PROPOSED BATHYMETRY SURVEY AND SEABED SEDIMENT SAMPLING IN BLOCK 11B/12B OFFSHORE SOUTH AFRICA

Fisheries Specialist Study

REV 01

04 December 2014

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EXECUTIVE SUMMARY

TOTAL Exploration & Production South Africa B.V. (TEPSA) is the operator and holder of an existing Exploration Right for undertaking seismic surveys and exploration well drilling in Block 11B/12B. The licence area is located offshore of the South Coast of South Africa roughly between Mossel Bay and Cape St Francis, approximately 130 km and 70 km offshore, respectively, in water depths ranging between 500 m and 2 000 m. TEPSA proposes to undertake additional exploration activities, including a bathymetry survey and seabed sediment sampling over selected areas of the licence block at various times over the Exploration Right. These activities would include a sonar survey of the seabed (three to four week in duration) and seabed sediment sampling (three to five weeks in duration). In compiling the Environmental Impact Report and Environmental Management Programme Addendum for the proposed bathymetry survey and seabed sampling activities, an assessment of the potential impacts of the proposed survey and sampling operations on the South Coast fishing industry was undertaken.

The primary risk to the fishing industry was identified as being the potential temporary exclusion of fishing activities due to the 500 m safety zone and proposed safe operational limits that would be in place around the survey vessel during the proposed survey and sampling activities. The demersal trawl, mid-water trawl, demersal hake-directed long-line, large pelagic long-line, traditional line-fish, small pelagic purse-seine, South Coast rock lobster and squid jig fisheries operate within the licence area and could potentially be affected by the survey operations. Based on the levels of effort expended by each fishery within the licence area relative to effort expended by each sector on a national scale, the impact on the mid-water trawl, demersal hake-directed long-line and South Coast rock lobster sectors was assessed to be of high intensity but of low significance overall due to the local extent and short-term duration of the impact. The impact on the demersal trawl and large pelagic long-line sector was assessed to be of medium intensity and of very low significance overall. The impact on the squid jig fishery was assessed to be of low intensity and of overall very low significance. The impact on the traditional line-fish and small pelagic purse-seine sectors was assessed to be of very low intensity and insignificant overall. There is no impact expected on the demersal shark-directed long-line and tuna pole sectors. In terms of the research surveys undertaken by the Department of Agriculture, Forestry and Fisheries on a bi-annual basis, the impact of the proposed bathymetry survey and seabed sampling activities is assessed to be of very low significance overall.

The acoustic impact of the proposed bathymetry survey and seabed sampling programme on marine fauna was assessed in a separate specialist report undertaken by Pisces Environmental Services (Pty) Ltd. These effects included the noise generated by the survey vessel as well as that of the multi-beam sonar during the bathymetric survey which could potentially present a secondary risk to the fishing industry in terms of the effects on availability of fish resources for capture. The impact of underwater noise generated by the survey and sampling vessels during the proposed exploration activities in Block 11B/12B was considered to be of low intensity and of very low significance. No specific mitigation measures were deemed necessary.

The impact of the seabed sediment sampling programme on the fishing industry would be limited to the safety zone and safe operational limits around the sampling vessel, rather than the effects of the removal of a relatively insignificant volume of seabed material. The extent of the impact would be local and of short-term duration was would not increase the significance rating to any of the fisheries assessed.

The implementation of a communication strategy with the fishing industry is considered essential and would not reduce the overall significance of the impact of the impact on fisheries sectors:

- Fishing industry bodies and other key affected parties should be informed of the proposed activities and requirements with regards to the safe operational limits around the survey vessel prior to the commencement of the project. The following industrial bodies and affected parties include:
    - Department of Agriculture, Forestry and Fisheries (DAFF);
    - Department of Environmental Affairs (DEA);

  - South African Tuna Association (SATA);
  - South African Tuna Long-Line Association (SATLA);
  - Fresh Tuna Exporters Association (FTEA);
  - South African Hake Long-Line Association (SAHLA);
  - South African Deep-Sea Trawling Industry Association (SADSTIA);
  - South East Coast Inshore Fishing Association (SECIFA);
  - South African Fishing Industry Associations (South African Pelagic Fishing Industry Association, South African Pelagic Fish Processors Association and South African Inshore Fishing Industry Association);
  - South African Midwater Trawling Association;
  - South Coast Rock Lobster Association;
  - South African Commercial Linefish Association;
  - South African Squid Management Industrial Association (SASMIA);
  - Transnet National Ports Authority;
  - South African Maritime Safety Authority (SAMSA); and
  - South African Navy Hydrographic Office.
- The required safety zones around the research vessel should be communicated via the issuing of Daily Navigational Warnings for the duration of the survey through the South African Naval Hydrographic Office;
- Any fishing vessel targets at a radar range of 12 nautical miles from the survey vessel should be called via radio and informed of the navigational safety requirements; and
- Affected parties should be notified through fishing industry bodies when the programme is complete.

CAPRICORN MARINE ENVIRONMENTAL PTY LTD

PROPOSED BATHYMETRY SURVEY AND SEABED SEDIMENT SAMPLING IN BLOCK 11B/12B OFFSHORESOUTH AFRICA

Fisheries Specialist Study

02 December 2014

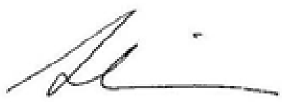
EXPERTISE AND DECLARATION OF INDEPENDENCE

This report was prepared by Dave Japp and Sarah Wilkinson of Capricorn Marine Environmental (Pty) Ltd (previously CapFish SA (Pty) Ltd). Dave Japp has a BSC in Zoology, University of Cape Town (UCT) and a MSc degree in Fisheries Science from Rhodes University. Sarah Wilkinson has a BSc (Hons) degree in Botany from UCT.

Both have considerable experience in undertaking specialist environmental impact assessments relating to fishing and fish stocks. Dave Japp has worked in the field of Fisheries Science and resource assessment since 1987. His work has included environmental economic assessments and the evaluation of the environmental impacts on fishing. Sarah Wilkinson has worked on marine resource assessments, specialising in spatial and temporal analysis (GIS), as well as the economic impacts of fisheries exploitation.

This specialist report was compiled for CCA Environmental (Pty) Ltd on behalf of TOTAL Exploration & Production South Africa B.V for their use in compiling the Environmental Impact Report and Environmental Management Programme Addendum for the proposed bathymetry survey and seabed sampling activities in Block 11B/12B located off the south coast of South Africa. We do hereby declare that Capricorn Marine Environmental (Pty) Ltd is financially and otherwise independent of the Applicant and CCA Environmental.

Dave Japp (Chief Executive Officer)



Sarah Wilkinson (Project Director)

1. INTRODUCTION

1.2 Background

TOTAL Exploration & Production South Africa B.V. (hereafter referred to as “TEPSA”) is the operator and holder of an existing Exploration Right for undertaking seismic surveys and exploration well drilling in Block 11B/12B. Block 11B/12B is located offshore of the South Coast of South Africa roughly between Mossel Bay and Cape St Francis, approximately 130 km and 70 km offshore, respectively, (see **Figure 1.1**). The block area is 18 734 km^2 in extent and water depths range between 500 m and 2 000 m. Adjacent Petroleum Licence Blocks include Block 9 to the west, Pletmos Inshore Block and Algoa and Gamtoos Block to the north, and east and the Outeniqua South Area located to the south.

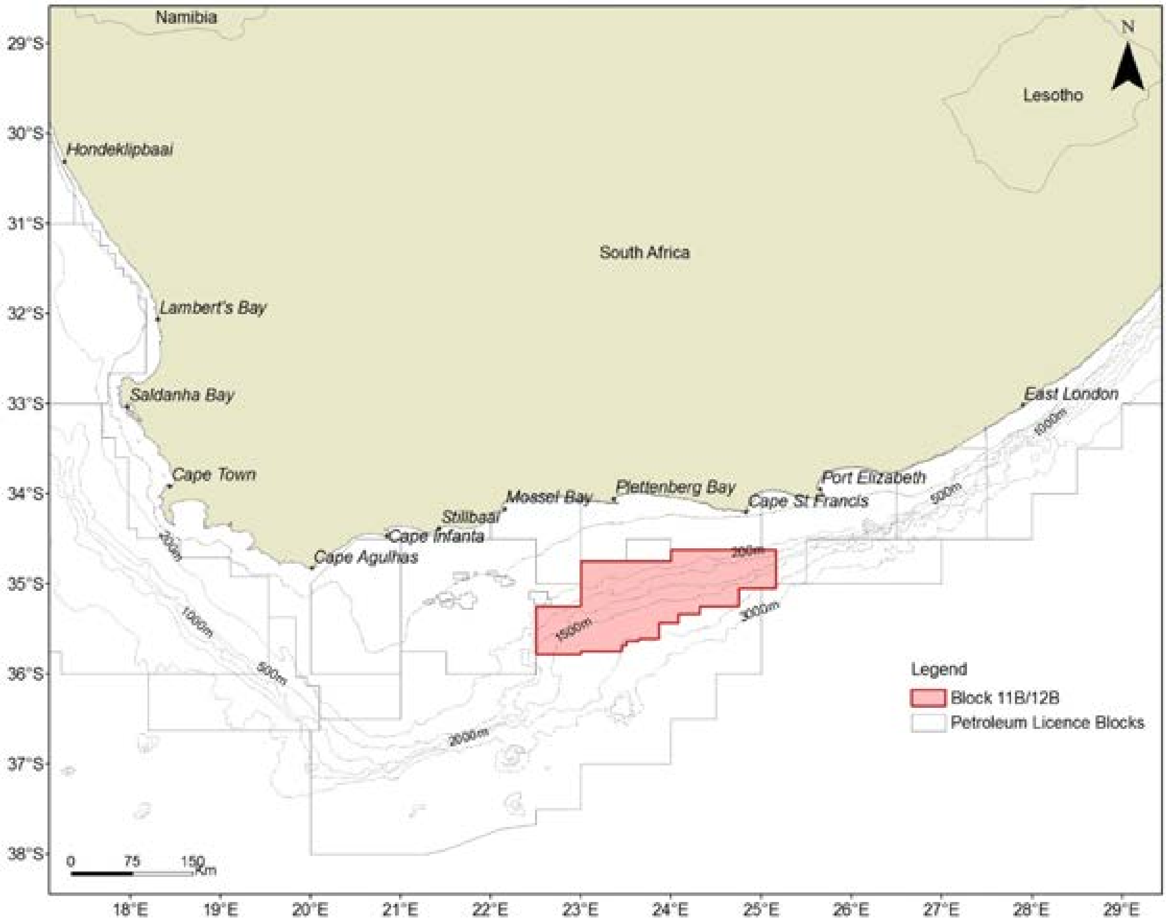


Figure 1.1: Locality of Block 11B/12B off the South Coast of South Africa.

TEPSA took over as operator of Block 11B/12B from CNR International (South Africa) Limited (hereafter referred to as "CNRI"), which has retained a 50% working interest in the block. Prior to TEPSA's involvement, CNRI obtained the Exploration Right for Block 11B/12B in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA). As part of the process of applying for the Exploration Right, an Environmental Management Programme (EMPr) was compiled and approved for the undertaking of seismic surveys and exploration drilling within the licence area. Exploration drilling also received Environmental Authorisation under the National Environmental Management Act, 1998 (No. 107 or 1998) (NEMA), as amended. Under the aforementioned Exploration Right and Environmental Authorisation, both seismic surveying and exploration well drilling have been undertaken within the licence area to date.

TEPSA is now proposing to undertake additional exploration activities, including a bathymetry survey and seabed sediment sampling over selected areas of the licence block at various times over the Exploration Right. CCA Environmental (Pty) Ltd (CCA) has been appointed by TEPSA to undertake the necessary application processes in terms of the MPRDA, as amended. CCA requested Capricorn Marine Environmental (Pty) Ltd (previously CapFish SA (Pty) Ltd) to undertake the Fisheries Specialist Study required for the amendment process.

1.3 Project Description

The proposed exploration activities would include a sonar survey of the seabed and seabed sediment sampling. These activities provide for the rapid collection of data and provide critical information regarding the exploration potential of the licence area and would guide future exploration efforts. These exploration activities are described in more detail below.

1.3.1 Sonar Surveys

In order to further investigate the structure of the ocean bed sediment layers, TEPSA is proposing to undertake surveys of the seabed. In this regard, the following sonar surveying tools are currently considered for use:

- Depth sounders;
- Side scan sonar;
- Bottom profilers; and
- Multi-beam bathymetry.

A description of each of the above techniques is provided below. However, it is noted that at this stage, multi-beam bathymetry surveying is the most likely technique that would be used. The survey would be undertaken in small specific areas across the block. It is anticipated that each data acquisition operation would take place in the order of three to four weeks to complete.

1.3.1.1 Depth Sounders

The majority of hydrographic depth/echo sounders are dual frequency, transmitting a low frequency pulse (typically around 24 kHz) at the same time as a high frequency pulse (typically around 200 kHz). Dual frequency depth/echo sounding has the ability to identify a vegetation layer or a layer of soft mud on top of a layer of rock. The pulse emitted would be for a duration of more than 0.025 seconds and typically produces sound levels in the order 180+ dB re 1 µPa at 1m.

1.3.1.2 **Side Scan Sonar**

Side scan sonar systems produce acoustic intensity images of the seafloor and are used to map the different sediment textures of the seafloor. Side-scan uses a sonar device, towed from a surface vessel or mounted on the ship's hull, that emits conical or fan-shaped pulses down toward the seafloor across a wide angle perpendicular to the path of the sensor through the water (see **Figure 1.2**). The intensity of the acoustic reflections from the seafloor of this fan-shaped beam is recorded in a series of cross-track slices. When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of the beam. A typical side scan sonar emits a pulse at frequencies ranging from 50 to 500 kHz and typically produces sound levels in the order of 220-230 db re 1µPa at 1m.

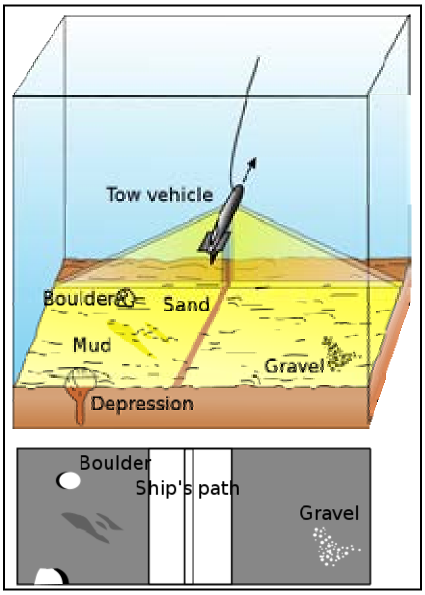


Figure 1.2: Schematic of a typical side scan sonar device and resulting information.

1.3.1.3 **Bottom Profilers**

Bottom profilers are powerful low frequency echo-sounders that provide profiles of the upper layers of the ocean floor. A typical bottom profiler emits an acoustic pulse at frequencies ranging from 0.4 to 30 kHz and typically produces sound levels in the order of 200-230 db re 1µPa at 1m.

1.3.1.4 **Multi-Beam Bathymetry**

The use of multi-beam bathymetry survey allows the operator to produce a digital terrain model of the seafloor (see **Figure 1.3**).

The survey vessel would be equipped with a multi-beam echo sounder to obtain swath bathymetry and a sub-bottom profiler to image the seabed and the near surface geology. The multi-beam system provides depth sounding information on either side of the vessel's track across a swath width of approximately two times the water depth. Although this type of survey typically does not require the vessel to tow any cables, it is "restricted in its ability to manoeuvre" due to the operational nature of this work.

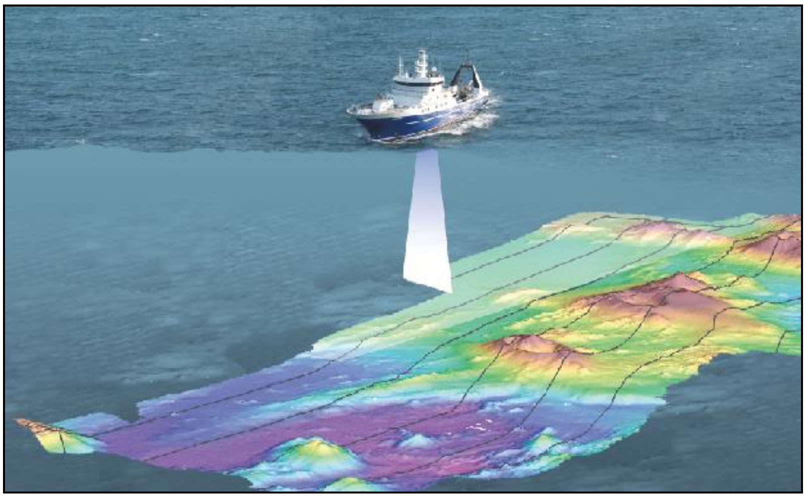


Figure 1.3: Illustration of a vessel using multi-beam depth/echo sounders (http://www.gns.cri.nz/).

Typical multi-beam echo sounder emits a fan of acoustic beams from a transducer at frequencies ranging from 10 kHz to 200 kHz and typically produces sound levels in the order of 207 db re 1µPa at 1m. A typical sub-bottom profiler emits an acoustic pulse from a transducer at frequencies ranging from 3 kHz to 40 kHz and typically produces sound levels in the order of 206 db re 1µPa at 1m.

The multi-beam bathymetry survey would be undertaken in small specific areas across the block. It is anticipated that each data acquisition operation would take in the order of three to four weeks to complete.

1.3.2 **Seabed Sediment Sampling**

The seabed sediment sampling programme would involve the collection of sediment samples for laboratory geochemical analyses in order to determine if there is any naturally occurring hydrocarbon seepage at the seabed. Piston and box coring (or grab samples) techniques would be used to collect seabed sediment samples. The seabed sediment sampling would be undertaken in small specific areas across the block. Each individual piston and box core would have a maximum volume of 0.02 m^3 and 0.03 m^3, respectively. It should be noted that the total cumulative volume of material that would be removed from the seabed would be less than 5 m^3. It is anticipated that the seafloor sampling would take in the order of three to five weeks to complete per sampling campaign.

1.3.2.1 **Piston Coring**

Piston core (or drop core) is one of the more common seafloor sampling methods. A piston coring device with ultra-short baseline (USBL) navigation would be used to accurately target and collect the seafloor samples (see **Figure 1.4**). The programme would likely utilise a piston corer (approximately 1 000 kg) capable of retrieving sediment samples that are up to a maximum of 6 m in length and 0.016 m in diameter.

The piston corer is lowered over the side of the survey vessel on a line and allowed to free fall from about 3 m above the seafloor to allow better penetration (see **Figure 1.4**-A). As the trigger weight hits the bottom (**Figure 1.4**-B), it releases the weight on the trigger arm and the corer is released to "free-fall" the 3 m distance to the bottom (**Figure 1.4**-B & C), forcing the core barrel to travel down over the piston into the sediment (**Figure 1.4**-D). The movement of the core barrel over the piston creates suction below the piston and expels the water out the top of the corer. When forward momentum of the core has stopped, a slow pull-out of the winch commences. This suction triggers the separation of the top and bottom sections of the piston (**Figure 1.4**-E). The corer and sample are then slowly pulled from the seafloor and retrieved.

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

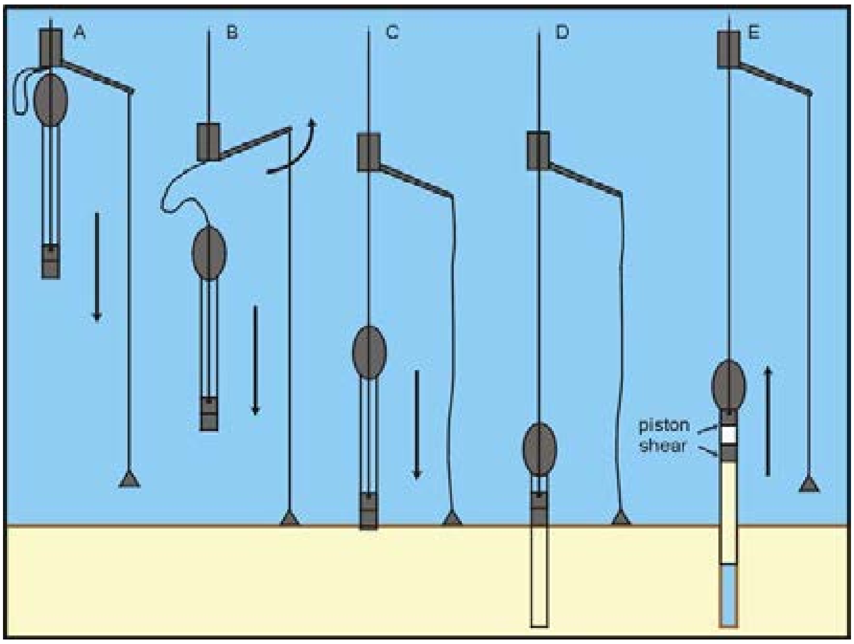


Figure 1.4: Schematic of a drop piston core operation at the seabed (from TDI Brooks).

1.3.2.2 **Box Coring / Grab Samples**

Figure 1.5: Box corer (http://en. wikipedia.org/ wiki/Box corer).

The box corer (**Figure 1.5**) is deployed from a survey vessel by lowering it vertically to the seabed. At the seabed the instrument is triggered by a trip as the main coring stem passes through its frame. The stem has a weight of up to 800 kg to aid penetration. While pulling the corer out of the sediment a spade swings underneath the sample to prevent loss. When hauled back on board, the spade is under the box. The recovered sample is completely enclosed after sampling, reducing the loss of finer materials during recovery. Stainless steel doors, kept open during the deployment to reduce any "bow-wave effect" during sampling, are triggered on sampling and remain tightly closed, sealing the sampled water from that of the water column. On recovery, the sample can be processed directly through the large access doors or via the removal of the box completely, together with its cutting blade. A spare box and spade can then be added, ready for an immediate redeployment.

Grab sampling (see **Figure 1.6**) is the simple process of bringing up surface sediments from the seafloor. This method, however, cannot be used to characterize different sedimentary layers since it is unable to penetrate the ground to depth and a mixture of sediments is produced. Once the grab sampler is launched, the jaws open and it descends to the seafloor. A spring closes the jaws and they trap sediments or loose substrate. The grab sampler is then brought up to the surface where its contents are studied in detail.

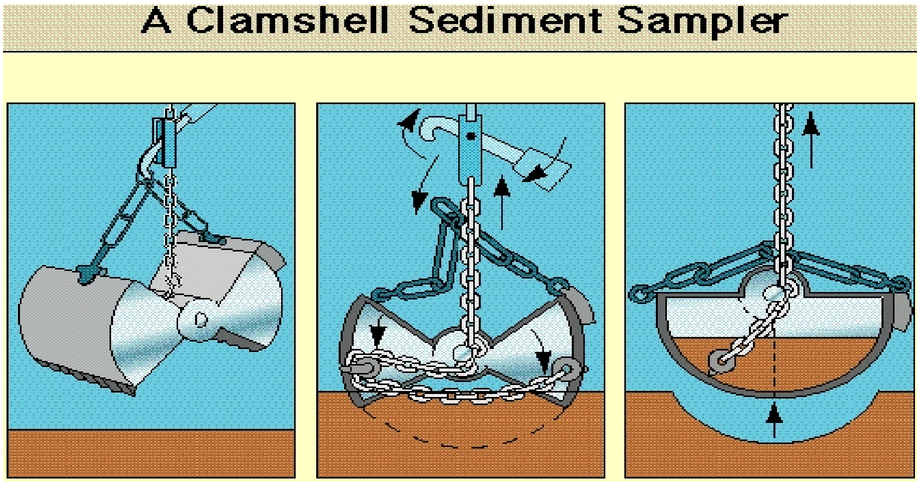


Figure 1.6: Grab sampler (Source: http://www.jochemnet.de/fiu/OCB3043_35.html).

1.4 Scope of this Study

The scope of this specialist study is as follows:

- Describe the fishing activities expected in and around the licence area;
- Undertake a spatial and temporal assessment of expected fishing effort and catch per sector in the proposed survey/sampling area;
- Determine the primary risks to the different fishing sectors associated with the proposed bathymetry survey and seabed sediment sampling;
- Assess the impact of the proposed safety zones around the sampling support vessel on the fishing activities in terms of estimated catch and effort and due to the loss of fishing grounds, as well as the effect on fish behaviour; and
- Identify practicable mitigation measures to reduce any negative impacts on the fishing industry.

2. DATA SOURCES

Data was sourced from the Department of Agriculture, Forestry and Fisheries (Branch: Fisheries) (DAFF) record of commercial catch and effort for the years 2000 to 2012. All data were referenced to a latitude and longitude position and were redisplayed on a 10x10 minute grid. There is an associated minimal amount of incorrectly-reported data associated with the commercial datasets. Additional information was obtained from the Marine Administration System from DAFF and from the *South Africa, Namibia and Mozambique Fishing Industry Handbook 2013*.

3. SOUTH AFRICAN COMMERCIAL FISHERIES

South Africa's commercial fisheries are regulated and monitored by DAFF (previously managed under the Department of Environmental Affairs and Tourism: Directorate: Marine and Coastal Management). Approximately 14 different commercial fisheries sectors currently operate within South African waters (see **Table 3.1Table 3.1:** South African offshore commercial fishing sectors (TAC = total allowable catch)). In addition to commercial sectors, recreational fishing is active along the coastline comprising shore angling and small, open boats generally less than 10 m in length.

Table 3.1: South African offshore commercial fishing sectors (TAC = total allowable catch)

Sector	Areas of Operation	Number of Vessels (2012)	Rights Holders (2012)	Landed Catch (2012)
Hake deep sea trawl	West Coast, South Coast	45	49	166 925 t
Hake/ sole inshore trawl	South Coast	31	18	6 990 t
Mid-water trawl	South Coast	6	19	18 942 t
Hake long-line	West Coast, South Coast	64	146	9 257 t
Hake hand-line	West Coast, South Coast	100	86	non-operational
Demersal shark long-line	South Coast	6	7	834 t
Pelagic long-line	West Coast, South Coast, East Coast	31	30	1 570 t
Tuna pole	West Coast, South Coast	128	170	4 400 t (2013 TAC)
Traditional line fish	West Coast, South Coast, East Coast	450	-	11 855 t
Small pelagics	West Coast, South Coast	101	111	487 274 t
West coast rock lobster	West Coast	105	240	1 879 t
South coast rock lobster	South Coast	12	15	609 t
Crustacean trawl	East Coast	5	8	383 t
Squid jig	South Coast	138	121	6 110 t

The primary fisheries in terms of highest economic value and greatest landed tonnage are the demersal (bottom) trawl and long-line fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*) and the pelagic-directed purse-seine fishery targeting pilchard (*Sardinops sagax)*, anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whitheadii*). Secondary species in these fisheries includes a large assemblage of demersal fish of which monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*) and snoek (*Thyrsites atun*) are the most commercially important.

The pelagic long-line and pole fisheries target migratory stocks of tuna including albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*) and yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*).

The traditional line fishery refers to a long-standing fishery based on a large assemblage of primarily 35 different species. The fishery extends both into warm-temperate and cool-temperate biogeographical regions; but operates relatively close to shore. Within the Western Cape the predominant catch species is snoek (*Thyrsites atun*), whereas towards the East Coast catch species increase in number and include both resident reef fish (Sparidae and Serranidae), pelagic migrants (Carangidae and Scombridae) and demersal migrants (Sciaenidae and Sparidae).

Crustacean fisheries comprise a trap fishery targeting West Coast rock lobster (*Jasus lalandii*), a line trap fishery targeting the South Coast rock lobster (*Palinurus gilchristi*) and a trawl fishery based solely on the East Coast targeting penaeid prawns, langoustines (*Metanephrops andamanicus* and *Nephropsis stewarti*), deep-water rock lobster (*Palinurus delagoae*) and red crab (*Chaceon macphersoni*).

Other fisheries include a mid-water trawl fishery targeting horse mackerel (*Trachurus trachurus capensis*) predominantly on the South Coast, and a hand-jig fishery targeting chokka squid (*Loligo vulgaris reynaudii*) also based on the South Coast.

The principle commercial fish species undergo a critical spawning and migration pattern in the Benguela and Agulhas ecosystems which is central to the sustainability of South African fisheries. Four coastal nursery grounds have been identified between Moçambique and Angola (see **Figure 3.1**), namely the Natal Bight, the Agulhas Bank, the inshore Western Cape coast and the central Namibian shelf region. Each is linked to a spawning area, a transport and/or recirculation mechanism, a potential for deleterious offshore or alongshore transport and an enriched productive area of coastal or shelf-edge upwelling (Hutchings et al, 2002).

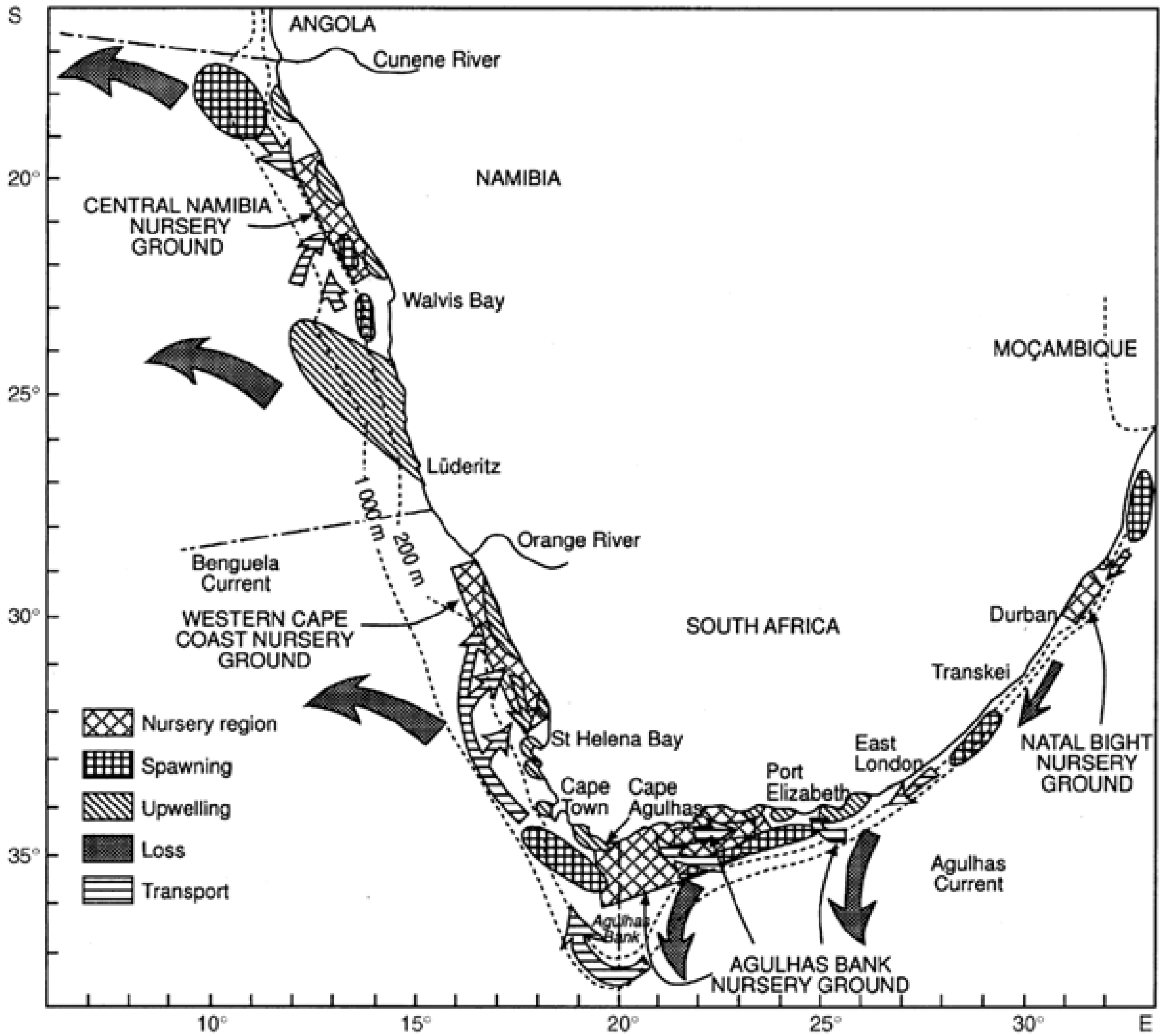


Figure 3.1: Main reproductive habitats of fish on the southern African continental shelf. Each habitat incorporates an upstream spawning area, a transport/retention mechanism, an area of potential offshore losses, and a nursery area associated with a broadened shelf and some enrichment mechanism (Hutchings et al, 2002).

In terms of the small pelagic and hake fisheries (**Figure 3.2** and **Figure 3.3**), adults spawn on the central Agulhas Bank in spring (September to November). Spawn drifts northwards in the Benguela current across the shelf and, as eggs drift northwards, they hatch and the larvae develop. Settlement of larvae occurs in the inshore areas, in particular the bays that are used as nurseries. This takes place from October through to Autumn (March onwards). Thereafter, juveniles shoal and begin a southward migration. This is the main period the anchovy and sardine are targeted by the small pelagic purse seine fishery. The demersal species such as hake migrate offshore into deeper water.

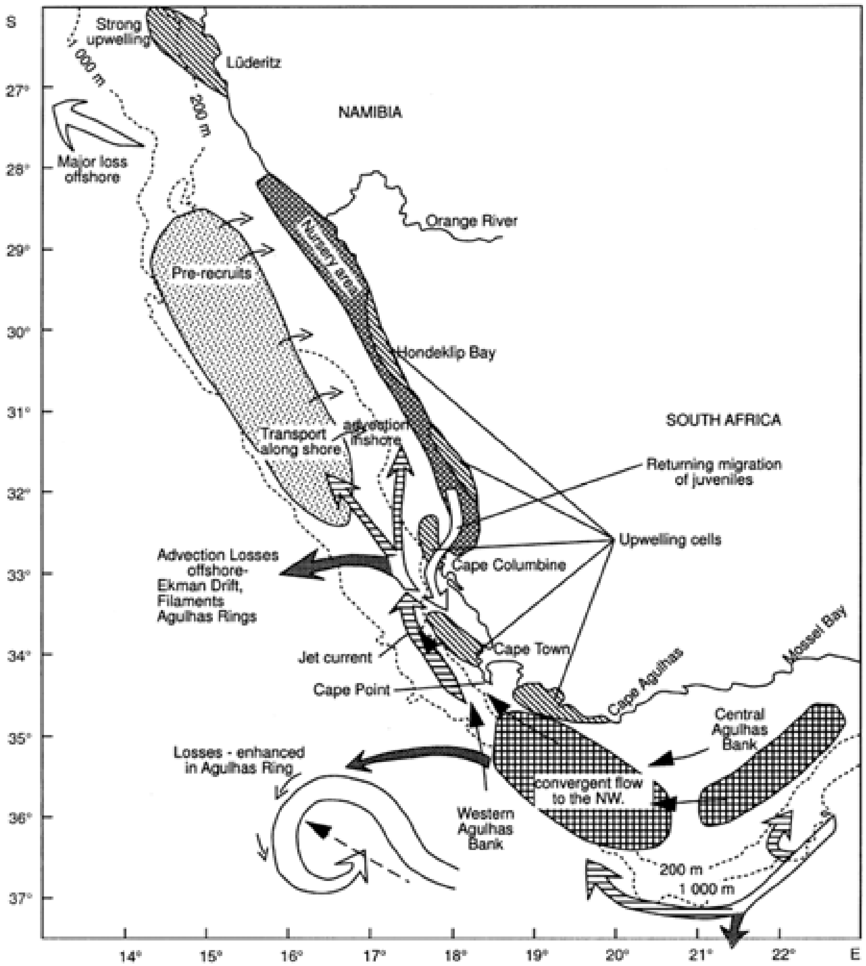


Figure 3.2: West Coast nursery ground and western/central Agulhas Bank spawning ground. Generalised figure of the main fish recruiting process for species caught in South Africa (after Hutchings et al., 2002).

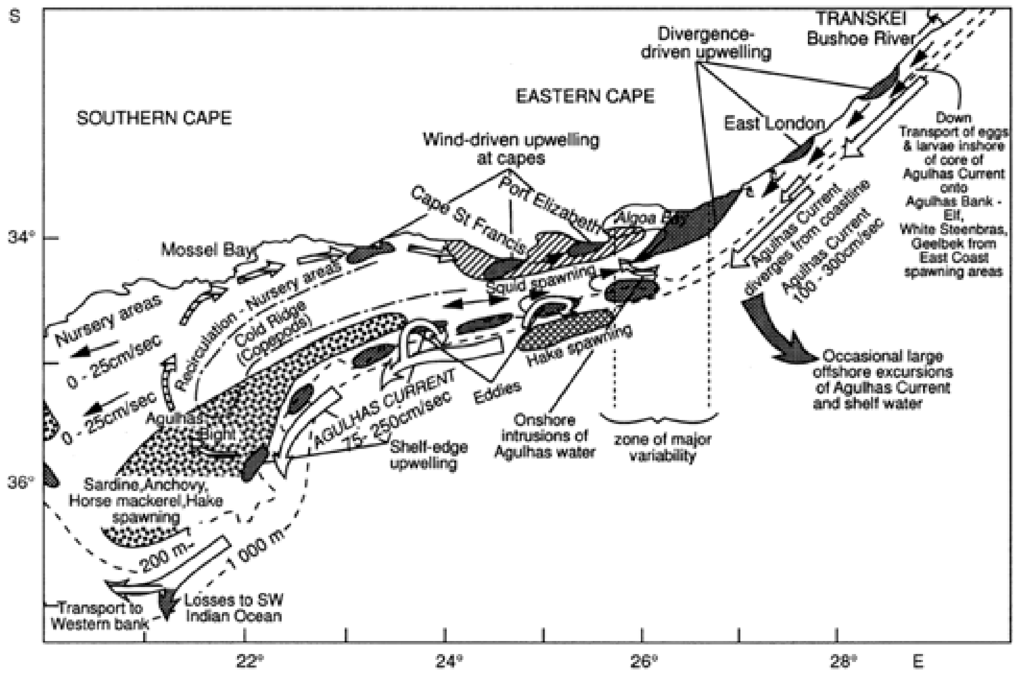


Figure 3.3: Central-eastern Agulhas Bank nursery/spawning ground. Generalised figure of the main fish recruiting process for species caught in South Africa (after Hutchings et al., 2002).

3.1 South Coast Commercial Fisheries Sectors

The commercial fisheries which operate on the South Coast of South Africa are described in section 3.1 and an impact assessment of the proposed bathymetry survey and seabed sampling programme on each sector is presented in Section 4. The following sectors are identified as being operational in the vicinity of Block 11B/12B:

1. Demersal trawl;
2. Mid-water trawl;
3. Demersal long-line;
4. Large pelagic long-line;
5. Tuna pole;
6. Traditional line-fish;
7. Small pelagic purse-seine;
8. South Coast rock lobster; and
9. Squid jig.

3.1.1 **Demersal Trawl**

The hake-directed trawl fishery is the most valuable sector of the South African fishing industry and is split into two sub-sectors: the offshore ("deep-sea") sector which is active off both the South and West Coasts, and the much smaller inshore trawl sector which is active off the South Coast.

A fleet of 45 trawlers operate within the offshore sector targeting the Cape hakes (*Merluccius capensis* and *M. paradoxus;* **Figure 3.4**). Main by-catch species include monkfish (*Lophius vomerinus,* **Figure 3.5**), kingklip (*Genypterus capensis;* **Figure 3.6**) and snoek (*Thyrsites atun*; **Figure 3.7**). A fleet of 31 vessels operate within the inshore sector targeting shallow-water hake (*M. capensis*) as well as Agulhas sole (*Austroglossus pectoralis*).

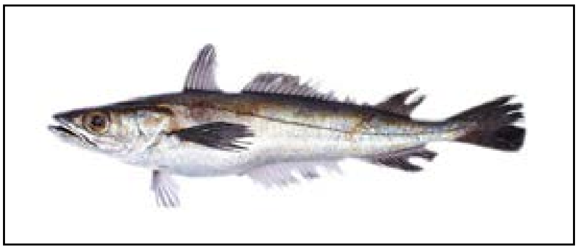


Figure 3.4: Cape hake: *Merluccius capensis*

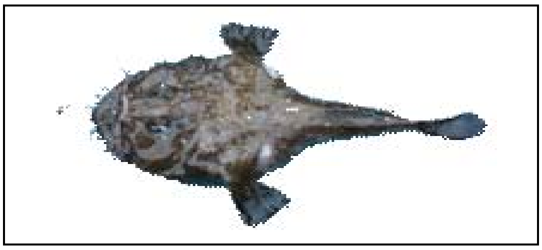


Figure 3.5: Anglerfish (monk): *Lophius vomerinus*

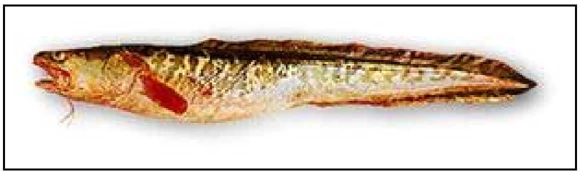


Figure 3.6: Kingklip: *Genypterus capensis*

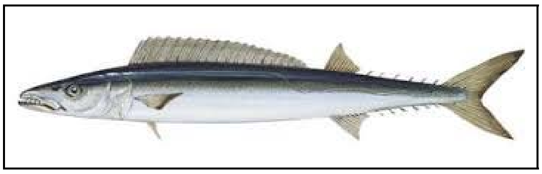


Figure 3.7: Snoek: *Thyrsites atun* (source: www.illustrationsource.com)

The current annual Total Allowable Catch (TAC) of hake across all sectors targeting hake is 156 075 tons (2013), of which the majority is landed by the demersal trawl sector. In 2012, of a total hake TAC of 144 671 tons, 118 688 tons (82%) was landed by the demersal trawl sector. Of this amount, 115 465 tons was landed by the offshore demersal trawl sector and 3 223 tons by the inshore trawl sector. The relative landed proportions of by-catch species to targeted species approximates 20%. According to permit conditions for the sector, there is an Upper Precautionary Catch Limit (UPCL) of 8300 tons and 5264 tons for monkfish and kingklip, respectively. Catches of snoek may not exceed 20% of any landing and there is a "move on" clause that requires a vessel to change its fishing position where the catch of snoek in any one trawl exceeds 25% of the total catch. Should this occur, a vessel has to move to a new fishing position with a difference in water depth of at least 50 m.

Over the period 2000 to 2012, the demersal trawl fishery reported an average of 57 920 trawls per year with an associated catch of 127 743 tons of hake and 166 902 tons of all species landed. Recent years (2008 to 2012) have seen a decline in catch and effort with a reported 44 092 trawls per year and an associated catch of 113 607 tons of hake and 125 599 tons of all species landed[1]. The fishery is active year-round, with a relatively constant amount of effort expended each month. **Figure 3.8** shows the average effort at approximately 4 700 trawls per month.

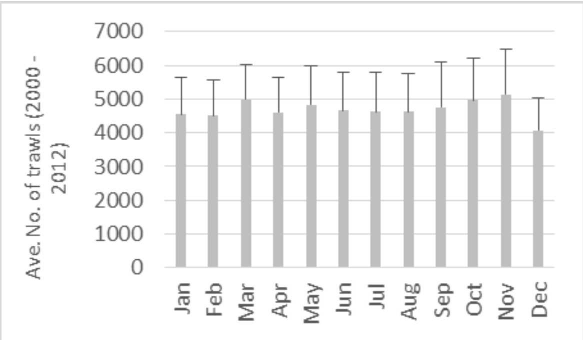


Figure 3.8: Average number of trawls undertaken by the demersal trawl fleet by month over the period 2000 to 2012.

Figure 3.9: Example of a South African-registered demersal trawler (source: I&J trawling división).

The offshore fleet is segregated into wetfish and freezer vessels which differ in terms of the capacity for the processing of fish at sea and in terms of vessel size and capacity. While freezer vessels may work in an area for up to a month at a time, wetfish vessels may only remain in an area for about a week before returning to port. Wetfish vessels range between 24 m and 56 m in length while freezer vessels are usually larger, ranging up to 80 m in length (**Figure 3.9**). The gear configurations are similar for both freezer and wet fish vessels. Trawl gear is deployed astern of the vessel and the main elements of the gear include (**Figure 3.10**):

- Steel trawl 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; maximum 200 kg) 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 mesh size minimum limit of 110 mm (stretched).

Generally, trawlers tow their gear at 3.5 knots for two to four hours per drag. When towing gear, the distance of the trawl net from the vessel is usually between two and three times the depth of the water.

[1] Although catch and effort data are available for the period 1983 to 2012, records prior to 2000 were reported on a 20' x 20' grid system rather than as a GPS latitude and longitude.

The horizontal net opening may be up to 50 m in width and 10 m in height and the swept area on the seabed between the doors may be up to 150 m.

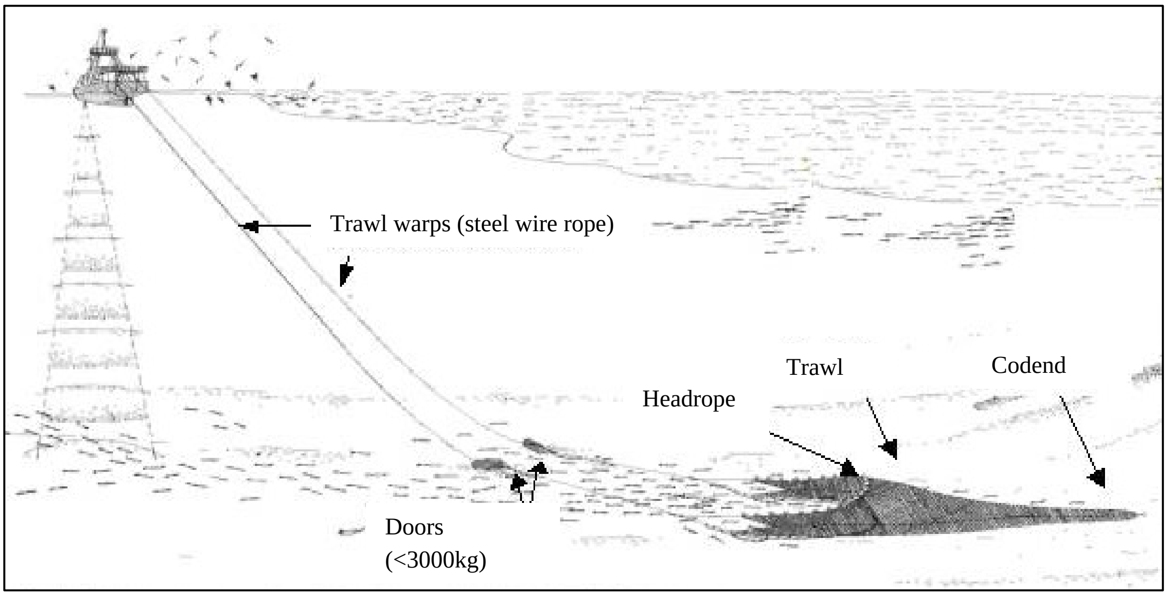


Figure 3.10: Typical gear configuration used by demersal trawlers targeting hake.

Trawls are usually conducted along specific trawling lanes on "trawl friendly" substrate (flat, soft ground). The total trawl footprint within the South African Exclusive Economic Zone (EEZ) is approximately 70 400 km^2 of which offshore grounds amount to 57 420 km^2 and inshore grounds 12 983 km^2 (SADSTIA, 2009). On the West Coast, these grounds extend in a continuous band along the shelf edge between the 300 m and 1 000 m bathymetric contours[2] (see Figure **Figure 3.11**). Monk-directed trawlers tend to fish shallower waters than hake-directed vessels on mostly muddy substrates. Trawl nets are generally towed along depth contours (thereby maintaining a relatively constant depth) running parallel to the depth contours in a north-westerly or south-easterly direction. Trawlers also target fish aggregations around bathymetric features, in particular seamounts and canyons (i.e. Cape Columbine and Cape Canyon), where there is an increase in seafloor slope and in these cases the direction of trawls follow the depth contours. Trawlers are prohibited from operating within five nautical miles of the coastline.

In this southern and eastern region, hard ground (deep water coral and rock mostly) results in patchy trawling areas and therefore areas of concentration of effort mostly towards the edge of the Agulhas Bank in variable water depth up to 800 m. Inshore trawl grounds are located between Cape Agulhas and the Great Kei River. In this region hake directed trawling is most intense between the 100-200 m depth contours. In the vicinity of Mossel Bay and in particular around bays, trawling, mostly for Agulhas sole, occurs close inshore. Sole directed fishing takes place primarily between Mossel Bay and Struisbaai and there is no sole-directed activity west of the 20° E line of longitude.

[2] Trawling to these depths started in the mid 1990's for deep-water species such as orange roughy.

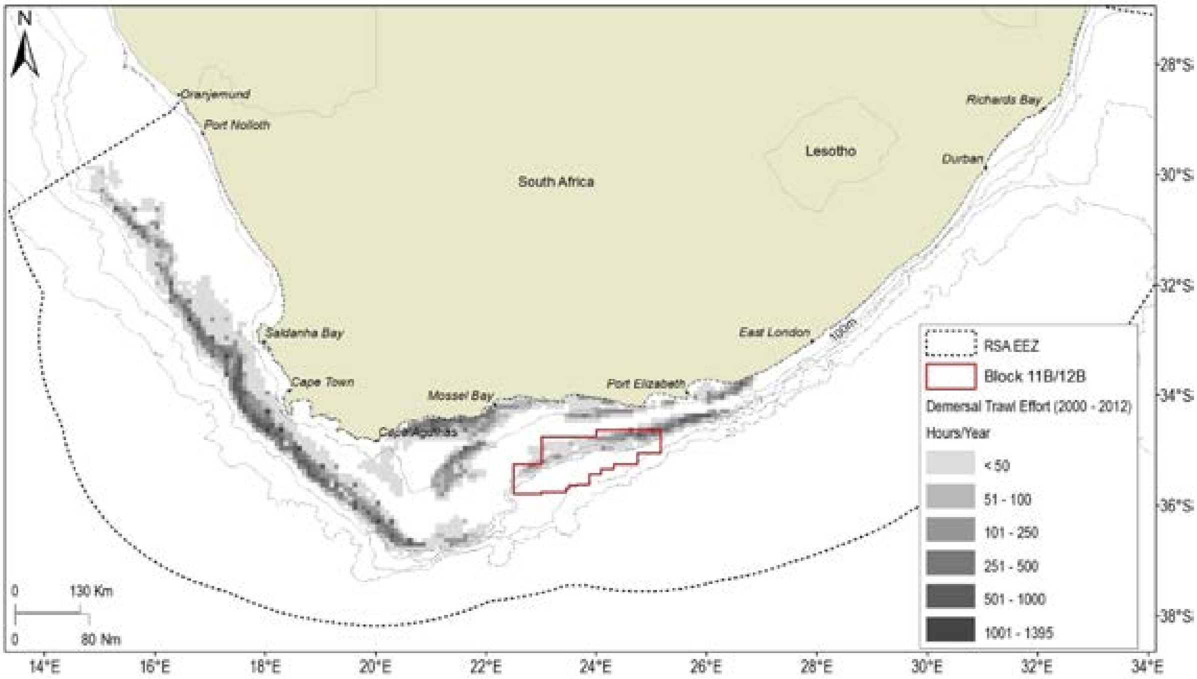


Figure 3.11: Spatial distribution of trawling effort expended by the South African hake-directed offshore and inshore trawl sectors in relation to Block 11B/12B. Effort is presented as the number of hours trawled per year on a 10' x 10' grid resolution.

3.1.2 Mid-Water Trawl

There are currently 15 rights holders within this fishing sector, however the majority of effort is undertaken by a single dedicated vessel which operates all year round. A large factory vessel capable of sustained operation has made economically viable targeting of horse mackerel possible. The fishery targets adult horse mackerel (*Trachurus trachurus capensis* – see **Figure 3.12**).

Figure 3.12: Horse mackerel: *Trachurus trachurus capensis* (Source: RV *Fridtjof Nansen*)

Mid-water trawling is defined in the Marine Living Resources Act (No. 18 of 1998) (MLRA) as any net which can be dragged by a fishing vessel along any depth between the sea bed and the surface of the sea without continuously touching the bottom. In practice, mid-water trawl gear does occasionally come into contact with the seafloor. Mid-water trawling gear configuration is similar to that of demersal trawlers, except that the net is manoeuvred vertically through the water column (refer to **Figure 3.13**).

Currently the FMV *Desert Diamond* is the only dedicated mid-water trawler and is the largest registered South African commercial fishing vessel. The *Desert Diamond* is 120 m in length and has a Gross Registered Tonnage (GRT) of 8000 t. The towed gear may extend up to 1 km astern of the vessel and comprises trawl warps, net and codend. Trawl warps between 32 mm and 38 mm in diameter. The trawl doors (3.5 t each) maintain the net opening which ranges from 120 to 130 m in width and from 40 m to 80 m in height. Weights in front of, and along the ground-rope provide for vertical opening of the trawl. The cable transmitting acoustic signal from the net sounder might also provide a lifting force that maximizes the vertical trawl opening. To reduce the resistance of the gear and achieve a large opening, the front part of the trawls are usually made from very large rhombic or hexagonal meshes. The use of nearly parallel ropes instead of meshes in the front part is also a common design. Once the gear is deployed, the net is towed for several hours at a speed of 4.8 to 6.8 knots predominantly parallel with the shelf break.

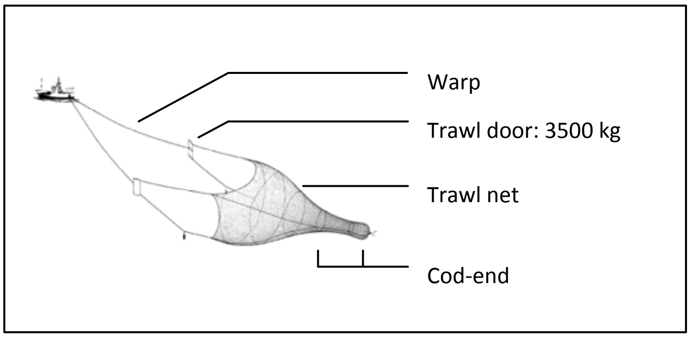


Figure 3.13: Typical configuration of mid-water trawl gear.

The fishery targets adult horse mackerel which aggregate in highest concentration on the Agulhas Bank. Shoals of commercial abundance are found in limited areas and the spatial extent of mid-water trawl activity is relatively limited when compared to that of demersal trawling. Fishing grounds are condensed into three areas on the shelf edge of the south and east coasts. The first lies between 22 °E and 23 °E at a distance of approximately 70 nm offshore from Mossel Bay and the second extends from 24 °E to 27 °E at a distance of approximately 30 nm offshore. A more recently exploited area lies to the south of the Agulhas Bank 21 °E and 22 °E. These grounds range in depth from 100 m to 400 m. However, isolated trawls are occasionally made further offshore in deeper water (up to 650 m) (see **Figure 3.14**).

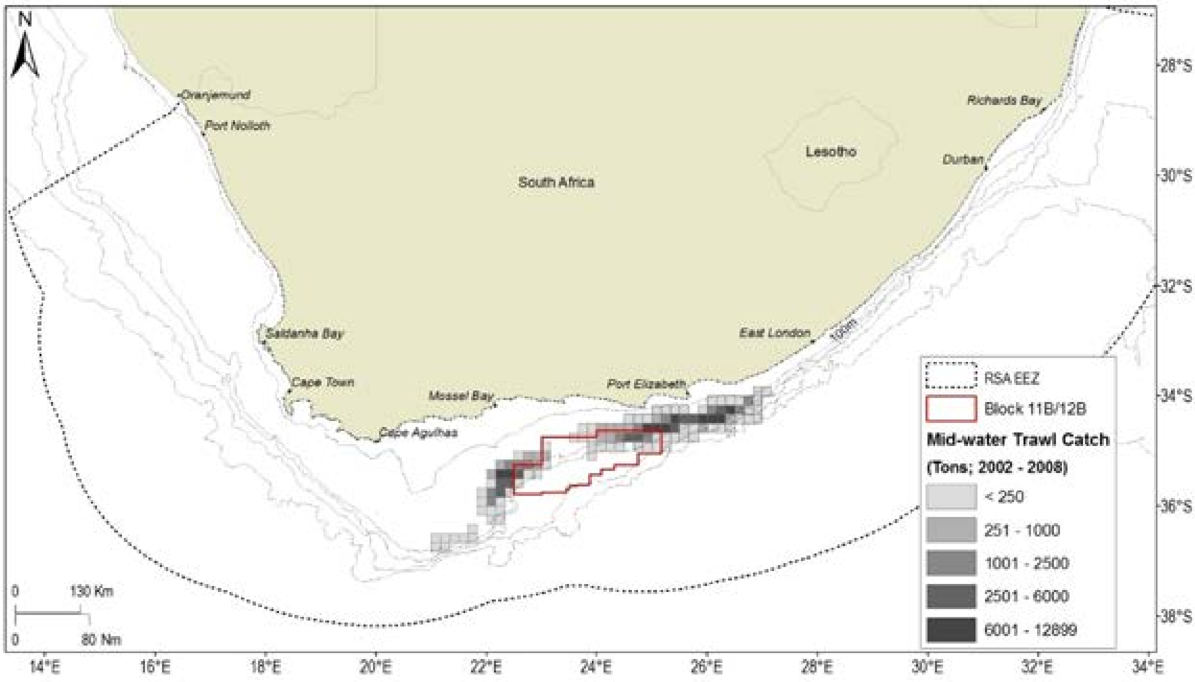


Figure 3.14: Spatial distribution of trawling effort expended by the South African mid-water trawl sector in relation to Block 11B/12B. Effort is presented as the number of tons landed (cumulative; 2002 – 2008) on a 10' x 10' grid resolution.

3.1.3 **Demersal Long-Line**

The demersal long-line fishing technique is used to target bottom-dwelling species of fish. Two fishing sectors utilize this method of capture, namely the hake long-line fishery targeting the Cape hakes (*M. capensis* and *M. paradoxus*) and the shark long-line sector targeting only demersal species of shark.

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 3.15**). Steel anchors, of 40 kg to 60 kg, are placed at the ends of each line to anchor it, and are marked with an array of floats. If a double line system is used, top and bottom lines are connected by means of dropper lines. Since the top-line (polyethylene, 10 – 16 mm diameter) is more buoyant than the bottom line, it is raised off the seafloor and minimizes the risk of snagging or fouling. The purpose of the top-line is to aid in gear retrieval if the bottom line breaks at any point along the length of the line. Lines are typically between 10 km and 20 km in length, carrying between 6 900 and 15 600 hooks each. Baited hooks are attached to the bottom line at regular intervals (1 to 1.5 m) by means of a snood. Gear is usually set at night at a speed of between five and nine knots. Once deployed the line is left to soak for up to eight hours before it is retrieved. A line hauler is used to retrieve gear (at a speed of approximately one knot) and can take six to ten hours to complete. Long-line vessels vary in length from 18 m to 50 m and remain at sea for four to seven days at a time. Currently 64 hake-directed and six shark-directed vessels are operational within the fishery, most of which are based at Cape Town and Hout Bay harbours.

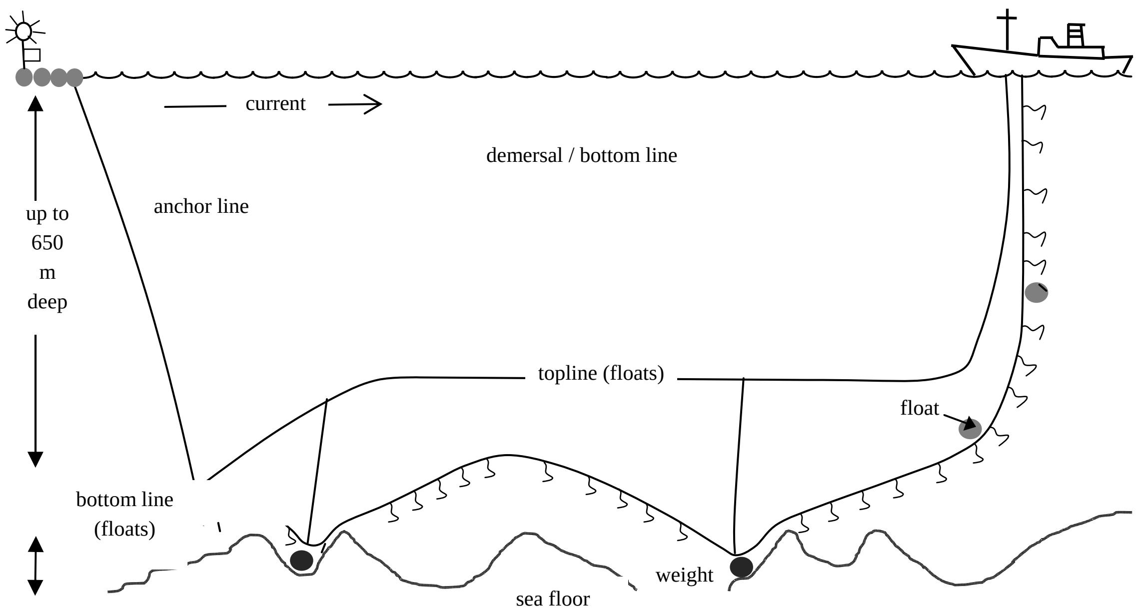


Figure 3.15: Typical configuration of demersal (bottom-set) hake long-line gear used in South African waters.

Demersal Hake-Directed Fishery

Like the demersal trawl fishery the target species of the long-line fishery is the Cape hakes, with a small non-targeted commercial by-catch that includes kingklip (**Figure 3.6**). The catch landed is predominantly prime quality hake for export to Europe and is packed unfrozen on ice therefore the value is approximately 50% higher than that of trawled hake. Operations are *ad hoc* and intermittent, subject to market demand. Of the total hake TAC of 144 671 tons set for 2012, the catch taken by the long-line fleet amounted to 8 399 tons (~6% of the allowed hake catch, and 9 257 tons if all other bycatch species are included). Over the period 2000 to 2012, the fishery set an average of 30.7 million hooks and landed 8 791 tons of hake per year. This is slightly higher than the reported catch and effort over the last five years (2008 to 2012), during which time the fishery set an average of 28.9 million hooks and landed 8 368 tons of hake per year. The fishery operates year-round with a slight increase in activity between August and December (see **Figure 3.16**).

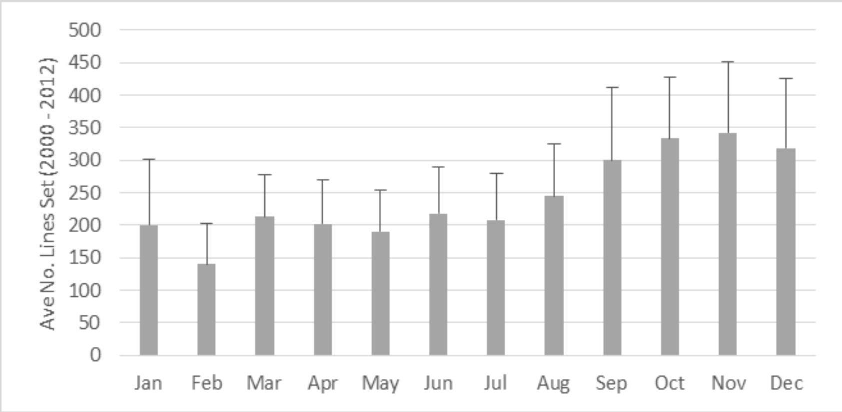


Figure 3.16: Average number of lines set by the hake-directed demersal long-line fleet by month over the period 2000 to 2012.

Demersal long-line fishing grounds are similar to those targeted by the hake-directed trawl fleet. Lines are set parallel to bathymetric contours, along the shelf edge up to the 1 000 m isobath. **Figure 3.17** shows the spatial distribution of hake-directed long-line catch recorded off the West Coast of South Africa between 2000 and 2012.

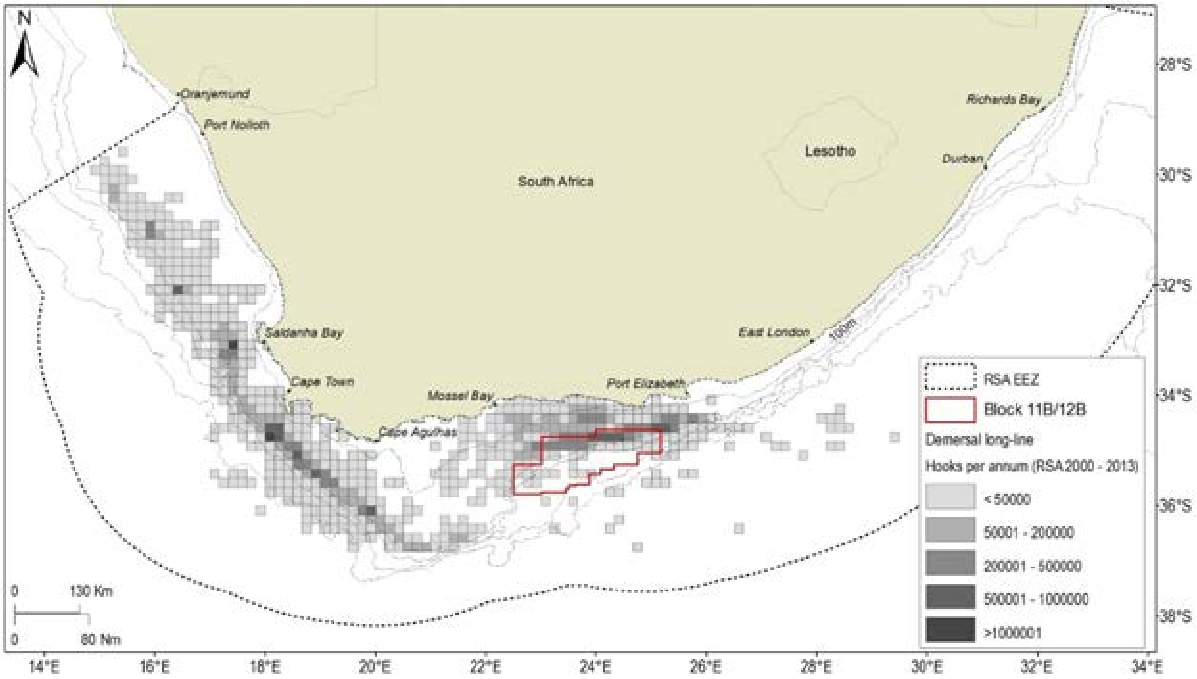


Figure 3.17: Spatial distribution of effort expended by the South African hake-directed demersal long-line fishery in relation to Block 11B/12B (2000 – 2012). Effort is presented as the number of hooks set per year on a 10' x 10' grid resolution.

Demersal Shark-Directed Fishery

Capture of demersal shark species occurs primarily in the demersal shark long-line fishery whilst catches of pelagic shark species occurs primarily in the large pelagic sector that targets tuna and swordfish. Prior to 2006, both demersal and pelagic shark catches were managed as a single shark fishery. The demersal shark fishery targets soupfin shark (*Galeorhinus galeus* – **Figure 3.18**), smooth-hound shark (*Mustelus spp*. – **Figure 3.19**), spiny dogfish (*Squalus* spp), St Joseph shark (*Callorhinchus capensis*), *Charcharhinus* spp., rays and skates. Other species which are not targeted but may be landed include cape gurnards (*Chelidonichthys capensis*), jacopever (*Sebastichthys capensis*) and smooth hammerhead shark (*Sphyrna zygaena*). The fishery operates within coastal waters and catches are landed at the harbours of Cape Town, Hout Bay, Mossel Bay, Plettenberg Bay, Cape St Francis, Saldanha Bay, St Helena Bay, Gansbaai and Port Elizabeth.

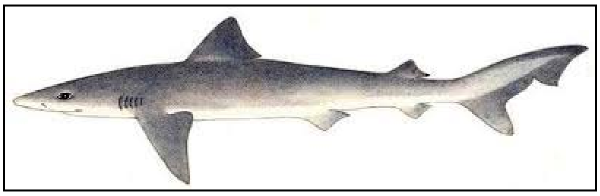


Figure 3.18: Soupfin shark (*G. galeus*)

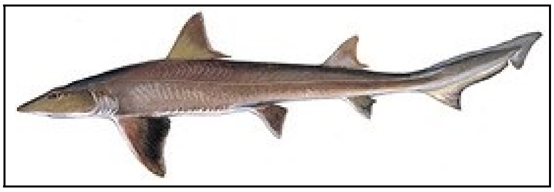


Figure 3.19: Smooth-hound shark (*M. mustelus*)

There are currently six permit holders that have been issued with long-term rights to operate within the fishery. The fishery was first formerly introduced with the allocation of medium-term fishing rights in 2002. With only six rights allocated and vessels limited in size, fishing effort has remained relatively low. Over the period 2007 to 2012, the fishery reported an annual average of 430 500 hooks set and 175 tons landed annually. Effort is continuous throughout the year with a relative increase between May and October (see

Figure 3.20). The fishery operates in coastal waters, predominantly inshore of the 150 m isobaths (**Figure 3.21**).

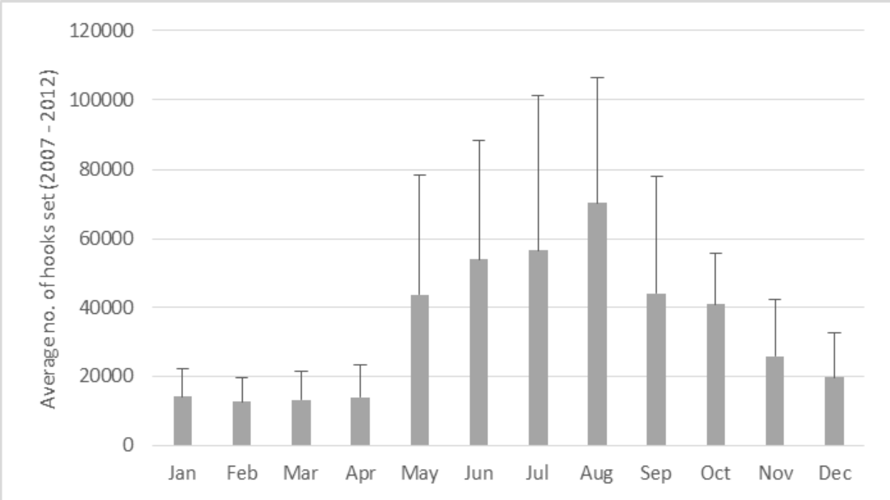


Figure 3.20: Average number of hooks set by the shark-directed demersal long-line fishery by month (2007 – 2012).

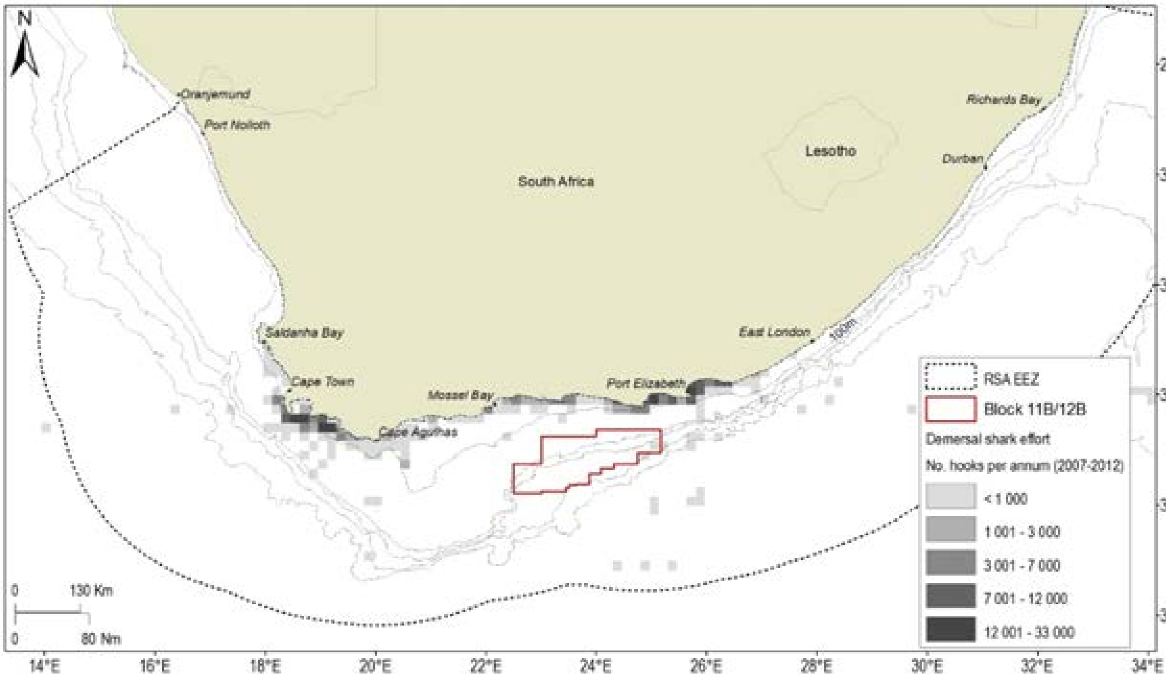


Figure 3.21: Spatial distribution of effort expended by the demersal long-line fishery targeting shark species in relation to Licence Block 11B/12B. Effort is presented as the number of hooks set per year on a 10' x 10' grid resolution.

3.1.4 Large Pelagic Long-Line

The large pelagic long-line fishery operates extensively within the South African Exclusive Economic Zone (EEZ) targeting primarily tuna and swordfish. The main target species is yellowfin tuna (**Figure 3.22**) with a high bycatch of blue shark (**Figure 3.23**). Tuna, tuna-like species and billfishes are migratory stocks and are therefore managed as a “shared resource” amongst various countries. In the 1970s to mid-1990s the fishery was exclusively expedited by Asian fleets (up to 130 vessels) under bilateral agreements with South Africa. From the early 1990s these vessels were banned from South African waters and South Africa went through a period of low effort as the fishing rights issues were resolved. Thereafter a domestic fishery developed and 50 fishing rights were allocated to South Africans only. These rights holders now include a small fleet of local long-liners although the fishery is still undertaken primarily with Japanese vessels fishing in joint venture with South African companies. There are currently 30 commercial large pelagic fishing rights issued for South African waters and 31 vessels active in the fishery.

During the period 2000 to 2012, the national catch and effort recorded within the large pelagic fishery amounted to an average of 3 018 tons and 3.49 million hooks set per year. The last five years (2008 to 2012) have seen an increase in effort, whilst landings have remained relatively constant within the fishery (3 047 tons and 4.84 million hooks set per year). The fishery operates year-round with a relative increase in effort during winter and spring (see **Figure 3.24** below).

Figure 3.22: Yellowfin tuna *Thunnus albacares* is the principle target species in the pelagic longline fishery.

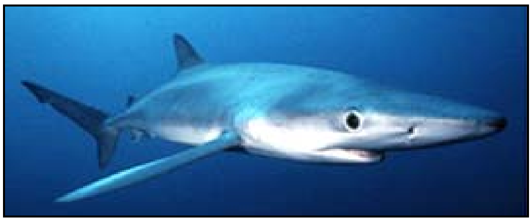


Figure 3.23: Blue shark *Prionace glauca* is one of the most commonly caught shark species in RSA waters but is discarded due to its high urea content.

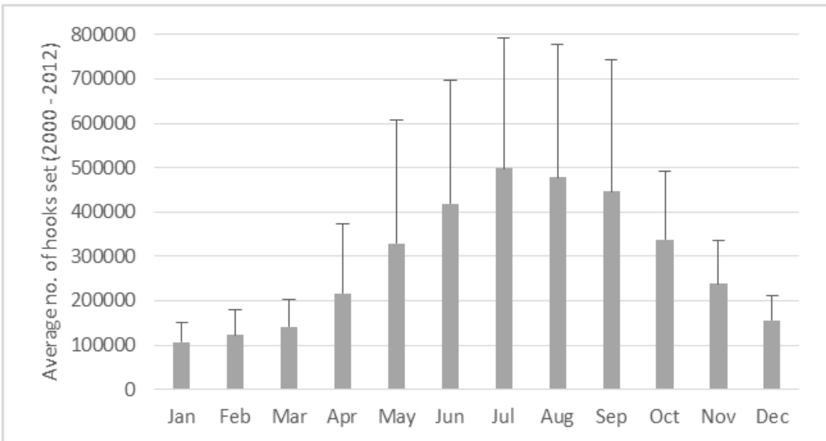


Figure 3.24: Average number of hooks set by the large pelagic long-line fishery by month (2000 – 2012).

Catch per unit effort (CPUE) variations are driven by both the availability of fish (the spatial and temporal distribution of the target species) and the vulnerability of the target fish species to the gear used by the fishery (i.e. the catchability). The CPUE can also be influenced by changes in the behaviour of the target species. These changes in behaviour are driven by variability in environmental factors such as oceanic thermal structure and dissolved oxygen (Punsly and Nakano, 1992). Feeding behaviour may vary depending on light level, temperature, and abundance of natural prey (Quinn et al., 1985; Engås and Løkkeborg, 1994; Sigler, 2000). The catchability of a target species also varies depending on the presence of conspecifics and the associated density and size distribution of competitors.

Historically, the fishery operates extensively from the continental shelf break into deeper waters, year-round. Vessels range from 30 m to 54 m in length. Gear consists of monofilament mainlines of between 25 km and 100 km in length which are suspended from surface buoys and marked at each end (see **Figure 3.25** and **Figure 3.26**). The main fishing line is normally suspended 20 m below the water surface via droppers connecting it to surface buoys at regular intervals. Baited hooks are attached to the mainline via 20 m long trace lines, thereby targeting fish at a depth of 40 m below the surface. Up to 3 500 hooks may be set per line. Lines are usually set at night, with hauling commencing the next morning. Various types of buoys are used in combinations to keep the mainline near the surface and locate it should the line be cut or break for any reason. Each end of the line is marked by a Dahn Buoy and radar reflector, which marks the line position for later retrieval. A line may be left drifting for a considerable length of time before retrieval by means of a powered hauler at a speed of approximately one knot. During hauling, vessel manoeuvrability is severely restricted and, in the event of an emergency, the line may be dropped and hauled in at a later stage. A photograph of a typical high seas long-line vessel is shown in **Figure 3.27**.

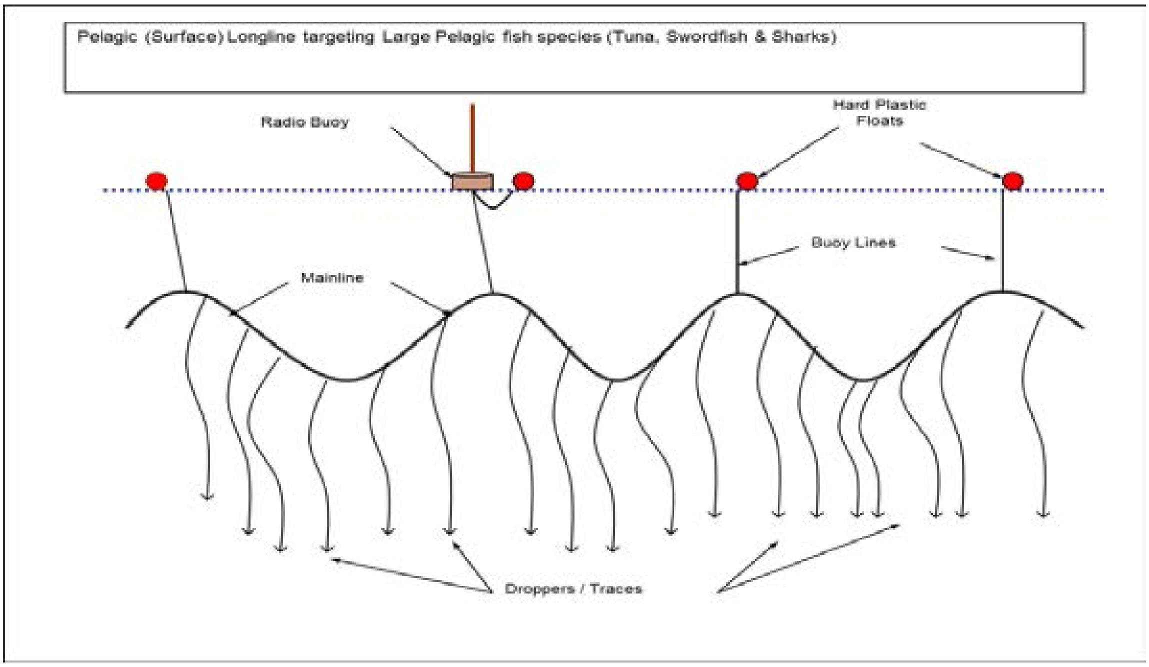


Figure 3.25: Typical pelagic long-line gear configuration targeting tuna, swordfish and shark species. Note: gear floats close to the surface of the sea and would present a potential obstruction to surface navigation.

Figure 3.26: Photograph of a mainline (braided monofilament, right) with a dropper line and trace typically used by the pelagic long-line fishery (left).

Figure 3.27: A typical high seas longline vessel

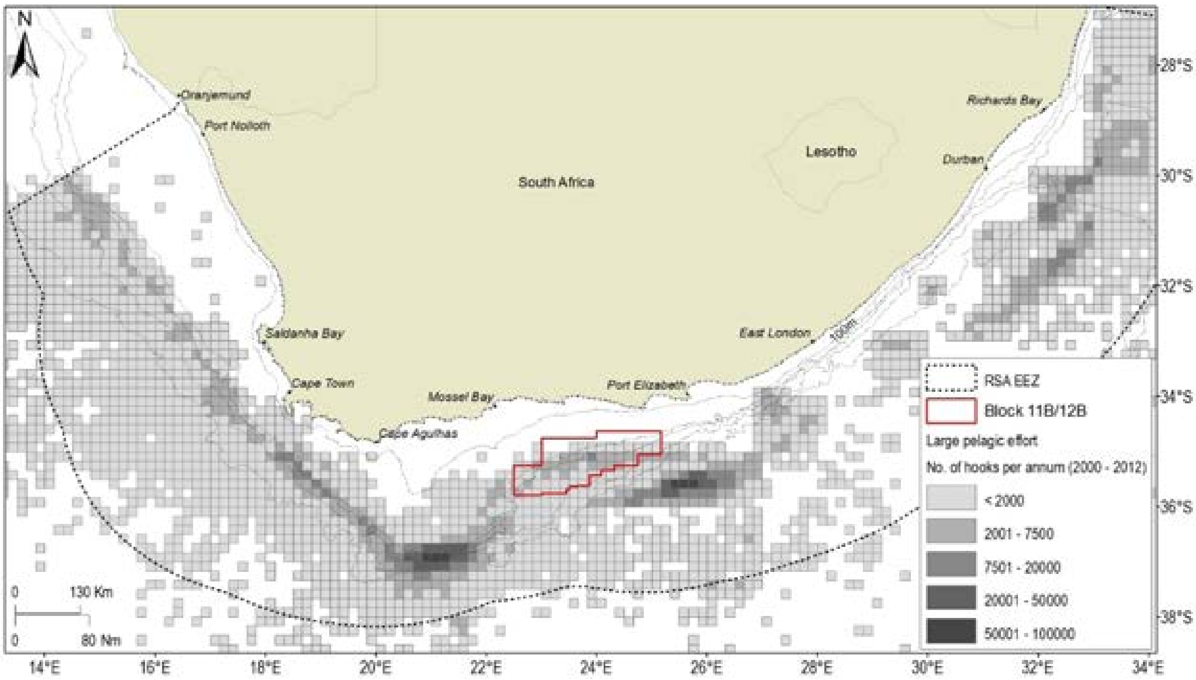


Figure 3.28: Spatial distribution of effort expended by the pelagic long-line sector in relation to Block 11B/12B. Effort is presented as the number of hooks set per annum on a 10´ x 10´ grid basis (2000 to 2012). Note that a set line may range up to 100 km in length and therefore extend across several blocks.

3.1.5 Tuna Pole

Poling for tuna is predominantly based on the southern Atlantic longfin tuna stock (*T. alalunga* - **Figure 3.29**) and a very small amount of skipjack tuna (*Katsuwonus pelamis* - **Figure 3.30**), yellowfin tuna and bigeye tuna. The fishery is seasonal with vessel activity mostly between December and May and peak catches in February and March. The South African fleet consists of approximately 128 pole-and-line vessels which are based at the ports of Cape Town, Hout Bay and Saldanha Bay.

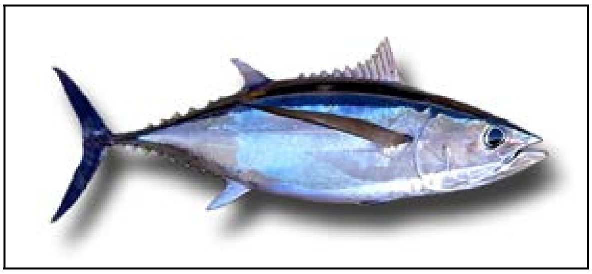


Figure 3.29: Longfin tuna *Thunnus alalunga* (Source: http://www.wwfsassi.co.za/)

Figure 3.30: Skipjack tuna *Katsuwonus pelamis*

Vessels operating within the fishery are typically small (< 25 m in length). Catch is stored on ice, chilled sea water or frozen and the storage method often determines the range of the vessel. Trip durations average between four and five days, depending on the distance of the fishing grounds from port. Vessels drift whilst attracting and catching pelagic tuna species. 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 also 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 these 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 3.31**).

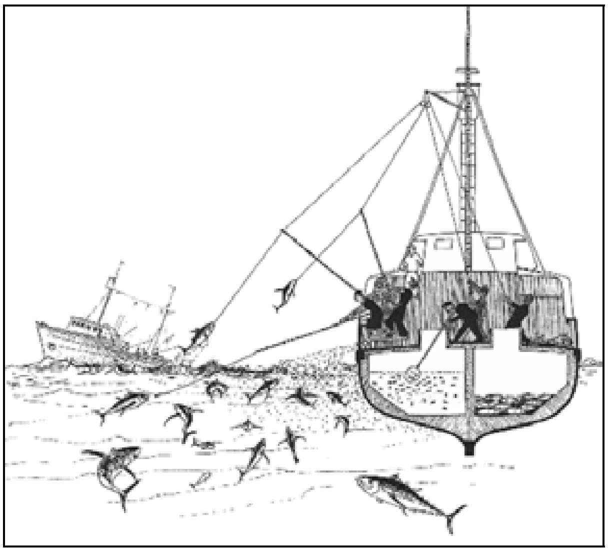


Figure 3.31: Schematic diagram (left) and photography (right) of pole and line operation (Source: www.fao.org/fishery).

Fishing activity occurs along the entire West Coast beyond the 200 m isobath. Activity would be expected to occur along the shelf break with favoured fishing grounds including areas north of Cape Columbine and between 60 km and 120 km offshore from Saldanha Bay. The nature of the fishery and communication between vessels often results in a large number of these vessels operating in close proximity to each other at a time. The vessels fish predominantly during daylight hours and as they do not anchor or have any fixed gear in the water, these vessels remain highly manoeuvrable and could take avoiding action at any time. However, at night in fair weather conditions the fleet of vessels may drift or deploy drogues to remain within an area and would be less responsive during these periods. Effort fluctuates according to the availability of fish in the area, but once a shoal of tuna is located a number of vessels will move into the area and target a single shoal which may remain in the area for days at a time. As such the fishery is dependent on window periods of favourable conditions relating to catch availability. The fishery operates year-round, although fishing activity is highly variable from month to month. Data recorded between 2003 and 2012 shows that effort was relatively higher from November to January during this period (**Figure 3.32**).

The 2014 TAC for the South African tuna pole fishery (albacore) was set at 4 400 tons. The total catch landed and effort expended by the tuna pole sector over the period 2003 to 2012 was 4 110 tons and 5 723 fishing events per year. Over the period 2008 to 2012, effort within the fishery was slightly lower, whilst reported landings remained constant (4 221 tons and 4 707 fishing events per annum). **Figure 3.33** shows the spatial distribution of catch reported by the South African tuna pole fishery in relation to Block 11B/12B.

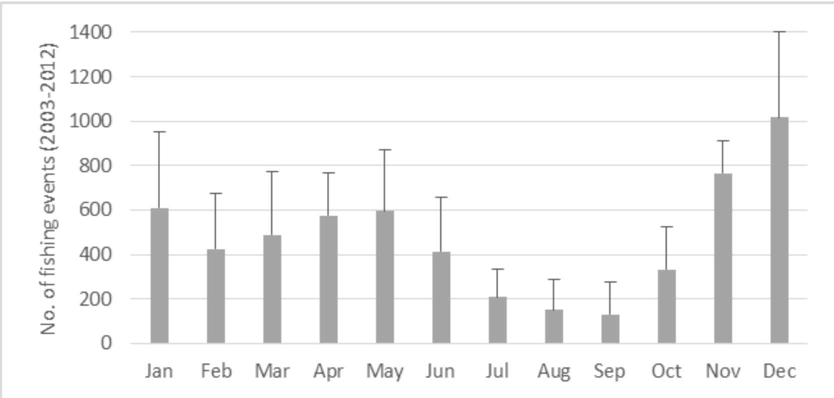


Figure 3.32: Average number of fishing events recorded by month for the tuna pole fishery between 2003 and 2012.

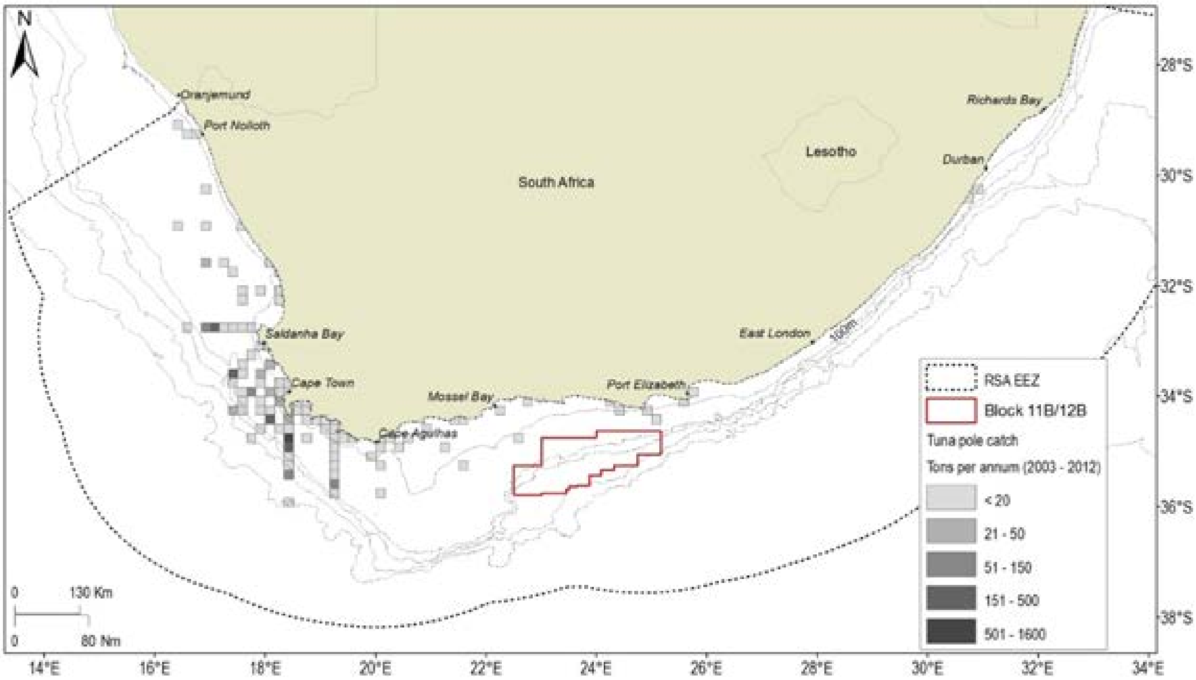


Figure 3.33: Spatial distribution of tuna pole catch within South African waters (2003 to 2012) in relation to Block 11B/12B. Catch is presented as tons landed per year on a 10' x 10' grid resolution.

3.1.6 Traditional Line-Fish

The South African commercial line fishery is the country's third most important fishery in terms of total tons landed and economic value. The bulk of the fishery catch is made up of about 35 different species of reef fish as well as pelagic and demersal species which are mostly marketed locally as "fresh fish". The fishery is widespread across the country's shoreline from Port Nolloth on the West Coast to Cape Vidal on the East Coast. Effort is managed geographically with the spatial effort of the fishery divided into three zones. The majority of the catch (up to 95%) is landed by the Cape commercial fishery, which operates on the continental shelf from the Namibian border on the West Coast to the Kei River in the Eastern Cape. Fishing vessels generally range up to a maximum of 40 nm offshore, although fishing at the outer limit and beyond this range would be sporadic (C. Wilke, pers. comm[3]).

Line fishing techniques consist of hook and line deployments (up to 10 hooks per line), and differ from the pelagic long-line fishing technique in that the use of set long-lines is not permitted. The fishery includes commercial, subsistence and recreational sectors[4]. Up to 3 000 boats are involved in the fishery on the national level, 450 of which are involved in the commercial fishery, and range in size from 3 m beach-launched dinghy's (see **Figure 3.34**) to 20 m harbour-based vessels that may remain at sea for up to 30 days (Mann, 2000). The fishery operates year-round (see **Figure 3.35**).

[3] Mr C. Wilke (christopherW@daff.gov.za) is the chief technician at DAFF for 35 years and is the principle contact for linefish data collation.
[4] Note: These fisheries are not artisanal in nature.

Figure 3.34: Hand-line fishing vessels

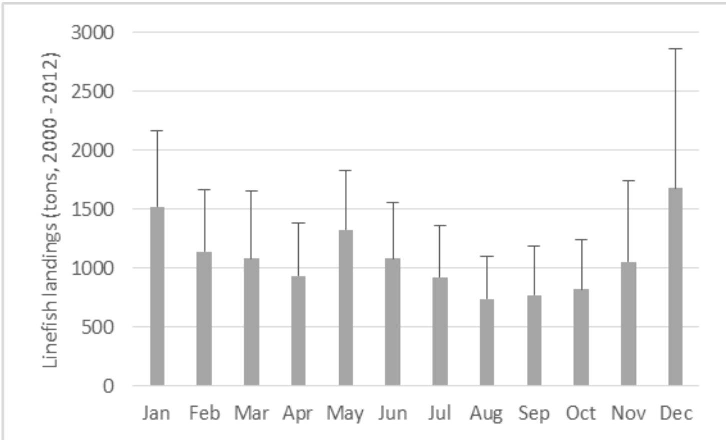


Figure 3.35: Average annual landings recorded by month for the traditional line fishery between 2000 and 2012.

Over the period 2000 to 2012, the fishery reported an annual catch of 13 082 tons. Recent landings have diminished since the reduction of commercial effort. Annual catches for the sector were reported as 8 551 tons over the period 2008 to 2012 compared to 15 913 tons over the period 2000 to 2007. Records of fishing activity off the West Coast of South Africa are predominantly coastal, up to the 200 m isobath (see **Figure 3.36**).

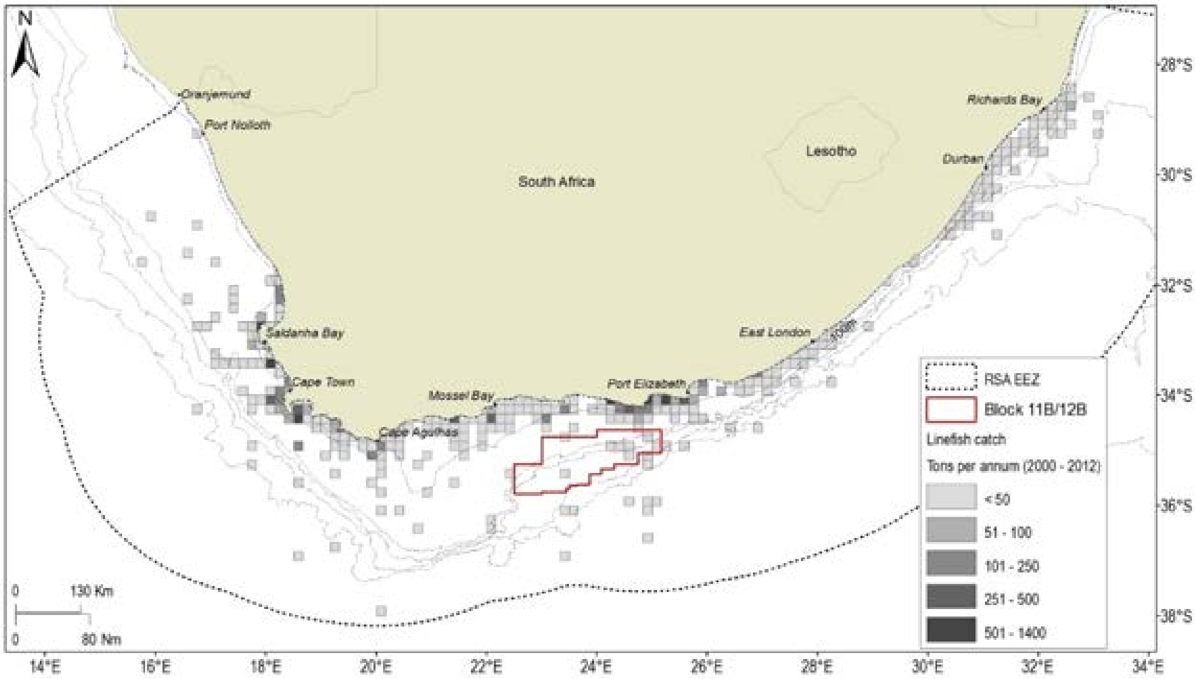


Figure 3.36: Spatial distribution of catch landed by the South African traditional linefish sector in relation to Block 11B/12B (2000 – 2012).

3.1.7 Small Pelagic Purse-Seine

The small pelagic fishery is the largest South African fishery by volume and the second most important in terms of value. Small pelagic species abundance and distribution fluctuates considerably in accordance with the upwelling ecosystem in which they exist. The two main targeted species are sardine (**Figure 3.37**) and anchovy (**Figure 3.38**), with associated by-catch of round herring (red-eye) and juvenile horse mackerel. Fishing grounds occur primarily along the West and South Coasts of the Western Cape and the Eastern Cape coast up to a maximum distance of 100 km offshore, but usually closer inshore.

The majority of the fleet of 101 vessels operate from St Helena Bay, Laaiplek, Saldanha Bay and Hout Bay with fewer vessels operating on the South Coast from the harbours of Gansbaai, Mossel Bay and Port Elizabeth. Ports of deployment correspond to the location of canning factories and fish reduction plants along the coast.

The fleet consists of wooden, glass-reinforced plastic and steel-hulled vessels ranging in length from 11m to 48m. The targeted species are surface-shoaling and once a shoal has been located the vessel will steam around it and encircle it with a large net, extending to a depth of 60 m to 90 m (**Figure 3.39**). Netting walls surround aggregated fish, preventing them from diving downwards. These are surface nets framed by lines: a float line on top and lead line at the bottom. Once the shoal has been encircled the net is pursed, hauled in and the fish pumped on board into the hold of the vessel. It is important to note that after the net is deployed the vessel has no ability to manoeuvre until the net has been fully recovered on board and this may take up to 1.5 hours. Vessels usually operate overnight and return to offload their catch the following day. See **Figure 3.40** for an image of a pelagic purse-seine vessel pumping pursed fish on board.

Figure 3.37: Sardine, *Sardinops sagax*, also called pilchard is a shoaling species and is the most valuable species in the purse-seine fishery.

Figure 3.38: Anchovy, *Engraulis encrasicolus.*

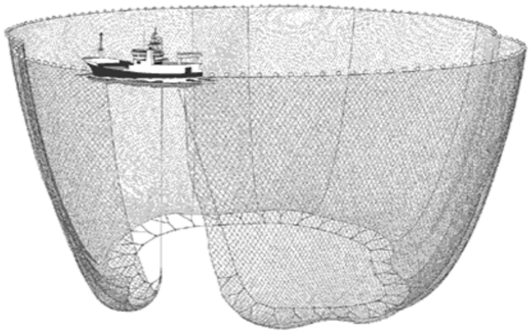


Figure 3.39: Schematic showing typical configuration and deployment of a small pelagic purse-seine net for anchovy and pilchard in South African waters.

Figure 3.40: A South African purse-seine vessel (Source: Geja, Y & C.D. van der Lingen, 2011).

The fishery for sardine commenced off South Africa during the 1930s but only underwent major development following World War II (Beckley and van der Lingen 1999). Effort was initially (early-1950s) limited to within St Helena Bay with catches of large fish peaking during March-July, but effort soon spread southwards towards Cape Agulhas (Hutchings *et al.* 2012). Catches peaked at around 400 000 tons during the early-1960s and then declined rapidly to around 50 000 tons, with anchovy becoming the mainstay of the fishery. Sardine catches started to rise from the early-1990s following an increase in sardine biomass and peaked again at 365 000 tons in 2004, before again showing a rapid decline. The increase in sardine abundance during the 1990s and early-2000s was accompanied by an eastward range extension such that the majority of sardine biomass has been off the South Coast (to the east of Cape Agulhas) since 1999 (Coetzee *et al*. 2008). Annual landings have fluctuated between 300 000 and 600 000 tons over the last decade[5], with average landings of 468 000 tons (all species) per annum over the period 2000 to 2012 compared to 391 000 tons per annum recorded between 2008 and 2012.

The fishery operates throughout the year with a short break from mid-December to mid-January[6] (see **Figure 3.41**). The geographical distribution and intensity of the fishery is largely dependent on the seasonal fluctuation and distribution of the targeted species. The sardine-directed fleet concentrates effort in a broad area extending from Lambert's Bay, southwards past Saldanha and Cape Town towards Cape Point and then eastwards along the coast to Mossel Bay and Port Elizabeth. The anchovy-directed fishery takes place predominantly on the South-West Coast from Lambert's Bay to Kleinbaai (19.5°E) and similarly the intensity of this fishery is dependent on fish availability and is most active in the period from March to September. Round herring (non-quota species) is targeted when available and specifically in the early part of the year (January to March) and is distributed from Lambert's Bay to south of Cape Point. This fishery may extend further offshore than the sardine and anchovy-directed fisheries.

[5] Acoustic surveys are conducted to assess the pre- and post-spawning biomass of small pelagic species and the TAC is set and adjusted accordingly each year.

[6] The fishery has traditionally "rested" in December and early January primarily to reduce impact on juvenile sardine.

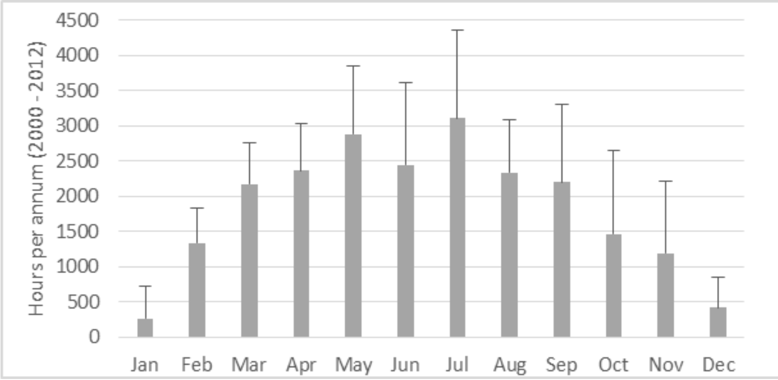


Figure 3.41: Average annual effort (hours) recorded by month for the pelagic purse-seine fishery between 2000 and 2012.

Figure 3.42 shows the spatial distribution of the average annual effort expended by the small pelagic purse-seine fishery from 2000 to 2012, indicating the range of fishing grounds predominantly within 100 km of the shoreline.

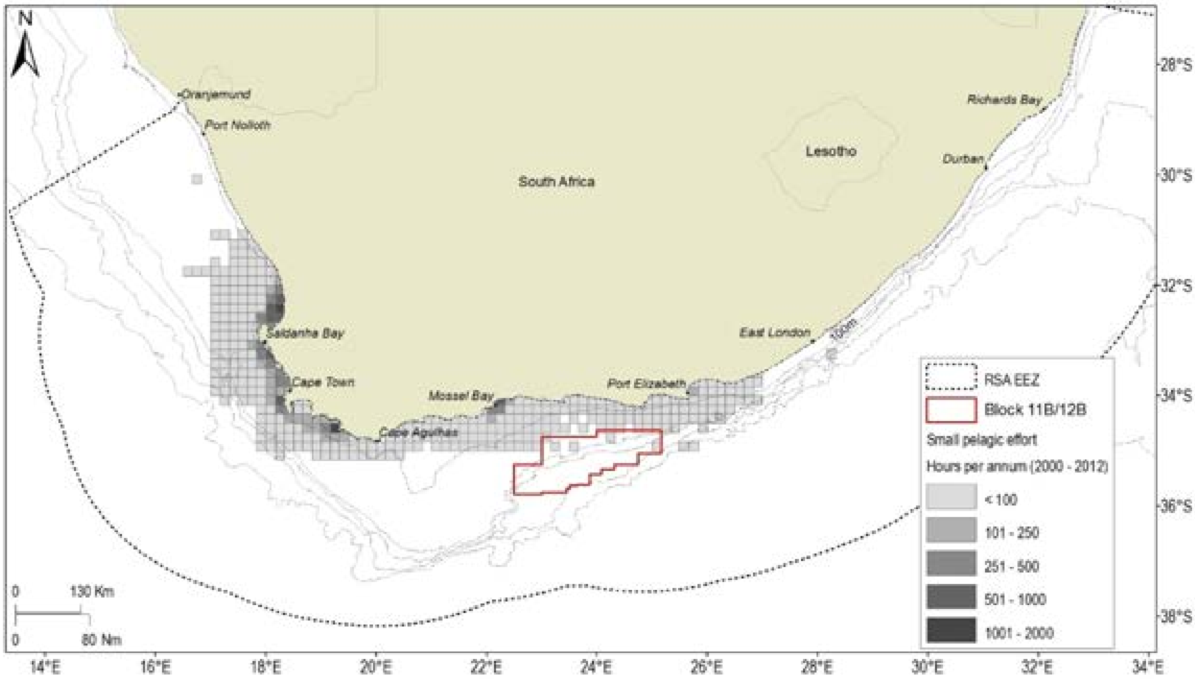


Figure 3.42: Spatial distribution of effort expended by the South African small pelagic purse-seine fishery in relation to Block 11B/12B. Effort is presented as the number of fishing hours per year (2000 – 2012) on a 10' x 10' grid resolution.

3.1.8 South Coast Rock Lobster

The South Coast rock lobster fishery is a deep-water long-line trap fishery. Barrel-shaped plastic traps are set for periods ranging from 24 hours to several days. Each vessel typically hauls and resets approximately 2 000 traps per day in sets of 100 to 200 traps per line. They will set between ten lines and 16 lines per day, each of which may be up to 2 km in length. Each line will be weighted to lie along the seafloor and will be connected at each end to a marker buoy at the sea surface. Vessels are large, ranging from 30 m to 60 m in length. Those that have on-board freezing capacity will remain at sea for up to 40 days per trip, while those retaining live catch will remain at sea between seven and 10 days before discharging at port. The fishery operates year-round with the month of October showing relatively low activity within the fishery. There are currently seven vessels operating within the fishery which landed a total lobster tail weight of 274 tons in 2012.

Figure 3.43: *Palinurus gilcristi* (Source: http://www.ruwekusfishing.co.za/)

South Coast Rock Lobster (*Palinurus gilchristi* – see **Figure 4.43**) occurs on the continental shelf of the South Coast between depths of 50 m and 200 m. Two areas are commercially viable to fish on the South Coast, the first is approximately 200 km offshore on the Agulhas Bank and the second is within 50 km of the shoreline between Mossel Bay and East London (see **Figure 3.44**). The fishery is restricted by the Agulhas Current from operating far offshore, but would be expected to operate within the proposed survey area west of East London and inshore of the 200 m isobath.

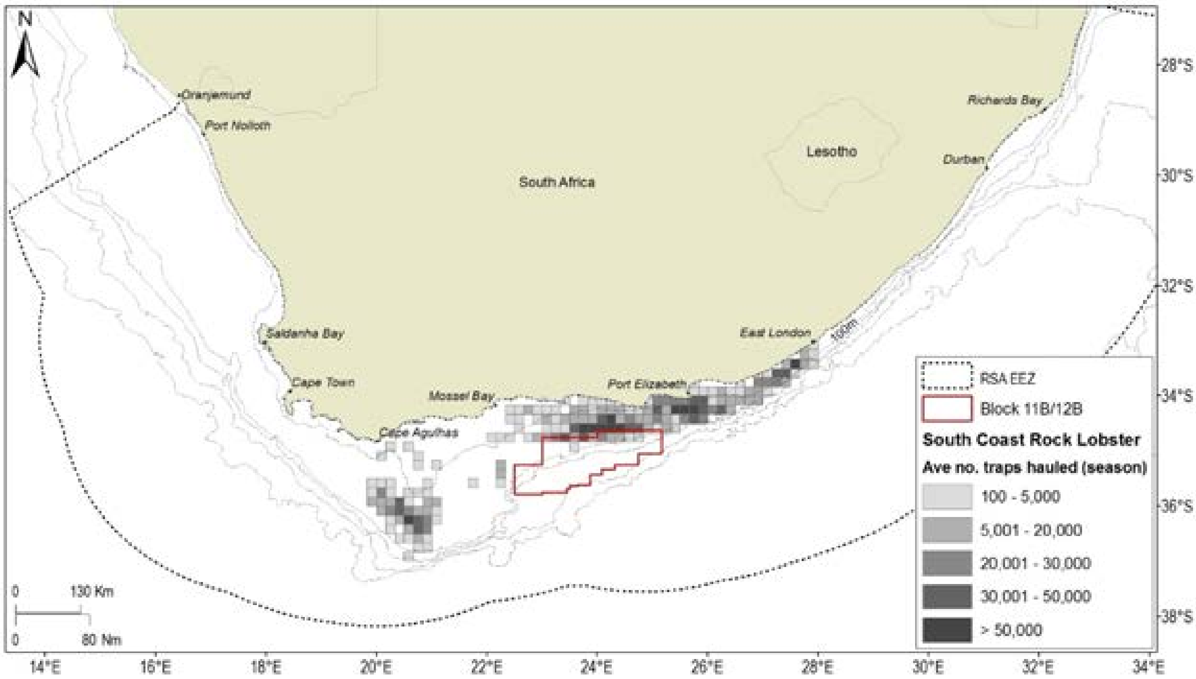


Figure 3.44: Spatial distribution of effort expended by the South Coast rock lobster fishery in relation to Block 11B/12B. Effort is presented as the number of traps hauled per year (2000 – 2012) on a 10' x 10' grid resolution.

3.1.9 Squid Jig

Chokka squid (*Loligo vulgaris reynaudii* – **Figure 3.45**) is distributed from the border of Namibia to the Wild Coast. Along the South Coast adult squid is targeted in spawning aggregations on fishing grounds extending from Plettenberg Bay to Port Alfred between 20 m and 120 m depths (see **Figure 3.46**). The fishery is seasonal, with most effort conducted between November and March. The method of fishing involves hand-held jigs and bright lights which are used to attract squid at night. The catch is frozen at sea or at land-based facilities at harbours between Plettenberg Bay and Port Alfred.

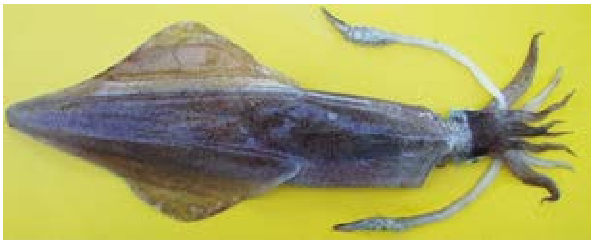


Figure 3.45: Chokka squid: *Loligo vulgarus reynaudii* (Source: RV *Fridtjof Nansen*)

The squid fishery is managed in terms of the Total Allowable Effort (TAE) allowed within the fishery and also sees an annual four week closure between October and November during which time DAFF undertakes a survey on spawning aggregations in the bay areas. Fishing rights were issued to 121 companies for the period 2006 to 2013 with the number of crew and vessels active within the fishery listed as 2422 and 136 respectively. A maximum landed catch of 12 000 tons was recorded in 2003/4 with a leveling-off thereafter to 9 000 tons between 2005 and 2008. In 2012 the recorded landings were 6 000 tons with an annual catch value of approximately R180 million.

Squid spawn in the nearshore zone on the eastern Agulhas Bank (Augustyn *et al.* 1994). They lay benthic egg sacs and the larvae that hatch from the sacs are distributed close inshore. Juvenile squid are dispersed over the entire shelf region of the Agulhas Bank and it is likely that larvae and early juvenile squid use the bottom currents, which generally move slowly westwards (Boyd and Shillington 1994).

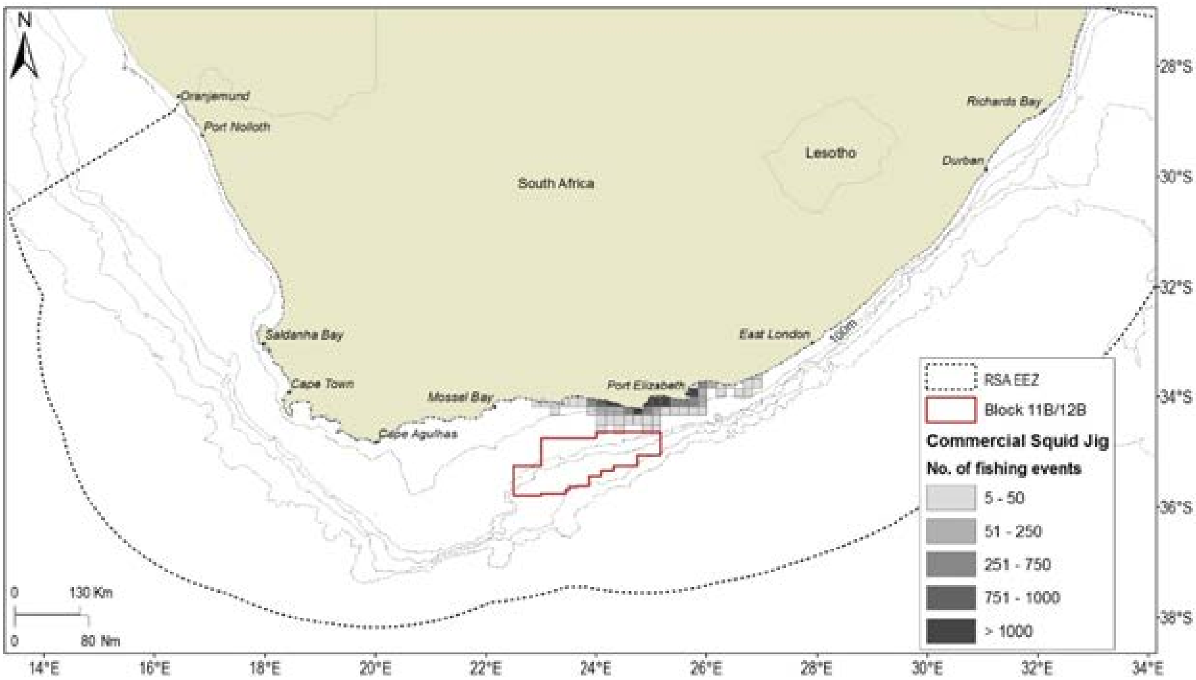


Figure 3.46: Spatial distribution of effort expended by the squid jig fishery in relation to Block 11B/12B.

3.2 Fisheries Research

Swept-area trawl surveys of demersal fish resources are carried out twice a year by DAFF in order to assess the stock abundance indices used set the annual TACs for demersal fisheries. First started in 1985, the West Coast survey extends from Cape Agulhas (20°E) to the Namibian maritime boarder and takes place over the duration of approximately one month during January. The survey of the Southeast coast (20°E – 27°E longitude) takes place in April/May. Stratified, bottom trawls are conducted to assess the biomass, abundance and distribution of hake, horse mackerel, squid and other demersal trawl species on the shelf and upper slope of the South African coast. A similar gear configuration to that of commercial demersal trawlers is used, however nets are towed for a shorter duration of generally 30 minutes per tow. Trawl positions are randomly selected to cover specific depth strata that range from the coast to the 1 000 m isobath (see **Figure 3.47**). Approximately 120 trawls are conducted during each survey and the location of these trawls is pre-determined usually a week before the cruise is scheduled to take place.

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

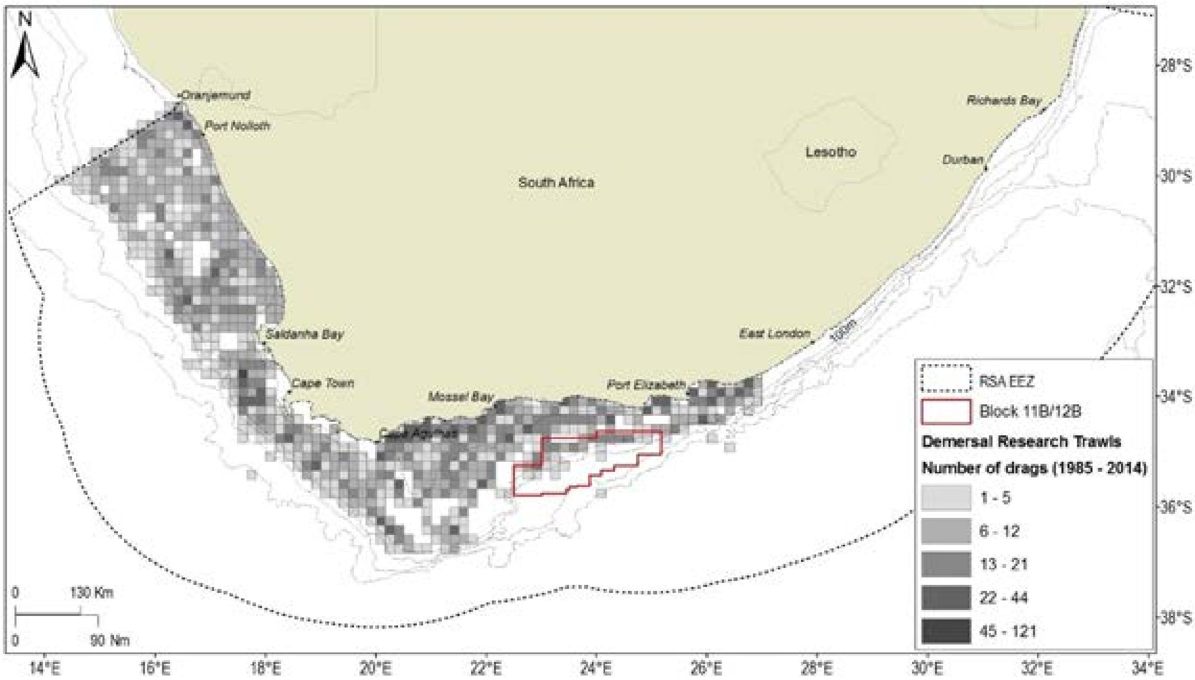


Figure 3.47: Spatial distribution of the number of demersal research trawls undertaken by DAFF in South African waters between 1985 and 2014.

4. DESCRIPTION OF IMPACTS ON FISHERIES

4.2 Exclusion Zones

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part B, Rule 18), survey vessels engaged in surveying or towing operations are defined as "vessel restricted in its ability to manoeuvre[7]" which requires that power-driven and sailing vessels give way to a vessel restricted in its ability to manoeuvre. Vessels engaged in fishing shall, so far as possible, keep out of the way of the survey operations. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel (including array of airguns and hydrophones) used for the purpose of exploiting the seabed falls under the definition of an "offshore installation" and as such it is protected by a 500 m safety zone. It is an offence for an unauthorised vessel to enter the safety zone.

The 500 m safety zone and proposed safe operational limits would be communicated to key stakeholders well in advance of the proposed exploration programme. Notices to Mariners will also be communicated through the proper channels.

The safety zone and proposed safe operational limits could impact fisheries through the temporary physical exclusion or displacement of fishing effort during surveying and sampling operations, as well as through the effects of the use of sonar equipment on the potential availability of fish resources, which may extend beyond the range of the safety zone and proposed safe operational limits around the survey vessel. The multi-beam bathymetry survey would take in the order of three to four weeks to complete. The impact would therefore be short-term in duration and localized in extent.

The seabed sediment sampling would be undertaken in small specific areas across the Block 11B/12B over a period of three to five weeks. Each individual piston and box core would have a maximum volume of 0.02 m^3 and 0.012 m^3, respectively and the cumulative volume of material that would be removed from the seabed would be less than 5 m^3. The impact of the seabed sediment sampling programme on the fishing industry would be limited to the safety zone and safe operational limits around the sampling vessel, rather than the effects of the removal of a relatively insignificant volume of seabed material. The extent of the impact would be local and the duration would be short-term.

4.3 Acoustic Impacts on Marine Fauna

The acoustic impact of the proposed bathymetry survey and seabed sampling programme on marine fauna has been assessed in a separate specialist report undertaken by Pisces Environmental Services (Pty) Ltd. These effects included the noise generated by the survey vessel as well as that of the multi-beam sonar during the bathymetric survey.

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[7] Definition: The term "vessel restricted in her ability to manoeuvre" means a vessel which from the nature of her work is restricted in her ability to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel. The term "vessels restricted in their ability to manoeuvre" shall include but not be limited to:

(i) a vessel engaged in laying, servicing, or picking up a navigation mark, submarine cable or pipeline;
(ii) a vessel engaged in dredging, surveying or underwater operations;
(iii) a vessel engaged in replenishment or transferring persons, provisions or cargo while underway;
(iv) a vessel engaged in the launching or recovery of aircraft;
(v) a vessel engaged in mine clearance operations; and
(vi) a vessel engaged in a towing operation such as severely restricts the towing vessel and her tow in their ability to deviate from their course.

The impact of underwater noise generated by the survey and sampling vessels during the proposed exploration activities in Block 11B/12B was considered to be of low intensity and of very low significance. No specific mitigation measures were deemed necessary.

There are significant differences in the effects of seismic and multi-beam/side-scan surveys. Despite having similar sound levels to seismic surveys, the higher frequency emissions utilised in normal multi-beam operations tend to be dissipated to safe levels over a relatively short distance. The anticipated radius of influence of multi-beam sonar would thus be significantly less than that for a seismic airgun array. Hence the most likely scenario for injury to an animal by acoustic equipment would be if the equipment were turned on full power while the animal was close to the source. It is thus generally understood that in open coastal waters the effects of multi-beam sonars on marine fauna are of very low significance without mitigation

5. IMPACT ASSESSMENT

5.1 Demersal Trawl

Figure 5.1 shows the spatial distribution of trawl fishing effort (2000 to 2012) in relation to Block 11B/12B. Off the South Coast, offshore hake-directed vessels fish the western edge of the Agulhas Bank where Block 11B/12B coincides with trawling grounds inshore of the 1 000 m isobath. Over the period 2000 to 2012, the average effort directed by the offshore demersal trawl fishery within the licence area amounted to 5 900 trawling hours per year with a catch of 11 164 tons per annum. This represents approximately 5.0 % of the total national effort and 8.6 % of the total catch landed by the hake trawl sector.

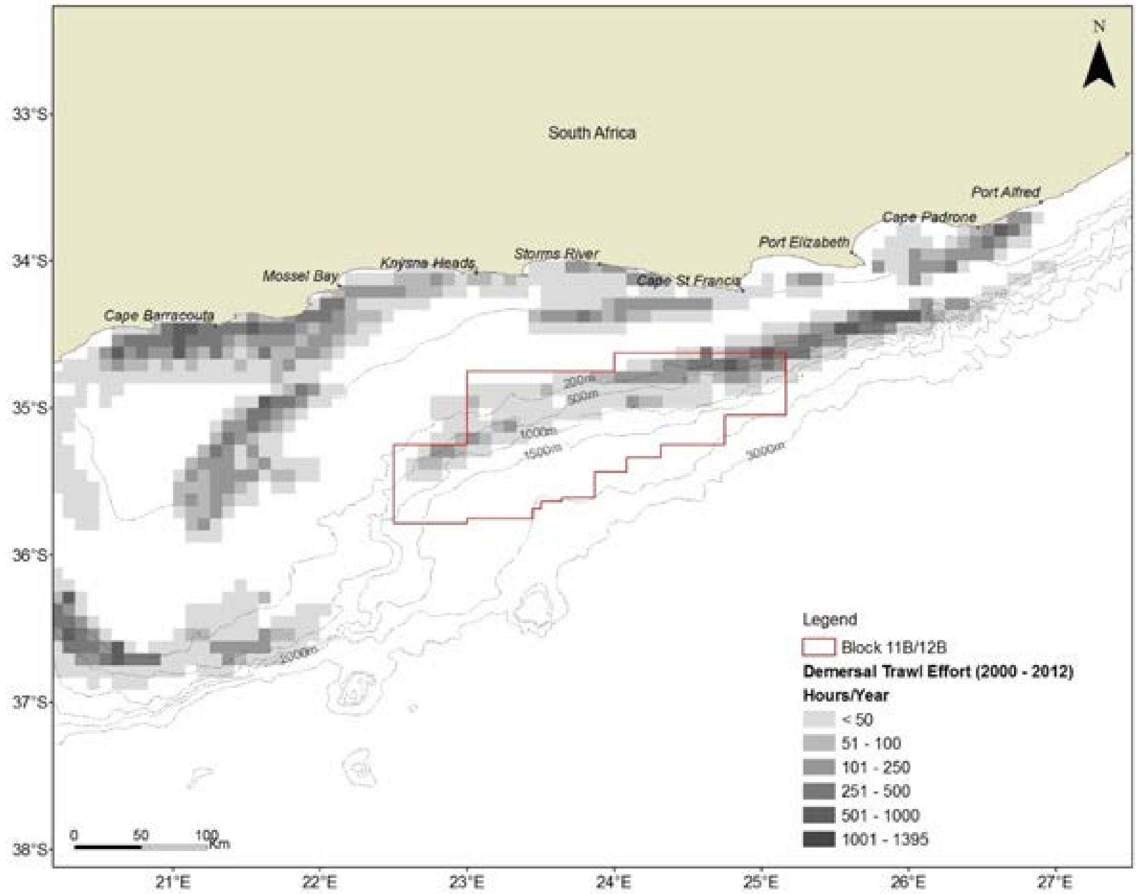

Figure 5.1: Spatial distribution of fishing effort expended by the South African demersal trawl sector targeting hake over the period 2000 to 2012 in relation to Block 11B/12B.

The impact of the proposed bathymetry survey operations on the demersal trawl fishery is assessed to be negative and the likelihood of the impact occurring is probable. The impact is assessed to be of short-term duration and of localised extent. The intensity of the impact is assessed to be medium and the impact is assessed to be of very low overall significance. The degree of confidence in the assessment is high.

Table 5.1: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the demersal trawl sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Demersal Trawl						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Medium	Very Low	Probable	High
With mitigation	Local	Short-term	Medium	Very Low	Probable	High

5.2 Mid-Water Trawl

Mid-trawling grounds to the South of the Agulhas Bank coincide with Block 11B/12B, inshore of the 1 000 m isobaths (see **Figure 5.2**). Between 2000 and 2012, an average effort of 350 trawls were conducted within the licence area and a catch of 11 020 tons per annum was landed by the fishery which represents 35.8 % of the total national effort and 36.8 % of the total catch landed by the sector over this period. The impact of the proposed bathymetry survey operations on the mid-water trawl fishery is assessed to be negative and the likelihood of the impact occurring is probable. The impact is assessed to be of short-term duration and of localised extent. The intensity of the impact is assessed to be high and the impact is assessed to be of low overall significance. The degree of confidence in the assessment is high.

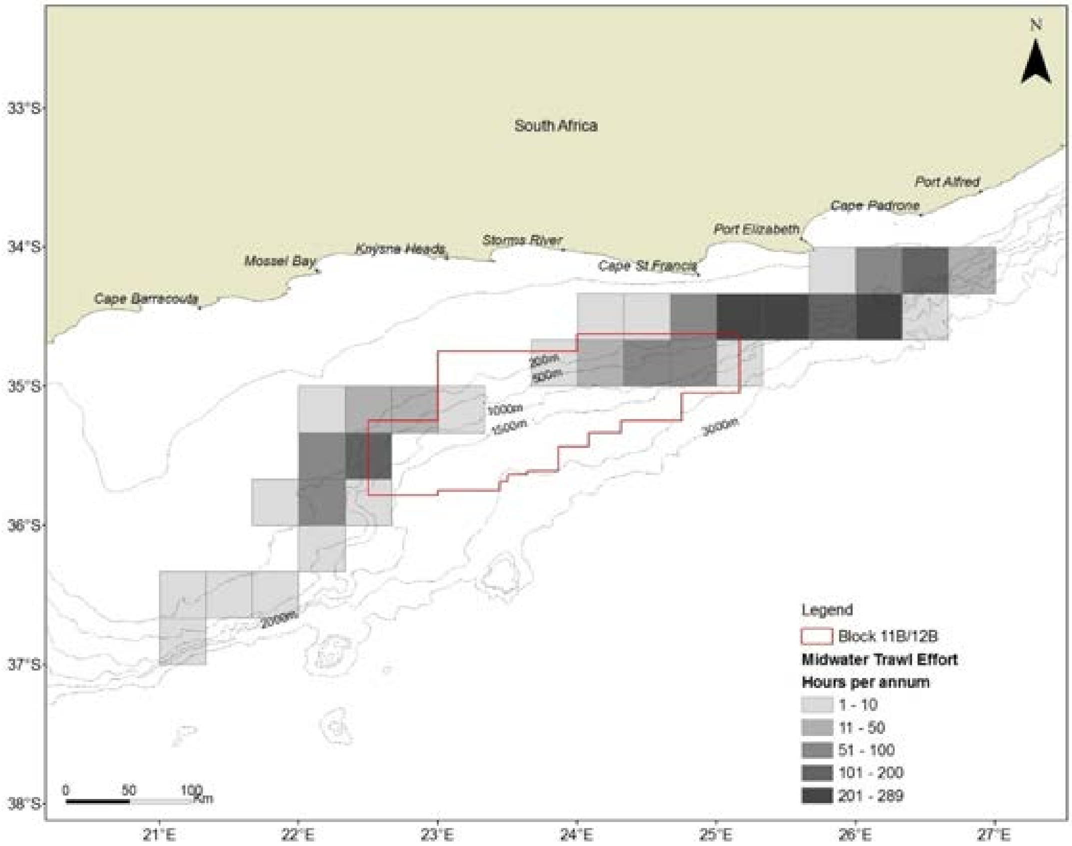

Figure 5.2: Spatial distribution of fishing effort expended by the South African mid-water trawl sector targeting horse-mackerel over the period 2000 to 2012 in relation to Block 11B/12B.

Table 5.2: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the mid-water trawl sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Mid-Water Trawl						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	High	Low	Probable	High
With mitigation	Local	Short-term	High	Low	Probable	High

5.3 Demersal Long-Line

5.3.1 Hake-Directed

Figure 5.3 shows the spatial distribution of hake-directed long-line catch recorded in the vicinity of Block 11B/12B over the period 2000 to 2012. Data reported by the South African fishery over this 13-year period indicate that fishing grounds are situated within the licence area inshore of the 500 m isobath. Lines are usually set parallel to bathymetric contours. Approximately 25.3 % of the total national effort is conducted within the licence area annually and 18.0 % of the total national catch is taken in this area. This amounts to 8.5 million hooks set and 2 340 tons landed per year, respectively.

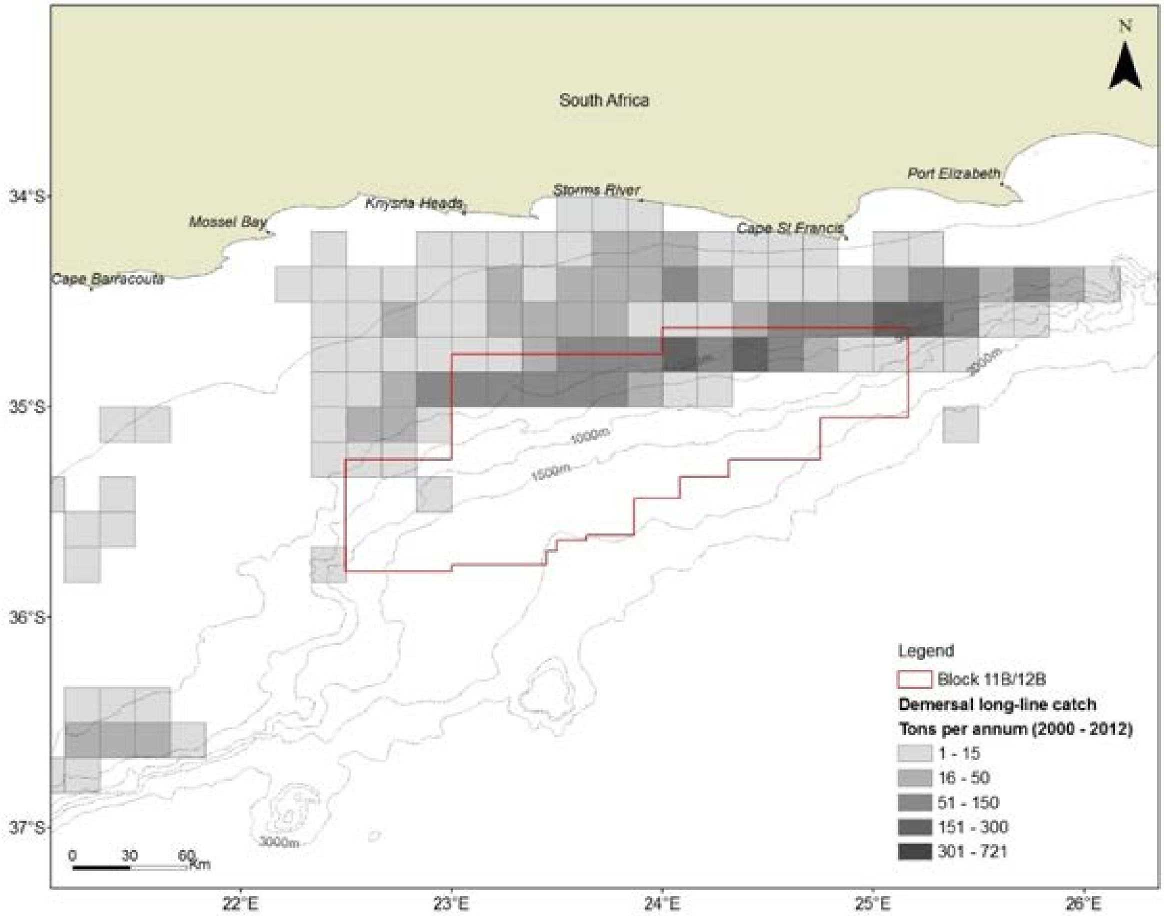

Figure 5.3: Spatial distribution of catch landed by the South African hake-directed demersal long-line fishery in relation to Block 11B/12B (2000 – 2012). Catch is reported as tons landed per annum on a 10' x 10' grid resolution.

The impact of the proposed bathymetry survey and seabed sediment sampling operations on the hake-directed long-line fishery is assessed to be negative and the likelihood of the impact occurring is probable. The intensity of the impact is assessed to be high and overall of low significance due to the local extent and short-term duration of the proposed impact. The degree of confidence in the assessment is high (see **Table 5.3**).

Table 5.3: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the demersal long-line (hake-directed) sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Demersal Long-Line (Hake-Directed)						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	High	Low	Probable	High
With mitigation	Local	Short-term	High	Low	Probable	High

5.2.2 Shark-Directed

Spatial records show that fishing effort does not coincide with Block 11B/12B, with the closest reported fishing activity located approximately 30 km inshore of the licence area. The likelihood of the fishery being impacted is improbable and there is no impact expected on the fishery. The degree of confidence in the assessment is high.

5.4 Large Pelagic Long-Line

Figure 5.4 shows the spatial distribution of catch reported by the large pelagic long-line sector in the vicinity of Block 11B/12B. Fishing activity is concentrated at the shelf break, located approximately along the 500 m isobath. Pelagic long-line vessels can be expected across the licence area and are likely to be especially concentrated where the continental slope is steepest. Over the period 2008 to 2012, effort directed within the licence area amounted to 128 000 hooks (56 lines) with a catch of 72.4 tons per annum. This represents approximately 3.7 % of the total national effort and 2.9 % of the total catch landed by this sector. The intensity of the impact of the proposed bathymetry survey and seabed sediment sampling operations on the sector is expected to be medium and of very low significance due to the local extent and short-term duration of the impact. The degree of confidence in the assessment is high (see **Table 5.4**).

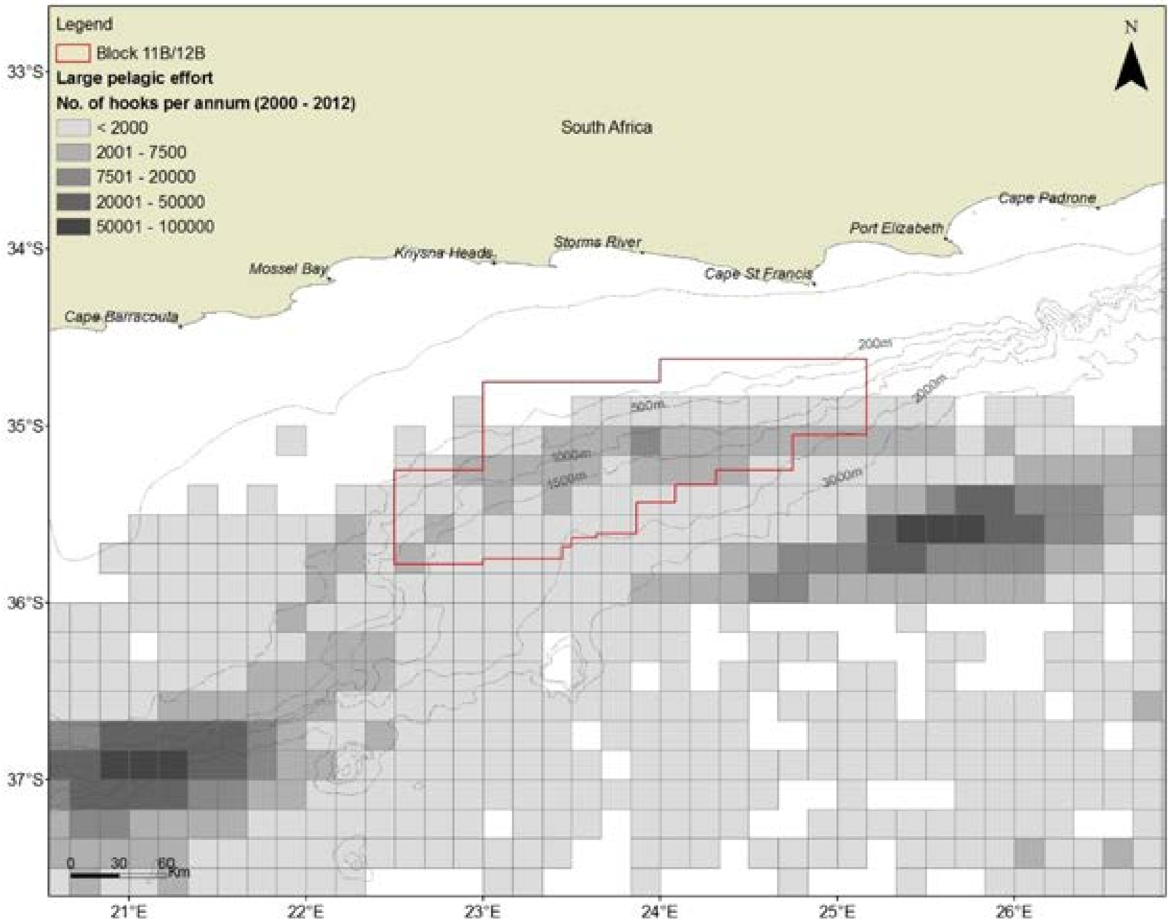

Figure 5.4: Spatial distribution of effort expended by the large pelagic long-line sector between 2000 and 2012 in relation to Block 11B/12B. Effort is presented as the number of hooks set on a 10´ x 10´ grid basis. Note that a set line may range up to 100 km in length and therefore cover several grids.

Table 5.4: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the large pelagic long-line sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Large Pelagic Long-Line						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Medium	Very Low	Probable	High
With mitigation	Local	Short-term	Medium	Very Low	Probable	High

5.5 Tuna Pole

Figure 3.33 shows the spatial distribution of catch reported by the South African tuna pole fisheries in relation to Block 11B/12B. Catch and effort records for the fishery for the period 2003 to 2012 show no spatial overlap between the licence area and the tuna pole sector, with the closest reported activity situated 30 km inshore of the licence area. There is therefore no impact expected on the tuna pole sector from the proposed bathymetric survey and seabed sampling activities. The degree of confidence in the assessment is high.

5.6 Traditional Line-Fish

Records of traditional line fishing activity off the South Coast of South Africa show that fishing is predominantly coastal, extending up to the 200 m isobath (see **Figure 5.5**). Over the period 2000 to 2012, 0.05% of the total recorded national landings were taken from Block 11B/12B. This amounts to 6.2 tons per annum – although no effort has been reported within the licence area since 2008. The impact of the proposed bathymetry survey and seabed sediment sampling operations on the sector is expected to be of very low intensity and of overall insignificance due to the local extent and short-term duration of the impact. The degree of confidence in the assessment is high (see **Table 5.5**)

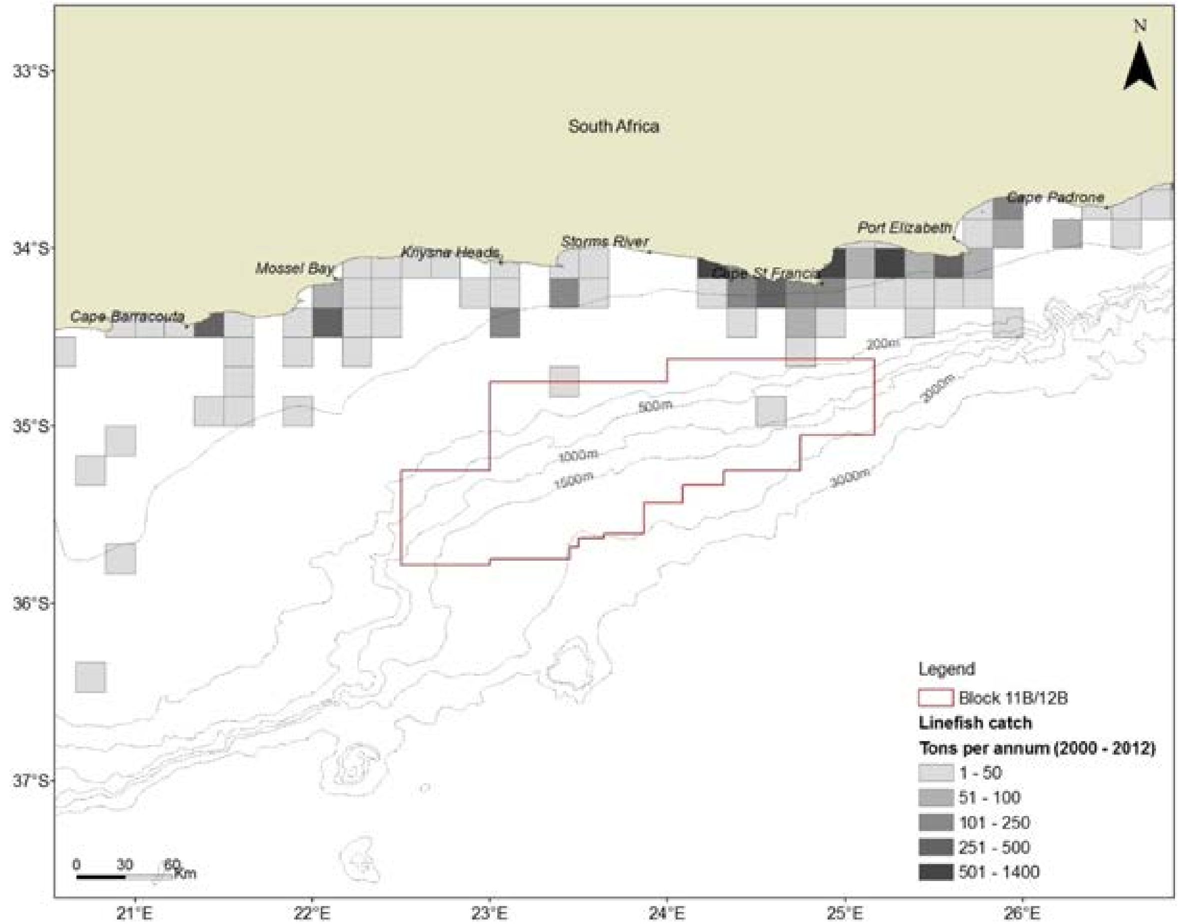

Figure 5.5: Spatial distribution of catch landed by the South African traditional linefish sector (2000 – 2012) in relation to Block 11B/12B.

Table 5.5: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the traditional linefish sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Traditional Line-Fish						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High
With mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High

5.7 Small Pelagic Purse-Seine

Figure 5.6 shows the spatial distribution of the average annual effort expended by the small pelagic purse-seine fishery from 2000 to 2012, indicating the range of fishing grounds in relation to Block 11B/12B. The sector operates predominantly on the West Coast and to a lesser extent on the South Coast and Eastern Cape Coast up to a maximum distance of 100 km offshore, but usually closer inshore. Minimal catch is expected within the shallower section of Block 11B/12B. Over the period 2008 to 2012, the average effort directed by the small pelagic purse-seine fishery within the licence area amounted to 4 hours per year with a catch of 71 tons per year. This amounts to less than 0.02% of the total national catch and effort. It is likely that these recorded fishing events within the licence area were erroneous reports as vessels fish within 20 nautical miles from port. The impact of the proposed bathymetry survey and seabed sediment sampling operations on the sector is expected to be of very low intensity and of overall insignificance due to the local extent and short-term duration of the impact. The degree of confidence in the assessment is high (see **Table 5.6**)

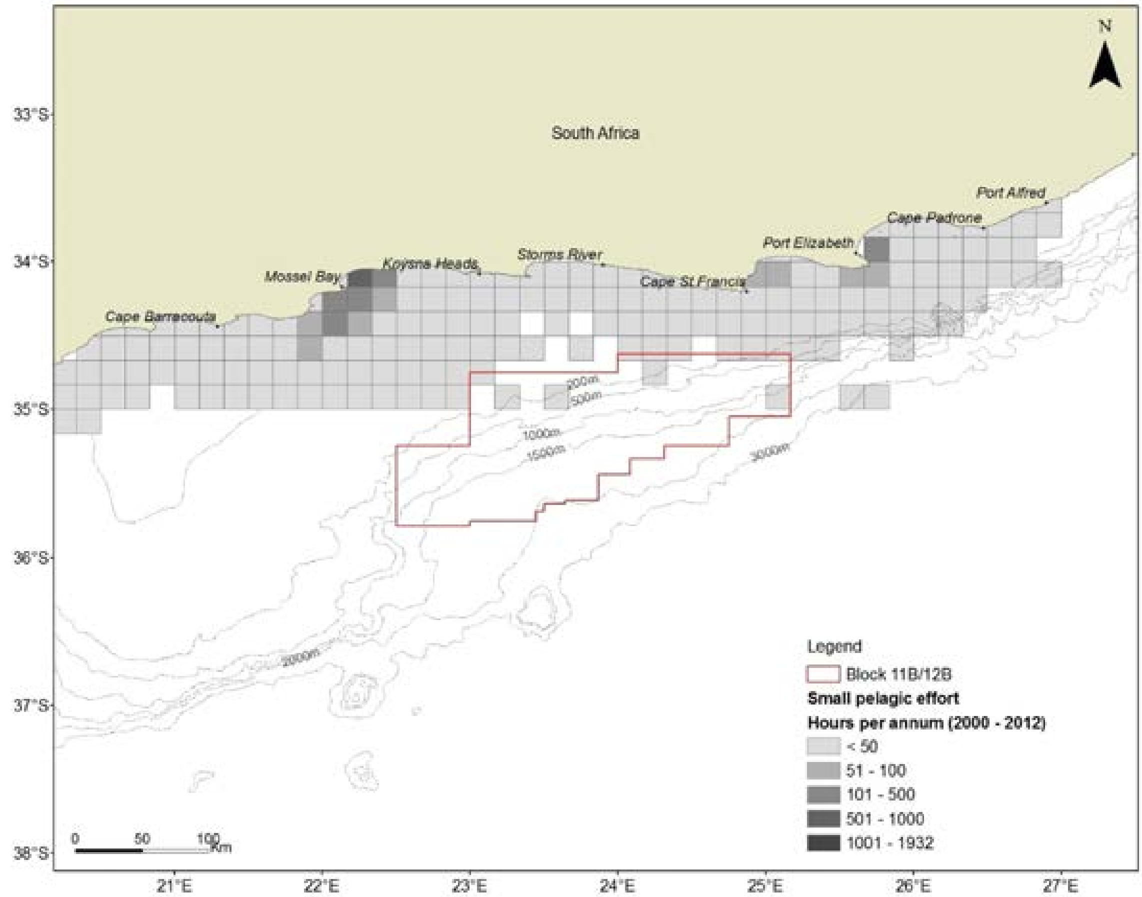

Figure 5.6: Spatial distribution of effort reported by the South African small pelagic purse-seine fishery (2000 – 2012) in relation to Block 11B/12B.

Table 5.6: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the small pelagic purse-seine sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Small Pelagic Purse-Seine						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High
With mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High

5.8 South Coast Rock Lobster

Figure 5.7 shows the spatial distribution of effort expended by the South Coast rock lobster fishing fleet. Targeted stock occurs on the continental shelf of the South Coast between depths of 50 m and 200 m. Two areas are commercially viable to fish, the first of which is approximately 200 km offshore on the Agulhas Bank and the second is within 50 km of the shoreline between Mossel Bay and East London. The fishery is restricted by the Agulhas Current from operating far offshore, but would be expected to operate within the licence area, inshore of the 300 m isobath. Over the period 2008 to 2012, an annual average of 328 000 traps were set and 42.5 tons (tail weight) were landed from Block 11B/12B. This is approximately 17.4 % and 15.7 % of the total effort expended and catch landed by the sector, respectively. The impact of the proposed bathymetry survey and seabed sediment sampling operations on the South Coast rock lobster fishery is expected to be of high intensity and of overall low significance due to the local extent and short-term duration of the proposed impact. The degree of confidence in the assessment is high (see **Table 5.7**).

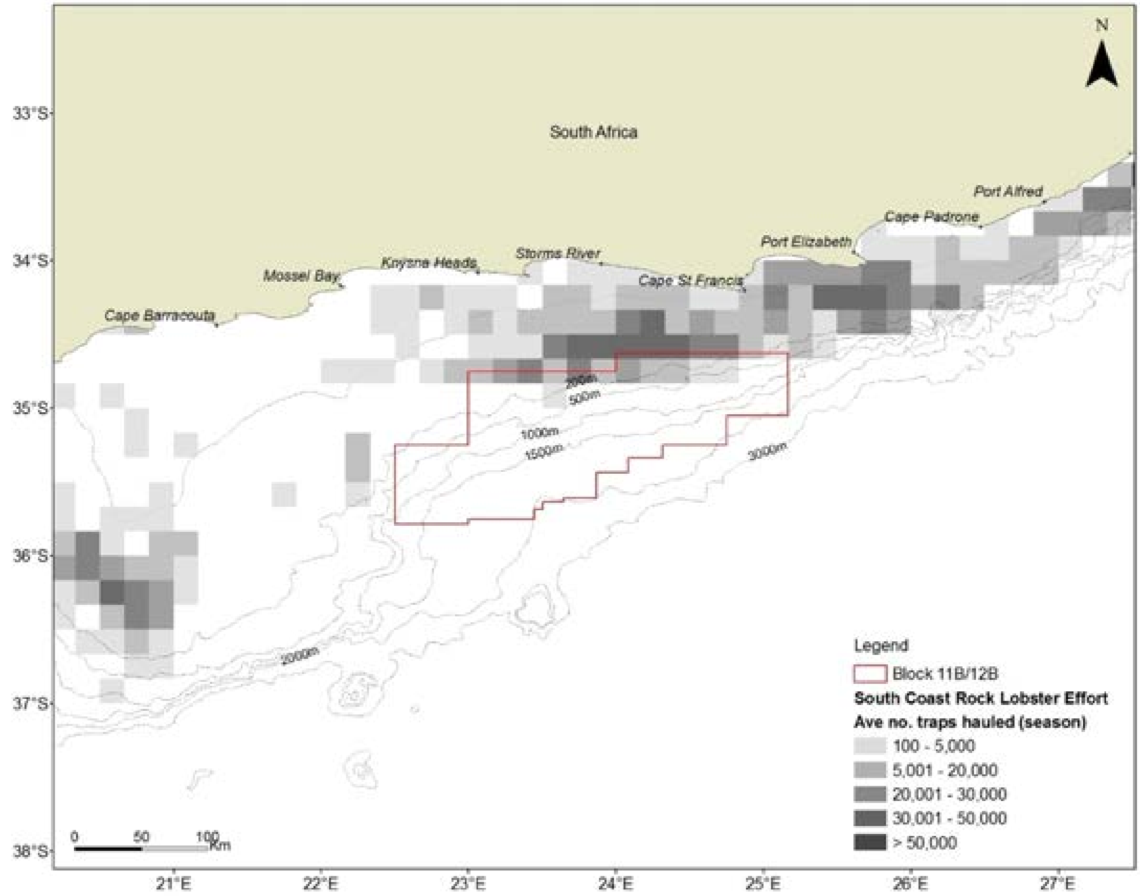

Figure 5.7: Spatial distribution of effort expended by the South Coast rock lobster fishery in relation to Block 11B/12B. Effort is presented as the number of traps hauled per year (2000 – 2012) on a 10' x 10' grid resolution.

Table 5.7: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the South Coast rock lobster sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
South Coast Rock Lobster						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	High	Low	Probable	High
With mitigation	Local	Short-term	High	Low	Probable	High

5.9 Squid Jig

Figure 5.8 shows the distribution of fishing effort expended by the jig fishery targeting squid. Effort is mostly concentrated in the bay areas around Cape St Francis and Port Elizabeth. Fishing activity takes place in the north-eastern portion of Licence Block 11B/12B. Effort within the licence area averaged 300 fishing events per year with a catch of 110.6 tons per annum between 2006 and 2012. This amounts to 1.1 % of the total national effort and 1.5 % of the total catch landed by the fishery. The impact of the proposed bathymetry survey and seabed sediment sampling operations on the squid fishery is expected to be of low intensity and of overall very low significance due to the local extent and short-term duration of the proposed impact. The degree of confidence in the assessment is high (see **Table 5.8**).

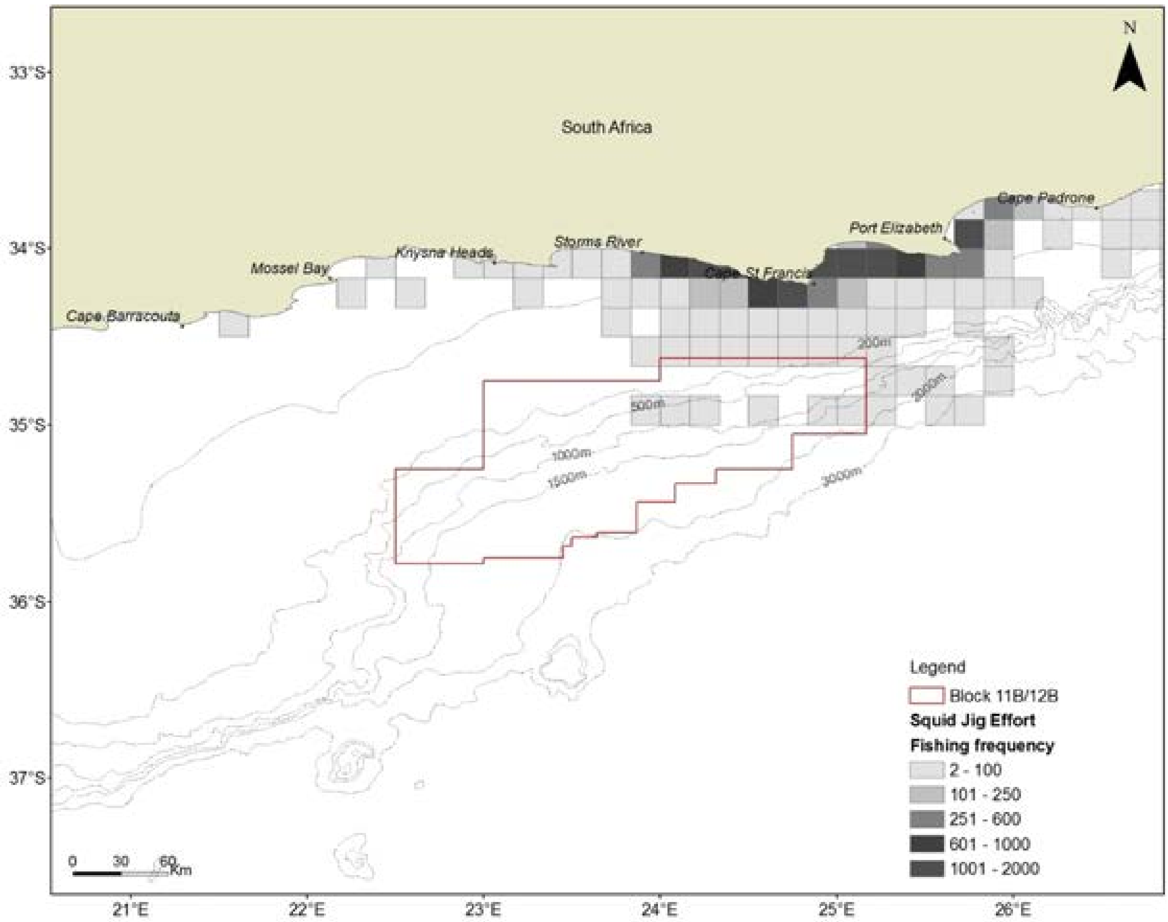

Figure 5.8: Spatial distribution of effort expended by the squid jig fishery (2006 – 2012) in relation to Block 11B/12B.

Table 5.8: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the squid jig sector both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Squid jig						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Low	Very Low	Probable	High
With mitigation	Local	Short-term	Low	Very Low	Probable	High

5.10 Fisheries Research

Figure 5.9 indicates the spatial distribution of demersal research trawls undertaken by the Department of Agriculture, Forestry and Fisheries (DAFF) off the South Coast of South Africa. Records between 2001 and 2012 indicate an average of 10 trawls per year undertaken within the licence area up to a maximum depth of 1 500 m (see **Figure 5.9**). These trawls took place either during the period from April to May or from September to October. The potential impact of the proposed bathymetry survey and seabed sampling operations on the demersal research survey is considered to be of low intensity and of overall very low significance due to the short-term duration and local extent of the impact. The intensity of the impact could be lowered through liaison with DAFF to determine any overlaps so that minor adjustments can be made to the sampling programme if necessary. The degree of confidence in the assessment is high (see **Table 5.9**). It is recommended that the Department of Agriculture, Forestry and Fisheries (DAFF) are notified of the research survey programmes prior to the commencement of the programme. The relevant contacts at DAFF currently responsible for the planning of the demersal and acoustic cruises are Deon Durholtz (DeonD@daff.gov.za) and Janet Coetzee (JanetC@nda.agric.za) respectively.

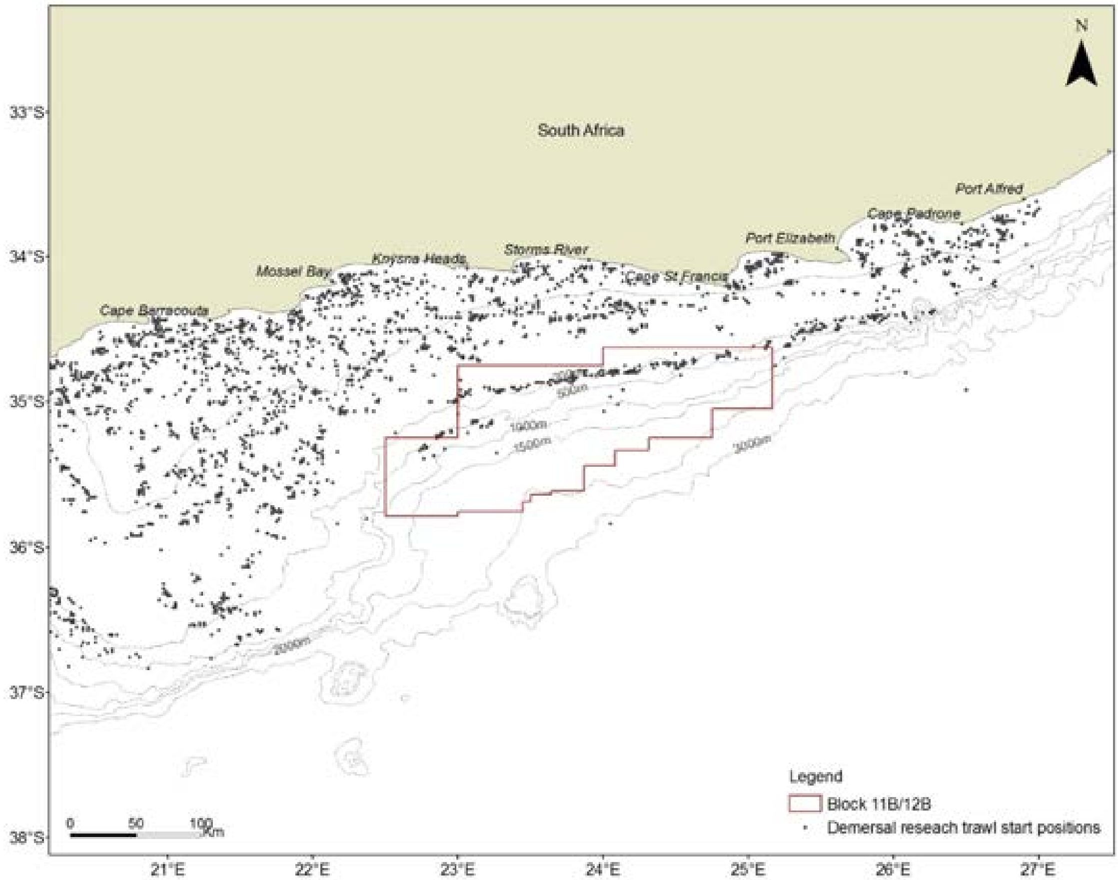

Figure 5.9: Spatial distribution of research trawls undertaken by DAFF between 1985 and 2013 in relation to Block 11B/12B.

Table 5.9: Summary table showing the impact ratings of the proposed bathymetry survey and seabed sediment sampling in Block 11B/12B on the demersal research surveys both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Research: Demersal Biomass and Acoustic Biomass Surveys						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Low	Very Low	Probable	High
With mitigation	Local	Short-term	Low	Very Low	Probable	High

6. CONCLUSIONS AND RECOMMENDATIONS

A summary of the impact ratings of the proposed bathymetry survey and seabed sampling programme on the South African South Coast fishing industry is presented in **Table 6.1** below.

Table 6.1: Summary table showing impact ratings of the proposed bathymetry survey and seabed sampling activities and oil spill scenarios on the South Coast fishing industry both with and without mitigation measures in place.

	Extent	Duration	Intensity	Significance	Probability	Confidence
Demersal Trawl						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Medium	Very Low	Probable	High
With mitigation	Local	Short-term	Medium	Very Low	Probable	High
Mid-Water Trawl						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	High	Low	Probable	High
With mitigation	Local	Short-term	High	Low	Probable	High
Demersal Long-Line (Hake-Directed)						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	High	Low	Probable	High
With mitigation	Local	Short-term	High	Low	Probable	High
Demersal Long-Line (Shark-Directed)						
Impact of 500 m exclusion zone around survey and sampling vessel						
No Impact						
Large Pelagic Long-Line						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Medium	Very Low	Probable	High
With mitigation	Local	Short-term	Medium	Very Low	Probable	High
Tuna Pole						
Impact of 500 m exclusion zone around survey and sampling vessel						
No Impact						
Traditional Line-Fish						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High
With mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High
Small Pelagic Purse-Seine						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High
With mitigation	Local	Short-term	Very Low	Insignificant	Improbable	High
South Coast Rock Lobster						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	High	Low	Probable	High
With mitigation	Local	Short-term	High	Low	Probable	High
Squid jig						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Low	Very Low	Probable	High
With mitigation	Local	Short-term	Low	Very Low	Probable	High
Research: Demersal Biomass and Acoustic Biomass Surveys						
Impact of 500 m exclusion zone around survey and sampling vessel						
Without mitigation	Local	Short-term	Low	Very Low	Probable	High
With mitigation	Local	Short-term	Low	Very Low	Probable	High

6.1 Communications strategy

The following measures are proposed with a view to reducing potential negative effects between the proposed bathymetry survey/seabed sampling operations and the fishing industry. The implementation of a communication strategy with the fishing industry is considered essential and would not reduce the overall significance of the impact of the impact on fisheries sectors:

- Fishing industry bodies and other key affected parties should be informed of the proposed activities and requirements with regards to the safe operational limits around the survey vessel prior to the commencement of the project. The following industrial bodies and affected parties include:
    - Department of Agriculture, Forestry and Fisheries (DAFF);
    - Department of Environmental Affairs (DEA);
    - South African Tuna Association (SATA);
    - South African Tuna Long-Line Association (SATLA);
    - Fresh Tuna Exporters Association (FTEA);
    - South African Hake Long-Line Association (SAHLA);
    - South African Deep-Sea Trawling Industry Association (SADSTIA);
    - South East Coast Inshore Fishing Association (SECIFA);
    - South African Fishing Industry Associations (South African Pelagic Fishing Industry Association, South African Pelagic Fish Processors Association and South African Inshore Fishing Industry Association);
    - South African Midwater Trawling Association;
    - South Coast Rock Lobster Association;
    - South African Commercial Linefish Association;
    - South African Squid Management Industrial Association (SASMIA);
    - Transnet National Ports Authority;
    - South African Maritime Safety Authority (SAMSA); and
    - South African Navy Hydrographic Office.
- The required safety zones around the research vessel should be communicated via the issuing of Daily Navigational Warnings for the duration of the survey through the South African Naval Hydrographic Office;
- Any fishing vessel targets at a radar range of 12 nautical miles from the survey vessel should be called via radio and informed of the navigational safety requirements; and
- Affected parties should be notified through fishing industry bodies when the programme is complete.

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8. APPENDIX 1: CONVENTION FOR ASSIGNING SIGNIFICANCE RATINGS TO IMPACTS

Specialists will consider seven rating scales when assessing potential impacts. These include:

1 Extent;
2 Duration;
3 Intensity;
4 Significance;
5 Status of impact;
6 Probability; and
7 Degree of confidence.

In assigning significance ratings to potential impacts before and after mitigation specialists are instructed to follow the approach presented below:

1. The core criteria for determining significance ratings are "extent" (Section 1), "duration" (Section 2) and "intensity" (Section 3). The preliminary significance ratings for combinations of these three criteria are given in Section 4.

2. The status of an impact is used to describe whether the impact would have a negative, positive or zero effect of the surrounding environment. An impact may therefore be negative, positive (or referred to as a benefit) or neutral.

3. Describe the impact in terms of the probability of the impact occurring (Section 5) and the degree of confidence in the impact predictions, based on the availability of information and specialist knowledge (Section 6).

4. Additional criteria to be considered, which could "increase" the significance rating if deemed justified by the specialist, with motivation, are the following:

   - Permanent / irreversible impacts (as distinct from long-term, reversible impacts);
   - Potentially substantial cumulative effects; and
   - High level of risk or uncertainty, with potentially substantial negative consequences.

5. Additional criteria to be considered, which could "decrease" the significance rating if deemed justified by the specialist, with motivation, are the following:

   - Improbable impact, where confidence level in prediction is high.

6. When assigning significance ratings to impacts *after mitigation*, the specialist needs to:

   - First, consider probable changes in intensity, extent and duration of the impact after mitigation, assuming effective implementation of mitigation measures, leading to a revised significance rating; and
   - Then moderate the significance rating after taking into account the likelihood of proposed mitigation measures being effectively implemented. Consider:
     - Any potentially significant risks or uncertainties associated with the effectiveness of mitigation measures;
     - The technical and financial ability of the proponent to implement the measure; and
     - The commitment of the proponent to implementing the measure, or guarantee over time that the measures would be implemented.

The significance ratings are based on largely objective criteria and inform decision-making at a project level as opposed to a local community level. In some instances, therefore, whilst the significance rating of potential impacts might be "low" or "very low", the importance of these impacts to local communities or individuals might be extremely high. The importance which I&APs attach to impacts must be taken into consideration, and recommendations should be made as to ways of avoiding or minimising these negative impacts through project design, selection of appropriate alternatives and / or management.

The relationship between the significance ratings after mitigation and decision-making can be broadly defined as follows:

Significance rating	Effect on decision-making
Very Low; Low	Will not have an influence on the decision to proceed with the proposed project, provided that recommended measures to mitigate negative impacts are implemented.
Medium	Should influence the decision to proceed with the proposed project, provided that recommended measures to mitigate negative impacts are implemented.
High; Very High	Would strongly influence the decision to proceed with the proposed project.

EXTENT

"Extent" defines the physical extent or spatial scale of the impact.

Rating	Description
LOCAL	Extending only as far as the activity, limited to the site and its immediate surroundings. Specialist studies to specify extent.
REGIONAL	South Coast
NATIONAL	South Africa
INTERNATIONAL	

DURATION

"Duration" gives an indication of how long the impact would occur.

Rating	Description
SHORT TERM	0 - 5 years
MEDIUM TERM	6 - 15 years
LONG TERM	Where the impact would cease after the operational life of the activity, either because of natural processes or by human intervention.
PERMANENT	Where mitigation either by natural processes or by human intervention would not occur in such a way or in such time span that the impact can be considered transient.

INTENSITY

"Intensity" establishes whether the impact would be destructive or benign.

Rating	Description
ZERO TO VERY LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
LOW	Where the impact affects the environment in such a way that natural, cultural and social functions and processes continue, albeit in a slightly modified way.
MEDIUM	Where the affected environment is altered, but natural, cultural and social functions and processes continue, albeit in a modified way.
HIGH	Where natural, cultural and social functions or processes are altered to the extent that it will temporarily or permanently cease.

SIGNIFICANCE

"Significance" attempts to evaluate the importance of a particular impact, and in doing so incorporates the above three scales (i.e. extent, duration and intensity).

Rating	Description
VERY HIGH	Impacts could be EITHER: of *high intensity* at a *regional level* and endure in the *long term*; OR of *high intensity* at a *national level* in the *medium term*; OR of *medium intensity* at a *national level* in the *long term.*

Rating	Description
HIGH	Impacts could be EITHER: of *high intensity* at a *regional level* and endure in the *medium term*; OR of *high intensity* at a *national level* in the *short term*; OR of *medium intensity* at a *national level* in the *medium term;* OR of *low intensity* at a *national level* in the *long term*; OR of *high intensity* at a *local level* in the *long term*; OR of *medium intensity* at a *regional level* in the *long term.*
MEDIUM	Impacts could be EITHER: of *high intensity* at a *local level* and endure in the *medium term*; OR of *medium intensity* at a *regional level* in the *medium term*; OR of *high intensity* at a *regional level* in the *short term*; OR of *medium intensity* at a *national level* in the *short term*; OR of *medium intensity* at a *local level* in the *long term*; OR of *low intensity* at a *national level* in the *medium term;* OR of *low intensity* at a *regional level* in the *long term.*
LOW	Impacts could be EITHER of *low intensity* at a *regional level* and endure in the *medium term*; OR of *low intensity* at a *national level* in the *short term*; OR of *high intensity* at a *local level* and endure in the *short term*; OR of *medium intensity* at a *regional level* in the *short term*; OR of *low intensity* at a *local level* in the *long term*; OR of *medium intensity* at a *local level* and endure in the *medium term.*
VERY LOW	Impacts could be EITHER of *low intensity* at a *local level* and endure in the *medium term*; OR of *low intensity* at a *regional level* and endure in the *short term*; OR of *low to medium intensity* at a *local level* and endure in the *short term.*
INSIGNIFICANT	Impacts with: *Zero to very low* intensity with any combination of extent and duration.
UNKNOWN	In certain cases it may not be possible to determine the significance of an impact.

STATUS OF IMPACT

The status of an impact is used to describe whether the impact would have a negative, positive or zero effect on the affected environment. An impact may therefore be negative, positive (or referred to as a benefit) or neutral.

PROBABILITY

“Probability” describes the likelihood of the impact occurring.

Rating	Description
IMPROBABLE	Where the possibility of the impact to materialise is very low either because of design or historic experience.
PROBABLE	Where there is a distinct possibility that the impact would occur.
HIGHLY PROBABLE	Where it is most likely that the impact would occur.
DEFINITE	Where the impact would occur regardless of any prevention measures.

DEGREE OF CONFIDENCE

This indicates the degree of confidence in the impact predictions, based on the availability of information and specialist knowledge.

Rating	Description
HIGH	Greater than 70% sure of impact prediction.
MEDIUM	Between 35% and 70% sure of impact prediction.
LOW	Less than 35% sure of impact prediction.