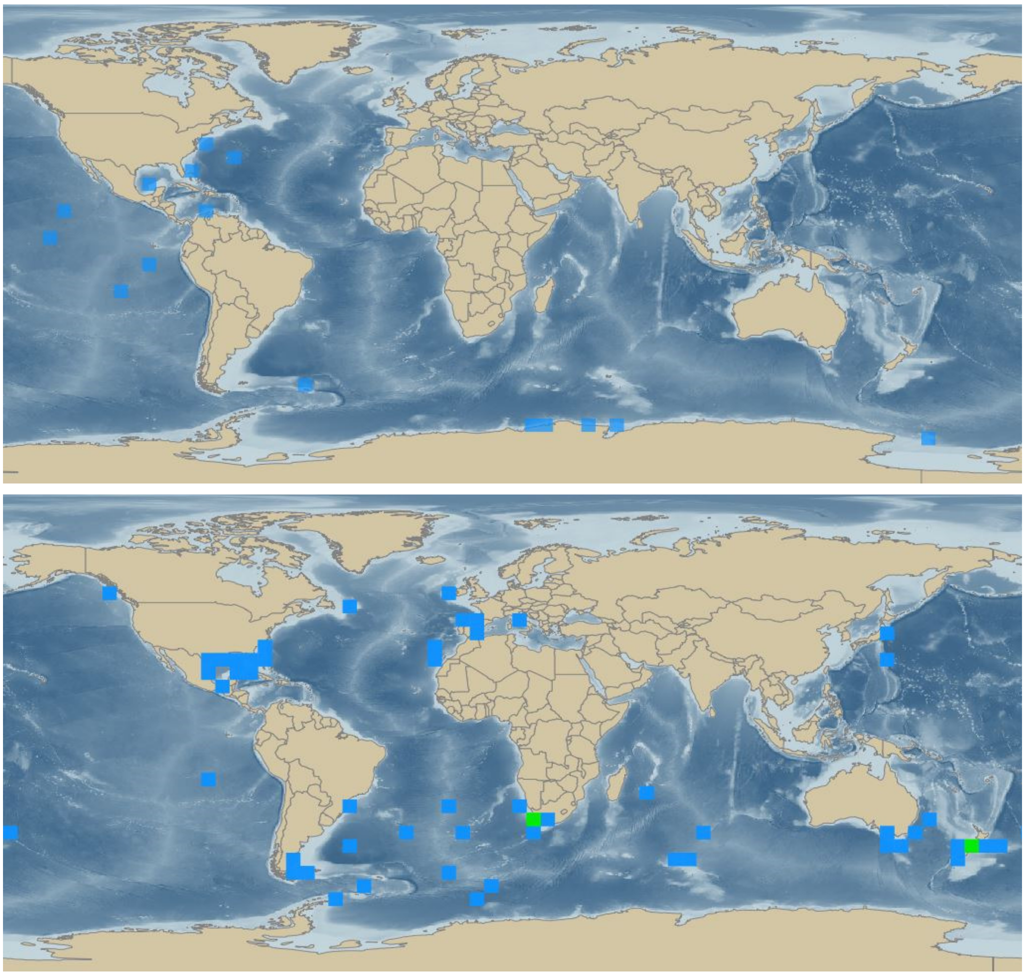

Figure 7-13: Distribution of the colossal squid (top) and the giant squid (bottom) (blue = <5 observations; green = 6-10 observations)

Source: **http://iobis.org**, accessed 2022

7.4.6 Fish

Due to the cold temperate nature of the region, the fish fauna off the Namibian coast is characterised by a relatively low diversity of species compared with warmer oceans. However, the upwelling nature of the region results in huge biomasses of specific species that supports a commercially important fishery (Hampton, 2001; Hampton *et al.*, 1998).

Marine fish species can generally be divided in three categories, namely pelagic (species associated with water column), demersal (species associated with the substratum) or meso-pelagic (species associated with both the seafloor and the pelagic environment).

7.4.6.1 Pelagic fish

Pelagic fish species include two major groups, the planktivorous clupeid-like fishes (e.g. anchovy or pilchard) and piscivorous predatory fish (e.g. snoek).

Planktivorous shoaling fish

Three commercially important clupeoids (shoaling / schooling fish) are found within the Benguela system. These are the anchovy (*Engraulis capensis*), the South African pilchard (*Sardinops sagax ocellatus*) and the round herring (*Etrumeus whiteheadi*). These species typically occur in mixed shoals of various sizes (Crawford *et al*., 1987) and generally occur within the 200 m contour. They are thus unlikely to be encountered in Block 2912.

Two distinct populations of pilchard and anchovy inhabit the northern and southern Benguela systems. The northern population centres in the area between the Kunene River and Lüderitz, while southern populations are focused to the south of the Orange River (Boyd & Cruikshank, 1983; Hewitson & Cruikshank, 1993; Crawford, 1991; Crawford, 1989). Both populations of each species are known to demonstrate spatial segregation of different life stages (Crawford, 1989; Hewitson & Cruikshank, 1993). The northern population nursery grounds are located off Walvis Bay. Recruitment to the fishery occurs in this region between March and August, where after a northward migration of juveniles starts. When upwelling in the Lüderitz cell is weak, larvae and pre-recruits from the southern stock may move into the northern population. The southern populations of both species consist of juvenile fish which aggregate in the nursery area between St Helena Bay and the Orange River mouth. Adult anchovy spawn on the Agulhas Bank between October and January. Spawning in pilchard occurs over a longer period with maximal egg abundance from late October to early April.

Round herring (*Etrumeus whiteheadi*) occur over the continental shelf mainly to the south of the Orange River in the southern Benguela system (Roel & Armstrong, 1991). This species does not form a dominant fishery although small catches are made off the Namibian coast each year. Recruitment occurs along the Southern African West Coast from April to September, where the species often occurs together with juvenile anchovy, pilchard and horse mackerel. A general southward migration occurs at the end of winter. Spawning occurs offshore along the West Coast of South Africa and southern Namibia as far north as Lüderitz with an onshore movement of eggs and larvae. A second spawning ground occurs off the shelf break in northern Namibia (Roel & Armstrong, 1991).

Piscivorous predators

Snoek (*Thyristes atun*) are found off Namibia between September and March, where after individuals move southwards as far as the Western Cape of South Africa by August (Crawford *et al.*, 1987; Crawford, 1989). The return migration commences between August and October and occurs further offshore than do the southerly movements. The movements of this species correlate with distribution patterns of major prey species, including sardinellas off northern Namibia and juvenile anchovy and pilchard in the southern Benguela system. Spawning occurs off the coast between St Helena Bay and the Cape Peninsula from July to October. The movements of chub mackerel (*Scomber japonicus*) are very similar to those of snoek and appear to be related to the presence of prey (Crawford *et al.*, 1987; Crawford, 1989). Chub mackerel are most abundant in the northern Benguela in spring and summer, migrating southward to occur south of the Orange River in winter to mid spring. They move inshore in June and July to spawn before starting the return migration northwards offshore later in the year.

The fish most likely to be encountered on the shelf, beyond the shelf break and in the offshore waters of Block 2912 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 (see Table 7-2). Tuna species are usually distributed offshore near the thermal front (at the shelf break). Their offshore distribution is also related to the presence of shoaling pelagic fish species (*e.g.* pilchard, anchovy and round herring). Many of these tuna species are found along the whole of the southern African West Coast, although no tuna populations are permanently resident within the Benguela system, and no tuna species spawn within it. Tuna are classified as highly migratory species and the many stocks of these species are a shared resource between the coastal states on both sides of the South Atlantic.

The big-eye tuna (*Thunnus obesus*) and the longfin tuna (*Thunnus alalunga*) are the two most common tuna species caught in Namibian waters (Lehmensiek, 1995). Longfin tuna or Albacore have a wide distribution in the south Atlantic Ocean and migrate annually through their distribution range between 10°S and 40°S (Penney *et al.*, 1992). The Namibian coast boasts one of the highest adult abundances of this species recorded globally (Yang & Sun, 1983).

Most spawning takes place in the tropical South Atlantic east of Brazil, and small Albacore are present throughout the year in the Benguela region (Nepgen, 1970). Adult abundances in the region peak in autumn and winter. Concentrations of Albacore are usually associated with hydrological features occurring at the shelf breaks or underwater features such as canyons and seamounts, and most tuna caught in the region are found in the vicinity of the Tripp Seamount, approximately 125 km east of Block 2912.

Table 7-2: Important large migratory pelagic fish likely to occur in the offshore waters around Block 2912

Common Name	Species	IUCN Conservation Status
Tunas		
Southern Bluefin Tuna	*Thunnus maccoyii*	Critically Endangered
Bigeye Tuna	*Thunnus obesus*	Vulnerable
Longfin Tuna/Albacore	*Thunnus alalunga*	Near Threatened
Yellowfin Tuna	*Thunnus albacares*	Near Threatened
Frigate Tuna	*Auxis thazard*	Least concern
Eastern Little Tuna	*Euthynnus affinis*	Least concern
Skipjack Tuna	*Katsuwonus pelamis*	Least concern
Billfish		
Blue Marlin	*Makaira nigricans*	Vulnerable
Striped Marlin	*Kajikia audax*	Near Threatened
Sailfish	*Istiophorus platypterus*	Least concern
Swordfish	*Xiphias gladius*	Least concern
Black Marlin	*Istiompax indica*	Data deficient
Pelagic Sharks		
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Vulnerable

Common Name	Species	IUCN Conservation Status
Dusky Shark	*Carcharhinus obscurus*	Vulnerable
Great White Shark	*Carcharodon carcharias*	Vulnerable
Shortfin Mako	*Isurus oxyrinchus*	Vulnerable
Longfin Mako	*Isurus paucus*	Vulnerable
Whale Shark	*Rhincodon typus*	Endangered
Blue Shark	*Prionace glauca*	Near Threatened

7.4.6.2 Demersal Fish

Changes in fish communities occur with increasing depth (Roel, 1987; Smale *et al*., 1993; Macpherson & Gordoa, 1992; Bianchi *et al*., 2001; Atkinson, 2009), with the most substantial change in species composition occurring in the shelf break region between 300 m and 400 m depth (Roel, 1987; Atkinson, 2009).

Three species of hake occur in Namibian offshore waters. Shallow-water Cape hake (*Merluccius capensis*) ranges from southern Angola round the Agulhas Bank, while deep-water Cape hake (*M. paradoxus*) has a similar long-shore distribution in deeper waters (Crawford *et al.*, 1987; Payne, 1989). Benguela hake (*M. polli*) is limited to Angolan waters and waters of northern Namibia.

Deep-water hakes are most abundant along the edge of the continental shelf between 300 and 500 m depth and at distances of 80 to 120 km from the coast. In contrast shallow-water hake occur primarily close inshore at bottom depths of 100 to 300 m, with densest abundances occurring between 40 and 80 km from the coast. Shallow-water Cape hake are the most common of the three species occurring off Namibia, although both shallow-water and deep-water hake are fished commercially (Van der Westhuizen, 2001).

Vertical migration off the ocean bottom at night has been noted for both commercial species of hake (Payne, 1989). Shallow-water hake spawn over large areas off the Namibian coast, but there is currently no evidence of spawning deep-water hake in Namibian waters (Crawford *et al.*, 1987). Although the main area of shallow-water hake recruitment occurs in the central region at depths of 100 to 250 m between 20°S and 24°S, the area offshore to the north-west of Lüderitz (26º30'S) is also an important recruitment zone. Deep-water hake recruit further offshore between Lüderitz and the Orange River at depths of between 150 and 300 m. Hake are known to be pelagic during the first year of life, and inhabit the mid-water and upper layers in the shallower waters nearer to the coast. Immature shallow-water hake occur over the entire coastal shelf usually at depths shallower than 150 m. In contrast, immature deep-water hake are found mainly south of the Lüderitz upwelling cell at depths ranging between 200 and 300 m. Hake migrate offshore into deeper water during their second year and settle close to the bottom west of the 150 m isobath where they become more typically demersal in habit.

Two species of monkfish (*Lophius vomerinus* and *L. vaillanti*) are found in Namibian waters, although only *L. vomerinus* is recorded south of Walvis Bay (Maartens & Booth, 2001). *L. vomerinus* is found at depths of between 150 and 500 m but occurs at high abundance between 300 and 400 m off central and southern Namibia (Maartens & Booth, 2001; Leslie & Grant, 1990). Spawning is irregular and variable and is thought to occur throughout the year (Macpherson, 1985) with two separate areas of recruitment recorded between the 100 m and 300 m isobaths off Walvis Bay and Lüderitz (Leslie and Grant 1990).

Two distinct stocks of West Coast Sole (*Austroglossus microlepis*) exist along the Namibian coast. The northern most stock is centred in the region of 20ºS - 25ºS (i.e. the Walvis Bay basin) in water depths of 75 to 300 m, while the southern stock occurs off the mouth of the Orange River (28°-30º S) in water depths of

50 to 100 m. Both stocks spawn between September and December, with slightly earlier spawning occurring in the southern stock.

Kingklip (*Genypterus capensis*) have a wide distribution and occur between northern Namibia and the Eastern Cape, South Africa. Depth distribution is size dependent, with larger fish found offshore. Water temperature also appears to play an important role in distribution. Spawning is believed to occur off the southern African West Coast and off Namibia to the north of Lüderitz between August and October. This species is often in association with rocky substrata.

7.4.6.3 Meso-pelagic fish

Meso-pelagic fish are typified by extensive vertical migration. At night they rise into the epipelagic zone while by day they occur in bottom waters.

While juvenile horse mackerel is pelagic, adults are meso-pelagic. Two species of horse mackerel, the Cape horse mackerel (*Trachurus capensis*) and the Cunene horse mackerel (*T. trecae*) are found within the Benguela system. There are believed to be two stocks of Cape horse mackerel; one each off the South African Western Cape and Namibia (Crawford *et al.*, 1987). Spawning grounds occur off the Western Cape and off the shelf edge of northern Namibia, while nursery grounds occur over the continental shelf between the Western Cape and the Orange River Mouth and to the north of Walvis Bay off Namibia.

The bearded or pelagic goby (*Sufflogobius bibartus*) occurs in inshore waters off the southern African coast to the south of Walvis Bay, with a distributional break between Lüderitz and the Orange River. Spawning occurs between spring and early summer between Walvis Bay and Lüderitz. While juveniles live in the epipelagic zone, adults occur in deeper waters, but do not form large schools like pilchard and anchovy. As pelagic goby feeds on similar plankton to pilchard, the collapse of the pilchard stock resulted in marked increases of pelagic goby in the late 1970's and early 1980's.

7.4.7 Seabirds

The Namibian coastline sustains large populations of breeding and foraging seabird and shorebird species, which require suitable foraging and breeding habitats for their survival. In total, 12 species of seabirds are known to breed along the southern Namibian coast, both on oceanic islands and in mainland colonies (see Table 7-3). Most seabirds breeding in Namibia are restricted to areas where they are safe from land predators, although some species are able to breed on the mainland coast, either cryptically on the open ground (e.g. Damara tern) or in inaccessible places. In general, most breed on islands or on the man-made guano platforms in Walvis Bay, Swakopmund and Cape Cross, well to the north of Block 2912. The islands along the Namibian coast, therefore, provide a vital breeding habitat to most species of seabirds that breed in Namibia. However, the number of successfully breeding birds at the particular breeding sites varies with food abundance (J. Kemper, MFMR Lüderitz, *pers. comm*.). With the exception of the Kelp Gulls and White-breasted Cormorants all the breeding species are listed Red Data species in Namibia.

Most of the seabird species breeding in Namibia feed relatively close inshore (10-30 km), although exceptions occur (Ludynia *et al*. 2012), particularly when birds are forced to alter their dispersal patterns in response to environmental change (Sherley *et al*. 2017). Cape gannets, however, are known to forage up to 140 km offshore (Dundee, 2006; Ludynia, 2007) and African penguins have also been recorded as far as 60 km offshore. **As Block 2912 is located approximately 290 km offshore at its closest point, encounters with Cape gannets and African penguins during the proposed exploration activities is highly unlikely.**

Table 7-3: Namibian breeding seabird species

Species	Namibian	Global IUCN
African Penguin *Spheniscus demersus*	Endangered	Endangered
Bank Cormorant *Phalacrocorax neglectus*	Endangered	Endangered
Cape Cormorant *Phalacrocorax capensis*	Endangered	Endangered
Cape Gannet *Morus capensis*	Critically Endangered	Endangered
Crowned Cormorant *Phalacrocorax coronatus*	Near Threatened	Near Threatened
African Black Oystercatcher *Haematopus moquini*	Near Threatened	Near Threatened
White-breasted cormorant *Phalacrocorax carbo*	Least Concern	Least Concern
Kelp Gull *Larus dominicanus*	Least Concern	Least Concern
Hartlaub's Gull *Larus hartlaubii*	Vulnerable	Least Concern
Sabine's Gull Xema sabini	Not listed	Least Concern
Swift Tern *Sterna bergii bergii*	Vulnerable	Least Concern
Damara Tern *Sterna balaenarum*	Near Threatened	Vulnerable

Note: Species recorded by Marine Mammal Observers (MMOs) en route to Block 2913B are highlighted (Benthic Solutions, 2019b, 2019c).

Source: Kemper *et al*., 2007; Simmons *et al*., 2015

Among the other species present off Namibia's southern coast there are nine species of albatrosses, petrels or giant-petrels recorded (Boyer and Boyer, 2015). However, population numbers are poorly known and they do not breed in Namibian waters. Forty-nine species of pelagic seabirds have been recorded in the region, of which 14 are resident. Highest pelagic seabird densities occur offshore of the shelf-break in winter. Pelagic seabirds potentially encountered in Block 2912, and encountered en route and within Block 2913B (Benthic Solutions, 2019b, 2019c) are provided in Table 7-4.

Table 7-4: Other Namibian red-listed bird species

Species	Namibian	Global IUCN
Tristan Albatross *Diomedea dabbenena*	Critically Endangered	Critically Endangered
Atlantic Yellow-nosed Albatross *Thalassarche chlororhynchos*	Endangered	Endangered
Black-browed Albatross *Thalassarche melanophrys*	Endangered	Least Concern
Wandering Albatross *Diomedea exulans*	Vulnerable	Vulnerable
Shy Albatross *Thalassarche cauta*	Near Threatened	Near Threatened
White-capped Albatross *Thalassarche sneadi*	Near Threatened	Near Threatened
Spectacled Petrel *Procellaria conspicillata*	Vulnerable	Vulnerable
Northern Giant-Petrel *Macronectes halli*	Near Threatened	Least Concern
Pintado Petrel *Daption capense*	Not listed	Least Concern
Kerguelen Petrel *Lugensa brevirostris*	Not listed	Least Concern
Great-winged Petrel *Pterodroma macroptera*	Not listed	Least Concern
Soft-plumaged Petrel *Pterodroma mollis*	Not listed	Least Concern
White-chinned Petrel *Procellaria aequinoctialis*	Vulnerable	Vulnerable
Leach's Storm-Petrel *Oceanodroma leucorhoa*	Not listed	Vulnerable
Wilson's Storm-Petrel *Oceanites oceanicus*	Not listed	Least Concern
European Storm-Petrel *Hydrobates pelagicus*	Not listed	Least Concern
Arctic Tern *Sterna paradisaea*	Not listed	Least Concern
Caspian Tern *Sterna caspia*	Vulnerable	Least Concern
Grey Phalarope *Phalaropus fulicarius*	Not listed	Least Concern

Species	Namibian	Global IUCN
Sub-Antarctic Skua *Catharacta antarctica*	Not listed	Least Concern
Pomarine Skua *Stercorarius pomarinus*	Not listed	Least Concern
Long-Tailed Skua *Stercorarius longicaudus*	Not listed	Least Concern
Sooty Shearwater *Puffinus griseus*	Near Threatened	Near Threatened
Cory's Shearwater *Calonectris diomedea*	Not listed	Least Concern
Manx Shearwater *Puffinus puffinus*	Not listed	Least Concern
Great Shearwater *Puffinus gravis*	Not listed	Least Concern

Notes: Species recorded by Marine Mammal Observers (MMOs) en route to Block 2913B are highlighted (Benthic Solutions, 2019a, 2019b).
In the IUCN scheme Endangered is a more extinction-prone class than Vulnerable, and differences between Namibia and global classifications are the result of local population size, and the extent and duration of declines locally.
Source: Kemper *et al*., 2007; Simmons *et al*., 2015

7.4.8 Turtles

Five of the eight species of turtle worldwide occur off Namibia (Bianchi *et al*., 1999). Leatherback turtles (*Dermochelys coriacea*) are occasionally sighted off central and southern Namibia. Observations of Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Hawksbill (*Eretmochelys imbricata*) and Olive Ridley (*Lepidochelys olivacea*) turtles in the area are rare. Although not reported in the MMOs reports for Block 2913B (Benthic Solutions, 2019b, 2019c), loggerhead turtles have been reported by MMOs during seismic operations in an adjacent licence area (PEL83). **The leatherback turtle may also be encountered in the offshore waters of southern Namibia, although abundance in the study area is expected to be low.**

The Benguela ecosystem, especially the northern Benguela where jelly fish numbers are high, is increasingly being recognised 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[7]). Leatherback turtles from the east South Africa population have been satellite tracked swimming around the West Coast of South Africa into central and southern Namibian waters and remaining in the warmer waters west of the Benguela ecosystem (Lambardi *et al*., 2008) (see Figure 7-14).

Leatherback, Loggerhead and Olive Ridley turtles are listed as "Vulnerable" worldwide by the International Union for Conservation of Nature (IUCN) and are in the highest categories in terms of need for conservation in the Convention on International Trade in Endangered Species (CITES) and Convention on Migratory Species (CMS). Hawksbill and Green turtles are listed as "Critically Endangered" and "Endangered", respectively. Namibia is, thus, committed to conserve these species at an international level.

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

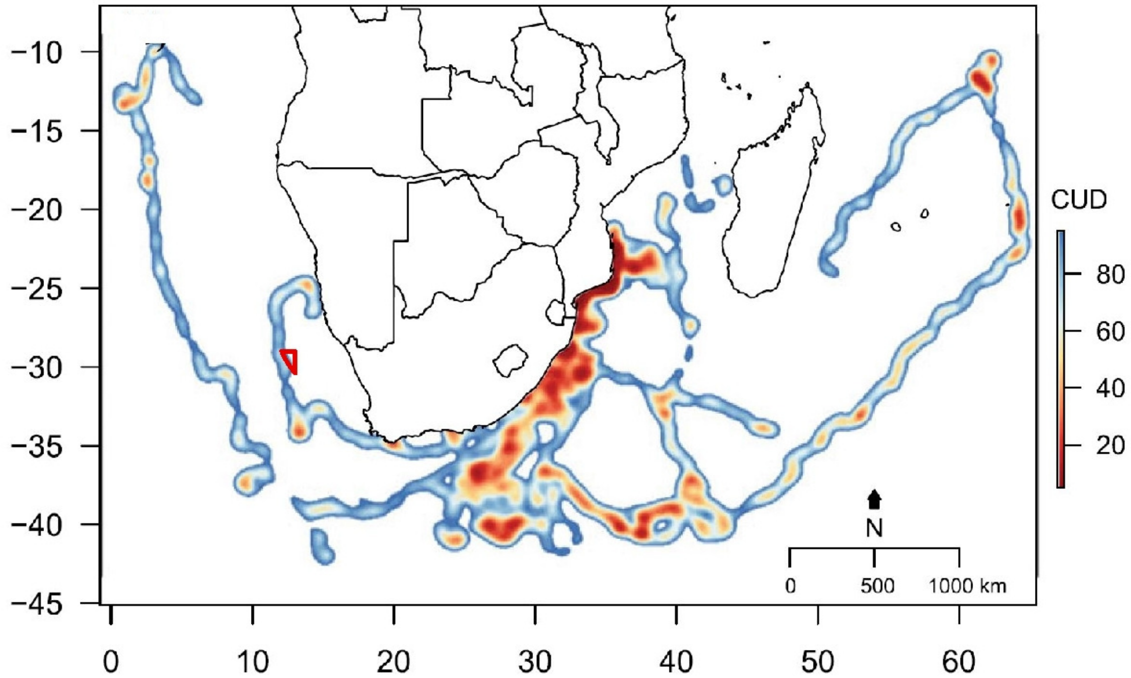

Figure 7-14: Block 2912 in relation to the migration corridors of leatherback turtles in the south-western Indian Ocean.

Relative use (CUD, cumulative utilisation distribution) of corridors is shown through intensity of shading – light = low use; dark = high use

Source: Harris *et al*., 2018

7.4.9 Marine Mammals

The marine mammal fauna occurring off the central Benguela ecosystem coast includes several species of whales and dolphins and one resident seal species.

7.4.9.1 Cetaceans

Thirty-three species of whales and dolphins are known or likely to occur in central Benguela region and in the offshore waters of the licence area (see Table 7-5 and Figure 7-15). Apart from the resident species such as the endemic Heaviside's, bottlenose and dusky dolphins, the Namibian waters also host species that migrate between Antarctic feeding grounds and warmer breeding ground waters, as well as species with a global distribution.

Table 7-5: List of cetacean species known or likely to occur in Namibian waters

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

Common Name	Species	Hearing Frequency	Shelf	Offshore	Seasonality	IUCN Conservation Status
Beaked whales						
Cuvier's	*Ziphius cavirostris*	HF	No	Yes	Year round	Data Deficient
Arnoux's	*Beradius arnouxii*	HF	No	Yes	Year round	Data Deficient
Southern bottlenose	*Hyperoodon planifrons*	HF	No	Yes	Year round	Least Concern
Layard's	*Mesoplodon layardii*	HF	No	Yes	Year round	Data Deficient
True's	*M. mirus*	HF	No	Yes	Year round	Data Deficient
Gray's	*M. grayi*	HF	No	Yes	Year round	Data Deficient
Blainville's	*M. densirostris*	HF	No	Yes	Year round	Data Deficient
Baleen whales						
Antarctic Minke	*Balaenoptera bonaerensis*	LF	Yes	Yes	Higher in Winter	Least Concern
Dwarf minke	*B. acutorostrata*	LF	Yes	Yes	Year round	Least Concern
Fin whale	*B. physalus*	LF	Yes	Yes	MJJ & ON, rarely in summer	Endangered
Blue whale	*B. musculus*	LF	No	Yes	Higher in MJJ	Critically Endangered
Sei whale	*B. borealis*	LF	Edge	Yes	MJ & ASO	Endangered
Bryde's (offshore)	*B. brydei*	LF	Yes	Yes	Higher in Summer (JFM)	Not assessed
Bryde's (inshore)	*B brydei (subspp)*	LF	Yes	Yes	Year round	Vulnerable
Pygmy right	*Caperea marginata*	LF	Yes	?	Year round	Data Deficient
Humpback	*Megaptera novaeangliae*	LF	Yes	Yes	Year round, higher in JJASON	Least Concern
Humpback B2 population	*Megaptera novaeangliae*	LF	Yes	Yes	Spring Summer peak ONDJF	Vulnerable
Southern right	*Eubalaena australis*	LF	Yes	No	Year round, higher in JASON	Least Concern

Notes: Species recorded by Marine Mammal Observers (MMOs) en route to Block 2913B are highlighted (Benthic Solutions, 2019b, 2019c).

Source: IUCN Conservation Status is based on the SA Red List Assessment (2014) (Child *et al*., 2016).

VHF = Very High Frequency; HF = High Frequency; LF = Low frequency

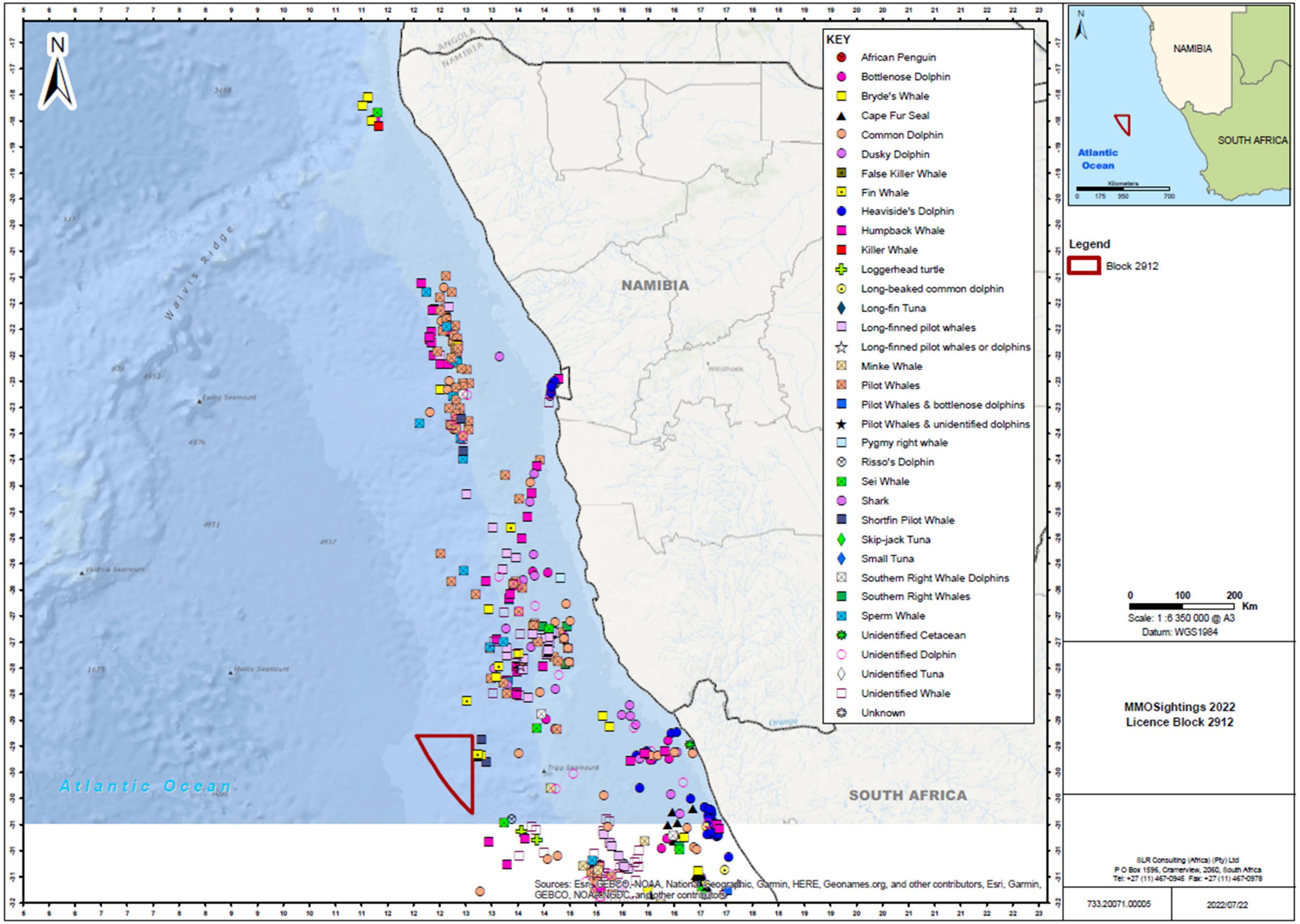

Figure 7-15: Block 2912 in relation to the distribution and movement of cetaceans sighted by Marine Mammal Observers along the Namibian coastline, collated between 2001 and 2021 (SLR MMO database)

Although the location of Block 2912 can be considered to be truly within the Benguela Ecosystem, the warmer waters that occur more than 100 km offshore provide an entirely different habitat, that despite the relatively high latitude, may host some species associated with the more tropical and temperate parts of the Atlantic such as rough toothed dolphins, striped dolphins, Pan-tropical spotted dolphins and short finned pilot whales.

The distribution of cetaceans in Namibian waters 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 in the continental slope (200 to 2 000 m) making this the most species-rich area for cetaceans. Cetacean density on the continental shelf is usually higher than in pelagic waters, as species associated with the pelagic environment tend to be wide ranging across thousands of kilometres. The most common species within the broader project area (in terms of likely encounter rate not total population sizes) are likely to be the humpback whale and pilot whale.

Cetaceans can be divided into two major groups, the mysticetes or baleen whales which are largely migratory, and the toothed whales or odontocetes which may be resident or migratory.

Mysticetes

The majority of mysticetes whales fall into the family Balaenopeteridae. Those occurring in the study area include the blue, fin, sei, Antarctic minke, dwarf minke, humpback, southern right, pygmy right and Bryde's whales. The majority of these species occur in pelagic waters with only occasional visits to shelf waters (<200 m deep). All of these species show some degree of migration either to, or through, the latitudes encompassed by Block 2912 when *en route* between higher latitude (Antarctic or Subantarctic) feeding grounds and lower latitude breeding grounds. Depending on the ultimate location of these feeding and breeding grounds, seasonality in Namibian waters can be either unimodal, usually in winter months, or bimodal (e.g. May-July and October-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. Due to the complexities of the migration patterns, each species is discussed separately below. A best estimate of expected seasonality within the broader project area is provided in Table 7-6.

Table 7-6: Seasonality of baleen whales in the licence area

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

Note: Values of High (H), Medium (M) and Low (L) are relative within each row (species) and not comparable between species.

- **Blue whales** (*Balaenoptera musculus*): Blue whales were historically caught in high numbers during commercial whaling activities, with a single peak in catch rates during June to July in Walvis Bay, Namibia and at Namibe, Angola suggesting that in the eastern South Atlantic these latitudes are close to the northern migration limit for the species (Best, 2007). Evidence of blue whale presence off Namibia is rapidly increasing. Recent acoustic detections of blue whales in northern Namibia between May and July (Thomisch, 2017) and several recent (2014-2015) sightings during seismic surveys in southern Namibian in water >1 000 m deep confirm their current existence in the area and occurrence in autumn months. **Encounters in the project area may occur**.
- **Fin whales** (*Balaenoptera physalus*): Fin whales were historically caught off the West Coast of Namibia and South Africa. A bimodal peak in the catch data from South Africa suggests animals were migrating further north to breed (during May-June) before returning to Antarctic feeding grounds (during August-October). 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). Four strandings have occurred between Walvis Bay and the Kunene River, Namibia in the last decade during January, April (2) and October (NDP unpubl. data). Groups of 5-8 animals have been seen on multiple occasions on the coast either side of Lüderitz in April, May of 2014 and January 2015 (NDP unpubl. data) confirming their contemporary occurrence in Namibian waters and potential use of the upwelling areas for feeding. To date, most sightings or strandings have occurred in late summer (April-May), supporting evidence from whaling data that this is a peak time of occurrence in southern Namibia. Five sightings of Bryde's whales were made en route to and within Block 2913B in late 2018 and early 2019 (Benthic Solutions Ltd 2019b, 2019c). **Encounters in the licence area are thus likely to occur**.
- **Sei whales** (*Balaenoptera borealis*): There is very little information on Sei whales in Namibian waters and most information on the species from the southern African sub-region originates from whaling data from 1958-1963. Sei whales spend time at high altitudes (40-50˚S) during summer months and migrate north through South African waters to unknown breeding grounds further north (Best, 2007). Since whaling catches were confirmed off both Congo and Angola, it is possible they migrate through Namibian waters. Due to their migration pattern, densities in the licence area are likely to show a bimodal peak with numbers predicted to be highest in May and June, and again in August, September and October. All whales were historically caught in waters deeper than 200 m with most catches from deeper than 1 000 m (Best & Lockyer, 2002). Importantly, there may be considerable variation in the number of sei whales within an area between years, which may be influenced by food availability in feeding areas. There is no current information on the abundance or distribution of this species in the region, but a recent sighting of sei whales in March 2012 (NDP unpublished data) and a live stranding in July 2013 in Walvis Bay confirms their contemporary occurrence in Namibian shelf waters and beyond. **Encounters in the licence block are likely to occur**.
- **Bryde's whale** (*Balaenoptera edeni*): Two genetically and morphologically distinct populations of Bryde's whales live off the coast of southern Africa (Best, 2001; Penry, 2010). The "offshore population" lives beyond the shelf (> 200 m depth) off West Africa and migrates between wintering grounds off equatorial West Africa (Gabon) and summering grounds off western South Africa. Its seasonality within Namibian waters is thus opposite to the majority of the balaenopterids with abundance likely to be highest in the broader potential impact zone in January - March. Several strandings of adult offshore Bryde's whales in January 2012 and November 2017 near Walvis Bay confirms the population's current occurrence in Namibia. The "inshore population" of Bryde's whales is unique amongst baleen whales in the region by being non-migratory. It lives on the continental shelf and Agulhas Bank of South Africa ranging from

approximately Durban in the east to at least St Helena Bay off the West Coast. It may move further north into the Benguela current areas off the West Coast of South Africa and Namibia, especially in the winter months (Best, 2007). A live stranding of a calf of this population near Walvis Bay confirms the current occurrence of this population in Namibian waters. An additional live sighting in the Namibian Islands marine Protected Area (MPA) and a third stranding of a Bryde's whale adult in April 2013 has not yet been assigned to population but supports regular, year round occurrence of the species in the northern Benguela ecosystem (NDP unpubl. data). Three sightings of Bryde's whales were made en route to and within the adjacent Block 2913B in early 2019 (Benthic Solutions, 2019b). **Encounters in the licence area are thus likely to occur.**

- **Minke whales** (*Balaenoptera bonaerensis / acutorostrata*): Two forms of minke whale occur in the Southern Hemisphere, the Antarctic minke whale and the dwarf minke whale; both species occur in the Benguela region (Best, 2007; NDP, unpubl. data). Antarctic minke whales range from the pack ice of Antarctica to tropical waters and are usually seen more than approximately 50 km offshore. Although adults of the species migrate from the southern ocean (summer) to tropical/temperate waters (winter) where they are thought to breed, some animals, especially juveniles, are known to stay in tropical/temperate waters year round. Regular sightings of semi-resident Antarctic minke whales in Lüderitz Bay, especially in summer months (December - March) and a stranding of a single animal in Walvis Bay (in February 2014) confirm the contemporary occurrence of the species in Namibia (NDP, unpubl. data). Recent data available from passive acoustic monitoring over a two-year period off the Walvis Ridge shows acoustic presence in June - August and November - December (Thomisch *et al*., 2016). 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 minke whales have a similar migration pattern to Antarctic minkes with at least some animals migrating to the southern ocean in summer months. Around southern Africa, dwarf minke whales occur closer to shore than Antarctic minkes and have been seen <2 km from shore on several occasions around South Africa. **Both species are generally solitary and densities are likely to be low in the broader project area, but encounters may occur**.
- **Pygmy right whale** (*Caperea marginata*): 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 and in Namibia there are no confirmed records north of Walvis Bay.
- **Southern right** (*Eubalaena australis*) and humpback (*Megaptera novaeangliae*) whales: The most abundant baleen whales in the Benguela region are southern right and humpback whales. In the last decade, both southern right whales and humpback whales have been increasingly observed to remain on the West Coast of Southern Africa well after the 'traditional' Southern African whale season (June-November) into spring and early summer (October-February) where they have been observed feeding in upwelling zones, especially off Saldanha and St Helena Bays (Barendse *et al*., 2011; Mate *et al*., 2011**). Increasing numbers of summer records of both species, suggest that animals may also be feeding in upwelling areas off Namibia, especially the southern half of the country near the Lüderitz upwelling cell (NDP unpubl. data) and will, therefore, occur in or pass through the project area.**

  The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baia dos Tigres) and is considered to be a single population within this range (Roux *et al.,* 2011). The most recent abundance estimate for this population is available for 2017 which estimated the population at approximately 6 100 individuals including all age and sex classes, and still growing at approximately 6.5% per annum. When the population numbers crashed, the range contracted down to just the South Coast of South Africa, but as the population recovers, it is repopulating its historic grounds, including Namibia (Roux *et al.,* 2001) and Mozambique (Banks *et al.,* 2011). Southern right whales are seen regularly in Namibian coastal waters (<3 km from shore), especially along the southern half of the Namibian coastline (Roux *et al*., 2001, 2011). Southern right whales have been recorded in Namibian waters in all months of the year (J-P. Roux, *pers. comm*.; NDP, unpublished data) but with numbers peaking in winter (June-August). A secondary peak in summer (November-January) also occurs, associated with animals feeding off the West Coast of South Africa (and possibly Namibia) and performing exploratory trips into southern Namibia (NDP, unpublished data). **Notably, all available records have been very close to shore with only a few out to 100 m depth, so they are unlikely to be encountered in Block 2912.**

The majority of **humpback whales** passing through the Benguela region are those migrating to breeding grounds off tropical West Africa, between Angola and the Gulf of Guinea (Rosenbaum *et al*., 2009; Barendse *et al*., 2010). A recent synthesis of available humpback whale data from Namibia (Elwen *et al*., 2013) shows that in coastal waters, the northward migration stream is larger than the southward peak supporting earlier observations from whale catches (Best & Allison, 2010). This supports previous suggestions that animals migrating north strike the coast at varying places mostly north of St Helena Bay (South Africa) resulting in increasing whale density on shelf waters as one moves north towards Angola. On the southward migration, there is evidence from satellite tagged animals and the smaller secondary peak in numbers in Walvis Bay, that many humpback whales 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 the West Coast of South Africa in summer (Elwen *et al.,* 2013; Rosenbaum *et al*., 2014) (see Figure 7-16). 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 and Allison, 2010; Elwen *et al.,* 2013). Regular sightings of humpback whales in spring and summer months in Namibia, especially in the Lüderitz area, suggest that summer feeding is occurring in Namibian waters as well (or at least that animals foraging off West South Africa range up into southern Namibia). Recent abundance estimates put the number of animals in the west African breeding population in excess of 9 000 individuals in 2005 (IWC, 2012), and it is likely to have increased since this time at about 5% per annum (IWC, 2012). Humpback whales are thus likely to be the most frequently encountered baleen whale in Block 2912, ranging from the coast out beyond the shelf, with year round presence but numbers peaking in June – July (northern migration) 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 (see Figure 7-17).

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 west South African 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 was linked to possible infectious disease or malnutrition (Siciliano *et al.* 2013), which suggests the West African population may be undergoing similar stresses and caution should be taken in increasing stress through human activities. 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 7-16: Block 2912 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.

Source: Johnson *et al.*, 2022

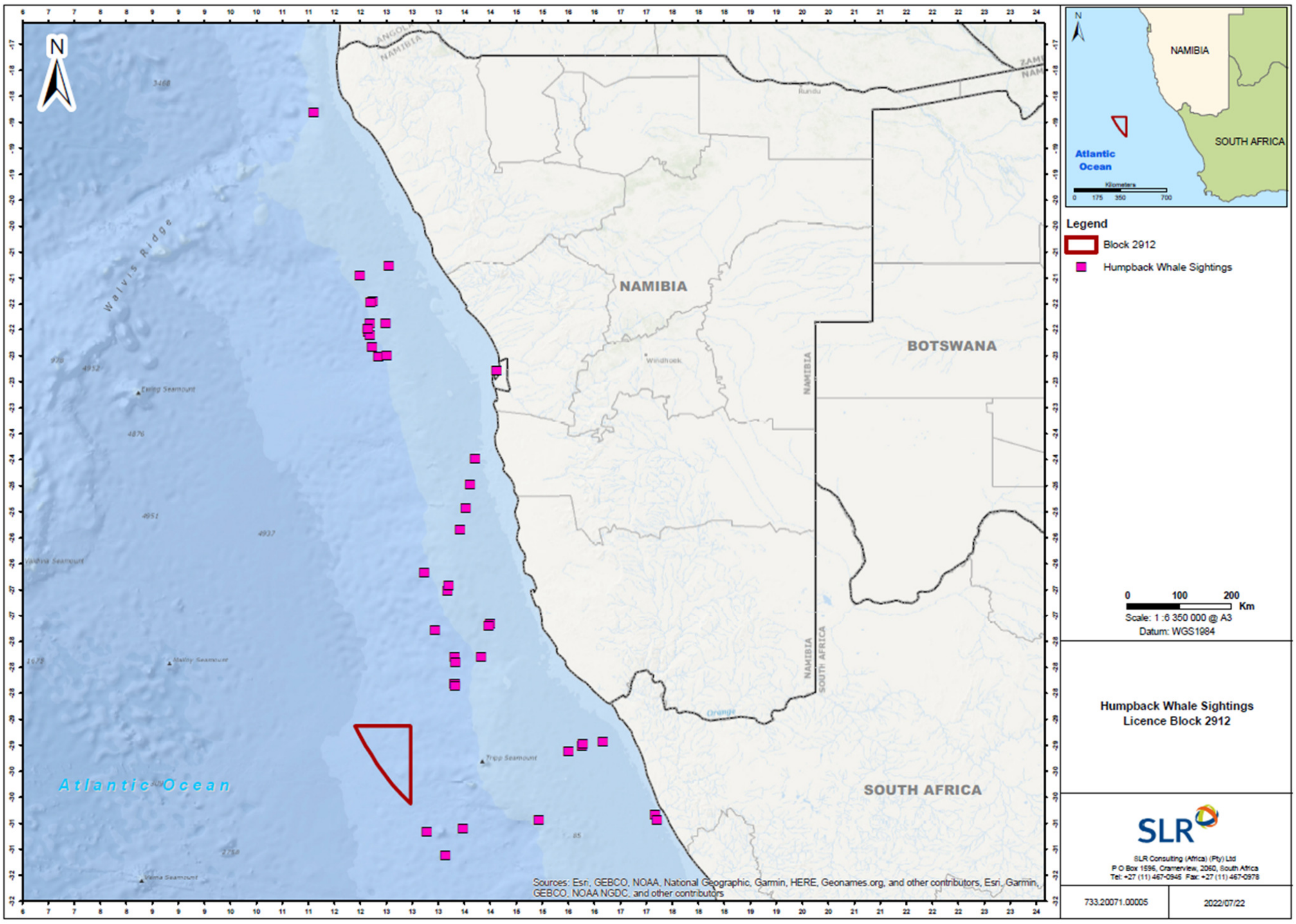

Figure 7-17: Block 2912 in relation to the distribution and movement of humpback whales sighted by MMOs along the Namibian and South African west coast, collated between 2001 and 2021.
Source: SLR MMO Database

<u>Odontocetes</u>

The majority of toothed whales and dolphins have more resident distribution patterns, rather than migratory. Those occurring in the study area are listed in Table 7-5 and discussed below.

- **Killer whales** (*Orcinus orca*) have a circum-global distribution being found in all oceans from the equator to the ice edge (Best, 2007). Killer whales occur year round in low densities off western South Africa (Best *et al.,* 2010), Namibia (Elwen & Leeney, 2011) and in the Eastern Tropical Atlantic (Weir *et al.,* 2010). Killer whales are found in all depths from the coast to deep open ocean environments and **may thus be encountered in Block 2912 at low levels.**
- The **false killer whale** (*Pseudorca crassidens*) has a tropical to temperate distribution and most sightings off southern Africa have occurred in water deeper than 1 000 m, although a few observations have also been made close to shore (Findlay *et al*., 1992). False killer whales usually occur in groups ranging in size from 1 - 100 animals (mean 20.2) (Best, 2007), and are thus likely to be fairly easily seen in most weather conditions. However, the strong bonds and matrilineal social structure of this species makes it vulnerable to mass stranding (8 instances of 4 or more animals stranding together have occurred in the Western Cape, all between St Helena Bay and Cape Agulhas). There is no information on population numbers or conservation status and no evidence of seasonality in the region (Best, 2007).

- **Long-finned** (*Globicephala melas*) and **short-finned pilot whales**: These whales display a preference for temperate waters and are usually associated with the continental shelf or deep water adjacent to it (Mate *et al.,* 2005; Findlay *et al.,* 1992, Weir, 2011). They are regularly seen associated with the shelf edge by Marine Mammal Observers, fisheries observers and researchers operating in Namibian waters (NDP, unpublished data). The distinction between long-finned and short-finned (*G. macrorhynchus*) pilot whales is difficult to make at sea. Short finned pilot whales are regarded as more tropical species (Best, 2007), it is likely that the vast majority of pilot whales encountered in the Namibian waters are long-finned. **Due to the low latitude and offshore nature of the project, it is likely that either could be encountered**. This is confirmed by the sighting of two short-finned pilot whales en route to the adjacent Block 2913B in late 2018 (Benthic Solutions, 2019b). There are many confirmed sightings of pilot whales along the shelf edge of South African and Namibia, including in the vicinity of Block 2912, since 2010 (de Rock *et al*., 2019, Sea Search unpublished data; SLR MMO database). Observed group sizes range from 8 to 100 individuals (Seakamela *et al*., 2022).
- **Sperm whales** (*Physeter macrocephalus*): 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 into waters 500 to 200 m deep on the shelf (Best, 2007). They are relatively abundant globally (Whitehead, 2002), although no estimates are available for Namibian waters. Seasonality of 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). Sperm whales were one of the most frequently seen cetacean species during a series of observations made from offshore seismic survey vessels operating in tropical West Africa between Angola and the Gulf of Guinea (Weir, 2011). Multiple sightings of sperm whales have been recorded during seismic surveys operating around Tripp Seamount in the last decade (NDP Unpublished data, De Rock *et al*., 2019). 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 in the project area are likely to be encountered in deeper waters (>500 m), predominantly in the winter months (April - October).** This is confirmed by the sighting / detection of two sperm whales en route to the adjacent Block 2913B in April 2019 (Benthic Solutions, 2019b).
- **Dwarf** (*Kogia sima*) and **pygmy** (*K. breviceps*) **sperm whales**: The genus *Kogia* currently contains two recognised species, the dwarf and pygmy sperm whales, both of which occur worldwide in pelagic and shelf edge water, with few sighting records of live animals in their natural habitat (McAlpine, 2018). There are >30 records of *K. breviceps* collected along the Namibian coastline with a peak in strandings in June and August. A single account of *K. sima* collected in Walvis Bay in 2010, demonstrates that this species also occurs in Namibian waters (Elwen *et al.,* 2014). ***Kogia* species are likely to occur in the project area at low levels**; seasonality is unknown. Dwarf sperm whales are associated with warmer tropical and warm-temperate waters, being recorded from both the Benguela and Agulhas ecosystems (Best 2007) in waters deeper than approximately 1 000 m.
- **Dusky dolphin** (*Lagenorhynchus obscurus*): Dusky dolphins are likely to be the most frequently encountered small cetacean in water less than 500 m deep. The dusky dolphin is resident year round throughout the Benguela ecosystem in waters from the coast to at least 500 m deep, but may occur as far as 2 000 m depth (Findlay *et al,.* 1992). Although no information is available on the size of the population, they are regularly encountered in near shore waters off South Africa and Lüderitz, although encounters

nearshore are rare along the central and southern Namibian coast (Walvis Bay area), with most records coming from beyond 5 nm from the coast (Elwen *et al.* 2010a; NDP unpubl. data). In a recent survey of the Namibian Islands MPA (between latitudes of 24˚29' S and 27˚57' S and depths of 30-200 m) dusky dolphin were the most commonly detected cetacean species with group sizes ranging from 1 to 70 individuals (NDP unpubl. data), although group sizes up to 800 have been reported in southern African waters (Findlay *et al.* 1992). Four sightings of dusky dolphins were made during the two trips to Block 2913B in late 2018 and early 2019 (Benthic Solutions, 2019a, 2019b). However, **due to the offshore location of Block 2912, encounters within the project area are unlikely**.

- **Heaviside's dolphin** (*Cephalorhynchus heavisidii*): Heaviside's dolphins are relatively abundant in both the southern and northern Benguela ecosystem within the region of 10 000 animals estimated to live in the 400 km of coast between Cape Town and Lamberts Bay (Elwen *et al.* 2009a) and several hundred animals living in the areas around Walvis Bay and Lüderitz. Heaviside's dolphins are resident year-round. This species occupies waters from the coast to at least 200 m depth (Elwen *et al.,* 2006; Best, 2007) and may show a diurnal onshore-offshore movement pattern feeding offshore at night, although this varies throughout the range. This species occupies waters from the coast to at least 200 m depth (Elwen *et al.,* 2006; Best, 2007; Elwen *et al.,* 2010). All sightings made during the two trips to Block 2913B in late 2018 and early 2019 (Benthic Solutions, 2019a, 2019b) occurred closer inshore suggesting **they are unlikely to be encountered in the project area**.
- **Common dolphin** (*Delphinus spp*): The common dolphin is known to occur offshore in Namibian waters (Findlay *et al.* 1992). 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 than 500 m deep (Best 2007), although more recent sightings, including those from MMOs, suggest sightings regularly out to 1 000 m or more (SLR data, Sea Search data). A stranding in Lüderitz (May 2012, NDP unpublished data) and MMO reports have confirmed their occurrence in the region. They are more frequently seen in the warmer waters offshore and to the north of the country. There is no evidence of seasonality. Although not reported in the MMOs reports for the adjacent Block 2913B (Benthic Solutions, 2019a, 2019b), common dolphins have been reported by MMOs during seismic operations in an adjacent licence area (PEL83). Thus, **encounters in the licence area may occur**. 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 deeper than 2 000 m are of the short-beaked form.
- **Southern right whale dolphins** (*Lissodelphis peronii*): The cold waters of the Benguela provide a northwards extension of the normally Subantarctic habitat of this species (Best, 2007). Most records in the region originate in a relatively restricted region between 26°S and 30°S roughly between Lüderitz and Tripp Seamount in water 100-2 000 m deep (Rose & Payne, 1991; Best, 2007; NDP Unpublished data). There has been a recent live stranding of two individuals in Lüderitz Bay in December 2013. They are often seen in mixed species groups with other dolphins such as dusky dolphins. This small area where they are seen overlaps with the broader project area. It is possible that the Namibian sightings represent a regionally unique and resident population (Findlay *et al*., 1992). **Encounter rates in the broader project area are likely to be low**.
- **Common bottlenose dolphin** (*Tursiops truncatus)*: Common bottlenose dolphins are widely distributed in tropical and temperate waters throughout the world, but frequently occur in small (10s to low 100s) isolated coastal populations. Within Namibian waters two populations of bottlenose dolphins occur.

A small population inhabits the very nearshore coastal waters (mostly <15 m deep) of the central and southern Namibian coastline from approximately Lüderitz in the south to at least Cape Cross in the north. The population is thought to number less than 100 individuals (Elwen *et al.,* 2011), but its nearshore habitat makes it **unlikely to be impacted by the proposed exploration activities**. 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.

- **Other Delphinids**: Several other species of dolphins that might occur in the deeper waters of broader project area at low levels include the pygmy killer whale, Risso's dolphin, rough toothed dolphin, pantropical spotted dolphin and striped dolphin (Findlay *et al.,* 1992; Best, 2007). Although nothing is known about the population size or density of these species in the broader project area, **it is likely that encounters would be rare**.
- **Beaked Whales** (Various Species) - Beaked whales are all considered to be true deep-water species, usually recorded in waters in excess of 1 000 – 2 000 m (Best, 2007) and thus may be encountered in the project area. 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**.

7.4.9.2 Pinnipeds

The Cape fur seal (*Arctocephalus pusillus pusillus*) **is the only species of seal resident along the West Coast of Africa and is considered as of 'Least Concern'**. 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).

Currently, half the Namibian seal population occurs in southern Namibia, south of Lüderitz and approximately 300 km northeast of Block 2912. It consists of about 300 000 seals, producing roughly 100 000 pups per year. Atlas Bay, Wolf Bay and Long Islands (near Lüderitz) together represent the largest breeding concentration (about 68 000 pups) of seals in Namibia. **The colonies closest to Block 2912 are at Van Reenen Bay and Baker's Bay approximately 290 km inshore and to the northeast of the north-eastern corner of the Block, in the Tsau//Khaeb (formally known as the Sperrgebiet) National Park** (see Figure 7-18).

These southern Namibian colonies have important conservation value since they are largely undisturbed at present, as public access to the southern Namibian coast is restricted. Further colonies occur at Kleinzee (incorporating Robeiland), at Bucchu Twins near Alexander Bay, and Strandfontein Point (south of Hondeklipbaai) in South Africa. The colony at Kleinzee has the highest seal population and produces the highest seal pup numbers on the Southern African coast (Wickens 1994). The colony at Buchu Twins, formerly a non-breeding colony, has also attained breeding status (M. Meÿer, SFRI, pers. comm.). These colonies are all located over 300 km east of Block 2912.

The Cape fur seal population in the Benguela is regularly monitored by the South African and Namibian governments (e.g. Kirkman *et al.* 2012). Surveys of the full species range are done every three years providing data on seal pup production (which can be translated to adult population size), thereby allowing for the generation of high quality data on the population dynamics of this species. The population is considered to be healthy and stable in size although there has been a northward shift in the distribution of the breeding population (Kirkman *et al.* 2012).

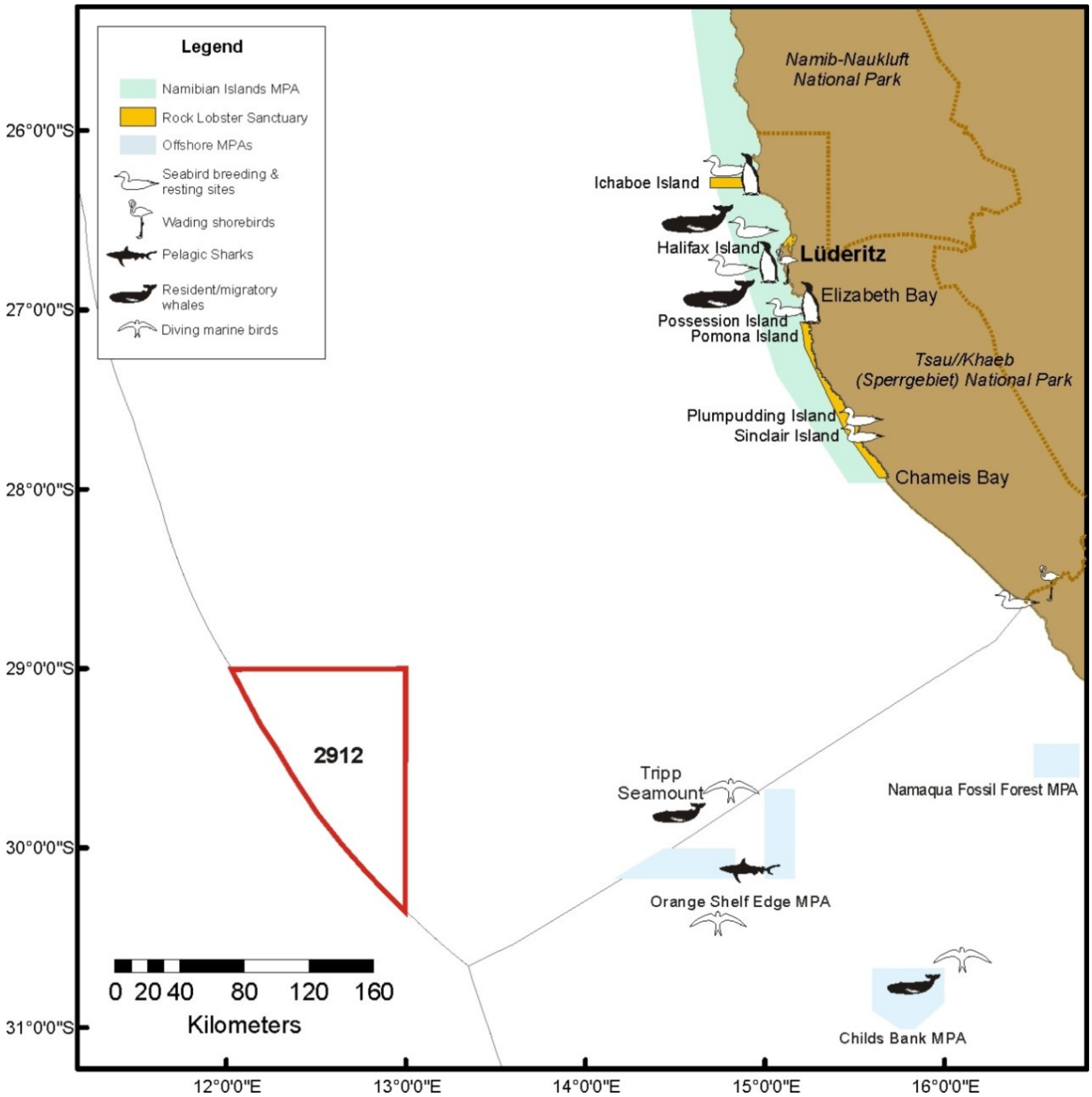

Figure 7-18: Block 2912 in relation to biodiversity sensitivities along the Namibian coast
Source: Pisces

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore (Shaughnessy 1979), with bulls ranging further out to sea than females. The foraging area of tracked seals from the South African West Coast colonies was provided in Harris *et al.* (2022) (see Figure 7-19), and although not illustrated extending across the border, the continued distribution ranges into Namibian waters can be inferred. Block 2912 lies well offshore of the foraging ranges of West Coast colonies. Seals were, regularly sighted by MMOs during seismic surveying in PEL 83, inshore and adjacent to Block 2913B, but no seals were reported from the immediately adjacent Block 2913B (Benthic Solutions Ltd, 2019b, 2019c), although they were encountered *en route*.

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

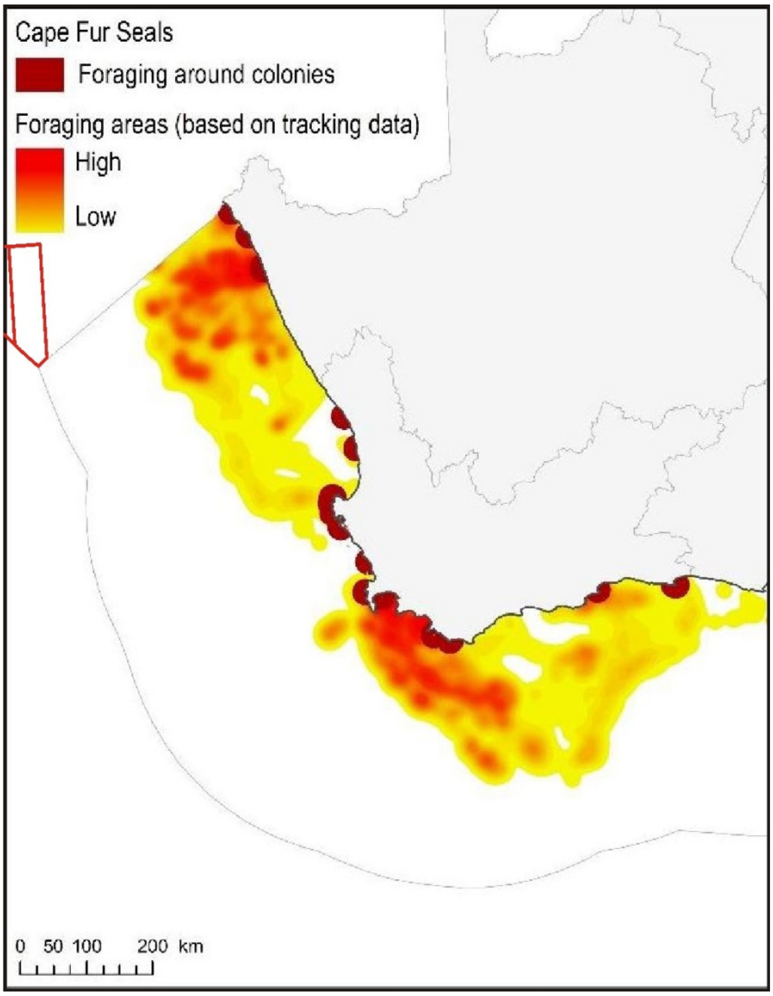

Figure 7-19: The adjacent Block 2913B in relation to seal foraging areas on the South African West Coast.
Source: Harris *et al*., 2022

There is a controlled annual quota, determined by government policy, for the harvesting of Cape fur seals on the Namibian coastline. The Total Allowable Catch (TAC) currently stands at 60 000 pups and 5 000 bulls, distributed among four licence holders. The seals are exploited mainly for their pelts (pups), blubber and genitalia (bulls). The pups are clubbed and the adults shot. These harvesting practices have raised concern among environmental and animal welfare organisations (Molloy & Reinikainen, 2003).

In South Africa, an unprecedented mortality event was recorded between September and December 2021 at colonies around the West Coast Peninsula and north to Lambert’s Bay and Elands Bay. 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). In Namibia, similar mortality events typically related to prey shortage occur periodically, the most recent being a large-scale abortion event in 2020, especially at the colonies in central Namibia (J.-P. Roux, pers.comm.).

7.5 CONSERVATION AREAS AND MARINE PROTECTED AREAS

7.5.1 National Parks

Inshore of Block 2912, the coastline of Namibia is part of a continuum of protected areas that stretch along the entire Namibian coastline, a distance of about 1 570 km, from Southern Angola into Namaqualand in South Africa. Recently proclaimed as the Namib-Skeleton Coast National Park, it incorporates four terrestrial Management Areas, namely the Skeleton Coast National Park, the Dorob National Park, the Namib-Naukluft National Park and the Tsau//Khaeb (Sperrgebiet) National Park (see Figure 7-18). The central and southern components of the **Namib-Skeleton Coast National Park** are described briefly below:

- The Namib-Naukluft National Park has an area of 49 800 km² and encompasses part of the Namib Desert, the Naukluft mountain range, Sandwich Harbour and Sossusvlei, which is a main visitor attraction in Namibia.
- The Sperrgebiet was proclaimed in 1908 to prevent public access to the rich surface diamond deposits occurring in the area, and has largely remained closed off to general public access since then. It extends between latitude 26° in the north and the Orange River in the south, extending inland from the coast for 100 km, covering an area of approximately 22 000 km^2. As diamond mining has remained confined to the narrow coastal strip and along the banks of the Orange River and around Elizabeth Bay, most the area has effectively been preserved as a pristine wilderness. Large parts of the Sperrgebiet have since been de-proclaimed from exclusive prospecting and mining licences, and reverted to unproclaimed State land. Consequently, the Tsau//Khaeb (Sperrgebiet) National Park was proclaimed in 2008. The park has been zoned in accordance with IUCN guidelines for Protected Area Management Categories. Management and tourism plans for the park are at an advanced stage of development.

7.5.2 Ramsar Sites

All three of the designated coastal **Ramsar sites** in Namibia possibly fall within the broader project area of influence and are described briefly below.

- The Walvis Bay Wetland is one of the most important coastal wetlands in Southern Africa. As the largest single area of shallow sheltered water along the Namibian coastline, it encompasses the lagoon, mudflats and sandbars, Paaltjies beach on the Pelican Point peninsula, the Walvis Bay saltworks, and sand dunes and gravel fields extending to the boundary of the Namib-Naukluft Park (Barnard 1998; www.nacoma.org.na). The estimated total area for these wetlands is 35 - 40 km^2. It supports up to 250 000 birds at peak times during the summer season and about 80 000 to 100 000 birds during winter. The wetland serves primarily as a dry-season and drought refuge for intra-African migrants and as a non-breeding area for Palaearctic migrants. Key species are Greater and Lesser Flamingos, Chestnut-banded Plover, Black-necked Grebe and the African Black Oystercatcher (www.nacoma.org.na, www.nnf.org.na/CTEN). Eleven endangered bird species are regularly observed (http://www.ramsar.org/profile/profiles_namibia.htm).
- Sandwich Harbour, located 55 km south of Walvis Bay, is one of southern Africa's richest and most unique coastal wetlands. Situated within the Namib-Naukluft Park, the area consists of two distinct parts. Firstly, a northern saltmarsh and adjoining intertidal sand flat area (5 km x 300 m), which supports emergent freshwater vegetation (37 species) and 4 000 – 5 500 wetlands birds. The more extensive (40 km²) southern area of unvegetated tidal mudflats and raised shingle bars supports up to 175 000 birds, mainly

waders, terns, pelicans and flamingos. Although the area is not directly associated with a river, water from an inland aquifer seeps into the northern portion of Sandwich Harbour, filling the lagoon and sustaining freshwater vegetation at the base of the dunes. Thirty-six species of fish and eight Namibian Red Data bird species can be found at Sandwich Harbour. The wetland and shallow lagoon is protected from the open ocean by a sand barrier thus supporting an extremely rich avifauna including eight endangered species among the large numbers of waders, terns, pelicans and flamingos. Bird numbers are reported to reach maximum concentrations of 238 000 birds, with Palearctic waders reaching densities of 7 800 birds per km^2. Several archaeological sites dating back 1 000 years also exist within the area (Barnard, 1998).

- The Orange River Mouth, at the border between South African and Namibia, is an important staging area for Palaearctic migrants. On the South African side the Orange River Mouth received its Ramsar status on 28 June 1991. The Namibian side was declared a Ramsar wetland on 23 August 1995. Processes are underway to declare a jointly-managed transboundary Ramsar reserve. The **Orange River Mouth is regarded as one of the most important coastal wetlands in southern Africa in terms of the number of birds supported**, at times supporting more than 20 000 water birds of between 50 and 57 species. It is consequentially also recognised as an Important Bird Area (SA030).

7.5.3 Important Bird Areas

Of the 19 Important Bird Areas (IBAs) designated by BirdLife International in Namibia, those located along the southern Namibian coastline are listed in Table 7-7.

Table 7-7: List of Important Bird Areas (IBAS) and their criteria listings

Site Name	IBA Criteria
Ichaboe Island	A1, A4i, A4ii, A4iii
Lüderitz Bay islands	A1, A4i, A4iii
Possession Island	A1, A4i, A4ii, A4iii
Sperrgebiet	A1, A2, A3, A4i

Key: A1. Globally threatened species; A2. Restricted-range species; A3. Biome-restricted species; A4. Congregations.

Various marine IBAs have also been proposed in Namibian territorial waters, with a candidate trans-boundary marine IBA suggested off the Orange River mouth (see Figure 7-20). **Block 2912 lies offshore of these marine IBAs.**

7.5.4 Marine Protected Areas

The first Namibian **Marine Protected Area (MPA),** the Namibian Islands' Marine Protected Area (NIMPA), was launched on 2 July 2009 under the Namibian Marine Resources Act (No. 29 of 1992 and No. 27 of 2000), with the purpose of protecting sensitive ecosystems and breeding and foraging areas for seabirds and marine mammals, as well as protecting important spawning and nursery grounds for fish and other marine resources (such as rock lobster). NIMPA comprises a coastal strip extending from Hollamsbird Island (24°38'S) in the north, to Chameis Bay (27°57'S) in the south, spanning approximately three degrees of latitude and an average width of 30 km, including 16 specified offshore islands, islets and rocks (Currie *et al.,* 2009). The NIMPA spans an area of 9 555 km^2, and includes a proposed rock-lobster sanctuary constituting 478 km^2 between Chameis Bay and Prince of Wales Bay (27°05'S). The offshore islands, whose combined surface area amounts to only 2.35 km^2 have been given priority conservation and highest protection status (Currie *et al.* 2009). The area has been further zoned into four degrees of incremental protection. These are detailed in Currie *et al*. (2009). The NIMPA lies inshore and north-eastwards of Block 2912, with the closest point (southern boundary of the NIMPA) being over 260 km away (see Figure 7-18).

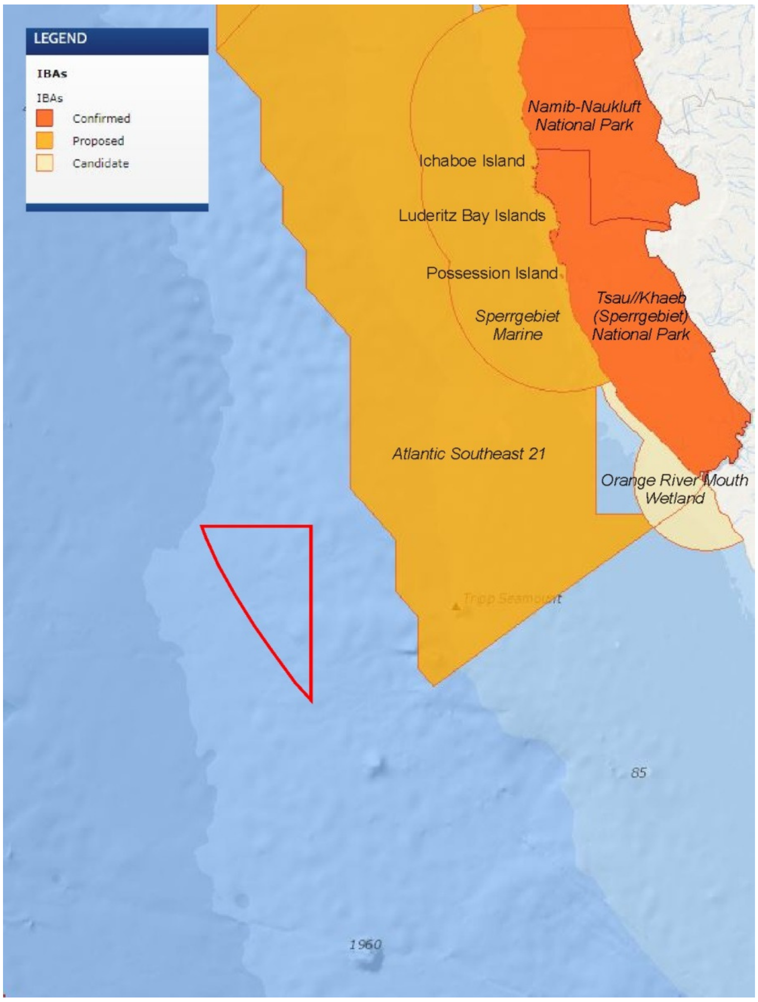

Figure 7-20: Block 2912 in relation to coastal and marine IBAs in Namibia
Source: https://maps.birdlife.org/marineIBAs

7.5.5 Ecologically or Biologically Significant Areas

In the spatial marine biodiversity assessment undertaken for Namibia (Holness *et al.* 2014), a number of offshore and coastal area were identified as being of high priority for place-based conservation measures. To this end, **Ecologically or Biologically Significant Areas (EBSA)** spanning the coastline between Angola and South Africa were proposed and inscribed under the Convention of Biological Diversity (CBD). The principal objective of the EBSAs is identification of features of higher ecological value that may require enhanced conservation and management measures. Although no specific management actions have as yet been formulated for the EBSAs, two biodiversity zones have recently been defined within each EBSA as part of the marine spatial planning process (see Figure 7-21) (https://cmr.mandela.ac.za/EBSA-Portal/Namibia/Namibian-EBSA-Status-Assessment-Management). The management objective in the zones marked for 'Conservation' is "*strict place-based biodiversity protection aimed at securing key biodiversity features in a natural or semi-natural state, or as near to this state as possible*". The management objective in the zones marked for 'Impact

Management' is "*management of impacts on key biodiversity features in a mixed-use area to keep key biodiversity features in at least a functional state*".

Although there is no overlap of Block 2912 with any of these EBSAs, the EBSAs in the project area are presented in Figure 7-21 and described briefly below:

- The Namibian Islands are located offshore of the central / southern Namibian coastline and within the intensive Lüderitz upwelling cell. These islands and their surrounding waters are significant for life history stages of threatened seabird species as they serve as crucial seabird breeding sites within the existing NIMPA. The surrounding waters are also key foraging grounds for both seabirds and for "Critically Endangered" leatherback turtles that nest along the north-eastern coast of South Africa. This EBSA lies well inshore of Block 2912.
- The Orange Seamount and Canyon Complex, occurs at the western continental margin of southern Africa, spanning the border between South Africa and Namibia. 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 and moderate chlorophyll levels related to the eastern limit of the Benguela upwelling on the outer shelf. Block 2912 lies west of this EBSA.
- The Orange Cone is a transboundary EBSA that spans the mouth of the Orange River. 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 for of river outflow for fish recruitment on the inshore Orange Cone is also likely. This EBSA lies well inshore of Block 2912.
- The Benguela Upwelling System EBSA is a transboundary EBSA 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 characterised by very high primary production. 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. Block 2912 lies west of this EBSA.
- The Namaqua Fossil Forest EBSA, which lies approximately 380 km inshore of Block 2912, 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. A portion of the EBSA comprised the Namaqua Fossil Forest MPA. The fossilised tree trunks form outcrops of laterally extensive slabs of rock have been colonised 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.

- The Childs Bank and Shelf Edge EBSA, which lies approximately 200 km southeast of Block 2912, is a unique submarine bank feature rising from 400 m to -180 m on the western continental margin on South Africa. 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.

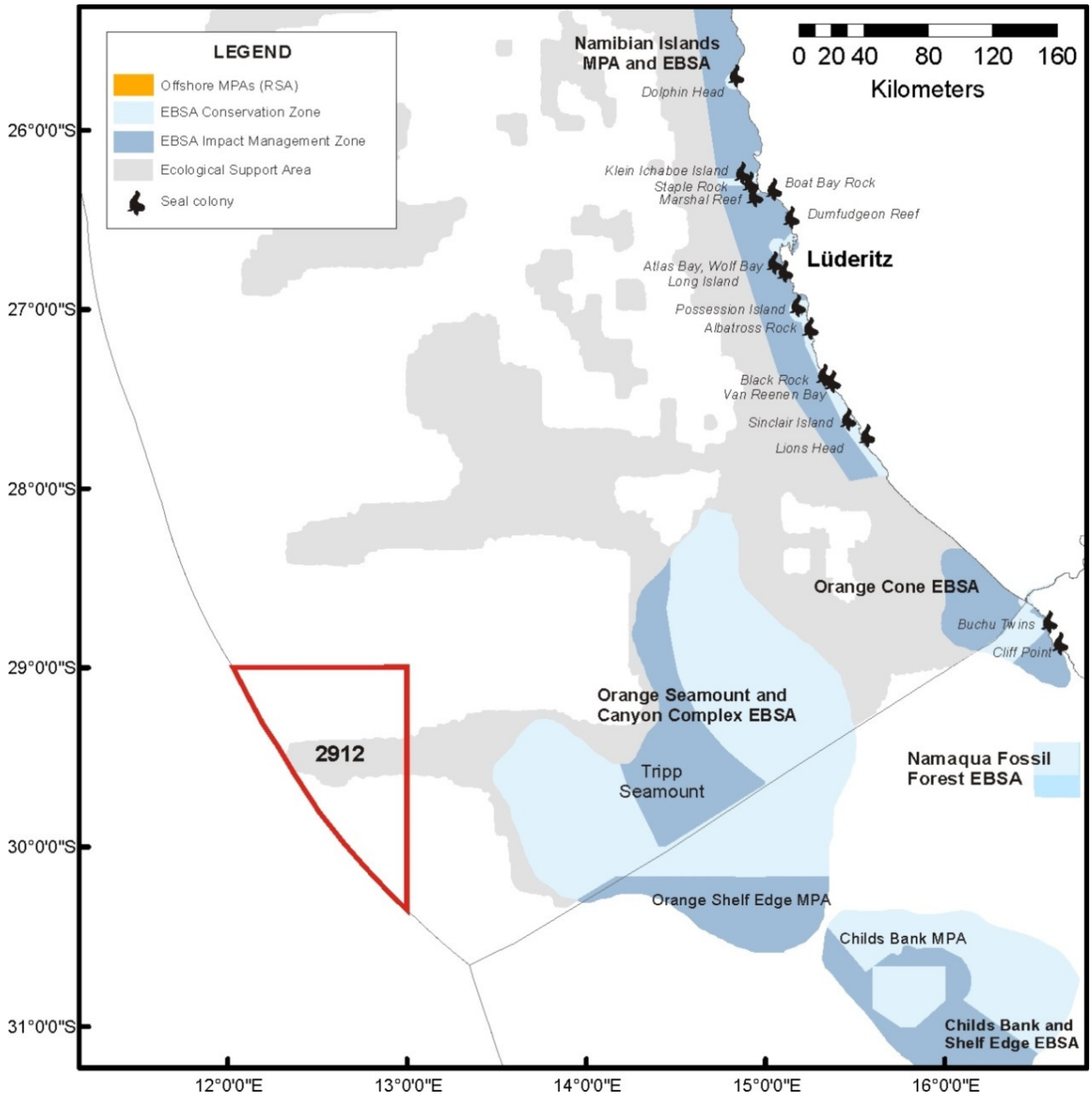

Figure 7-21: Block 2912 in relation to EBSAs and proposed spatial planning zones. Ecological support areas mapped by MFMR and the location of seal colonies are also shown.

Source: Pisces, MFMR, 2021 and NMU, 2022

7.5.6 Biodiversity Priority Areas and Marine Spatial Planning

In addition to EBSAs, Ecological Support Areas (ESAs) have been identified. Although these areas do not meet the EBSA criteria they reflect secondary priority conservation areas with special attributes that support a healthy and functioning marine ecosystem. One of these ESAs extends roughly through the centre of Block 2912 in an east-west direction (see Figure 7-21).

Namibia recently embarked on a Marine Spatial Planning (MSP) process implemented as a development planning approach to organize the use of the country's marine territory in such way that comprehensive, integrated and complementary planning and management across sectors and for all ocean uses is enabled. MSP in Namibia is highly precautionary and forward-looking given the relatively low intensity of current uses, has a strong ecosystem-based perspective due to the fairly pristine environment, is driven by a social equity and distributive justice agenda, and features a strong collaborative process governance (Finke *et al*. 2020a, 2020b). Although at this stage MSP lacks legislation and has only weak links to broader ocean governance exist, the MSP process has resulted in a clear framework for the development of the first marine plan (MFMR, 2019), as it was linked to a systematic conservation planning process from the outset.

The objectives and principles for MSP, as well as the steps each planning process is expected to follow, is set out in the National MSP Framework (MFMR, 2019). The Framework provides high-level direction to ensure consistent and coherent plan development, implementation and review across Namibia's marine space and its three proposed planning areas: a northern, central and southern area.. It also describes the background to MSP and its overarching objectives in Namibia and identifies relevant institutional structures, roles and responsibilities (MFMR, 2022). The first MSP for Namibia is being developed for the central area, followed by the northern and the southern areas. Although all three areas have sites of high ecological sensitivity and importance, growing economic interests and increasingly overlapping human uses, particularly in the central and southern MSP areas call for improved management.

The Marine Spatial Plans in each of the three planning areas will translate the National Framework for MSP into integrated and strategic sustainable development plans that guide users, developers and regulators in their decision-making, setting out which activities should take place where, when and under what conditions. Any future licensing decisions would need to be in line with the provisions set out in the respective plans.

7.6 SOCIO-ECONOMIC ENVIRONMENT

This section outlines the socio-economic context within which the proposed project would occur, focusing on the towns of Lüderitz (in the !Nami≠nüs Constituency, //Karas Region) and Walvis Bay (in the Walvis Bay Urban Constituency, Erongo Region) (see

Figure **7-22**).

7.6.1 Settlement Patterns

The Namibian southern and central coastline is sparsely populated and is dominated by the Namib-Naukluft National Park, the Tsau //Khaeb (Sperrgebiet) National Park and the Namibian Islands' Marine Protected Area (see Figure 7-18).

Lüderitz is the southern-most port town that supports fishing and mining sectors, with little other appreciable industrial development. Much of the town is comprised of residential neighbourhoods, made up of both formal housing concentrated around the port and informal or low-income settlements on the outskirts of the town.

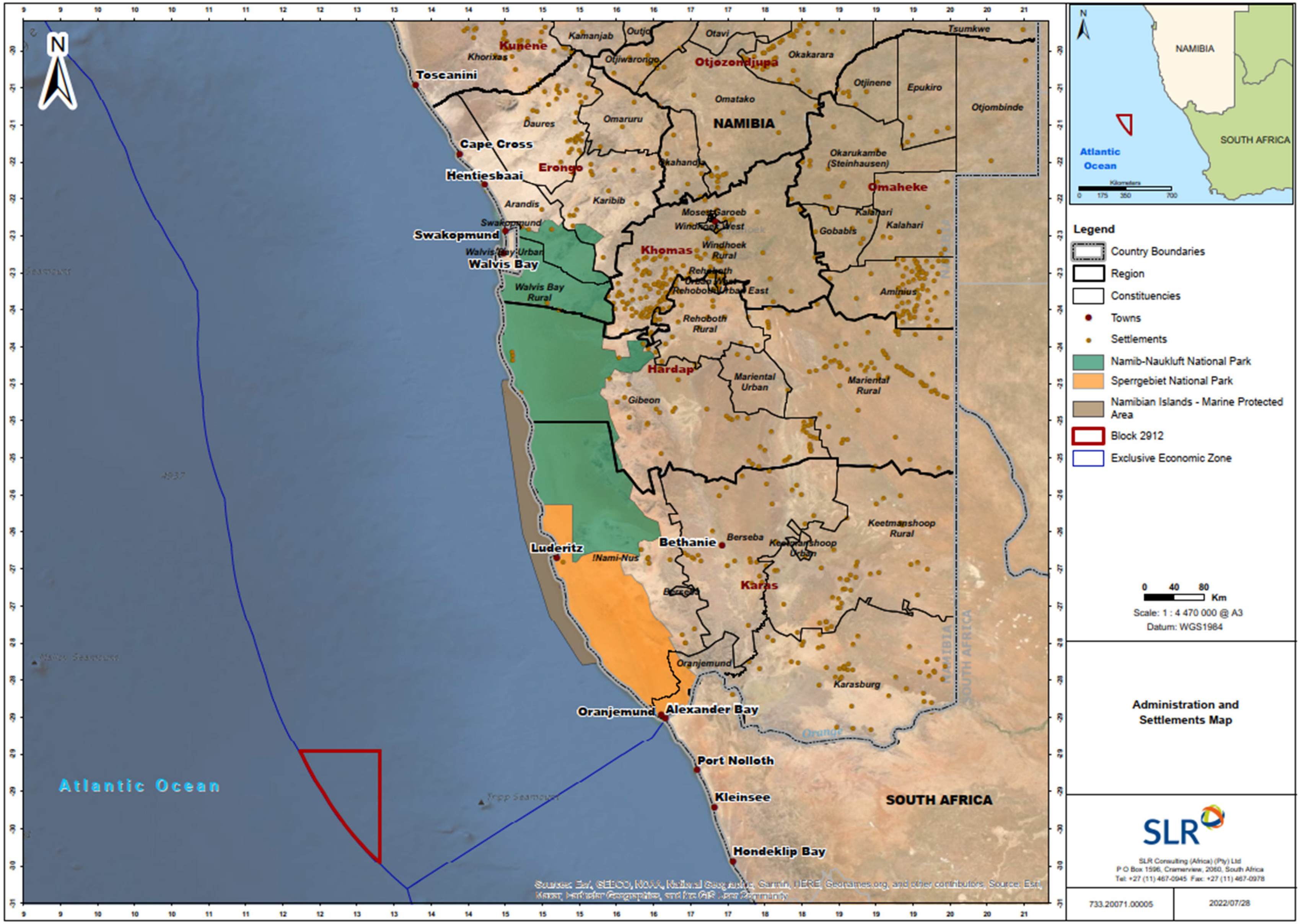

Figure 7-22: National Parks, administrative regions and settlements map

Walvis Bay is located along the central coastline and is the third largest town in Namibia (after Windhoek and Rundu). The municipality has Namibia's largest commercial port, which handles container imports, exports and transhipments, as well as bulk commodities. There is also notable industrial development that flanks the port operations and extends into the desert. Walvis Bay's residential suburbs are similarly structured to Lüderitz, with formalised (middle to high income) suburbs closer to the harbour and seafront and informal or low-income neighbourhoods north and east of the port, spreading into the desert.

7.6.2 Demographics

Against a backdrop of rapid urbanization elsewhere in the country, Lüderitz recorded 12 537 people in the latest 2011 census, a decrease of about 10% since 2001. Its town planners have estimated a modest growth rate of 2.05%, thereby anticipating the 2021 population was 15 358 (SPC, 2015). The 2011 census found a high proportion of the population (66%) was in the economically active age group of 15 – 59 years of age confirming in-migration in search of work (NSA, 2014).

The estimated population of Walvis Bay in 2012 was over 79 500 and the town's annual growth rate over the last 16 years has been 4.7% (Urban Dynamics, 2013), so the 2021 population was estimated to be 115 000. In 2012, over 78% of Walvis Bay's population (over 60 000 people) were living in low-income housing in the suburbs of Kuisebmond and Tutuleni (Urban Dynamics, 2013). Many of the single residential plots in Kuisebmond have allowed the construction of "back yard shacks" (as many as five to six in some cases) to low-income families or individuals for which they receive rental income. The residents of these shacks constitute over a third of the total population of the town. In-migration, in search of work, has resulted in 73% of the population being of working age (NSA 2014).

7.6.3 Housing and Living Conditions

Both the !Nami≠nüs and the Walvis Bay Urban Constituencies support a largely urbanised population, and the housing profile reflects this as indicated in Table 7-8. Most households are resident in a combination of formal free-standing houses, semi-detached houses or apartments – accounting for 58% and 64% of !Nami≠nüs and the Walvis Bay Urban Constituencies, respectively.

Informal urban settlements are, however, present and improvised housing (shacks) accounted for 34% and 41% of all housing in the two respective constituencies. The presence of such informal settlements is largely indicative of endemic inequality found nationally, as well as patterns of increased migration of rural households to urban areas.

Table 7-8: Housing type by constituency

Type of Housing	Percentage of Households (2011)	
	!Nami≠nüs Constituency	Walvis Bay (Urban) Constituency
Detached house	40.4	43.3
Semi-Detached House	9.4	9.9
Apartment/Flat	7.7	10.4
Guest Flat	0.9	1.6
Part Commercial/Industrial	0.5	0.3
Mobile Home	0.3	0.2
Single Quarters	6.1	2.5
Traditional Dwelling	0.1	0.2

Type of Housing	Percentage of Households (2011)	
	!Nami≠nüs Constituency	Walvis Bay (Urban) Constituency
Improvised Housing Unit (Shack)	34.4	31.5
Other	0.2	0.1
Total	**100**	**100**

Source: Namibian Statistics Agency , 2014

The level of access to basic services for the !Nami≠nüs and the Walvis Bay Urban Constituencies is presented in Table 7-9. Being mostly an urban population, basic services are largely provided by the State or via local municipal services with minimal dependency on natural resources.

In 2011, both Lüderitz and Walvis Bay had good access to electricity, with 76% of 99% of households in the !Nami≠nüs and the Walvis Bay Urban Constituencies using electricity for lighting, respectively (see Table 7-9). There is a noted use of candles by 16% of households in Lüderitz, which is indicative of a greater proportion of poorer households without access to electrical connections or lack of funds to pay for electricity.

In 2011, both the !Nami≠nüs and the Walvis Bay Urban Constituencies provided good access to piped and treated water; however, the level of access to piped water varied by neighbourhood. Walvis Bay provided a higher level of services with almost 100% of households having piped water inside their property (see Table 7-9). Lüderitz had substantively poorer levels of services, with 38% of households having access to internal piped water, while poorer households in surrounding informal or low-income settlements relied on water stands inside their property (32%) or communal standpipes (28%).

Access to sanitation also differed between the two constituencies in 2011 (see Table 7-9). Walvis Bay was substantively more developed, with almost 60% of households having access to private toilets and 40% to shared flush toilets connected to water-borne sewage. In contrast, only 38% of households in Lüderitz had access to private toilets, while 45% of households used shared flush toilets and 14% used buckets or had no toilet facility.

Table 7-9: Basic services profile by constituency

Type of Basic Services	Percentage of Households (2011)	
	!Nami≠nüs Const.	Walvis Bay (Urban) Const.
Source of Energy for Cooking		
Electricity from Mains	45.9	97.3
Gas	48.8	2.3
Source of Energy for Lighting		
Electricity from Mains	76.7	99.4
Candles	16.0	0.4
Source of Domestic Water		
Piped Water Inside House	38.6	71.6
Piped Water Outside House	31.7	27.9
Public Pipe	28.8	0.1
Type of Sanitation		
Private Flush Connected to Sewer	37.7	58.7
Shared Flush Connected to Sewer	39.6	40.0
Private Flush Connected to Septic/Cesspool	0.7	0.3

Shared Flush Connected to Septic/Cesspool	5.1	0.4
Bucket Toilet	4.0	0.0
No Toilet Facility	9.5	0.1
Waste Disposal		
Regularly Collected	77.4	95.7
Irregularly Collected	5.7	4.0
Burning	1.8	0.0
Roadside Dumping	4.2	0.2
Rubbish Pit	10.7	0.1

Source: Namibian Statistics Agency, 2014

In 2011, most households in Lüderitz (77% of households) and Walvis Bay (95% of households) had their domestic waste regularity collected by the municipality. The level of service in Lüderitz was, however, lower and some households had only irregular collections (5.7% of households) or rely on roadside dumping (4% of households) and burning (11% of households).

In summary, both Lüderitz and Walvis Bay are formalised urban settlements that support urban populations. Walvis Bay has a higher population growth rate and stronger economic profile than Lüderitz.

7.6.4 Public and Private Facilities

Both Lüderitz and Walvis Bay provide good access to public and private facilities and services (see Table 7-10).

Walvis Bay is a much larger settlement with a proportionately larger range of services, including a wider choice of banking, retail, public and private health facilities. Accommodation, restaurants and take-aways are numerous, as well as tourism and recreational facilities, that suggest that tourism is an important sector for Walvis Bay and there is a substantial local market for recreational activities. Most of these services and facilities are found in the residential and business areas of Walvis Bay, as well as in industrial areas that surround the Port.

Table 7-10: Profile of private and public services and facilities

Type of Facility / Service	Number of Facilities / Services	
	Lüderitz Town	Walvis Bay Town
Accommodation & Food	24	32
Cemetery	2	2
Education	7	22
Finance	3	12
Government Ministries	5	11
Health	3	5
Tourism and Recreation	10	40
Retail	4	7

Source: OpenStreetMap and GRN ministerial data

Lüderitz has fewer public and private facilities or services (see Table 7-10) due to its smaller population. These services are primarily used by residents of Lüderitz and the Port’s visitors, although there is provision for domestic and international tourism though accommodation (notably hotels, bed and breakfasts, back-backers etc.), as well as the expanded waterfront.

7.6.5 Economic Overview

Namibia's rich mineral base and small population of about 2.6 million gives it a World Bank classification of an upper-middle-income country. Political stability and social policies, such as public spending on pensions and welfare grants since Independence in 1990, have reduced poverty.

However, socio-economic inequalities inherited from the past apartheid system remain extremely high and structural constraints to growth have hampered job creation. Economic advantage remains in the hands of a relatively small segment of the population and the large disparities of income have led to a dual economy—a highly developed modern sector co-existing with an informal subsistence-oriented one. The duality of the labour market, combined with slow job creation and low primary-sector productivity, results in very high unemployment[8].

Poverty levels and the cost of living are high and thus the quality of life for many are not in unison with the country's macro-economic indicators. The economy grew between 2010 and 2015 by an average of 5.3% per annum, but since 2016, it has not come out of recession. COVID-19 negatively impacted commodity export markets, tourism and local consumption patterns and service industries and these resulted in a further 8.5% contraction of the economy in 2020 (IPPR, 2021). The World Bank predicts that the rebound will be slower than initially expected, with growth projected at 2.4% in 2022.

The size of the Namibian economy expanded from N$169 475 million in 2017 to N$177 020 million in 2018 (Namibian Statistics Agency, 2018. Tertiary industries have always been the most significant contributor to Namibia's GDP in recent years, contributing 58%, in 2019. These industries include the public sector, retail and wholesale, transport and services sectors. Secondary industries contributed 18% to GDP and include manufacturing such as meat and other food processing, beverages, mineral processing, electricity generation and construction. The primary industries, such as mining and agriculture, contributed 16% to GDP (NPC, 2020).

The country has good mineral resources, some remaining fish stocks, widespread livestock production, an increasingly urban population and high school attendance of both girls and boys up to Grade 11. However, the governing political party, South West Africa People's Organisation (SWAPO), is under more pressure than ever before to improve the lives of Namibians. There is widespread rural and urban poverty, low educational attainment, few technical skills, a major housing back-log and deepening unemployment.

The Economy of Lüderitz

The Port of Lüderitz is the bedrock of the town as it serves the local fishing industry, the local diamond industry, the mines in the southern Namibia and north-western South Africa with imports and exports of mining commodities and handling general cargo for those regions. In 2018/19, the port handled over 362,000 tonnes of cargo, 5,355 containers and received over 700 vessel visits during that year[9]. The port is hampered by being only 8.75 metres deep so that it cannot accommodate average sized, economic bulk carriers that are used to transport bulk ore and other cargoes; it also has no direct rail connection into the harbour. Nevertheless, Namport and other service providers contribute to the local economy with marine engineering, shipping and logistics, freight storage, vessels, boat builders and repairs, employing several hundred people. Namdeb and two other small diamond companies operate their operations out of Lüderitz.

The main employment sector in Lüderitz is the local commercial and subsistence fishing industry, which provides more than 80% of the employment (Lüderitz Town Council), even though the industry has been in steady decline as the larger vessels relocated to Walvis Bay. The lack of economic diversity has been identified as a key risk due

[8] Namibia Overview: Development news, research, data | World Bank accessed on 4/10/2022
[9] https://www.namport.com.na/files/files/Stats%20ended%20March%202019.pdf

to variations in fish stock and much of the national fishing fleet moving to the deeper harbour at Walvis Bay. There is, therefore, an increased focus towards tourism development and the logistics industry (Luderitz Town Council, 2020). In addition, the town supports a range of secondary / service businesses including supermarkets, commercial banks, insurance, and hospitality amongst others.

Tourism to the town is recovering from the Covid-19 pandemic, as Lüderitz offers various attractions such as the Kolmanskop deserted diamond town, quaint old German architecture, a port for smaller passenger liners, the annual Crayfish Festival, the annual Lüderitz Speed Sailing Challenge and other events. It is one of four entry points into the access restricted Tsau //Khaeb (Sperrgebiet) National Park, a protected area of high biodiversity. Tourism will always be a challenge as Lüderitz is far from Namibia's other main southern attractions of the Fish River Canyon and Sossusvlei.

The Economy of Walvis Bay

The economy of the Erongo Region and the Walvis Bay Urban Constituency is more developed and diversified when compared to Lüderitz. The region is largely dependent on the primary sector: mining (notably uranium), commercial and small-scale fishing, and agriculture (mostly livestock farming).

The economy of Walvis Bay revolves around the Port of Walvis Bay which is Namibia's largest commercial port and received between 1,800 and 2,500 vessel calls each year and handled about 5 million tonnes of cargo, prior to the Covid-19 pandemic. The Namibia Ports Authority (Namport) handles container imports, exports and trans-shipments, as well as bulk and breakbulk volumes of various commodities. The port serves a wide range of industries such as mining, petroleum, salt, and fishing. Namport is a major employer in the region, employing most of its 965 staff in Walvis Bay (Namport, 2019). The expanded container harbour at the port was in response to growth in port related activity serving the SADC region. Unfortunately, the growth has not been sustained, partly due to the impact of Covid-19 on world trade and perhaps over-ambitious targets.

Walvis Bay supports a diverse economy including industrial development largely centred around the Namibian Export Processing Zone and secondary / service sector businesses (finance, retail, accommodation and food). The fishing industry is however considered a critical economic sector (Walvis Bay Municipality, 2020) and provides an estimate 8 000 local jobs.

The fishing sector is critical for both the economies of Walvis Bay and Lüderitz and warrants more consideration. The Food and Agriculture Organisation (FAO) recognises that Namibia has one of the most productive fishing grounds in the world, with 20 fish species that are commercially exploited (Food and Agriculture Organisation, 2020). Most catches are landed at either Walvis Bay or Lüderitz; however, because of its strategic location in the middle of the fishing grounds, most of the landings and processing plants are in Walvis Bay (Food and Agriculture Organisation, 2020). Both Walvis Bay and Lüderitz support businesses in both primary commercial fishing as well secondary fish processing.

In 2012 / 2013, a total number of 256 vessels were licenced to operate in the Namibian Exclusive Economic Zone (Ministry of Fisheries and Marine Resources, n.d.), with the majority based at Walvis Bay.

7.6.6 Employment and Occupations

More people aged between 15 and 65 years are active in Erongo's labour force than in any other region in Namibia: the labour force stood at 112,800 in 2018, with a labour force participation rate of 81% (86% among males and 75% among females) compared to the national average of 71%. The //Karas Region's participation rate was 74%, and ranked 4th highest out of Namibia's 14 regions (NSA, 2019).

Namibia broadly defines all persons above the age of 15 being employable (i.e. economically active population). Of this total population, 56% and 60% were employed in 2011 in the !Nami≠nüs and Walvis Bay Urban Constituencies respectively (see Table 7-11), suggesting that employment levels are fairly equal in Lüderitz and Walvis Bay.

There is, however, a clear gender divide in terms of employment, as employment rates for women are 10% and 18% lower when compared to men in the two respective areas.

Table 7-11: Percentage of economically active and inactive persons above 15 years of age

Activity Status	Percentage of Total Population (2011)					
	!Nami≠nüs Constituency			Walvis Bay (Urban) Constituency		
	Male	Female	Total	Male	Female	Total
Economically Active	80.2	76.5	78.3	84.4	77.9	81.4
Employed	61.0	51.4	56.2	67.8	50.3	59.6
Unemployed	19.2	25.1	22.1	16.6	27.6	21.8
Economically Inactive	14.0	14.9	14.5	10.2	17.8	13.8
Don't Know	**5.5**	**7.9**	6.7	4.1	4.1	4.1

Source: Namibian Statistics Agency , 2014

The private sector accounted for 54% and 68% of all employment for Lüderitz and Walvis Bay in 2011, respectively, while employment by the State is higher in Lüderitz (37%) compared to 22% in Walvis Bay (NSA, 2014). Thus, the resident populations are near exclusively reliant on wage labour for income, which include either formal private employment, government employment or self-employment.

The major industry sector of the !Nami≠nüs Constituency is Agriculture, Forestry and Fishing; however, the fishing sub-sector emerges as the major local employer and accounted for 42% of all local employment in 2011. Other primary sector industries included mining (8% of employment), while secondary sector industries (including fish processing)[10] contributed 24% of all employment (NSA, 2014).

In contrast, the Walvis Bay Urban Constituency has a more diversified economy and employment is spread across multiple sectors. The two largest employment sectors are manufacturing (27% of employment), and wholesale / retail trade and motor repair (10% of employment). The Agriculture, Forestry and Fishing, Construction, Transportation and Storage Administrative and Support Services, Public Admin., Defence, Social Security sectors each contribute to around 7% of local employment (NSA, 2014b).

With respect to the gender split by industry, it is notable that the fishing sector is the dominant employer for both males and females in !Nami≠nüs Constituency. Males still dominate the mining, construction, transportation sectors while females dominate the accommodation and food services, education, human health and social work and household care sectors.

Walvis Bay is dominated by the manufacturing sector which shows a balance in terms of the employment of both males and females (27% of total employment for both genders). This is similarly reflected in the Wholesale and Retail Trade, Motor Repair sector (10-11% of total employment for both genders). Males still dominate Fishing, Mining and Quarrying, Construction, Transportation and Storage sectors, while females are more prominent in the financial insurance, education, human health and social work, and household care sectors.

10 Covering the Manufacturing, Electricity, Gas, Steam and Air Conditioning Supply, Water Supply, Sewerage, Sanitation, Construction and Wholesale and Retail Trade, Motor Repair Sectors combined.

7.6.7 Poverty

Namibia is defined as an upper middle-income country and it retained a Human Development Index (HDI)[11] of 0.645 in 2018, which places it in the medium human development level, and at 130 out of 189 monitored countries and territories (UNDP, 2019).

However, when the HDI is adjusted for inequality (IHDI) the score is reduced to 0.417. The loss of 35.3% from the HDI is strongly indicative of inequalities in Namibia, and such inequalities are generally recognised by the public, the national government, as well as international organisations (i.e. the World Bank). The IHDI places Namibia at 129 of 150 countries in terms of inequality (UNDP, 2019) alongside such countries as India, Guatemala and Tajikistan.

While there has been a general positive trajectory in terms of improvement in the IHDI since Namibia's independence in 1990, the rate of decline in inequality is slowing down (Namibian Statistics Office, 2012), and this has likely been exacerbated by the economic slow-down since 2016 and made worse by the Covid-19 pandemic.

In part, the endemic inequality is attributed to the exclusion of many households from the modern economy and associated benefits, despite the economy growing substantially since Namibia's independence in 1990 (Namibian Statistics Office, 2012). This is notably apparent between administrative regions, as well as between urban and rural areas.

Poverty mapping undertaken in 2011 (National Planning Commission, n.d.) shows that the Erongo Region has the second lowest rates of poverty (2.4% of the total population being below a predetermined poverty limit) while //Karas is higher at 6.7%. This compares positively against the national poverty rate of 26.9% of the total population.

At the Constituency level, Walvis Bay Urban is ranked the fifth <u>least</u> deprived constituency in the country while !Nami≠nüs is slightly more deprived[12] but still ranked high at 10/107 constituencies (NPC, 2015).

7.6.8 Human Rights Profile

Fundamental human rights are recognised in the Namibian Constitution of 1990, and Namibia is a signatory to a range of United Nations Human Rights Conventions (see Table 7-12). The latest universal review undertaken by the United Nations in 2016 indicates that human rights are largely respected; however, the country still faces challenges with respect to addressing the root causes of poverty, hunger and to uplift the living conditions of the poor.

Table 7-12: Ratified human rights treaties

Treaty Description	Ratification Date
Con against Torture and Other Cruel Inhuman or Degrading Treatment or Punishment	28 Nov 1994
Optional Protocol of the Convention against Torture	None
International Covenant on Civil and Political Rights	28 Nov 1994
Second Optional Protocol to the International Covenant on Civil and Political Rights	28 Nov 1994

[11] The HDI is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living.

12 The rankings considered scores of five different domains of deprivation, notably material, health, education, employment and the living environment.

Convention for the Protection of All Persons from Enforced Disappearance	None
Convention on the Elimination of All Forms of Discrimination against Women	23 Nov 1992
International Convention on the Elimination of All Forms of Racial Discrimination	11 Nov 1982
International Covenant on Economic, Social and Cultural Rights	28 Nov 1994
Int. Con. on the Protection of the Rights of All Migrant Workers and Their Families	None
Convention on the Rights of the Child	30 Sep 90
Op. Prot. to the Convention on the Rights of the Child (Armed Conflict)	16 Apr 02
Op. Prot. to the Convention on the Rights of the Child (Child Prostitution)	16 Apr 02
Convention on the Rights of Persons with Disabilities	04 Dec 07

7.6.9 Fishing Sector Activities

The commercial fishing sectors that operate off the coast of Namibia include:

- Demersal trawl;
- Midwater trawl;
- Deep-water trawl;
- Small pelagic purse seine;
- Large pelagic long-line;
- Demersal long-line;
- Tuna pole;
- Traditional line-fish;
- Deep-sea crab;
- Rock lobster;
- Mariculture.

Namibia has only two major fishing ports from which all the main commercial fishing operations are based namely, Walvis Bay and Lüderitz.

The major port is Walvis Bay and it is from here that the majority of fishing vessels operate. The majority of the fishing conducted from this port is, for economic and logistic reasons, directed mostly at fishing grounds in the central and northern part of Namibia and to a lesser extent the southerly fishing grounds. A significant amount of fishing activity also takes place from Lüderitz where hake trawlers and long-liners operate, as well as a small rock lobster fishery.

7.6.9.1 Demersal trawl

The demersal trawl sector targets primarily hake (*Merluccius capensis* and *M. paradoxus*). Main by-catch species include monkfish (*Lophius* spp.), kingklip (*Genypterus capensis*) and snoek (*Thyrsites atun*). The directed hake trawl fishery is Namibia's most valuable fishery with an annual hake Total Allowable Catch (TAC) of 154 000 tons. For the 2020/21 season, the TAC was set at 160 000 tons, approximately 4% above scientific advice. This was presumably due to the significantly lower than the TAC catch in the 2019/2020 season (130 000 tons).

This fishery operates along the shelf contours between depths of 200 m and 850 m (see Figure 7-23). Trawlers are prohibited from operating inshore of the 200 m isobath. **The demersal trawl grounds are situated 125 km eastward of Block 2912. There is thus no overlap with the licence block**.

Fishing effort is relatively constant throughout the year, except during the month of October when the fishery is closed, and relatively lower levels of effort expended during November and December (see Figure 7-24).

A fleet of about 71 Namibian-registered trawlers currently operate along the whole Namibian coastline (17°S to 30°S) following the distribution of hake along the continental shelf. Demersal trawlers are segregated into wet fish and freezer vessels which differ in terms of the capacity for the processing of fish offshore (at sea) and in terms of vessel size and capacity. Trawlers vary from 35 m to 90 m in length, with a shaft power of 750 to 3 000 kW. Wetfish vessels are generally smaller than freezer vessels and do not range as far offshore. While freezer vessels may work in an area for up to a month at a time, wetfish vessels fish for about seven days before returning to port.

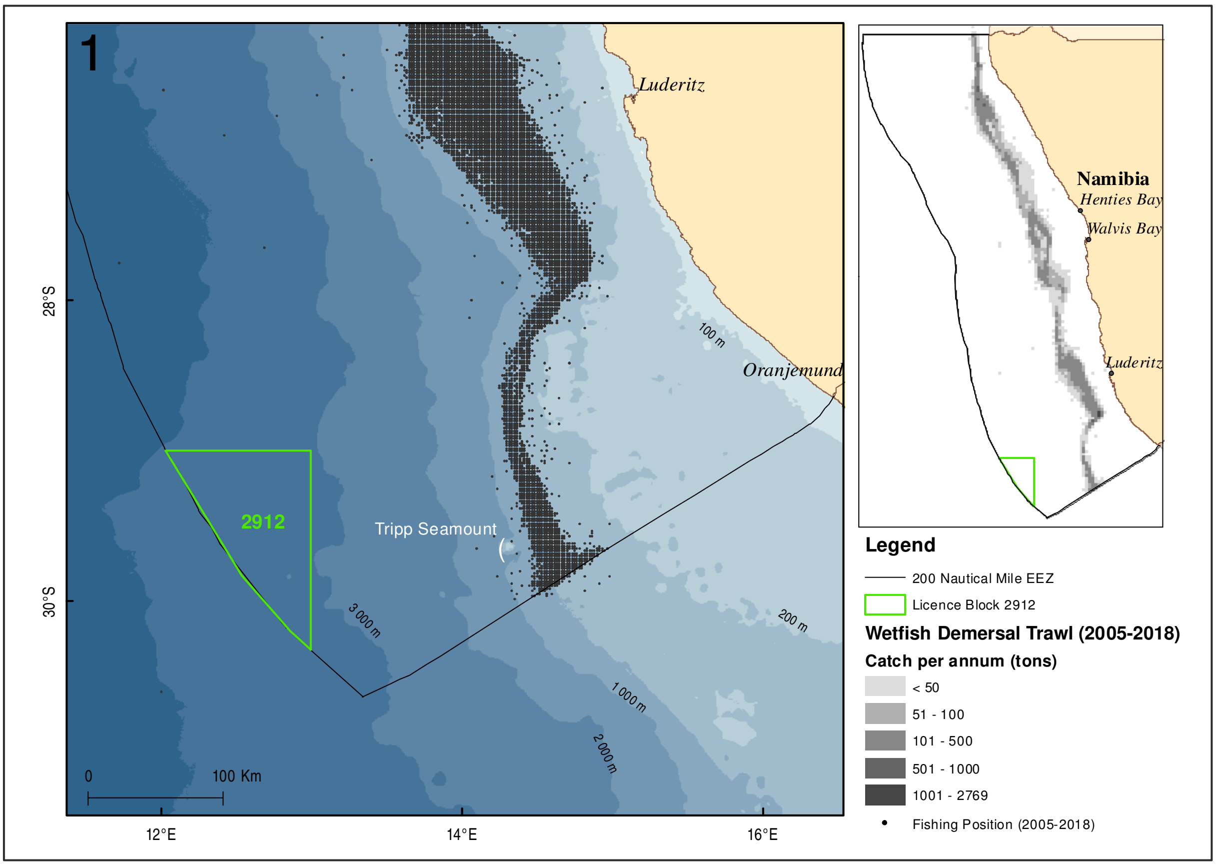

Figure 7-23: Block 2912 in relation to hake-directed demersal trawl grounds (2005-2018)
Source: CapMarine

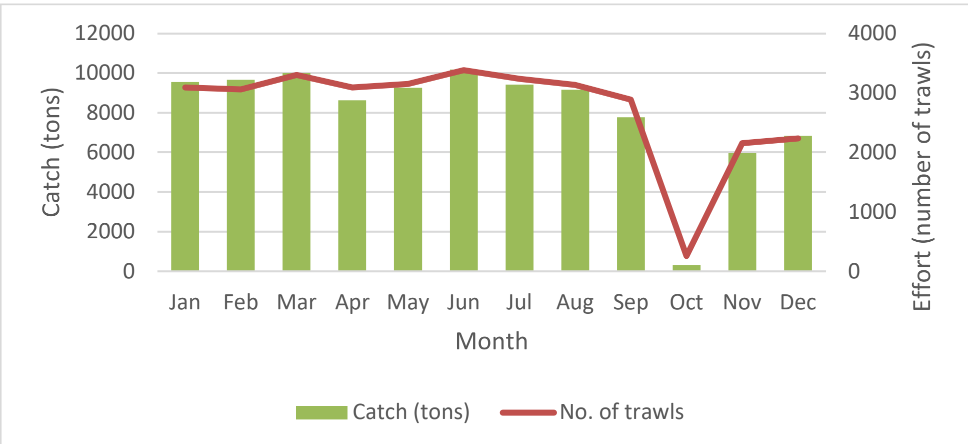

Figure 7-24: Average landings by month reported for wetfish trawlers from 2005 to 2017

Trawl gear configurations are similar for both freezer and wetfish vessels (see Figure 7-25). Typical demersal trawl gear configuration consists of:

- Steel warps up to 32 mm diameter (in pairs up to 3 km long when towed);
- A pair of trawl doors (500 kg to 3 tons each);
- Net footropes which may have heavy steel bobbins attached (up to 24" diameter), as well as large rubber rollers ("rock-hoppers"); and
- Net mesh (diamond or square shape) is normally wide at the net opening whereas the bottom end of the net (or cod-end) has a 130 mm stretched mesh.

Generally, trawlers tow their gear at 3.5 knots for up to four hours per drag, and hake-directed trawling occurs mainly from sunrise to sunset. When towing gear, the distance of the trawl net from the vessel is usually 2 to 3 times the water depth. The horizontal net opening may be up to 50 m in width and 10 m in height.

Figure 7-25: Schematic of trawl gear typically used by the Namibian hake trawl vessels
Source: http://www.afma.gov.au/portfolio-item/trawling

7.6.9.2 Midwater trawl

The midwater trawl fishery targets adult horse mackerel (*Trachurus capensis*). This fishery has the highest volume and catch of all Namibian fish stocks, but in terms of economic value is the second highest contributor behind the Cape hake fisheries. The TAC for horse mackerel for 2018/2019 was set at 349 000 tons and there are currently 67 rights-holders registered within the fishery.

The midwater trawl fleet operates almost exclusively out of the port of Walvis Bay and fishing grounds extend north of 25°S to the border of Angola and effort is highest in the north. Juvenile Cape horse mackerel move into deeper water when mature and are fished mostly between the 200 m and 500 m isobaths towards the shelf break. Although the main commercial fishing grounds are situated approximately 400 km northward of Block 2912, incidental fishing has been recorded 200 km north east of the block. **There is no overlap of midwater trawl fishing activity with the licence block** (see Figure 7-26). The fishery operates year-round with relatively constant catch and effort values by month (see Figure 7-27).

The target catch species migrate vertically upwards through the water column between dusk and dawn. Mid-water trawlers exploit this behaviour (diurnal vertical migration) by adjusting the depth at which the net is towed (this typically varies from 400 m to just below the water surface). The net itself does not come into contact with the seafloor (unlike demersal trawl gear) and towing speed is greater than that of demersal trawlers (between 4.8 and 6.8 knots).

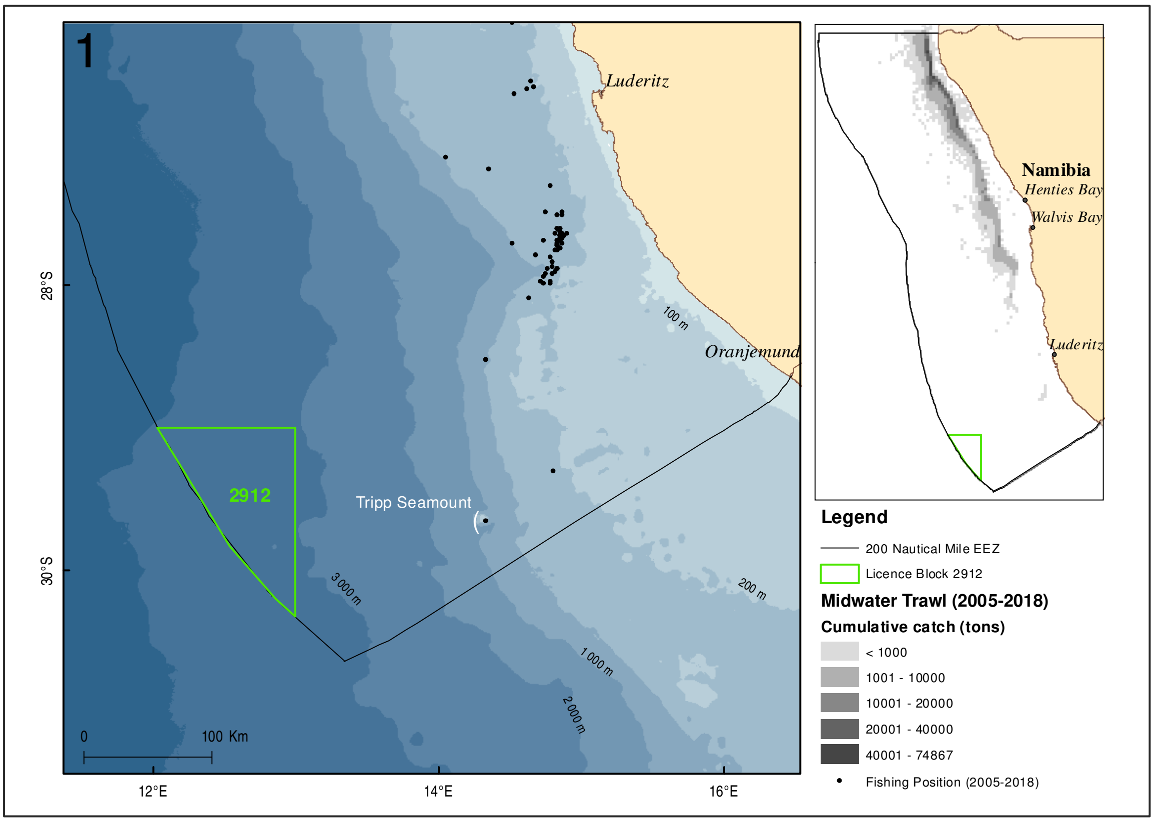

Figure 7-26: Block 2912 in relation to mid-water trawl catch targeting horse mackerel off the coast of Namibia (2005-2018)

Source: CapMarine

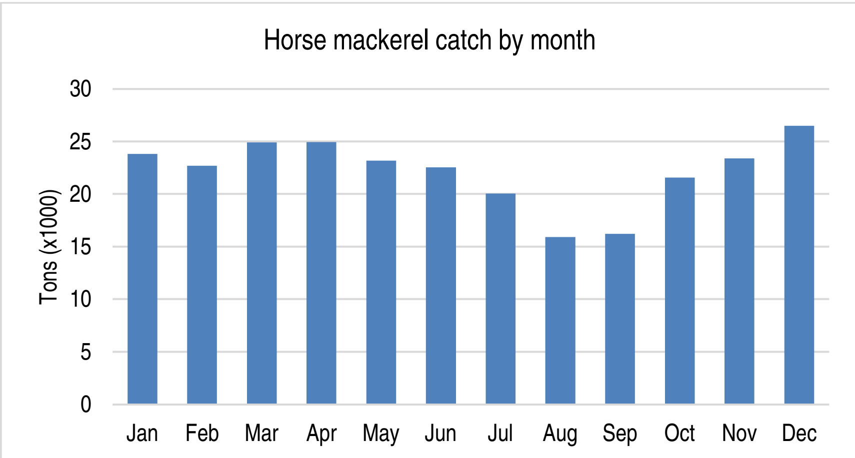

Figure 7-27: Average monthly catch (tons) of horse mackerel by the Namibian mid-water trawl fishery (2005 – 2018)

7.6.9.3 Deep-water trawl

The deep-water trawl fishery is a small fishing sector targeting orange roughy (*Hoplostethus atlanticus*) and alfonsino (*Beryx splendens*). The fishing grounds were discovered in 1995/1996 and total catches reached 15 500 tons in 1997. Following a drop in biomass levels, the TAC was decreased from 12 000 tons in 1998 to 1 875 tons in 2000. The fishery has been closed since 2007. Although the fishery is closed, the stock is currently being assessed with a view to considering the viability of re-opening the fishery.

The deep-water trawl fishery is directed at the outer Namibian shelf from 400 m to 1 500 m water depth. In Namibia the orange roughy fishery is split into four Quota Management Areas (QMAs) referred to as "Hotspot", "Rix", "Frankies" and "Johnies". Almost no fishing for this species takes place outside of the designated QMA's. **The licence area does not coincide with any of the QMA's with the closest being "Johnies", situated 100 km north-east of Block 2912** (see Figure 7-28).

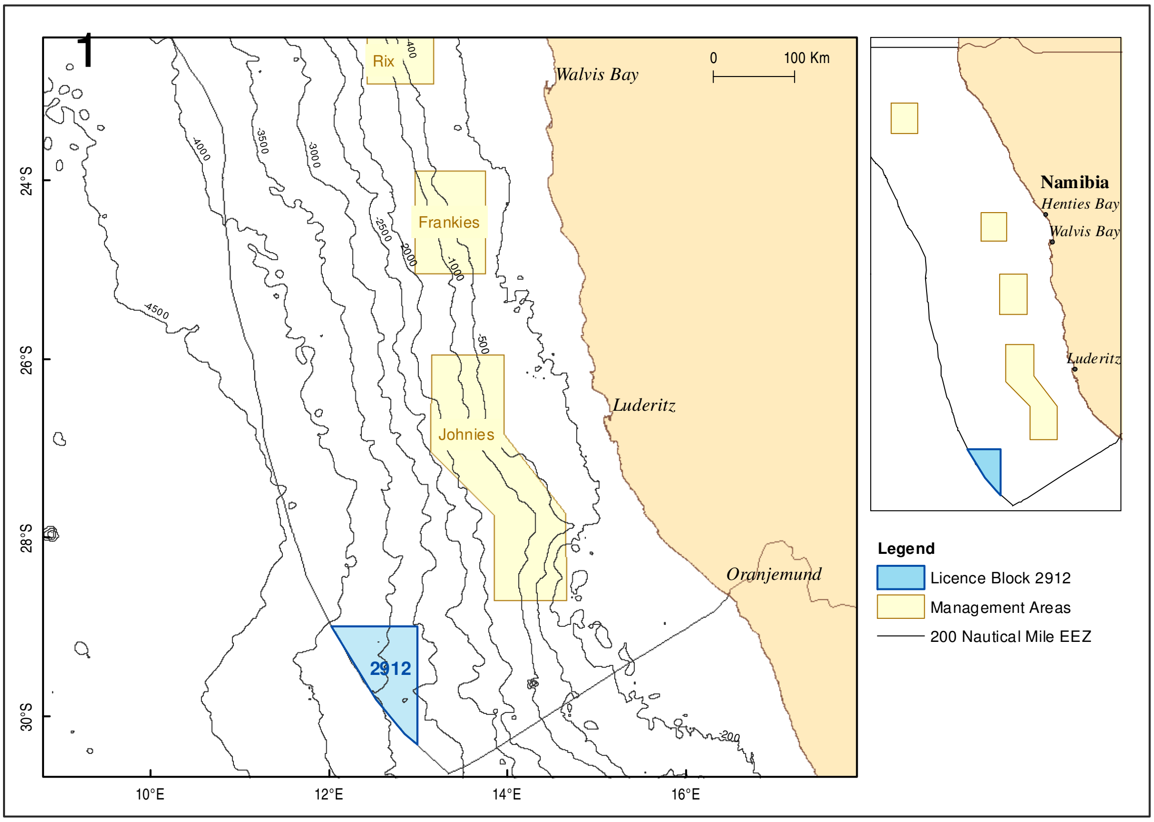

Figure 7-28: Block 2912 in relation to mid management areas used by the deep-water trawl sector (currently closed)

Source: CapMarine

7.6.9.4 Small pelagic purse seine

The pelagic purse seine fishery, which targets sardine (*Sardinops sagax*) and juvenile horse mackerel, was historically the largest fishery (by volume) in Namibia. The fishery started in 1947 and operated predominantly from the port of Walvis Bay. The fishery grew rapidly until 1968 when the fish stock collapsed. Since independence, Namibia has issued a small TAC of sardine to sustain the small pelagic sector and to allow land-based factory turnover. In addition, they allow part of this catch to target juvenile horse mackerel. However, in recent years the resource base has been unable to sustain even these minimal TACs and the fishery has been closed and reopened on an ad hoc basis depending on resource availability. The fishery was open in 2017 with a TAC of 14 000 t for sardine; however, in 2018 the TAC for sardine was set at zero and is expected to remain so until January 2021 (at the earliest) to allow recovery of the stock.

Fishing activity occurs primarily northwards of Walvis Bay extending to the Angolan border, inshore of the 200 m isobath. The fishing grounds targeted by the purse-seine fleet are largely located off and to the north of Walvis Bay. **The main commercial fishing grounds are situated at least 480 km northward of the licence area, and the closest fishing activity recorded 150 km east of Block 2912 is incidental. There is no overlap of fishing activity with the licence block** (see Figure 7-29).

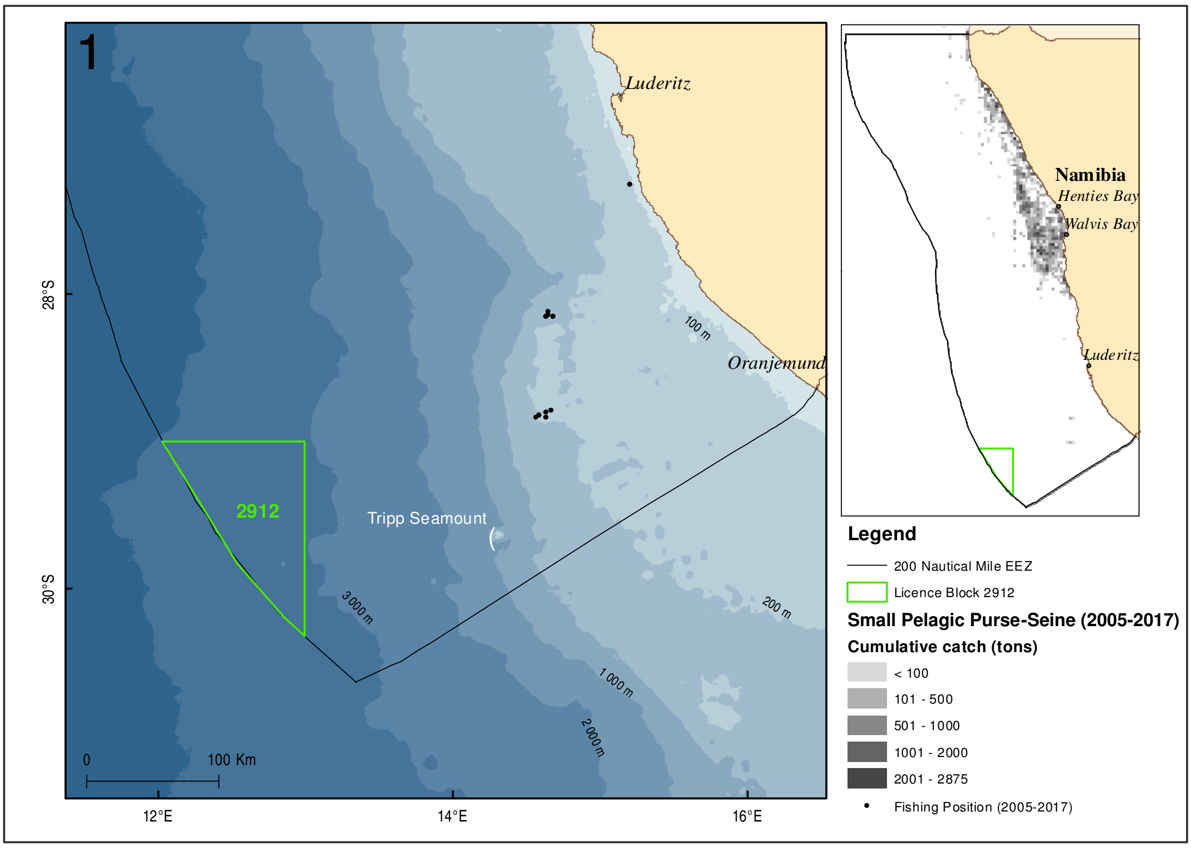

Figure 7-29: Block 2912 in relation to pelagic purse-seine catch (2005 – 2017; currently closed)
Source: CapMarine

Monthly pelagic purse seine trends in landings and catch composition are shown in Figure 7-30.

The pelagic purse seine fleet consists of approximately 36 wooden, glass-reinforced plastic and steel-hulled vessels ranging in length from 21 m to 48 m. The targeted species are surface-shoaling and once a shoal has been located the vessel encircles it with a large net (see Figure 7-31), which has a depth of 60 m to 90 m. Netting walls surround aggregated fish both from the sides and from underneath, thus preventing them from escaping by diving downwards. These are surface nets framed by lines: a float line on top and lead line at the bottom. Once the shoal has been encircled the net is pursed and hauled in and the fish are pumped on board into the hold of the vessel. It is important to note that after the net is deployed the vessel has no ability to manoeuvre until the net has been fully recovered on board and this may take up to 1.5 hours.

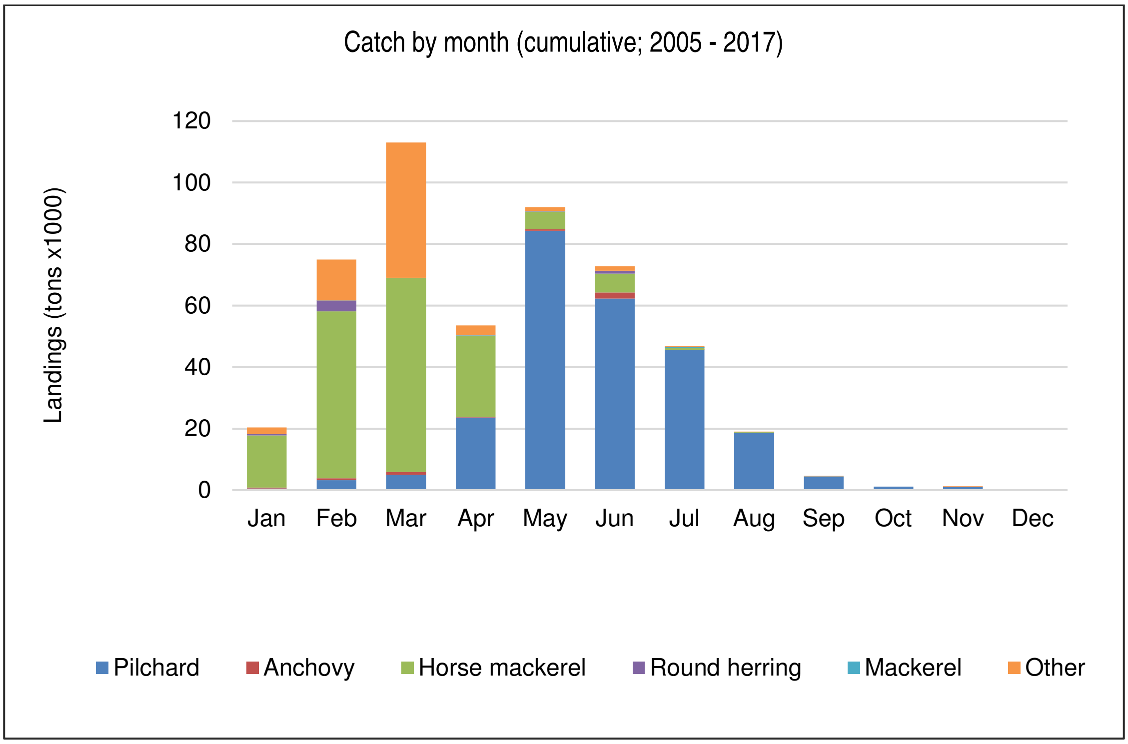

Figure 7-30: Monthly cumulative landings of small pelagic species by the purse-seine sector from 2005 to 2017

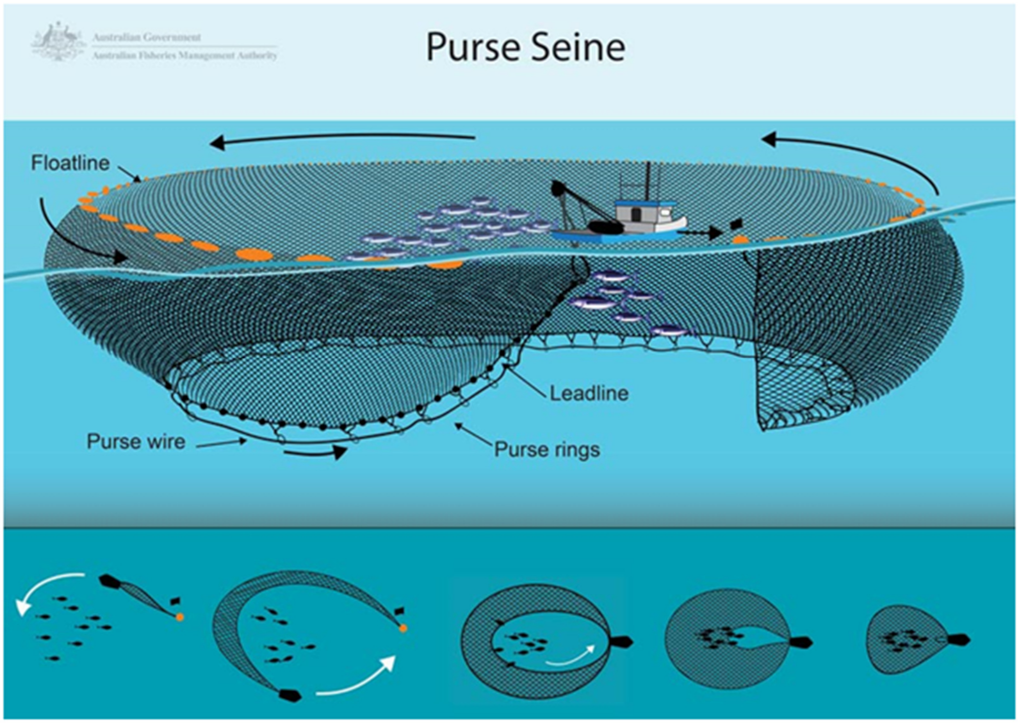

Figure 7-31: Schematic of typical purse-seine gear deployed in the "small" pelagic fishery

Source: **http://www.afma.gov.au/portfolio-item/purse-seine**

7.6.9.5 Large pelagic long-line

This sector uses surface long-lines to target migratory pelagic species including albacore tuna (*Thunnus alalunga*), yellowfin tuna (*T. albacares),* bigeye tuna (*T. obesus)*, swordfish (X*iphias gladius*) and various shark species.

Pelagic long-line vessels operate extensively around the entire coast along the shelf-break and into deeper waters between 200 m depth to beyond the 2 000 m isobath. **Thus, grounds used by the pelagic long-line fishery coincide with Block 2912, albeit to a lower degree of effort** (see Figure 7-32).

Effort occurs year-round with lower levels of fishing effort expected between June and October (see Figure 7-33).

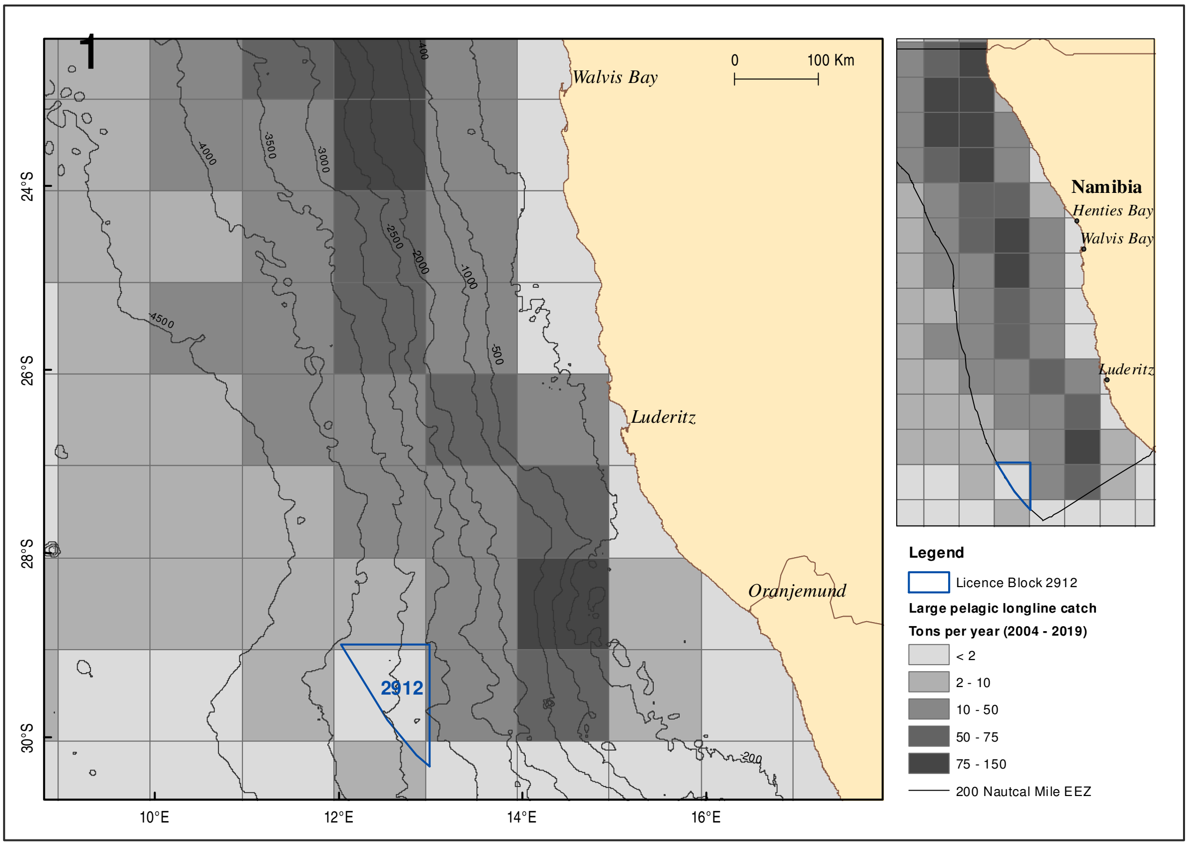

Figure 7-32: Block 2912 in relation to large pelagic long-line catch off the coast of Namibia (2004 – 2019)
Source: CapMarine, 2022

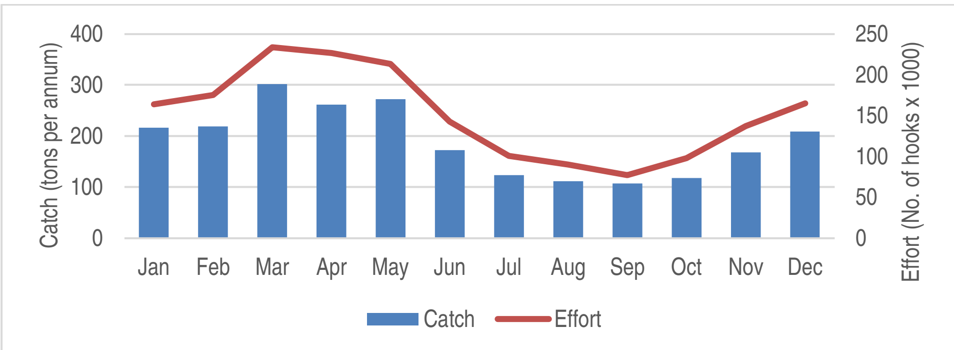

Figure 7-33: Monthly average catch and effort recorded within the large pelagic long-line sector within Namibian waters (2008 – 2013)

There is provision for up to 26 fishing rights and 40 vessels in this sector (http://www.mfmr.gov.na/). Pelagic long-line vessels set a drifting mainline, which are up to 100 km in length. The mainline is kept near the surface or at a certain depth by means of buoys (connected via "buoy-lines"), which are spaced approximately 500 m apart along the length of the mainline (see Figure 7-34). Hooks are attached to the mainline on relatively short sections of monofilament line ("snoods") which are clipped to the mainline at intervals of 20 to 30 m. A single main line consists of twisted tarred rope (6 to 8 mm diameter), nylon monofilament (5 to 7.5 mm diameter) or braided monofilament (6 mm diameter). Various types of buoys are used in combinations to keep the mainline near the surface and locate it should the line be cut or break for any reason. Each end of the line is marked by a Dahn Buoy and Radar reflector, which marks its position for later retrieval by the fishing vessel. A line may be left drifting for up to 18 hours before retrieval by means of a powered hauler at a speed of approximately 1 knot. During hauling a vessel's manoeuvrability is severely restricted and, in the event of an emergency, the line may be dropped to be hauled in at a later stage.

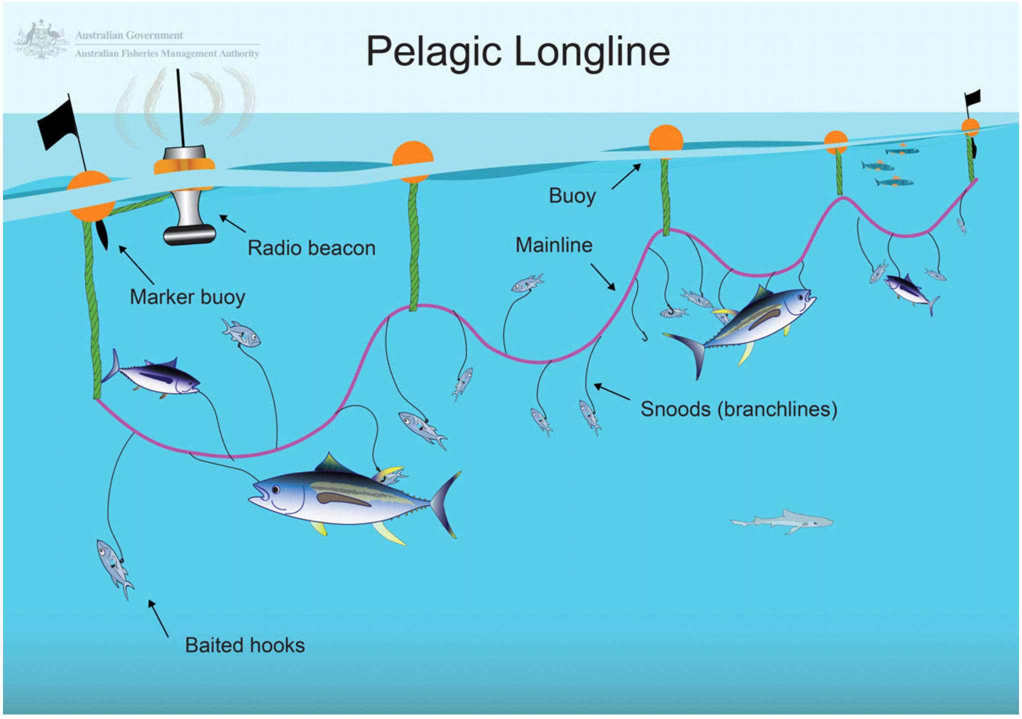

Figure 7-34: Typcial pelagic long-line gear configuration
Source: http://www.afma.gov.au/portfolio-item/longlining

7.6.9.6 Demersal long-line

The demersal long-line fishery targets bottom-dwelling species, predominantly hake (*Merluccius capensis* and *M. paradoxus*), with a small non-targeted commercial by-catch that includes kingklip. A total hake TAC of 154 000 tons is normally set in Namibian waters, but less than 10 000 tons of this is caught by long-line vessels.

Demersal long-lining is expected to occur in similar areas used by the hake-directed trawling, i.e. along the entire Namibian coastline at a depth range of 200 m to 650 m. Figure 7-35 shows the spatial distribution of the average annual catch landed by the demersal long-line fishery for the period 2005 to 2018. **Fishing grounds are situated 100 km eastward of Block 2912 and there is no overlap.**

Approximately 18 vessels are currently operating within the sector within three broad areas. Vessels based in Lüderitz work south of 26°S towards the South Africa border while those based in Walvis Bay operate between

23°S and 26°S and North of 23°S. Vessels operate year-round, but operations are particularly low in October (see Figure 7-36).

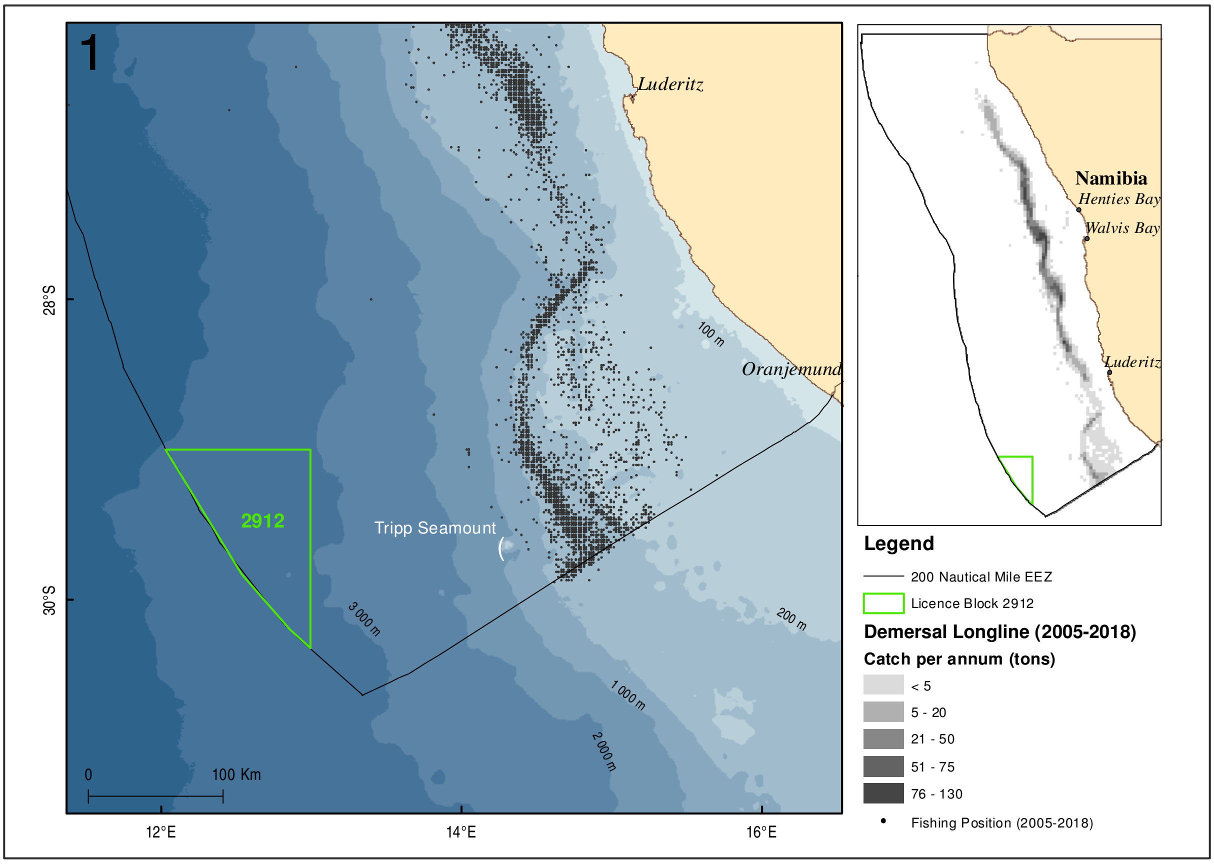

Figure 7-35: Block 2912 in relation to the catch landed by the demersal long-line fishery targeting Cape hake (2005 – 2018)

Source: CapMarine, 2022

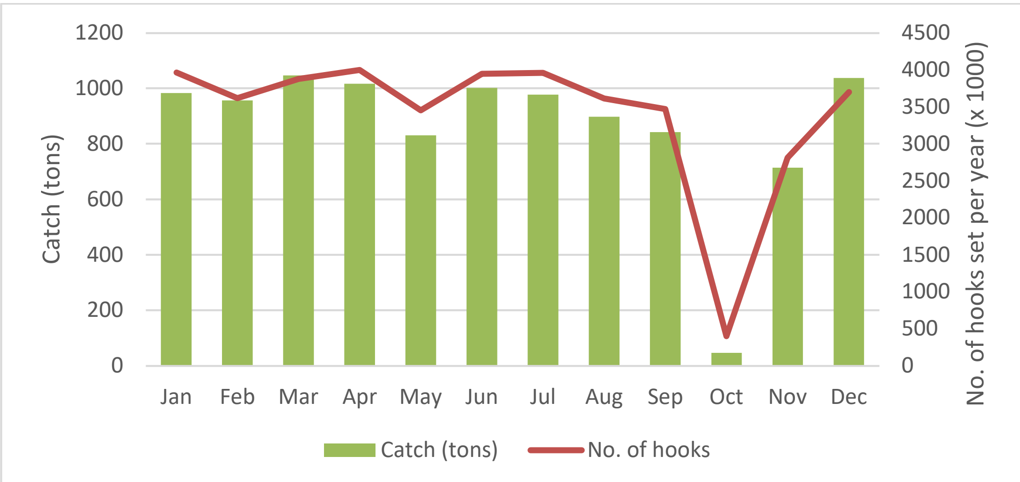

Figure 7-36: Average monthly catch (tons) recorded by the Namibian demersal long-line sector (2005 – 2018)

Long-line vessels vary from 18 m to 50 m in length and remain at sea for four to seven days at a time and retain their catch on ice. A demersal long-line vessel may deploy either a double or single line which is weighted along its length to keep it close to the seafloor (see Figure 7-37). Steel anchors are placed at the ends of each line to anchor it. These anchor positions 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 topline is more buoyant than the bottom line, it is raised off the seafloor and minimises the risk of snagging or fouling. The purpose of the topline is to aid in gear retrieval if the bottom line breaks at any point along the length of the set line, which may be up to 30 nm in length. Baited hooks are attached to the bottom line at regular intervals by means of a snood. Gear is usually set at night at a speed of 5 to 9 knots. Once deployed the line is left to soak for up to eight hours before retrieval. A line hauler is used to retrieve gear at a speed of approximately 1 knot and usually takes six to ten hours to complete. During hauling operations the vessel's manoeuvrability is severely restricted.

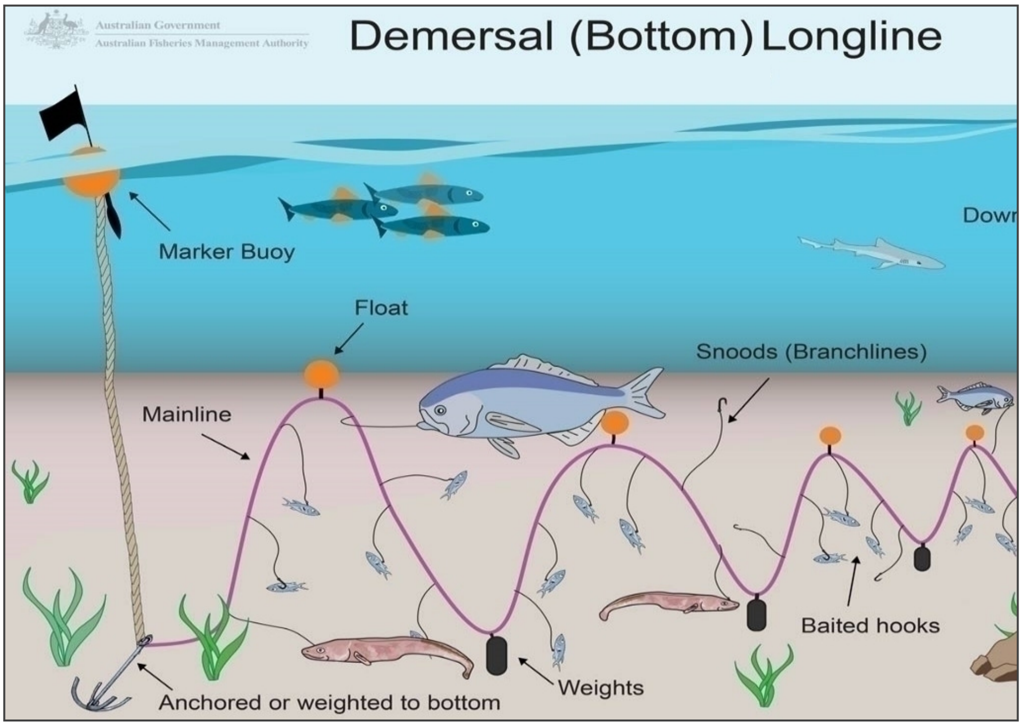

Figure 7-37: Typical configuration of demersal (bottom-set) hake long-line gear
Source: http://www.afma.gov.au/portfolio-item/longlining

7.6.9.7 Tuna pole

Poling for tuna (predominantly albacore tuna, yellowfin tuna and bigeye tuna), from mostly small boats (< 25 m), is common in southern Namibian waters. Albacore tuna migrate and are particularly important for fisheries in the Benguela ecosystem. Movement of albacore tuna between South Africa and Namibia is not clear although it is believed the fish move northwards following bathymetric features generally deeper than 200 m water depth. Within Namibian waters, the fishery operates southwards of 25°S between the 200 m and 500 m bathymetric contours. Aggregations of albacore tuna are known to occur in the vicinity of the Tripp Seamount (approximately 125 km east of Block 2912) and the highest effort levels are recorded in this area (see Figure 7-38). **Fishing activity has not been recorded within Block 2912, with minimal effort expended within the adjacent Block 2913B. Less than 1 ton of the overall annual catch between 2004 and 2019 was recorded in the deep water area of Block 2913B.**

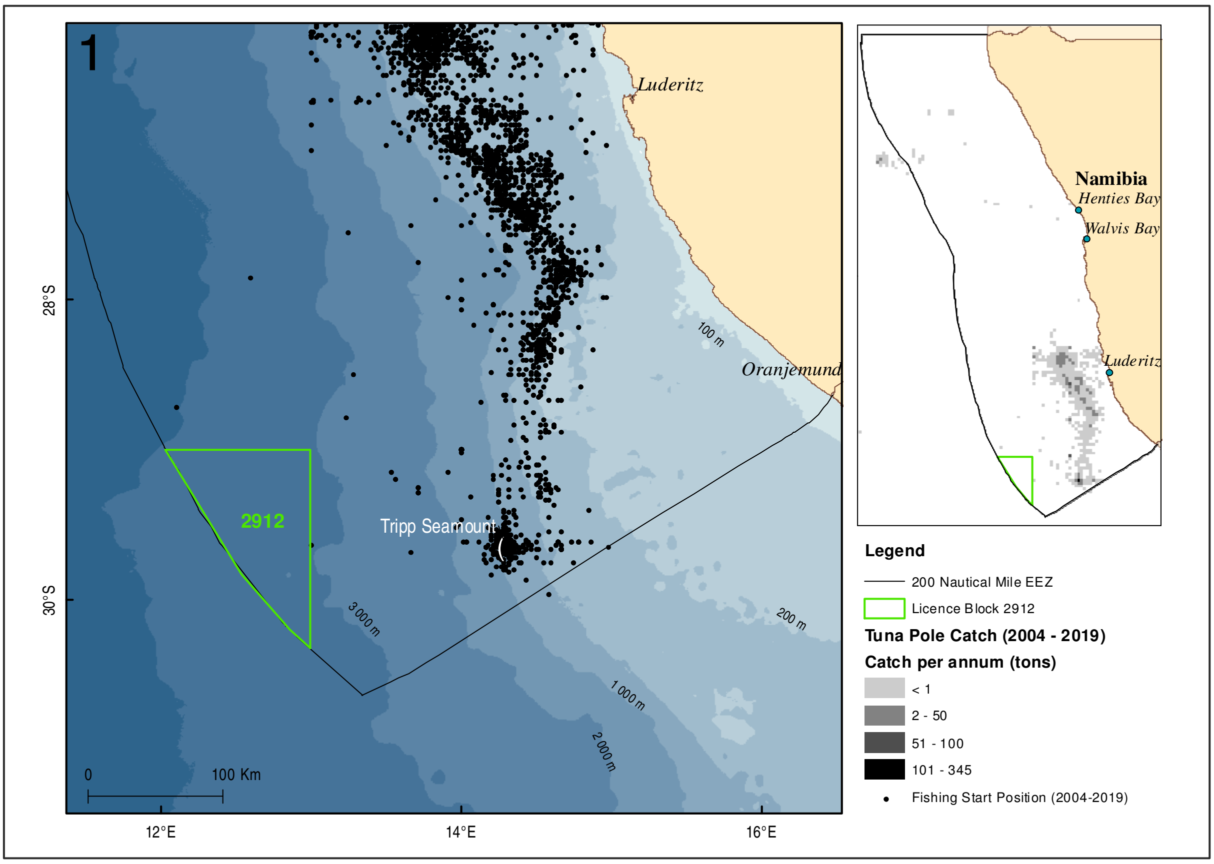

Figure 7-38: Block 2912 in relation to tuna pole catch (2004 – 2019)
Source: CapMarine, 2022

The fishery is seasonal with vessel activity mostly between December and May with peak catches in February, March and April (see Figure 7-39). The records that are available for this fishery are reported by Namibia for the whole Exclusive Economic Zone (EEZ) and no detailed spatial catch and effort data exists.

Approximately 36 South African vessels operate in the sector under arrangement with Namibian rights holders each year, however, the number of active vessels and landed catch have recently shown a decline. Historically catches of albacore tuna caught by South Africa and Namibia combined were very low, increasing steadily to a peak in 2000 and declining thereafter to below 6 000 tons in 2015. In 2016, the estimated Namibian and South African catches were below that of the previous five years (ICCAT, 2018) and, in 2018, Namibian catches declined to approximately 1 000 tons and in 2019 declined even further (ICCAT, 2021). During 2020, the tuna catches in Namibia increased dramatically to just below 4 000 tons (ICCAT, 2021). Figure 7-40 shows the total catches of albacore and yellowfin tuna by the South African and Namibian tuna pole sectors.

Whilst at sea, the majority of time is spent searching for fish with actual fishing events taking place over a relatively short period of time. Sonars and echo sounders are used to locate schools of tuna. At the start of fishing, water is sprayed outwards from high-pressure nozzles to simulate small baitfish aggregating near the water surface, thereby attracting tuna to the surface. Live bait is flung out to entice the tuna to the surface (chumming). Tuna swimming near the surface are caught with hand-held fishing poles. The ends of the 2 m to 3 m poles are fitted with a short length of fishing line leading to a hook. Hooked fish are pulled from the water and many tons can be landed in a short period of time. In order to land heavier fish, lines may be strung from the ends of the poles to overhead blocks to increase lifting power (see Figure 7-41).

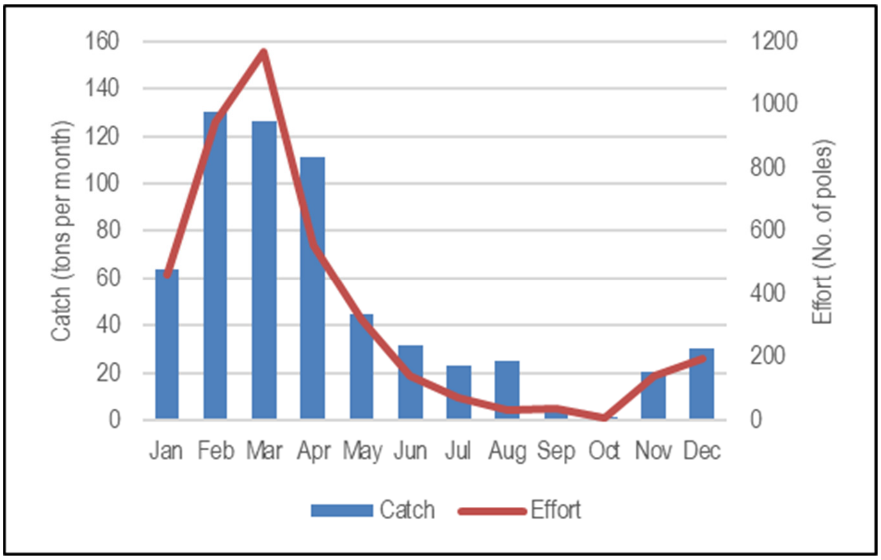

Figure 7-39: Average monthly catch and effort recorded by the tuna pole and line fleet in Namibian waters

Source: MFMR, 2014

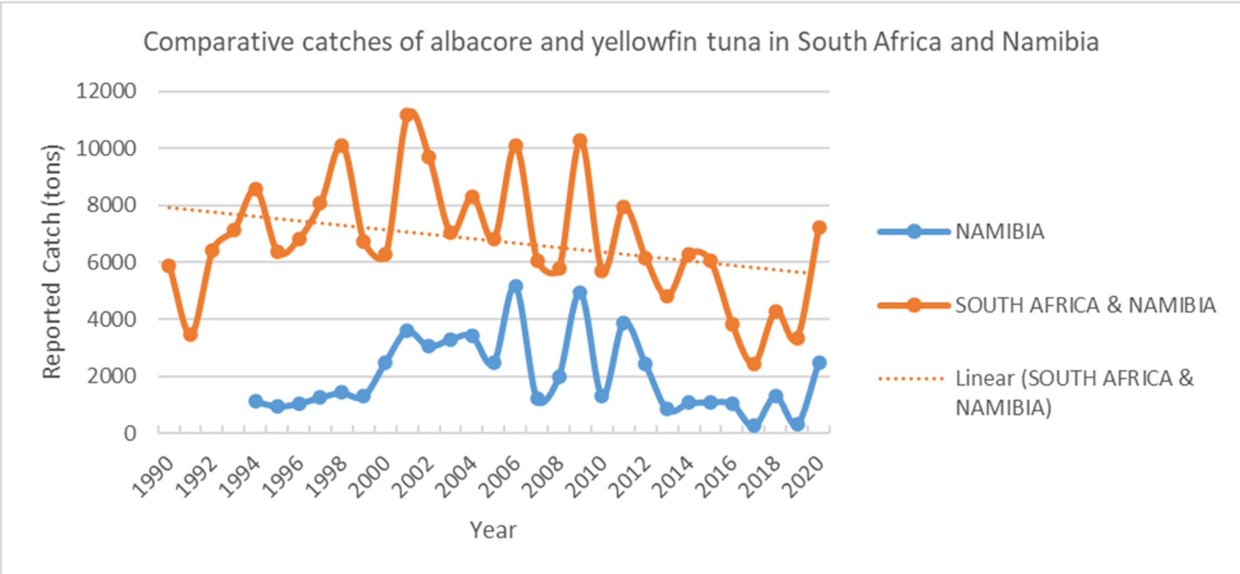

Figure 7-40: Total nominal baitboat and long-line catch (tons) of longfin (albacore) and yellowfin tuna reported by South Africa and Namibia between 1990 and 2020

Source: ICCAT statistical bulletin, 2018

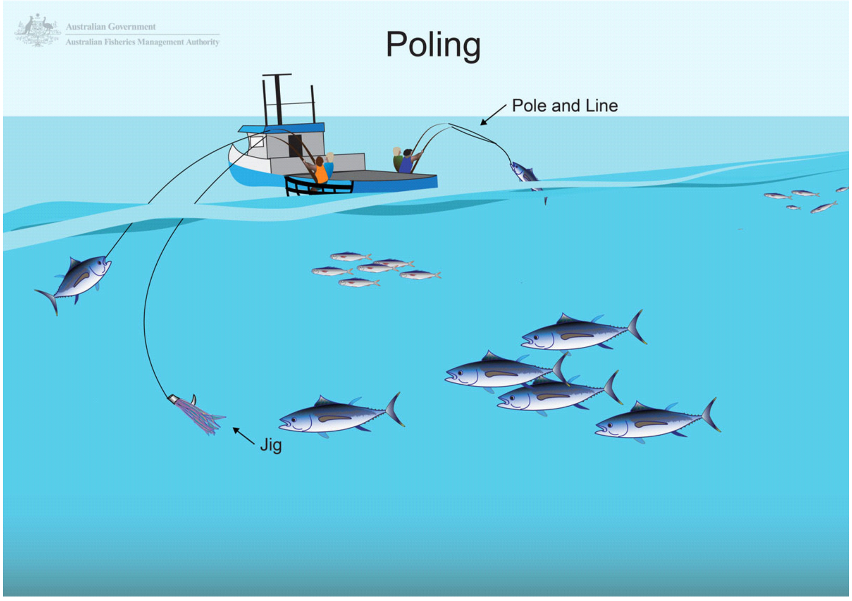

Figure 7-41: Schematic diagram of pole and line operation
Source: http://www.afma.gov.au/portfolio-item/minor-lines

7.6.9.8 Traditional line-fish

The traditional line fishery is based on only a few species that includes kob (*sciaenidae*), snoek (*Thyrsites atun*) and numerous shark species which are sold on the local market or exported.

The fishery is limited in extent mostly northwards of Walvis Bay and does not operate much further than 12 nm offshore (i.e. 22 km). The distribution of line-fish catch in relation to Block 2912 is shown in Figure 7-42. **The sector operates inshore of the 200 m depth contour with the closest fishing activity taking place from Lüderitz, at least 300 km north-east of Block 2912. There is no spatial overlap with the sector.**

The two commercial components of the line-fish fishery comprise a fleet of between 10 and 13 ski-boats and a fleet of 26 industrial vessels. While ski-boats fish close to the shore in the vicinity of Swakopmund and Walvis Bay, the industrial vessels fish offshore areas between Walvis Bay and the northern border with Angola.

7.6.9.9 Deep-sea crab

The Namibian deep-sea crab fishery is based on two species of crab, namely red crab (*Chaceon maritae*) and spider crab (*Lithodes ferox*). The fishery is small, with only two vessels currently operating from Walvis Bay at depths of between 500 m and 900 m. The fishery is seasonal (between June and August) and has a minimum operational depth limit of 400 m. The deep-sea crab fishery commenced in 1973 with a peak in catches between 5 000 and 7 000 tons during the 1980s. Since 1998, annual catches have averaged at approximately 2 000 tons. The TAC for 2018/2019 was set at 3 900 tons.

The distribution of this fishery extends from approximately 5°S to Walvis Bay at a depth range of 300 m to 1 000 m. There is a minimum operational depth of 400 m set for the fishery. **Fishing grounds are located at least 780 km to the north of Block 2912 and there is, therefore, no spatial overlap with the sector** (see Figure 7-43).

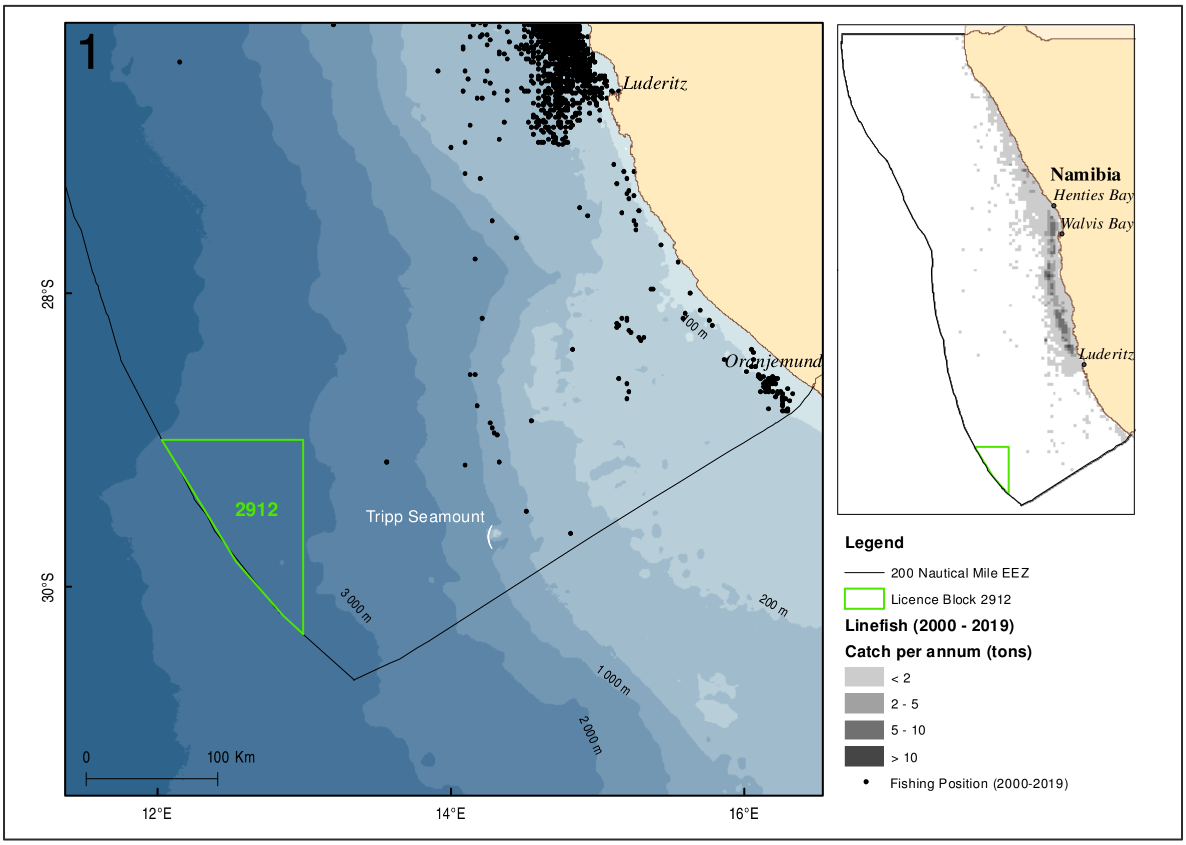

Figure 7-42: Block 2912 in relation to line-fish catch (2000 - 2019)

Source: CapMarine, 2022

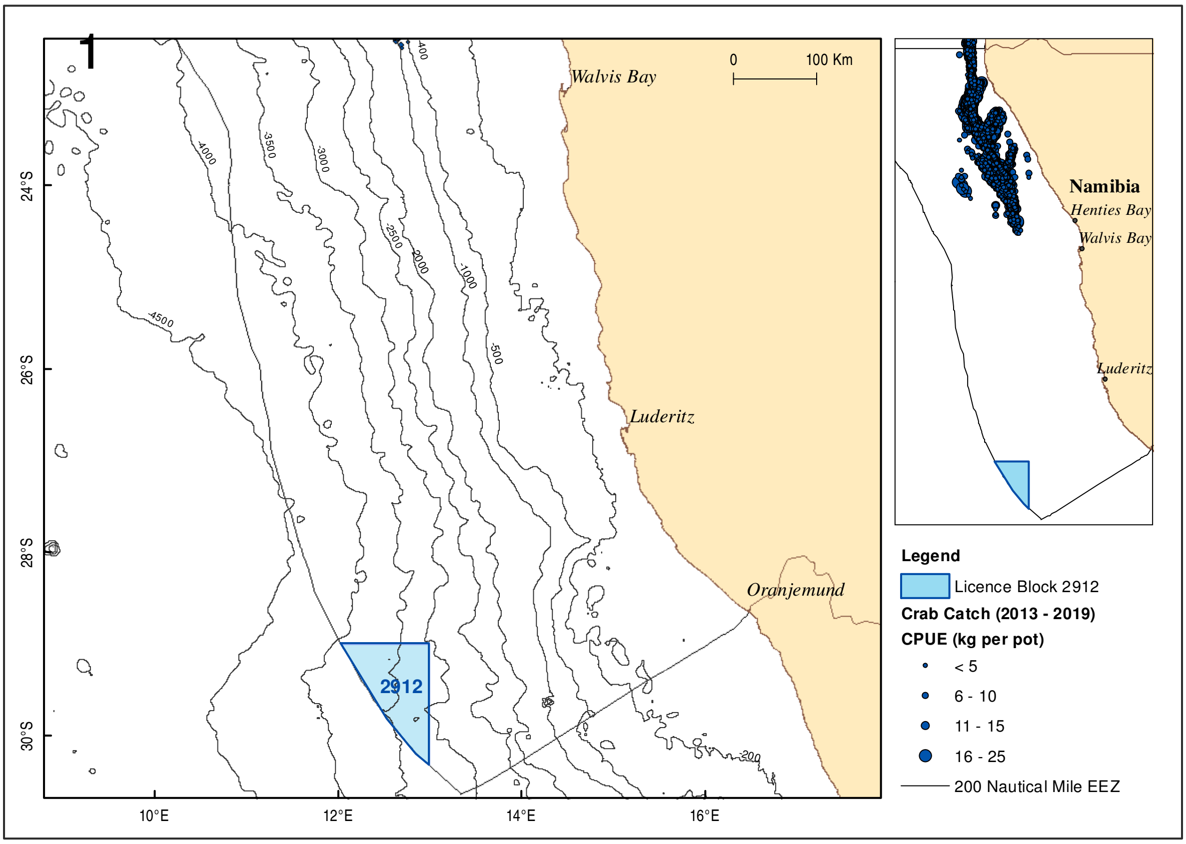

Figure 7-43: Block 2912 in relation to deep-sea crab catch (2013 – 2019)

Source: CapMarine, 2022

Method of capture involves the setting of a demersal long-line with a string of approximately 400 Japanese-style traps (otherwise known as "pots") attached to each line. Traps are made of plastic and dimensions are approximately 1.5 m width at the base and 0.7 m in height. They are spaced 15 m apart and typically baited with horse mackerel or skipjack. The line is typically 6 000 m in length and weighted at each end by a steel anchor. A surface buoy and radar reflector mark each end of the line via a connecting dropper line that allows retrieval of the gear. Up to 1 200 traps may be set each day (or two to three lines) and are left to soak for between 24 and 120 hours before being retrieved. Schematic diagrams of the types of gear used within the fishery are shown in Figure 7-44.

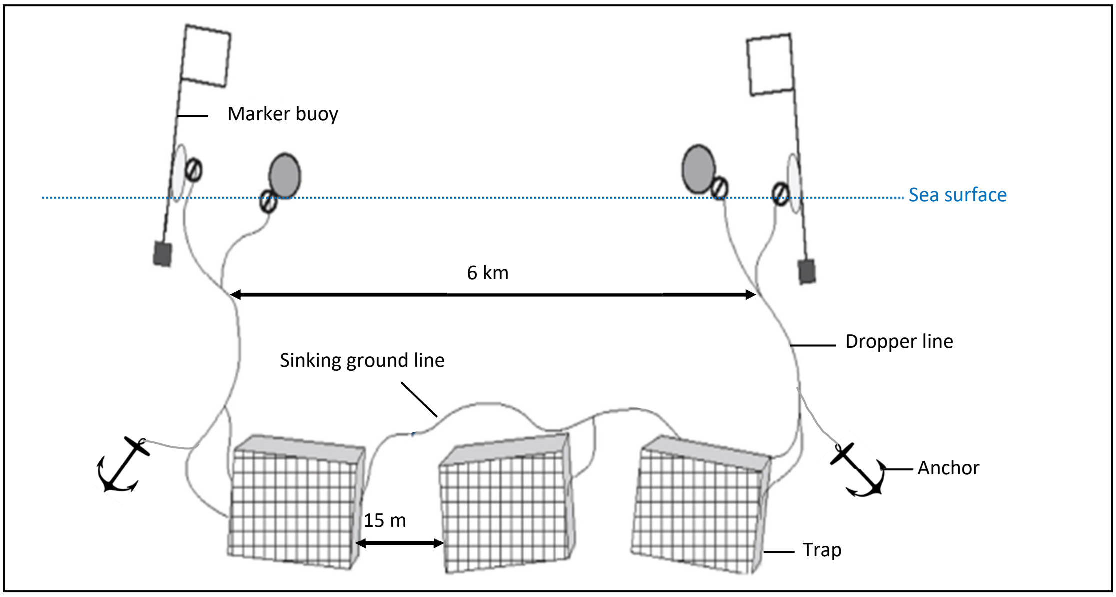

Figure 7-44: Schematic diagram of the gear configuration used within the deep-sea crab fishery
Adapted from: http://safinacenter.org

7.6.9.10 West Coast Rock lobster

The West Coast rock lobster (*Jasus lalandii*) is commercially exploited within Namibian waters between the Orange River in the south to Easter Cliffs/Sylvia Hill north of Mercury Island (approximately 25°S). The fishery is spatially managed through the demarcation of catch grounds by management area. Recent TACs for 2014/15 and 2015/16 were set at 300 and 250 tons, respectively. The industry lands between 50% and 80% of the total TAC each season. The fishing season for rock lobster is a six-month period with a closed period extending from 1 May to 31 October. Highest fishing activity levels are experienced over January and February. **This sector operates in water depths of between 10 and 80 m, thus well inshore of Block 2912. Thus, no interference is expected with this fishery** (see Figure 7-45).

Baited traps consisting of rectangular metal frames covered by netting are deployed from small dinghy's and delivered to larger catcher reefers to take to shore for processing. The rock lobster fishing fleet consists of vessels that range in length from 7 m to 21 m. Traps are set at dusk and retrieved during the early morning using a powerful winch for hauling.

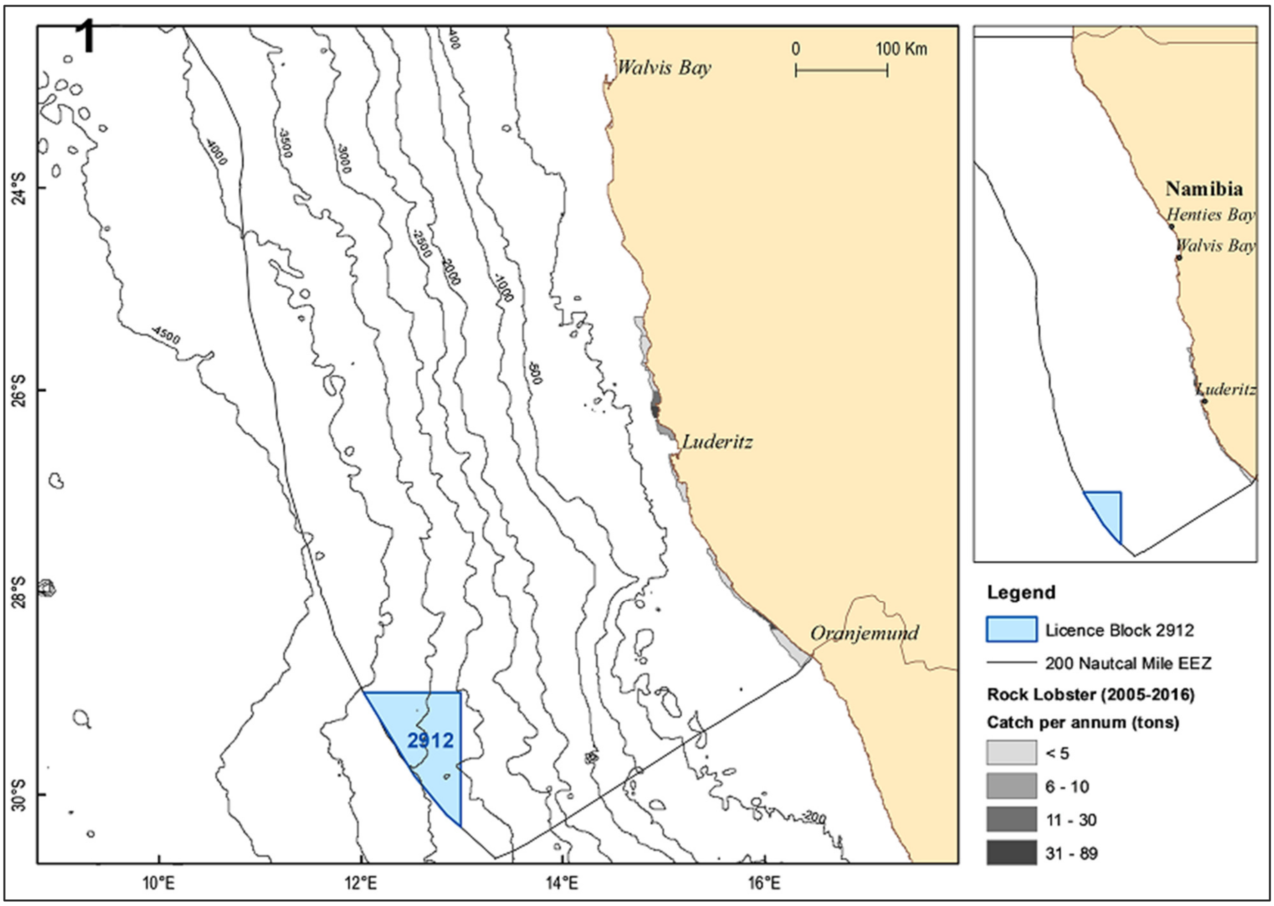

Figure 7-45: Block 2912 in relation to rock lobster catch (2005 to 2016)
Source: CapMarine, 2022

7.6.9.11 Mariculture

Namibia has a developing mariculture industry for oysters (*Crassostrea gigas* and *Ostrea edulis*), black mussel (*Choromytilus meridionalis* and *MytilusGallo-provincialis*), abalone (*Haliotis midae*) and seaweed (*Gracilaria gracilis*) (Oellermann, 2007). Mariculture methods vary but include rafts, suspended long-lines, racks in ponds and onshore flow-through tanks. Mariculture operations along the Namibian coastline are concentrated around Oranjemund, Lüderitz, Walvis Bay and Swakopmund. These coastal towns are of particular importance for Namibia's aquaculture industry due to their existing infrastructure and the shelter provided by the bays.

- Oranjemund: the abandoned diamond mine pits/ponds are used for the culturing of Pacific oysters (*Crassostrea gigas*). There was also a small-scale feeding and harvesting of marine finfish, mainly Steenbras (*Lithognathus lithognatus*).
- Lüderitz: NamPort has allocated 20 plots covering a total area of approximately 281 ha to mariculture (see Figure 7-46). Mariculture is aimed at oysters, with some experimental farming of mussels and rock lobsters. Abalone ranching takes place around the islands within the port limits.
- Walvis Bay: Mariculture production is mainly aimed at Pacific oysters, with one farm producing mussels (*Mytilus galloprovincialis*) for the local market, both using the long-line method for cultivation. There are 27 licenced aquaculture sites in Aqua Park 1 (not all are operational), located east of Walvis Peninsula, covering a cumulative area of approximately 1 341 ha. In addition, there are two open water sites located within the waters of Walvis Bay, one is located west of the Walvis Peninsula (known as Donkiesbaai) and the second is located approximately 13 km north-east of Pelican Point (known as Patrysberg).

- Swakopmund: The Swakopmund Municipality has earmarked a portion of land for mariculture purposes. There is one aquaculture producer in Swakopmund, which cultivates Pacific and European flat oysters (*Ostrea edulis*) in onshore holding ponds associated with the Salt Works, approximately 6.5 km north of Swakopmund. They use a variation of the rack and bag method for cultivation.

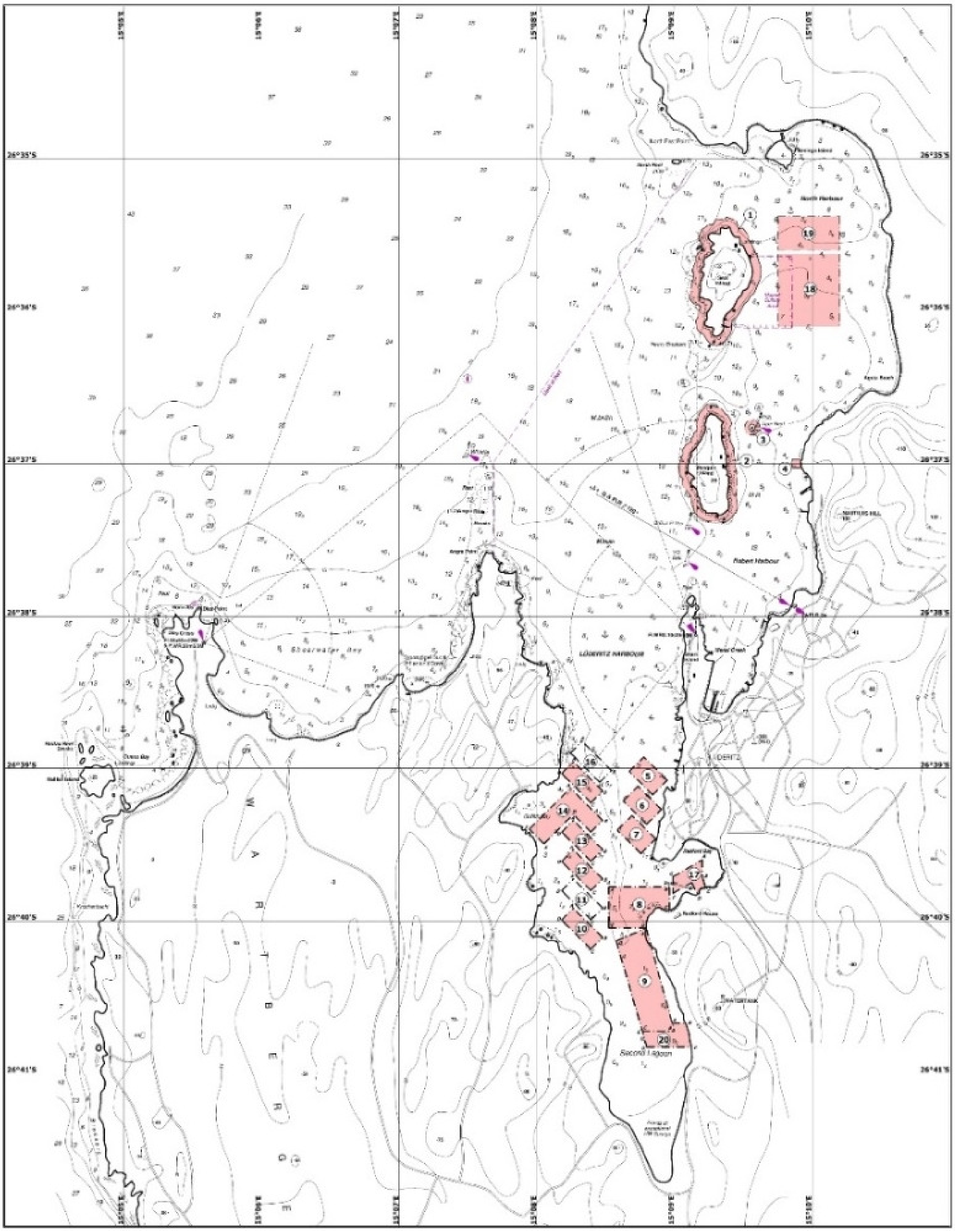

Figure 7-46: Areas allocated for aquaculture in the Port of Lüderitz

Source: Namibian Ports Authority, 2010

7.6.9.12 Fisheries research

MFMR conducts regular research (biomass) surveys for demersal, mid-water and small pelagic species. These surveys are normally fixed at specific times of the year and cover the entire continental shelf from the Angolan to South African maritime borders. Demersal trawl surveys normally take place over a one month period between January and February. In some years the Benguela Current Commission may conduct "transboundary" surveys. **The method of abundance estimation from these surveys is based on depth stratification and trawls range in depth from 100 m to 600 m; thus, well eastward of Block 2912**.

Scientific acoustic surveys are carried out between February and March each year to estimate the biomass of small pelagic species. These surveys cover the Namibian shelf from the coastline to the 500 m depth contour (and up to the 2 000 m contour northwards of 18°30´S). The vessel surveys along pre-determined transects that run perpendicular to depth contours (East-West / West-East direction).

7.6.10 Marine Traffic and Transport

There are various international shipping routes along the Namibian coastline. The majority of the international shipping traffic is located on the outer edge of the continental shelf. Traffic inshore of the continental shelf largely comprises fishing and mining vessels, especially off the coast of Oranjemund, which is inshore of Block 2912. The block is located along the western boundary of the main traffic route that passes around southern Africa (see Figure 7-47).

The two main ports in Namibia are (https://en.wikipedia.org/wiki/Namibian_Port_Authority; http://www.namport.com.na):

- Port of Walvis Bay: Walvis Bay is Namibia's largest commercial port and is a key port for regional and international shipping trade. It offers direct access to principal shipping routes and is a natural gateway for international trade. It has a sheltered deep water harbour which benefits from a temperate climate. The port is operated by Namport and receives approximately 3 000 vessel calls each year and handles over 5.3 million tons of cargo.
- Port of Lüderitz: Lüderitz Port is historically Namibia's second largest port, functioning mainly as a fishing port. It has expanded in recent years to ship cargo from the mining industry and to support and service offshore petroleum exploration and diamond mining activities. Lüderitz is closest Namibian port to Block 2912, approximately 340 km to the north-east.

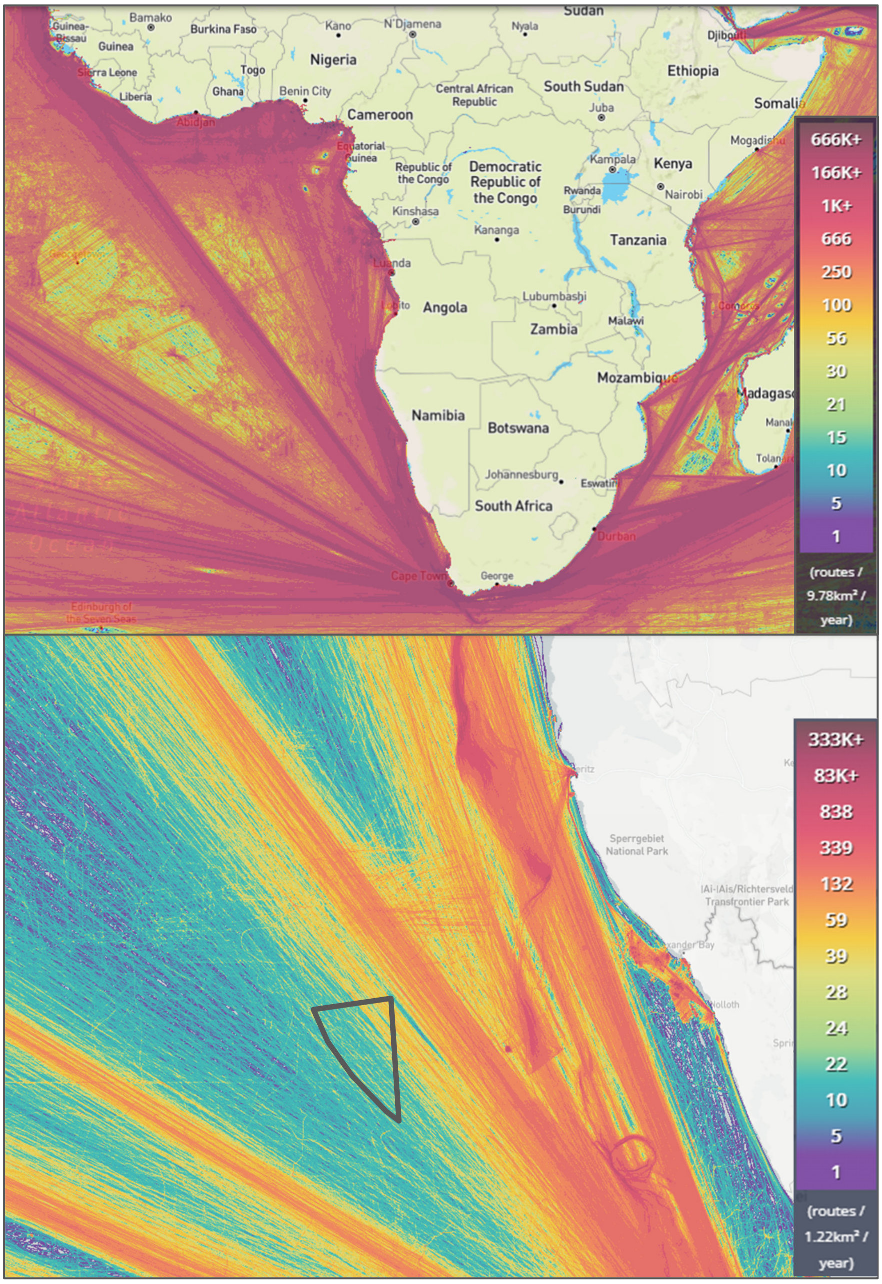

Figure 7-47: Block 2912 in relation to shipping density around Southern Africa
Source: http://www.marinetraffic.com/ (accessed August 2022)

7.6.11 Prospecting and Mining

7.6.11.1 Oil and gas exploration and production

A summary of the oil and gas industry in Namibia is provided in Section 5.3. Namibian Licence Blocks and their respective holders are shown in Figure 7-48.

Numerous seismic surveys (2D and 3D) have been undertaken and wells have previously been drilled in the Namibian offshore (see Figure 7-49 to Figure 7-51). Previous exploration activities undertaken in Block 2912 included a 2D seismic survey. This survey was undertaken by TGS (previously Spectrum) over the area in 2019. This data (1 097 km) was purchased and analysed by TEEPNA. Based on the analysis of this data, TEEPNA had undertaken a drilling campaign in the adjacent Block 2913B in 2020 and is now proposing to undertake further exploration drilling in Block 2912.

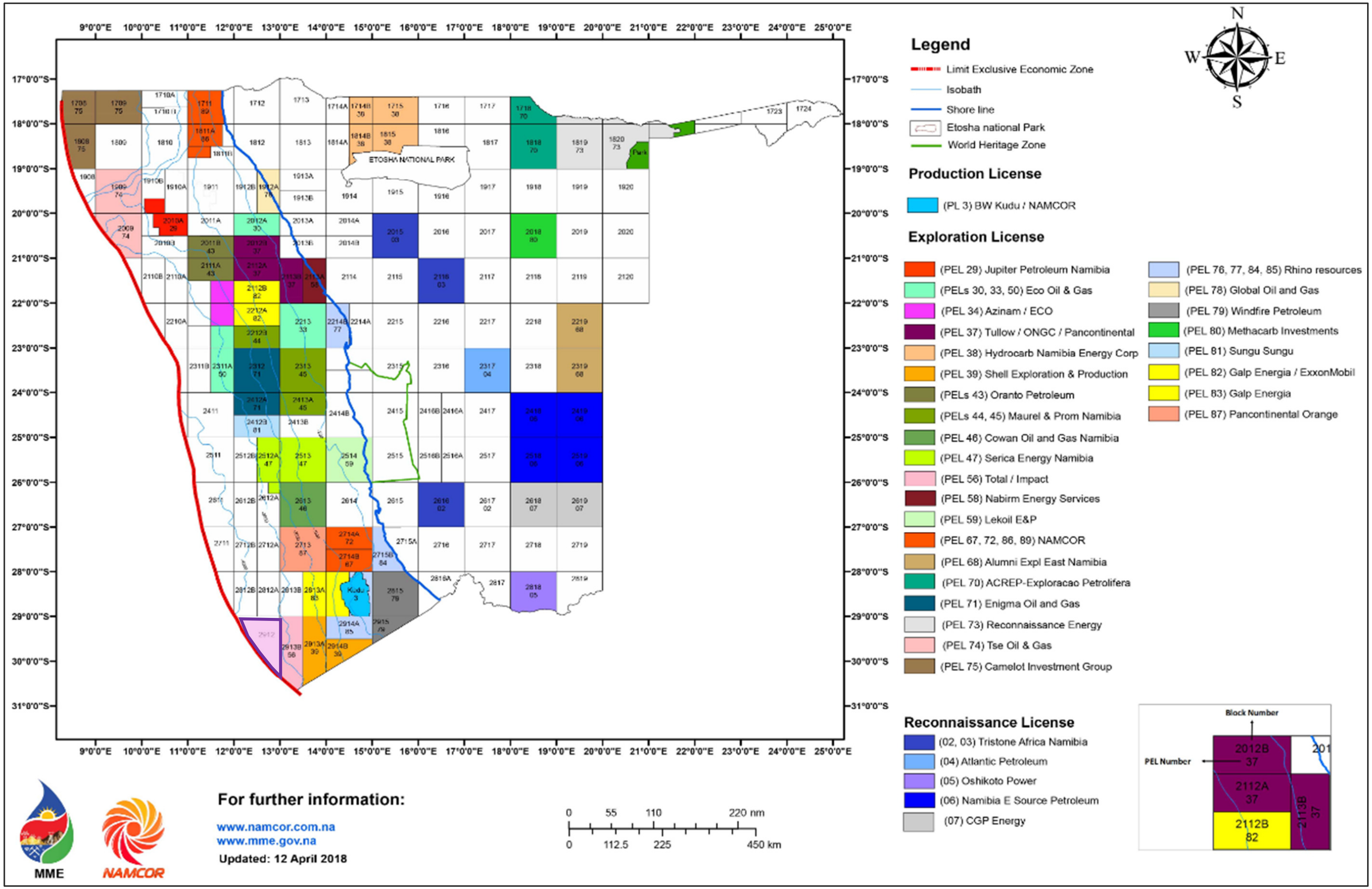

Figure 7-48: Namibian licence blocks and their respective licence holders

Source: **http://www.mme.gov.na/maps/**, 2022

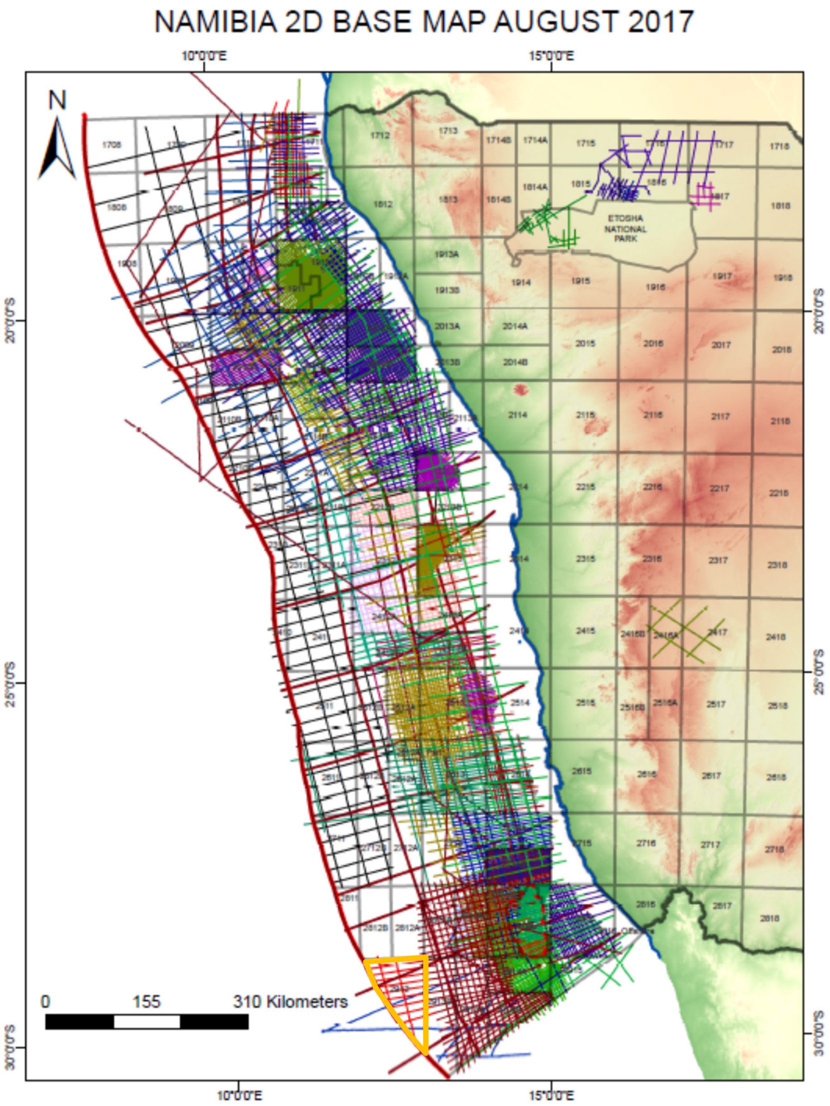

Figure 7-49: Block 2912 in relation to Namibian 2D seismic surveys

Source: **http://www.mme.gov.na/maps/**, 2022

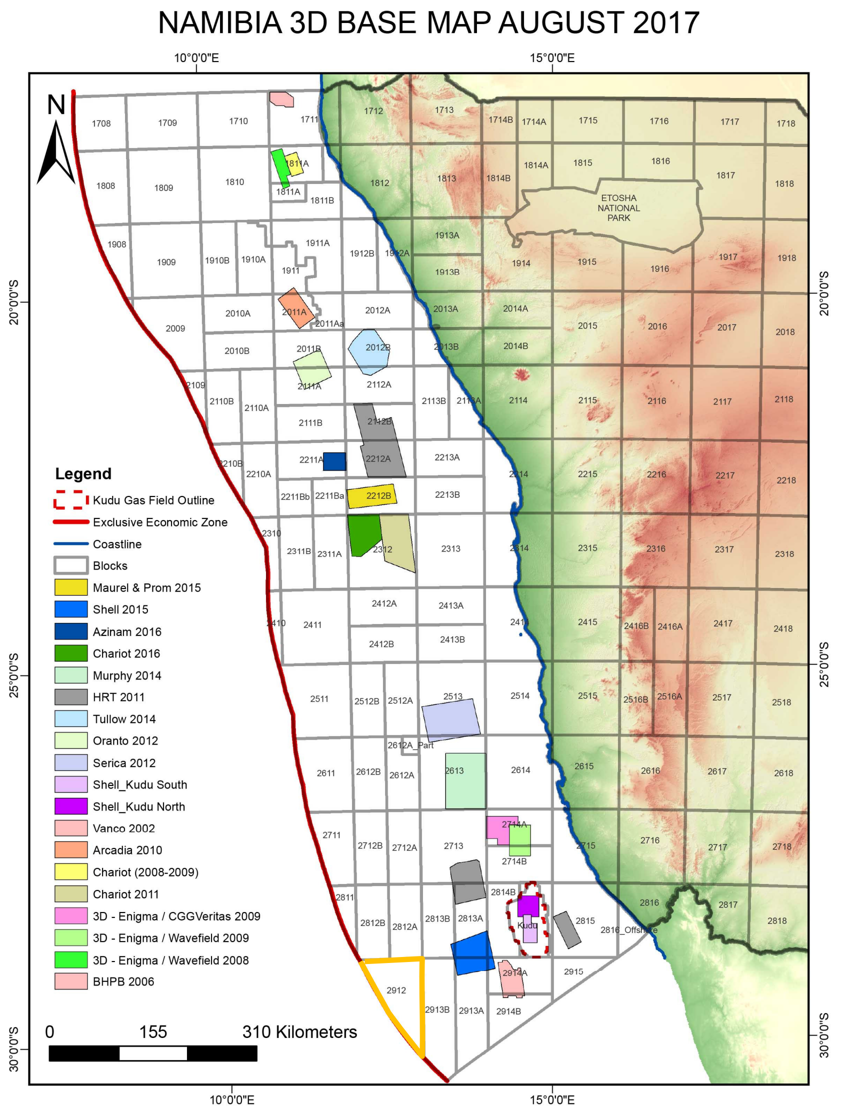

Figure 7-50: Block 2912 in relation to Namibian 3D seismic surveys

Source: **http://www.mme.gov.na/maps/**, 2022

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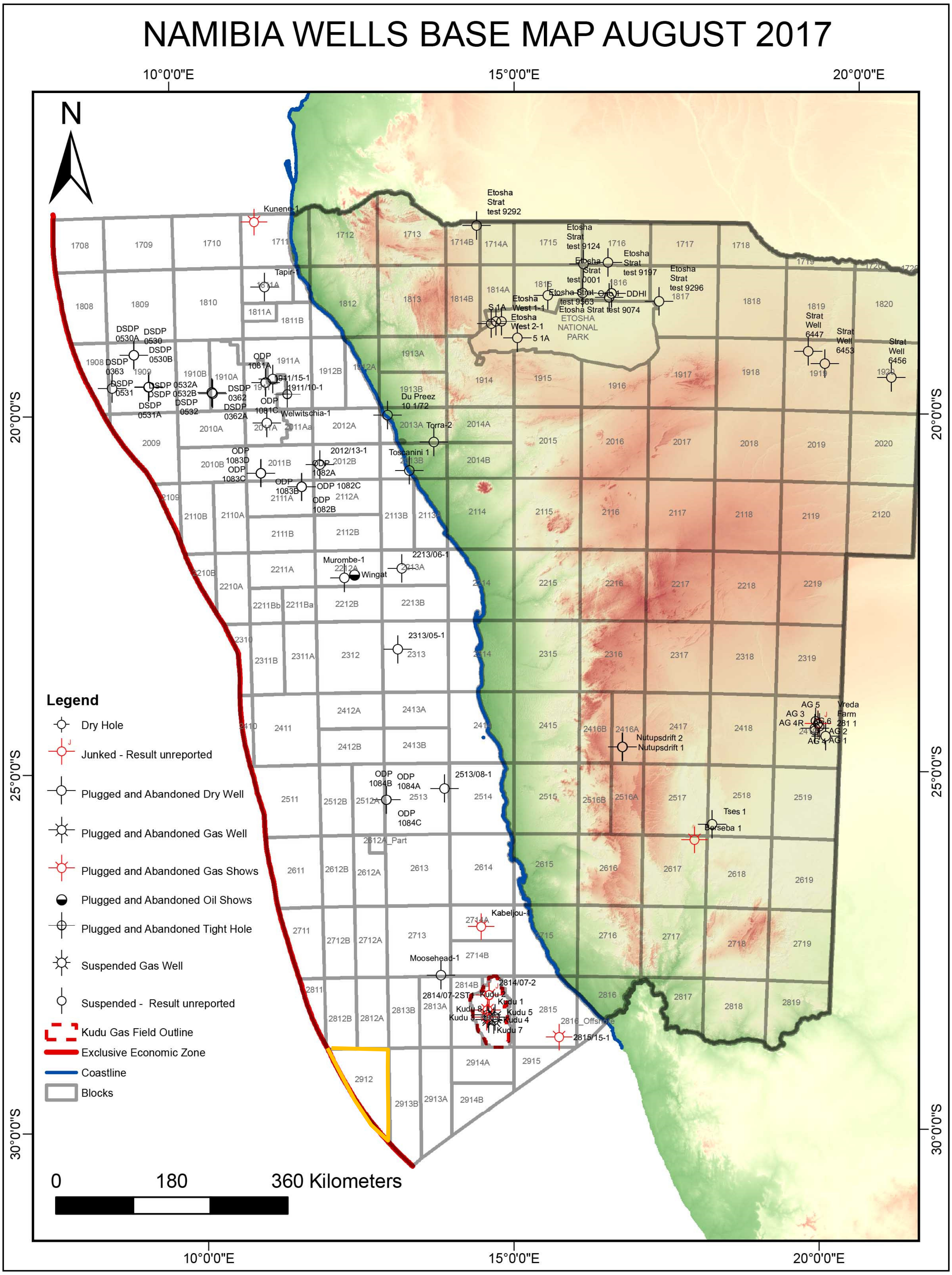

Figure 7-51: **Block 2912 in relation to Namibian offshore wells (also refer to Figure 7-45 for location of latest wells in Block 2913B)**

Source: **http://www.mme.gov.na/maps/**, 2017

7.6.11.2 Diamond prospecting and mining

Marine diamonds are mined along the Southern African West Coast from the Olifants River mouth northwards to Walvis Bay. Diamonds are mined either:

- in shallow waters (less than 30 m depths) by shore-based divers or small vessel-based divers who employ suction pipes to deliver gravel to land for sorting;
- in the midwater (30 - 70 m depth) region, where remote operated tools are used; or
- in deep waters, where custom mining equipment (undersea crawlers and large rotating drills) and high pressure airlift suction is used in waters depths of over 75 m.

Marine diamond mining is currently limited to the southern half of the Namibian offshore. Diamond Mining Licence (ML) Areas well inshore of Block 2912 are shown in Figure 7-52. Current diamond mining activities are minimal to non-existent, with the only active operations being in ML-47 (Atlantic 1) held by Debmarine Namibia. Deep-water diamond mining operations in the Atlantic 1 Mining Licence Area are typically conducted to depths of 150 m.

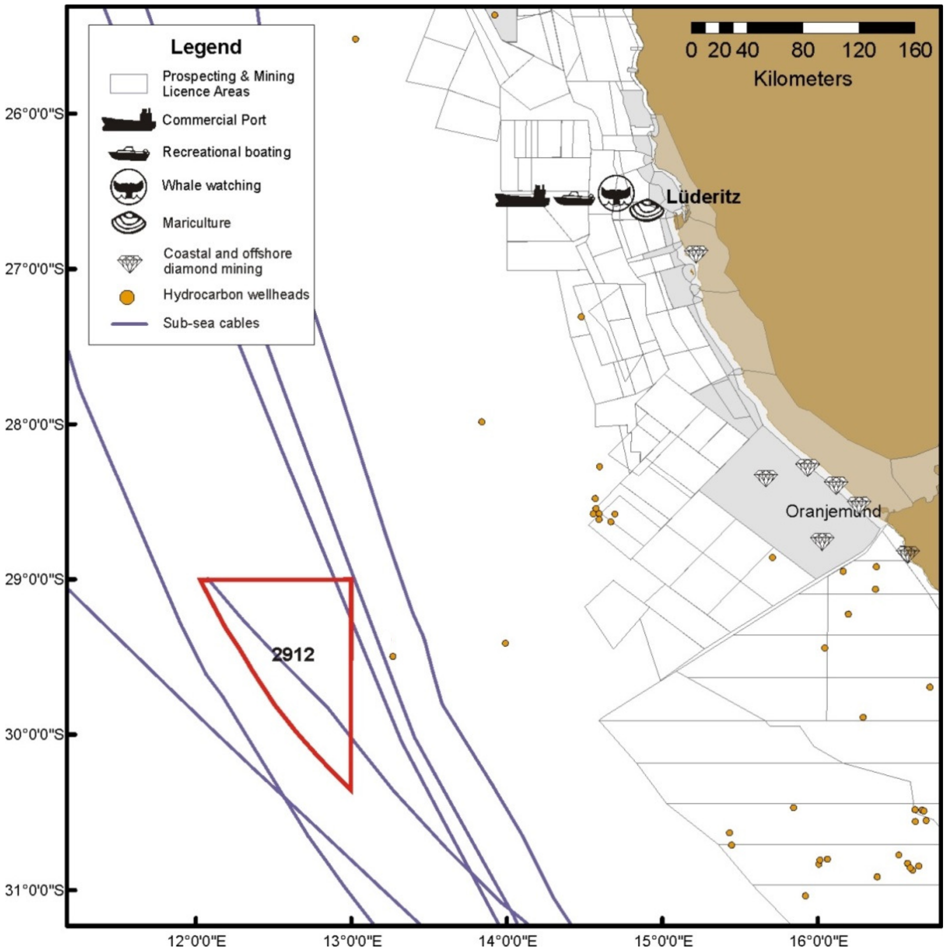

Figure 7-52: Block 2912 in relation to existing industries and other users in the coastal region on the Namibian coast

Source: Pisces. 2022

7.6.11.3 Phosphate prospecting and mining

Phosphate deposits off Namibia were delineated during regional studies in the 1970's, but have remained undeveloped to date. The deposits occur as unconsolidated seafloor sediments, which can be efficiently mined by applying currently available dredging technology. Preliminary reconnaissance sampling by Bonaparte Diamond Mines NL during 2007 demonstrated potential for enrichment to commercial grades (up to 35% P2O5) (Mining Review Africa. 2008).

In 2011, the MME granted mining licences to two companies Namibian Marine Phosphate (NMP) and LL Namibia Phosphates for licence areas located south-west of Walvis Bay (https://cer.org.za/wp-content/uploads/2016/06/CER_Factsheet3_web.pdf). Strong opposition to the granting of these rights resulted in the Namibian government establishing a moratorium on offshore phosphate mining. A condition of the moratorium was that an independent and comprehensive EIA must be conducted.

In 2016, NMP was awarded an ECC to mine offshore phosphates. Strong reaction to the issuing of the certificate resulted in legal action in which the High Court set-aside the ECC on concerns relating to the local fishing industry (specifically monk fish) and the environment (Perks, 2016). However, in May 2018 NMP received a further High Court judgment; winning back its ECC for its marine phosphate EIA. It is currently in the process of reapplying for the ECC, including revision and updating of its ESIA.

7.6.12 Recreational Use

Traditional recreational coastal pursuits are less popular in this region than in many other coastal areas because of the cold water and generally cool, foggy climate. Coastal recreation may be either consumptive or non-consumptive. Due to access restrictions along the coastline between Lüderitz and Oranjemund (part of the Namdeb mining area) no recreational activities occur within this area. Block 2912 being over 290 km offshore at the closet point, does not overlap with any recreational activities. Closer inshore, the ports of Lüderitz and Walvis Bay are fully operational and already supports existing commercial vessels. Thus, certified recreational and pleasure crafts have and continue to operate around the port and alongside existing commercial vessels.

7.6.12.1 Consumptive

Consumptive recreational uses involve collection of material from the sea for personal use. Recreational anglers (Brouwer *et al.,* 1997) and divers target line-fish from either a boat or the shore, with shore-based divers also targeting West Coast rock lobsters. Rock lobsters are also exploited recreationally from boats with the use of hoop nets. Consumptive recreational use is carried out more regularly near coastal settlements (e.g. Henties Bay), although is of a limited nature off the coast of Namibia, largely due to access restrictions imposed by diamond mining concessions.

7.6.12.2 Non-consumptive

Tourism is a major contributor (14.5%) to Namibia's GDP, creating approximately 18% of all employment (directly or indirectly). Offshore recreational and tourist activities which take place in the areas around Walvis Bay and Lüderitz include recreational boating, boat tours (including whale watching) and recreational angling. Since Block 2912 is located approximately 340 km south-west of Lüderitz, these activities occur well inshore and would not be impacted by the proposed exploration activities.

7.6.13 Other Human Use

7.6.13.1 Undersea cables

There are a number of submarine telecommunications cable systems across the Atlantic and the Indian Ocean (see Figure 7-52), two of which land in Namibia, namely, the African Coast to Europe (ACE) and the West Africa Cable System (WACS) with cable landings and connections at Swakopmund. Further details of these two cable systems are provided below:

- WACS: WACS is 14 530 km in length, linking South Africa (Yzerfontein) and the United Kingdom (London). It has 14 landing points, 12 along the western coast of Africa (including Swakopmund, Namibia) and two in Europe (Portugal and England).
- ACE: The ACE submarine communications cable is a 17 000 km cable system along the West Coast of Africa between France and South Africa (Yzerfontein). The ACE system has a landing point in Namibia (Swakopmund).

The South Atlantic Express (SAex) is a proposed submarine communications cable linking South Africa to the United States with branches to Namibia, Saint Helena, and Brazil. The proposed landing point in Namibia is Walvis Bay.

The SAT1 cable shown on Figure 7-52 to pass through the middle of Block 2912 is an old cable that has been decommissioned.

Where seafloor conditions permit, the cables are buried 0.7 m below the seafloor from the landing points to 1 000 m water depth. There is an activity exclusion zone applicable to the telecommunication cables one nautical mile (approximately 1.9 km) each side of the cable in which no anchoring is permitted.

7.6.13.2 Marine Cultural and Heritage Resources

There are a number of shipwrecks located along the Namibian coastline. In Namibian waters, wrecks older than 50 years are declared national monuments. The majority of identified shipwrecks occur close to the coastline (Turner, 1988) and are not likely to be present in Block 2912. However, because most of the sites described on the shipwreck list have been documented only through survivor accounts, archival descriptions and eyewitness reports, many remain uncharted and undiscovered. It is not, therefore, possible to provide accurate location data. **Although no wrecks are known to occur in the licence area based on available information, the possibility of identifying new shipwrecks remains, although of very low probability**.

7.6.13.3 Guano harvesting

There is limited guano harvesting on guano platforms off the coast of Namibia. A 1.7 ha wooden platform is located approximately 200 m offshore between Swakopmund and Walvis Bay (see Figure 7-53). North of Swakopmund at the Salt Pans and at Cape Cross, a further two platforms (4 ha each) have been erected (ref. http://www.namibweb.com/guano.htm, 6 Feb 2017). These sites are located well to the north-east of the licence area and would not be affected by the proposed exploration activities.

Figure 7-53: Guano platform off the coast of Namibia between Swakopmund and Walvis Bay

Source: https://freeassociationdesign.wordpress.com/2010/09/10/islands-and-post-peak-guano