substrates). Juveniles are mostly found inshore, and are reported to migrate into deeper water as they age.

Monkfish : Monkfish (*Lophius spp*) have an extensive distribution along the West Coast with the larger fish found in deeper water (up to 600 m). They are a bycatch of the hake-directed trawl fishery but are being increasingly targeted by the trawl fleets.

The inshore stretch of the West Coast east of Cape Point is inhabited by a large number of reef and soft-bottom fishes. The spawning areas of many are unknown, although estuaries, the surf zone and shallow protected embayments are important recruitment areas for some of them.

4.1.3.5 Birds

Seabirds inhabiting the Benguela system comprise migrant pelagic species (which do not breed in the system) and resident species (which breed within the system) (Duffy, Siegfried and Jackson 1987).

(a) Migrant pelagic species

Table 4.4 lists the densities and population estimates of nineteen migrant species, and shows that the majority of these are most abundant offshore of the shelf break in winter. The coast between Cape Point and the Orange River mouth is estimated to support 33% and 38% of the overall winter and summer populations of migrant seabirds found between Cape Point and the northern Namibian border respectively. The Blackbrowed Albatross, Yellownosed Albatross and Southern Giant Petrel are listed in the South African Red Data Book as "Near threatened".

Table 4.4: Densities (individuals/km^2) and population estimates (thousands) of migrant seabirds in the southern Benguela (Orange River mouth to Cape Point). Modified from Crawford *et al.* (1991).

Common name	Scientific name	Density		Population estimate	
		Inshore	Offshore	Winter	Summer
Shy albatross	*Diomedea cauta*	0.20	0.80	46.0	23.0
Black browed albatross	*Diomedea melanorphrys*	0.05	1.80	83.5	20.9
Yellownosed albatross	*Thalassarche chlororhynchos*	0.02	0.20	10.0	7.0
Southern Giant Petrel	*Macronectes giganteus*	0.02	0.05	3.3	1.6
Pintando petrel	*Daption capensis*	0.02	1.80	82.0	-
Great winged petrel	*Pterodroma macroptera*	0.08	0.20	1.3	13.0
Soft plumaged petrel	*Pterodroma mollis*	0.00	0.15	6.8	0.7
Prion spp.	*Pachyptila spp.*	4.00	7.00	515.0	-
Whitechinned petrel	*Procellaria aequinoctialis*	1.80	2.80	216.0	97.2
Cory's shearwater	*Calonectris diomedia*	0.01	1.00	-	50.0
Great shearwater	*Puffinus gravis*	0.80	1.20	28.2	28.2
Sooty shearwater	*Puffinus griseus*	2.00	2.40	208.0	104.0
Storm petrel spp.	*Hydrobates or Oceanites sp.*	0.80	1.40	103.0	72.1
Shua spp.	*Stercorarius spp.*	0.20	0.02	0.5	10.9
Subantarctic skua	*Catharacta antartica*	0.02	0.10	5.5	1.7
Sabine's gull	*Larus sabini*	0.05	0.01	-	3.0
Sandwich tern	*Sterna sandvicensis*	*	*	0.8	15.0
Common/arctic tern	*Sterna spp.*	*	*	10.0	200.0
Antartic tern	*Syerna vittata*	*	*	12.0	-

(b) Resident breeding species

The availability of breeding sites is extremely important determinant in the distribution of resident seabirds. Although breeding areas are distributed along the whole coast, islands are especially important, particularly those between Dyer Island and Lambert's Bay. Thirteen resident species breed along the West Coast (Table 4.5).

Cape Gannets breed only on islands and Lamberts Bay and Malgas Island are important colonies. Cape cormorants breed mainly on offshore islands (Dyer, Jutten, Seal, Dassen, Bird (Lamberts Bay), Malgas and Vondeling Islands), although the large colonies may associate with estuaries; lagoons or sewerage works. The bank and crowned cormorants are endemic to the Benguela system and both breed between Namibia and just to the west of Cape Agulhas. Although white-breasted cormorants occur between northern Namibia and the eastern Cape in southern Africa, the majority of the population is concentrated between Swakopmund and Cape Agulhas.

Table 4.5: Estimated number of non-chick populations of different species of breeding seabirds between Cape Point and the Orange River mouth during the early or mid 1980s. Information is summarised from different sources in Crawford *et al.* (1991).

Common name	*Scientific name*	Numbers
African penguin	*Spheniscus demersus*	17 000
Cape gannet	*Morus capensis*	78 000
Cape cormorant	*Phalacrocorax carbo*	339 000
Great cormorant	*Phalacrocorax capensis*	2 000
Bank cormorant	*Phalacrocorax neglectus*	4 000
Crowned cormorant	*Phalacrocorax coronatus*	4 000
White pelican	*Pelecanus onocrotalus*	1 000
Kelp gull	*Larus dominicanus*	20 000
Greyheaded gull	*Larus cirrocephalus*	<1 000
Hartlaub's gull	*Larus hartlaubii*	29 000
Caspian tern	*Sterna caspia*	<1 000
Swift tern	*Sterna bergii*	14 000
Damara tern	*Sterna balaenarum*	<1000

Most of these resident species feed on fish (with the exception of the gulls, which scavenge, and feed on molluscs and crustaceans). Feeding strategies can be grouped into surface plunging (gannets and terns), pursuit diving (cormorants and penguins) and scavenging and surface seizing (gulls and pelicans). All these species feed relatively close inshore, although gannets and kelp gulls may feed some distance offshore.

African penguin colonies (*Spheniscus demersus*) occur at 27 localities around the coast of South Africa and Namibia, being found throughout the West Coast region (Figure 4.11). The species forages at sea with most birds being found within 20 km of their colonies. African penguin distribution at sea is consistent with that of the pelagic shoaling fish, which generally occur within the 200 m isobath.

The African Penguin, Cape Gannet and Bank Cormorant are listed in the South African Red Data Book as "Vulnerable". The Caspian Term, Cape Cormorant and Crowned Cormorant are listed in the South African Red Data Book as ""Near-threatened". The Damara Tern is listed as "Endangered". The decline in the African Penguin population is ascribed primarily to the removal of the accumulated guano from the islands during the Nineteenth Century. Penguins used to breed in burrows in the guano and are now forced to nest in the open, thereby being exposed to much greater predation and thermal stress.

The Cape Gannet, a plunge diver feeding on epipelagic fish, is thought to have declined as a result of the collapse of the pilchard, whereas the Cape Cormorant was able to shift its diet to pelagic goby. Furthermore, the recent increase in the seal population has resulted in seals competing for island space to the detriment of the breeding success of both gannets and penguins.

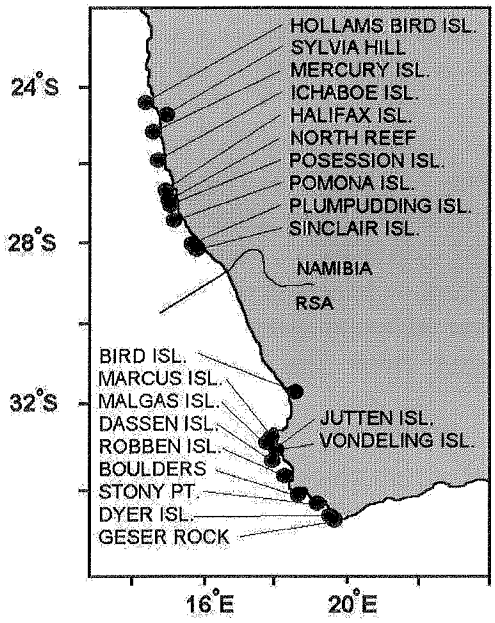

Figure 4.11: The distribution of breeding colonies of African penguins on the South African West Coast.

4.1.3.6 Marine mammals

The marine mammal fauna of the West Coast comprises between 28 and 31 species of cetaceans (whales and dolphins) and one seal species, the Cape fur seal (*Arctocephalus pusillus*).

The range of cetacean species reflects largely taxonomic uncertainty at species and sub-species level, rather than uncertainty of occurrence or distribution patterns (which are summarised in Table 4.6 and Figure 4.12, after Findlay *et al.* 1992).

Table 4.6: Whale and dolphin species found along the West Coast (After Best 1967; Findlay *et al.* 1992).

Common name	Scientific name	Distribution
Migratory cetaceans		
Southern right whale	*Eubalaena australis*	Extreme inshore
Humpback whale	*Megaptera novaeangliae*	Transit inshore
Minke whale	*Balaenoptera acutorostrata*	Cosmopolitan
Blue whale	*Balaenoptera musculus*	Transit offshore
Sei whale	*Balaenoptera borealis*	Transit offshore
Fin whale	*Balaenoptera physalus*	Transit offshore
Bryde's whale	*Balaenoptera brydei*	Seasonal offshore
Possibly migratory cetaceans		
Pygmy right whale	*Caperea marginata*	Possible extreme inshore
Strap-toothed whale	*Mesoplodon layardii*	Offshore
Arnoux's beaked whale	*Berardius arnuxii*	Recorded from Cape Columbine eastwards
Cetaceans resident in pelagic waters offshore of the continental shelf		
Killer whale	*Orcinus orca*	Cosmopolitan
Southern right-whale dolphin	*Lissodelphis peronii*	Localised distribution (see text)
Risso's dolphin	*Grampus griseus*	Offshore and shelf edge

Common name	Scientific name	Distribution
False killer whale	*Pseudorca crassidens*	Offshore
Pygmy killer whale	*Feresa attenuata*	Offshore
Long-finned pilot whale	*Globicephala melas*	Offshore
Sperm whale	*Physeter macrocephalus*	Offshore
Pygmy sperm whale	*Kogia breviceps*	Offshore
Dwarf sperm whale	*Kogia sima*	Offshore east of Cape Columbine
Cuvier's beaked whale	*Ziphius cavirostris*	Offshore
Gray's beaked whale	*Mesoplodon grayi*	Offshore
Blainville's beaked whale	*Mesoplodon densirostris*	Offshore east of Cape Columbine
True's beaked whale	*Mesoplodon mirus*	Offshore east of Cape Columbine
Common dolphin	*Delphinus species*	Offshore
Bottlenose dolphin	*Tursiops truncatus*	Offshore
Cetaceans resident over the shelf		
Heaviside's dolphin	*Cephalorhynchus heavisidii*	Extreme Inshore north of Cape Point
Dusky dolphin	*Lagenorhynchus obscurus*	Extreme Inshore west of False Bay
Longbeaked common dolphin	*Delphinus delphis*	Continental shelf south of Lamberts Bay
Southern right-whale dolphin	*Lissodelphis peronii*	Localised distribution (see text)
Killer whale	*Orcinus orca*	Cosmopolitan
Bryde's whale	*Balaenoptera brydei?*	Continental shelf south of Lamberts Bay

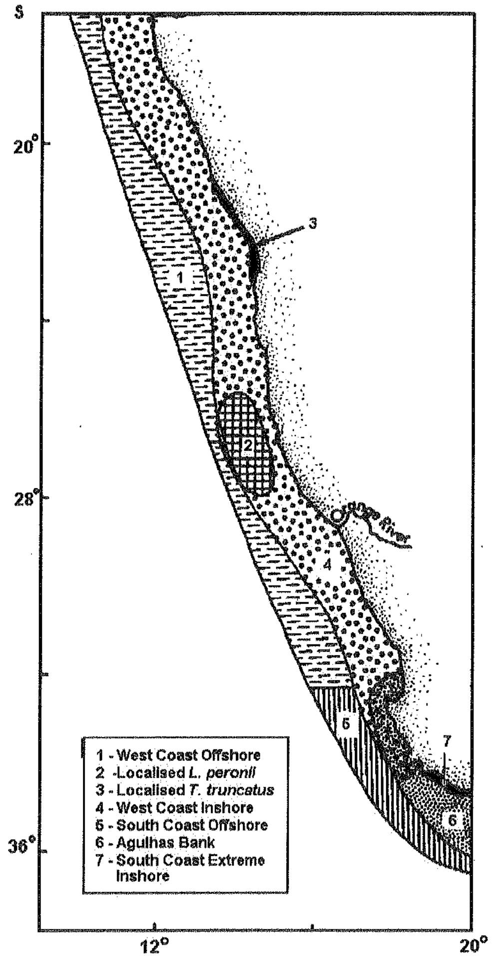

Figure 4.12: Distribution of resident cetaceans within the West Coast region (From Findlay *et al.* 1992).

(a) Cetaceans

The majority of migratory cetaceans in South African waters are large baleen whales. Populations of large baleen whales in South African waters were decimated by historical whaling and are presently a fraction of their pre-exploitation densities.

Blue (*Balaenoptera musculus*), fin (*B. physalus*), sei (*B. borealis*), minke (*B acutorostrata / B bonaerensis*) and humpback whales (*Megaptera novaeangliae*) make winter migrations through the West Coast region *en route* from Antarctic summer feeding grounds to winter breeding grounds (Table 4.7). While blue, fin and sei whales migrate off or along the continental shelf edge (and are thus distributed in deeper waters), humpback whales migrate over the continental shelf and along the coast.

Two types of Bryde's whales are recorded from South African waters (Best 1977) - a smaller neritic form (of which the taxonomic status is uncertain) and a larger pelagic form described as *Balaenoptera brydei*. While the smaller neritic form is resident (particularly over the Agulhas Bank) the larger offshore form is migratory along the African west coast, being found off Saldanha Bay in winter. Southern Right whales (*Eubalaena australis*) migrate into the extreme near-shore region of the West Coast (mainly south of Lamberts Bay) between June and January each year (animals may be sighted as early as April and as late as February).

Table 4.7 Synopsis of published migration trends of rorqual whales within Cape coast whaling Grounds.

Species	Source	Cape*
Blue	Olsen (1914)	U (Present from May to June)
	Harmer (1931)	U/B
Fin	Olsen (1914)	Throughout season
	Harmer (1931)	B (May-July, October-November
	Best (1967)	U
Sei	Harmer (1931)	B
	Matthews (1938)	B (May, August-October)
	Bannister and Cambell (1965)	U
	Best (1967)	B (May, June-September)
Humpback	Olsen (1914)	B
	Harmer (1931)	Touch coast north of Cape Town

* U = unimodal trend, B = bimodal trend. Months of maxima are presented in brackets.

This population is increasing at approximately 7% per annum, yet is still probably around 10% of the pre-exploitation abundance (Best 2000).

Killer whales are found year round in the waters of the West Coast, although the seasonality of sightings within the whaling grounds (in September and October) suggests that some killer whales are highly migratory. The pygmy right whale (*Caperea marginata*) shows a strong summer seasonality in water depths of less than 50 m along the coast between Algoa Bay in the east and Walvis Bay, Namibia. Arnoux's beaked whale (*Berardius arnuxii*) has been recorded along the West Coasts to the east of 18° E during summer. Layard's beaked whale (*Mesoplodon layardii*) is distributed throughout the West Coast pelagic waters in summer and early autumn.

Four faunal provinces define the distribution of resident cetaceans within the West Coast region (after Findlay *et al.* 1992; Peddemors 1999) (Figure 4.12). These include:

- *Agulhas Bank to Lamberts Bay (inshore)* - Two species, the long beaked common dolphin (*Delphinus delphis*) and the resident smaller inshore Bryde's whale appear to be strongly associated with the Agulhas Bank region and the West Coast inshore region as far north as Lambert's Bay. Although these species will be found elsewhere in southern African waters (a common dolphin species is recorded from strandings on the Namibian coast) the majority of records are from the Agulhas Bank region.

- *West Coast Inshore* – Two species, the Heaviside's dolphin (*Cephalorhynchus heavisidii)* and the dusky dolphin (*Lagenorhynchus obscurus)* are resident over the shelf with Heaviside's dolphin found inshore to the north of Cape Point and dusky dolphin found inshore west of False Bay.
- *West Coast Offshore* - Two pelagic species of cetacean, True's beaked whale (*Mesoplodon mirus*) and the dwarf sperm whale (*Kogia sima*) appear to be limited to offshore region between Cape Columbine and the Eastern Cape. A further two species, Gray's beaked whale (*Mesoplodon grayii*) and the long finned pilot whale (*Globicephala melas*) appear to be limited to the offshore region between Namibia and the Eastern Cape. These species are found in deep waters elsewhere in the world and apart from the pilot whale are recorded only as strandings on the South African coast. A localised distribution of southern right-whale dolphins is recorded off the coast of southern Namibia and may range into the northern waters of the South African West Coast region.
- *Cosmopolitan* - Killer whales (*Orcinus orca*) and minke whales (possibly *Balaenoptera acutorostrata*) are found in both continental shelf and offshore waters of the West Coast. Cuvier's beaked whale (*Ziphius cavirostris*), pygmy sperm whales (*Kogia breviceps*), False killer whales (*Pseudorca crassidens*), pygmy killer whales (*Feresa attenuata*), Risso's dolphins (*Grampus griseus*), and sperm whales (*Physeter macrocephalus*) are found throughout the offshore waters of the West Coast. A second common dolphin species occurs in the offshore region of the West Coast.

(b) Seals

The Cape fur seal (*Arctocephalus pusillus pusillus*) congregates in seven breeding and five non-breeding colonies along the West Coast (Figure 4.13). Five other seal species may occasionally be found as vagrants along the West Coast.

Cape fur seals were heavily exploited up until the late nineteenth century in South African waters. After 1 900 seals were harvested from certain colonies almost every year up until 1983, during which an estimated 2.5 million pups and bulls were harvested. The population has shown a rapid increase since the 1940s and in 1984 the population was thought to be some 1.1 million animals and increasing at about 3.7% per annum (1971 to 1984). In 1990, an estimated two million seals were distributed around the southern African coast (Butterworth and Wickens 1990), although numbers fluctuate. The increase is presumed to reflect the population's natural response to past overexploitation.

Kleinsee has the largest of the breeding colonies (population estimates ranging from 35 450 in 1972 to 74 620 in 1989) in South Africa, and produces the largest number of pups in the country (Table 4.8).

Cape fur seals appear to forage over the continental shelf to a maximum depth of approximately 200 m. However, two females from the Kleinsee colony tagged with depth recorders showed over 70% of dives to depths of less than 50 m (Kooyman and Gentry 1986).

Table 4.8: The contribution of seal pups (% of total born in South Africa) born at each of the breeding seal colonies depicted in Figure 4.13. Modified from Wickens (1994).

Breeding colony	% Seal pups
Kleinsee	65.2
Elephant Rock	2.9
Paternoster Rock	1
Jacobs Reef	3.4
Robbesteen	1.1
Seal Island	11.8
Geyser Rock	11.2
Quoin Rock	1.8

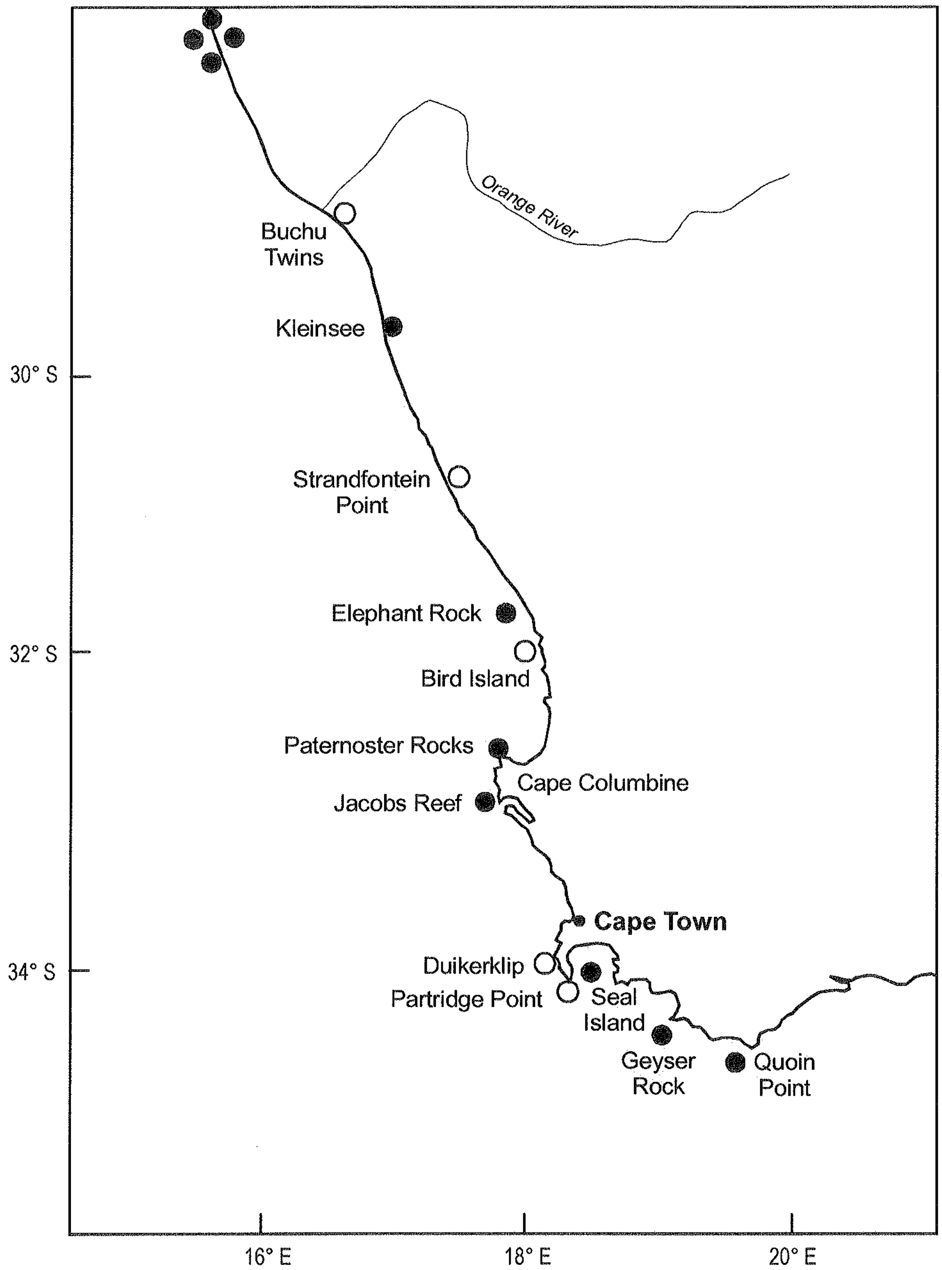

Figure 4.13: The location of breeding (●) and non-breeding (O) colonies of Cape fur seals along the West Coast (after Wickens *et al.* 1992).

4.1.4 HUMAN UTILISATION

4.1.4.1 Fisheries and other harvesting

The South African fishing industry consists of approximately 20 commercial sectors operating within the 200 nautical mile Exclusive Economic Zone (EEZ)[1]. The western coastal shelf is a highly productive upwelling ecosystem (Benguela current) and supports a number of fisheries.

The largest and most economically valuable of these are the demersal trawl and long-line fisheries, targeting the cape hakes *Merluccius paradoxus* and *M. capensis*, and the pelagic purse-seine fishery targeting pilchard (*Sardinops sagax*), anchovy (*Engraulis encrasicolus*) and round herring (*Etrumeus whitheadii*).

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

Secondary commercial species in the hake-directed fisheries include an assemblage of demersal (bottom-dwelling) fish of which monk fish (*Lophius vomerinus*) and snoek (*Thyrsites atun*) are the most important commercial species. Other fisheries active on the West Coast are the pelagic long-line fishery for tunas and swordfish and the tuna pole and traditional linefish sectors. West Coast rock lobster (*Jasus lalandi*) is an important trap fishery exploited close to the shoreline (waters shallower than 100 m) including the intertidal zone and kelp beds off the West Coast. The main commercial sectors operating in the vicinity of the study area are discussed below:

(a) Demersal longline

The target species of this fishery is hake (*M. capensis* and *M. paradoxus*) with a small non-targeted commercial by-catch species that includes kingklip. The hake long-line fishery is a relatively new fishery in South Africa. Currently 64 vessels are active within this sector and operate from all major fishing harbours. The fishery is directed both in inshore and offshore areas. Inshore hake long-lining is restricted in the number of hooks that may be set per line (a maximum of 5 000 hooks per day), while offshore long-lining may only take place in water deeper than 110 m and is restricted to a maximum of 20 000 hooks per line.

Bottom-set long-line gear is robust and comprises two lines as well as dropper lines with subsurface floats attached (see Figure 4.14). Lines are set over mostly rocky bottoms adjacent to demersal trawling grounds. Demersal long-lines are anchored at either end and marked by an array of large buoys. Boats "stand by" their gear and are also restricted in their movements when hauling and shooting. Hooks are spaced about one fathom apart and lines can be up to 20 km long.

On the West Coast, demersal long-liners operate in well-defined offshore areas extending along the shelf break from Port Nolloth to Cape Agulhas where they may be found working between the 200 and 750 m bathycontours. Although the predominant areas of operation lie well to the west of the study area, isolated fishing events have been recorded in the study area (see Figure 4.15).

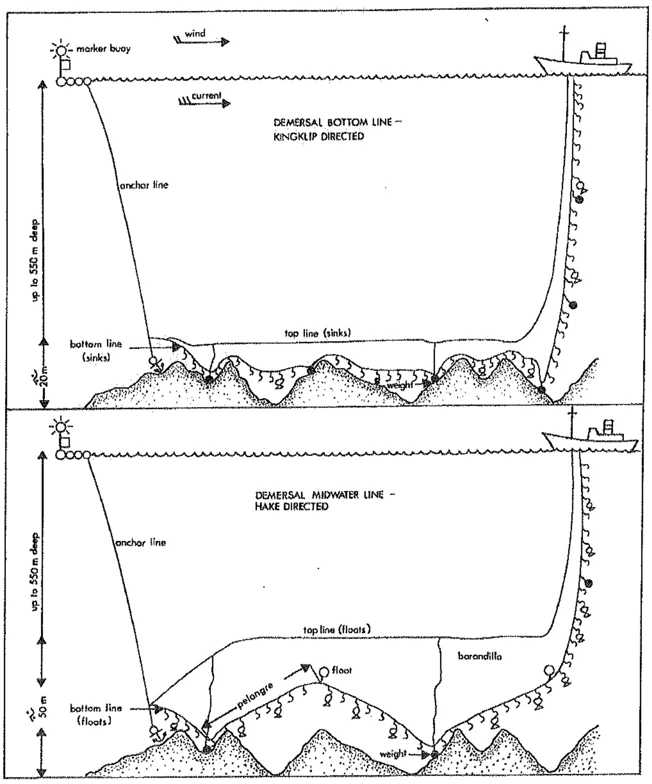

Figure 4.14: Diagram illustrating typical fishing gear deployed when fishing for demersal (bottom dwelling) species (gear for hake on bottom and kingklip on topi).

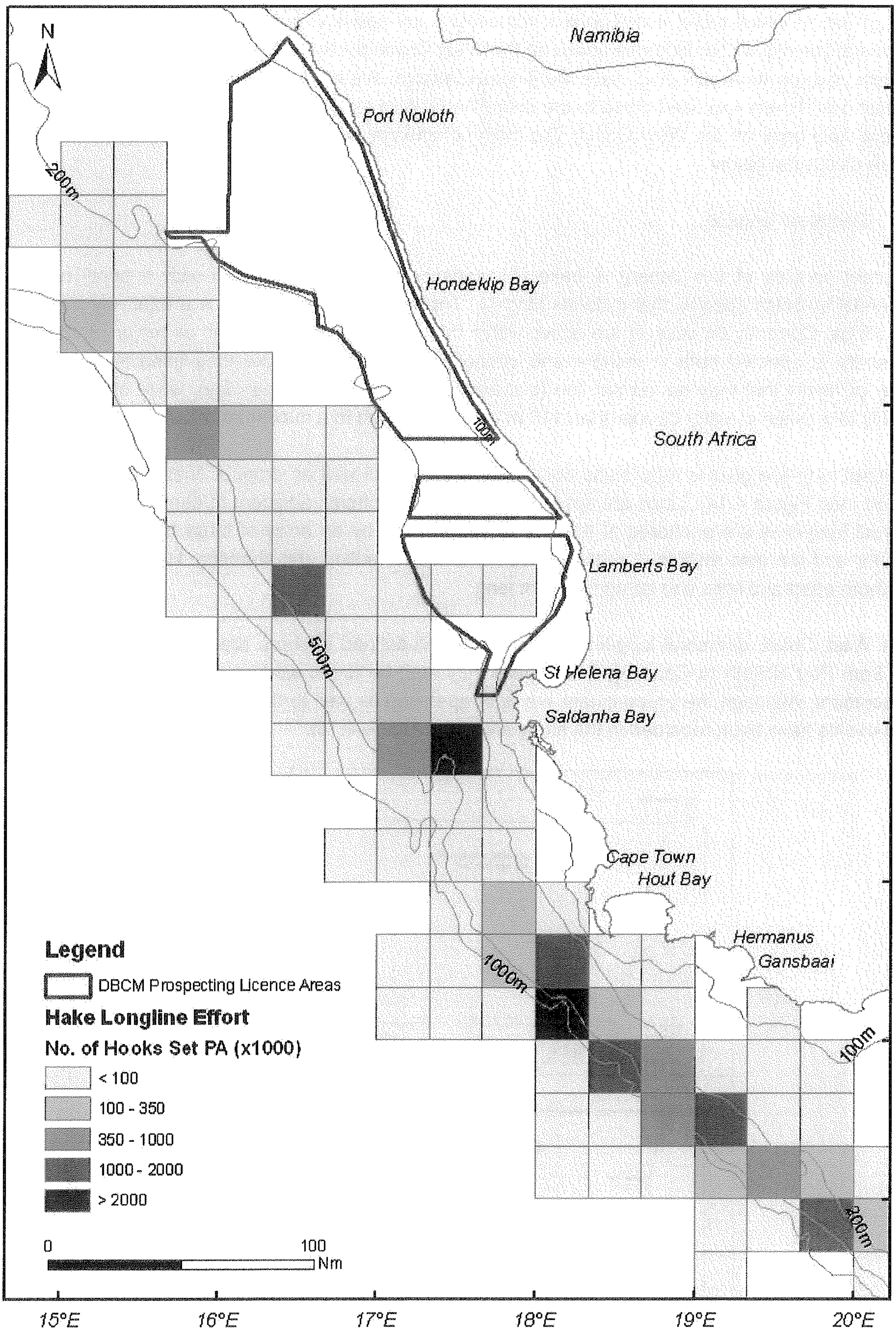

Figure 4.15: Distribution of effort within the demersal hake-directed long-line fishery (Capfish, 2011).

(d) *Rock lobster trap fishery*

This fishery targets the West Coast rock lobster (*Jasus lalandii*) along the West Coast. The fishery is divided into an inshore and offshore fishery which makes use of hoop-nets and traps, respectively. The inshore fishery operates from the coast up to one nautical mile offshore (predominantly waters shallower than 15 m), while the offshore trap fishery operates up to a depth of 100 m. Catch and effort figures are recorded according to management zone and prospecting licence areas coincide with zones A, B and C. Effort is seasonal (1 November to 20 June) and small boats operate from the shore and coastal harbours.

Activity within Zone A (extending from the Namibia / RSA border down to 31° 6' S is currently solely restricted to the hoop-net fishery and therefore is unlikely to coincide with the prospecting license area north of this point (see Figures 4.16 and 4.17).

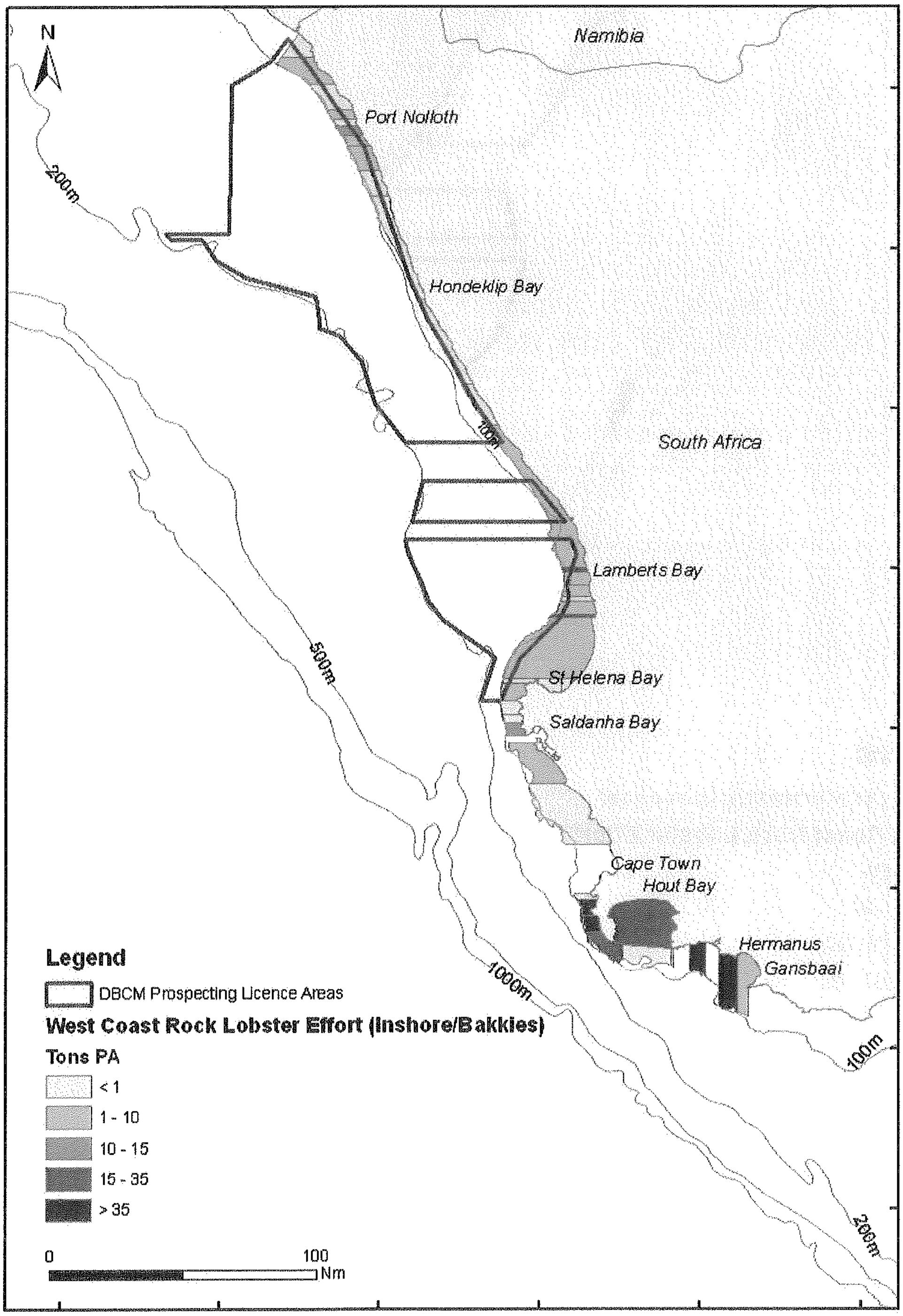

Figure 4.16: Distribution of catch within the inshore West Coast rock lobster fishery (Capfish, 2011).

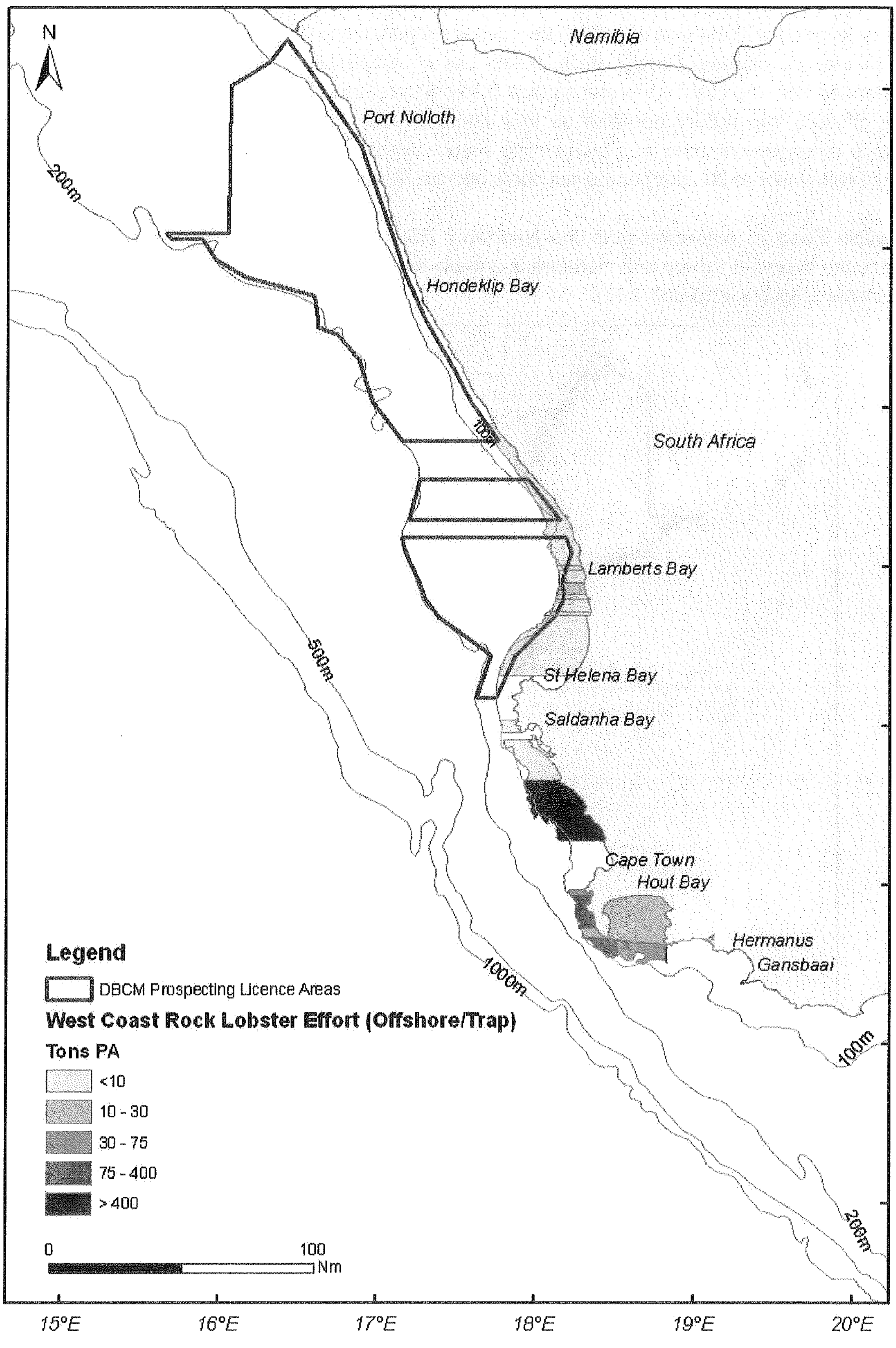

Figure 4.17: Distribution of catch within the offshore West Coast rock lobster fishery (Capfish, 2011).

(e) Pelagic purse-seine

The small pelagic purse-seine fishery targets pilchard (*Sardinops sagax*) and anchovy (*Engraulis encrasicolus*) and is the second most economically valuable commercial fishery in South Africa. Approximately 100 vessels operate within this fishery, predominantly along the West Coast from the harbours St Helena, Saldanha, Cape Town and Hout Bay. As the targeted species are coastal, fishing effort is not displaced more than 50 nm from harbours. Typically a vessel will fish overnight and return the following day to the harbour to offload their catch. A schematic diagram of the typical gear configuration of a pelagic purse-seiner is shown in Figure 4.18. The southern half of the prospecting area overlaps with the pelagic fishery. The concentration of pelagic purse-seine effort is the greatest inshore of the 100 m isobath, with effort increasing significantly towards the shallower portions of the study area (see Figure 4.19).

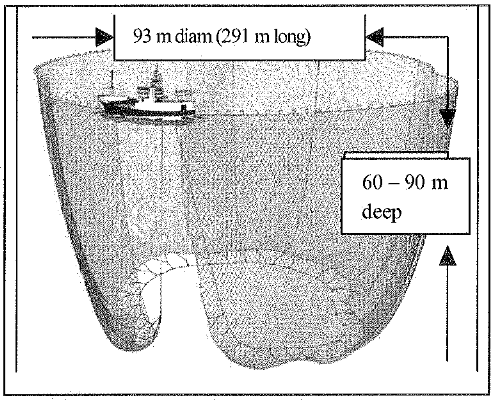

Figure 4.18: Typical gear configuration of a pelagic purse-seiner.

(f) Pelagic long-lining (large pelagic species)

The pelagic tuna long-line fishery is another fishery that occurs extensively off the West Coast of South Africa. The fishery targets tunas (including bluefin *Thunnus thynnus*, yellowfin *T. albacares*, bigeye *T. obsesus* and longfin or albacore *T. alalunga*), shark and broadbill swordfish (*Xiphias gladius*). Long-lining is carried out both by local and foreign vessels that fish around the entire South African coast. Approximately 30 vessels (17 tuna-directed and 14 swordfish-directed) are presently operational within this sector with activity predominantly centred along the continental shelf break and offshore. Occasional fishing events have been recorded closer inshore in the vicinity of the prospecting licence areas. Figure 4.20 shows the typical gear used and Figure 4.21 shows the annual distribution of long-line tuna effort on the West Coast.

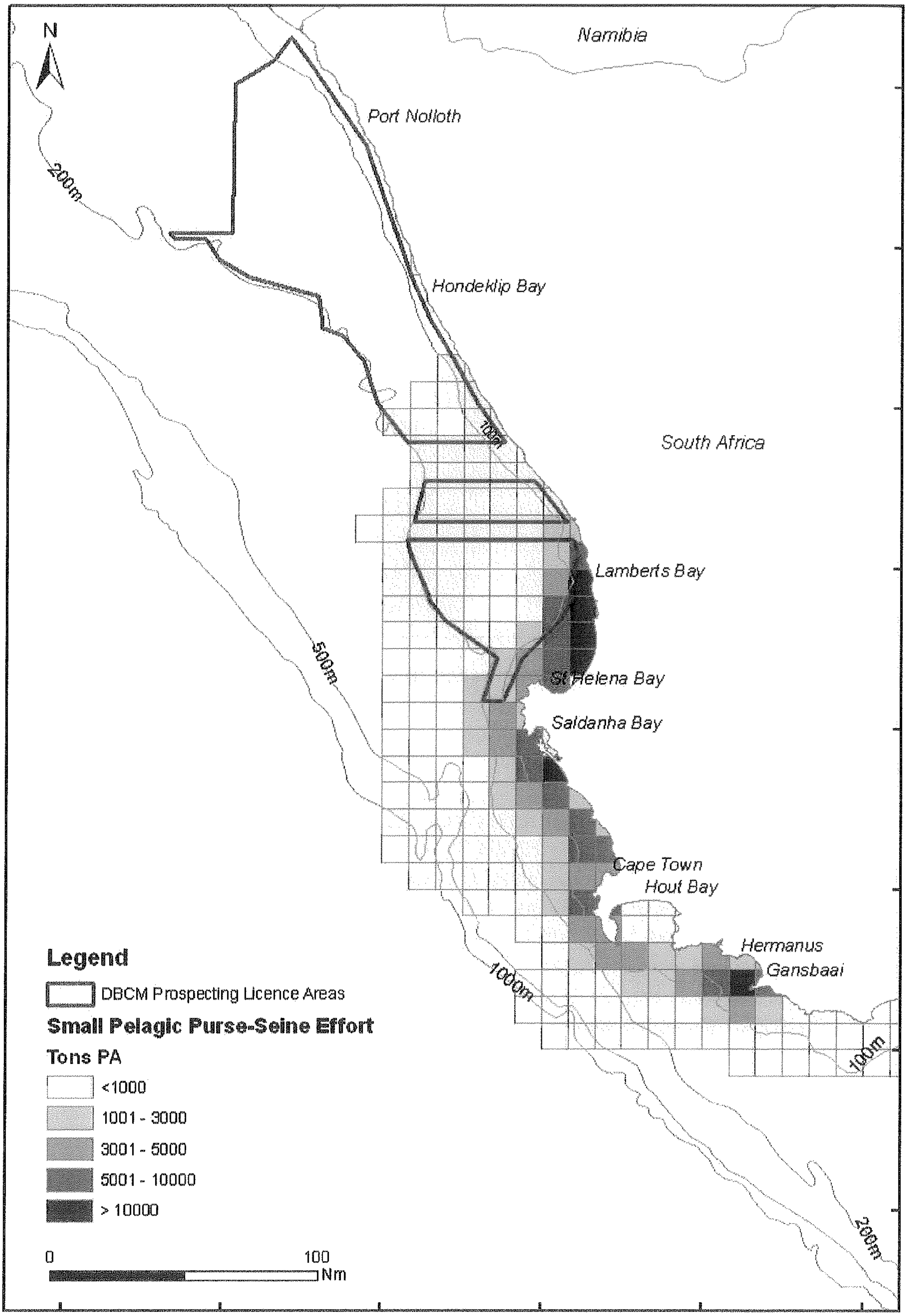

Figure 4.19: Distribution of catch within the pelagic purse-seine fishery (Capfish, 2011).

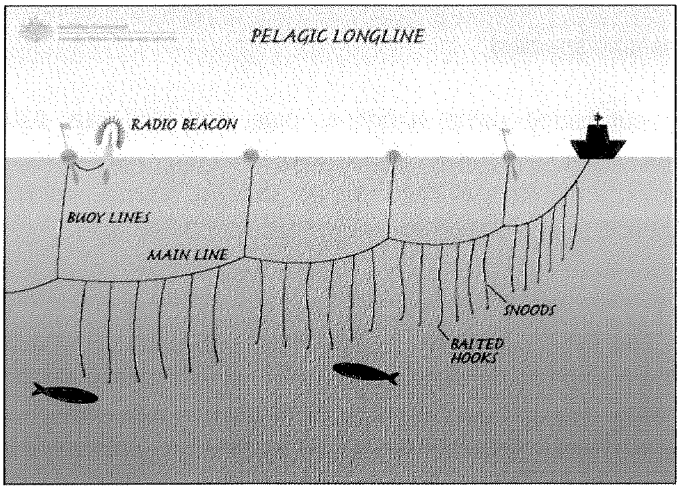

Figure 4.20: Typical pelagic longline gear configuration (tuna, swordfish and shark) (Capfish, 2011).

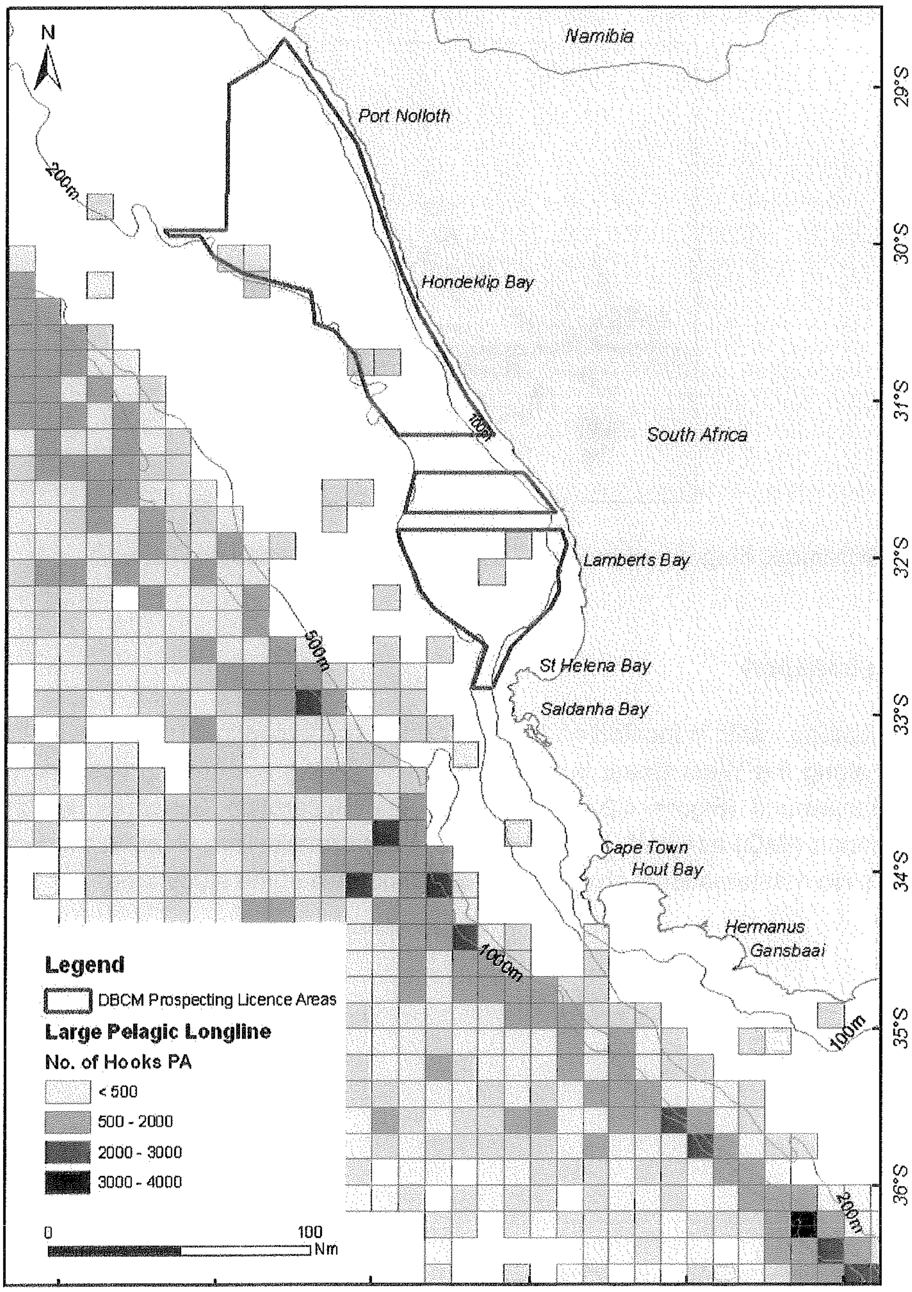

Figure 4.21: Distribution of catch within the pelagic long-line fishery (Capfish, 2011).

(e) Tuna Pole (large pelagic species)

The tuna pole fishery is conducted using handline, pole, rod and real fishing gear. Tuna species, predominantly yellowfin tuna (*Thunnus albacares*) and albacore (*Thunnus alalunga*), are targeted while other species caught include snoek, angel fish, oil fish, escolar, dorado, wahoo, yellowtail and squid. The fishery operates on the West Coast and sees an average annual catch of 3 500 tons.

The tuna pole fleet comprises up to 200 vessels (and a maximum of 3 600 crew) operating predominantly from Cape Town harbour. The fishery is seasonal with most of the effort conducted from October to early May. Vessels work from the 100 m bathycontour offshore and particularly along the shelf break at 500 m. These vessels drift whilst attracting and catching shoals of pelagic tunas. Once a shoal of tuna is located, water is sprayed alongside the vessel to attract fish to the surface, at which point they are caught with baited hooks and gaffed on board. There is little commercial information available for the tuna pole fishery off the west coast, however, some tuna pole fishing is likely to occur within the study area around the 100 m bathycontour. There is currently no map available showing the specific extent of this fishery.

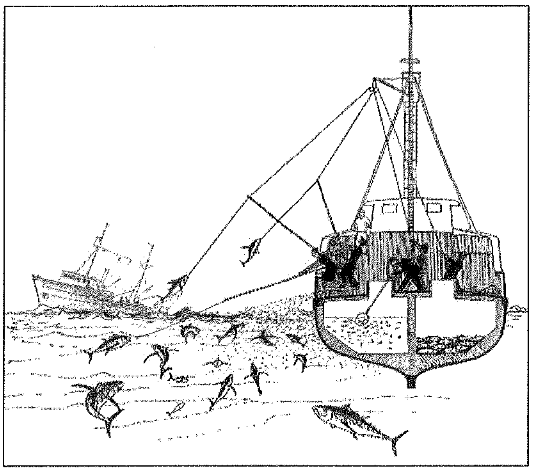

Figure 4.22: Schematic diagram of pole and line operation (www.fao.org/fishery).

4.1.4.2 Shipping transport

The majority of shipping traffic is located on the outer edge of the continental shelf with traffic inshore of the continental shelf along the West Coast largely comprising fishing and mining vessels, especially between Kleinsee and Oranjemund (Figure 4.23). Charted Traffic Separation Schemes, which are International Maritime Organisation (IMO) adapted, and other relevant information are listed in the South African Annual Notice to Mariners No 5. International shipping routes fall outside of the study area.

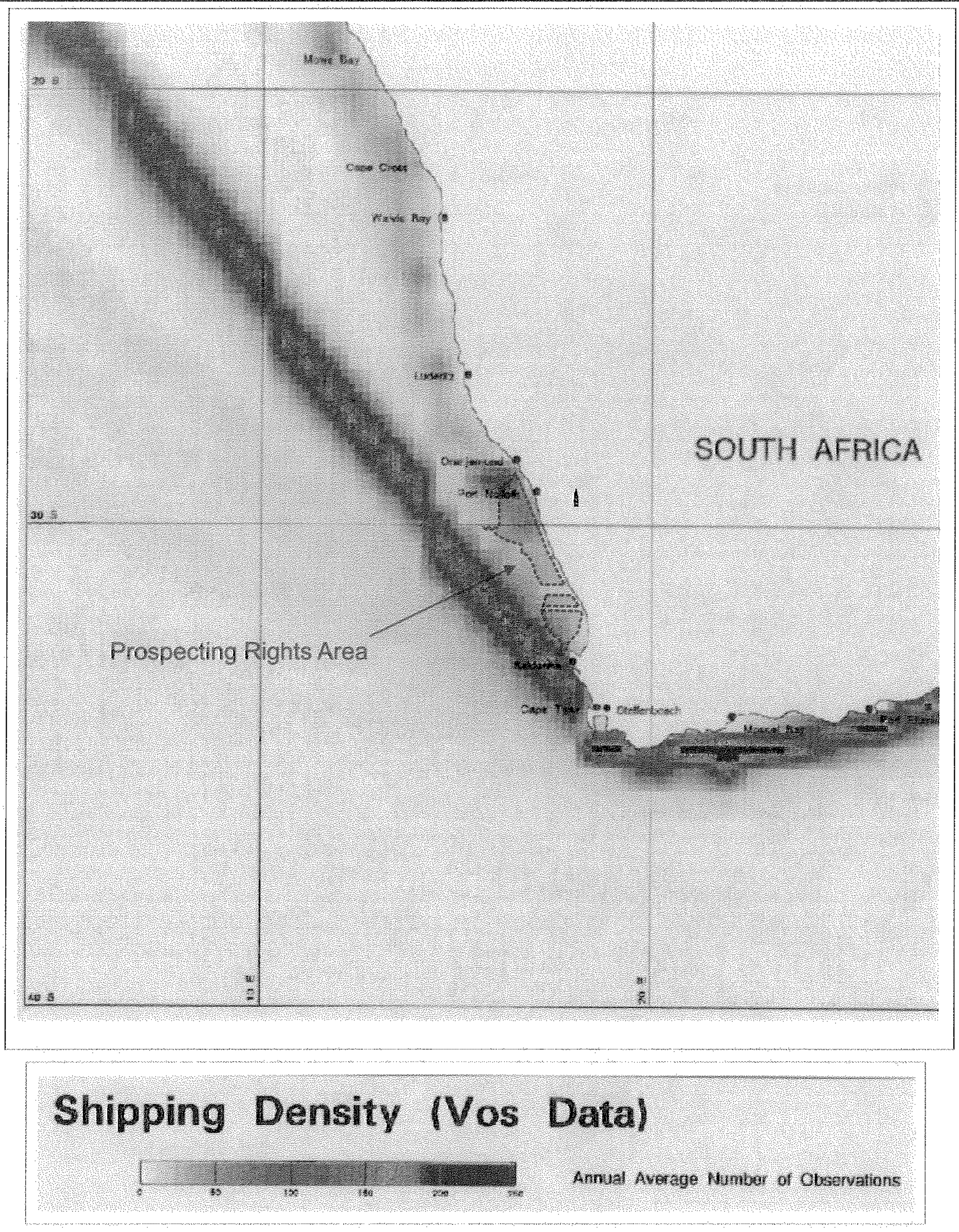

Figure 4.23: Primary and secondary shipping routes off the west coast of South Africa (from Lane & Carter 1999).

4.1.4.3 Oil and Gas exploration and production

(a) Exploration

Oil and gas exploration in the South African offshore commenced with seismic surveys in 1967. Since then numerous 2D and 3D seismic surveys have been undertaken on the west coast. Since 1976, approximately 40 wells have been drilled.

Prior to 1983, reliable technology was not available for removing wellheads from the seafloor. Since then, however, on completion of drilling operations, the well casing has been severed 3 m below the sea floor and removed from the seafloor together with the permanent and temporary guide bases. Of the approximately 40 wells drilled, 35 wellheads remain on the seafloor (Figure 4.24). Location and wellhead details are available from the Hydrographic office of the South African Navy (which issues the details to the public in a notice to mariners) or directly from PASA.

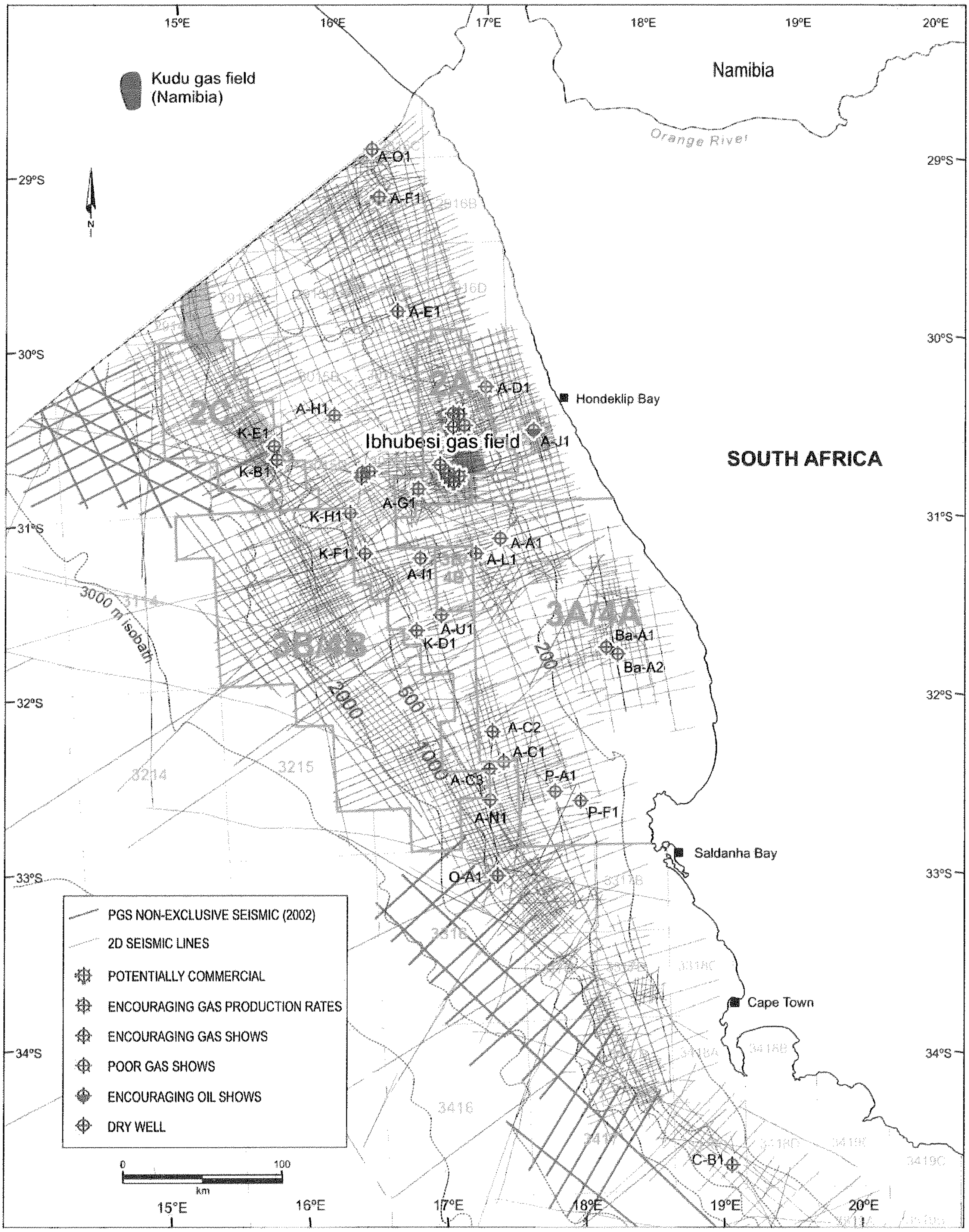

Figure 4.24: Location of wellheads and seismic lines off the West Coast of South Africa (after PASA).

Exploration for oil and gas off the West Coast of South Africa is currently undertaken in the following blocks (see Figure 4.25):

- Block 1: PetroSA - 4 to 6 exploration wells proposed (current project);
- Block 2A: Forest Exploration International (South Africa) – 99 production wells proposed;
- Block 2B: Thombo Petroleum;
- Block 2C: Forest Exploration International (South Africa) – 3 exploration wells proposed;
- Block 3A/4A: BHP Billiton – 1 exploration well proposed; and
- Block 3B/4B: BHP Billiton.

(b) Development and production

There is no current development or production from the South African west coast offshore. The Ibhubesi Gas Field (Block 2A) and Kudu Gas Field (which lies several hundred kilometres to the north-west off the coast of southern Namibia) have been identified for development.

4.1.4.4 Diamond prospecting and mining

The Department of Minerals and Energy have demarcated marine diamond concession areas on the west coast of South Africa, which are referred to as the South African Sea Areas (SASA). The concessions are divided into four categories from the coat seaward (see Figure 26 and Table 4.9):

- 'a' concessions which begin at 31.49 m seaward of the Low Water Mark and end 1 km from the High water mark;
- 'b' concessions which start 1 km from the high water mark and end 5 km from the high water mark;
- 'c' concessions which begin at 5 km from the high water mark to a water depth of 200 m below sea level; and
- 'd' concessions which occur between 200 m and 500 m water depths.

The majority of concessions worked at present are those closer inshore, where diamonds are mined either by divers who employ suction pipes to deliver gravel to land or vessels for sorting, or by land-based mining equipment that extracts the gravel from areas where the sea has been pushed back by temporary dykes.

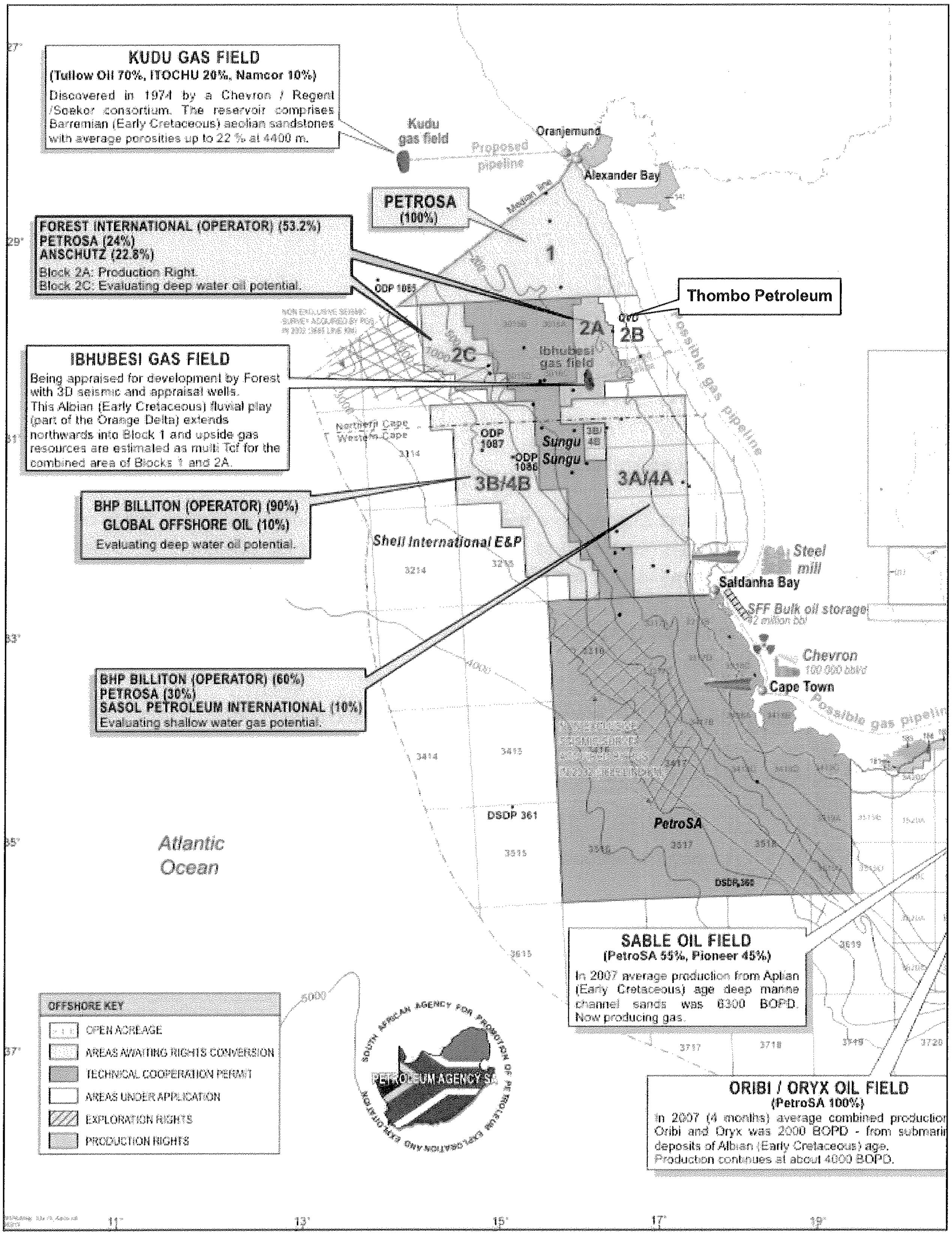

Figure 4.25: Petroleum exploration blocks off the west coast of South Africa (after PASA, 2011).

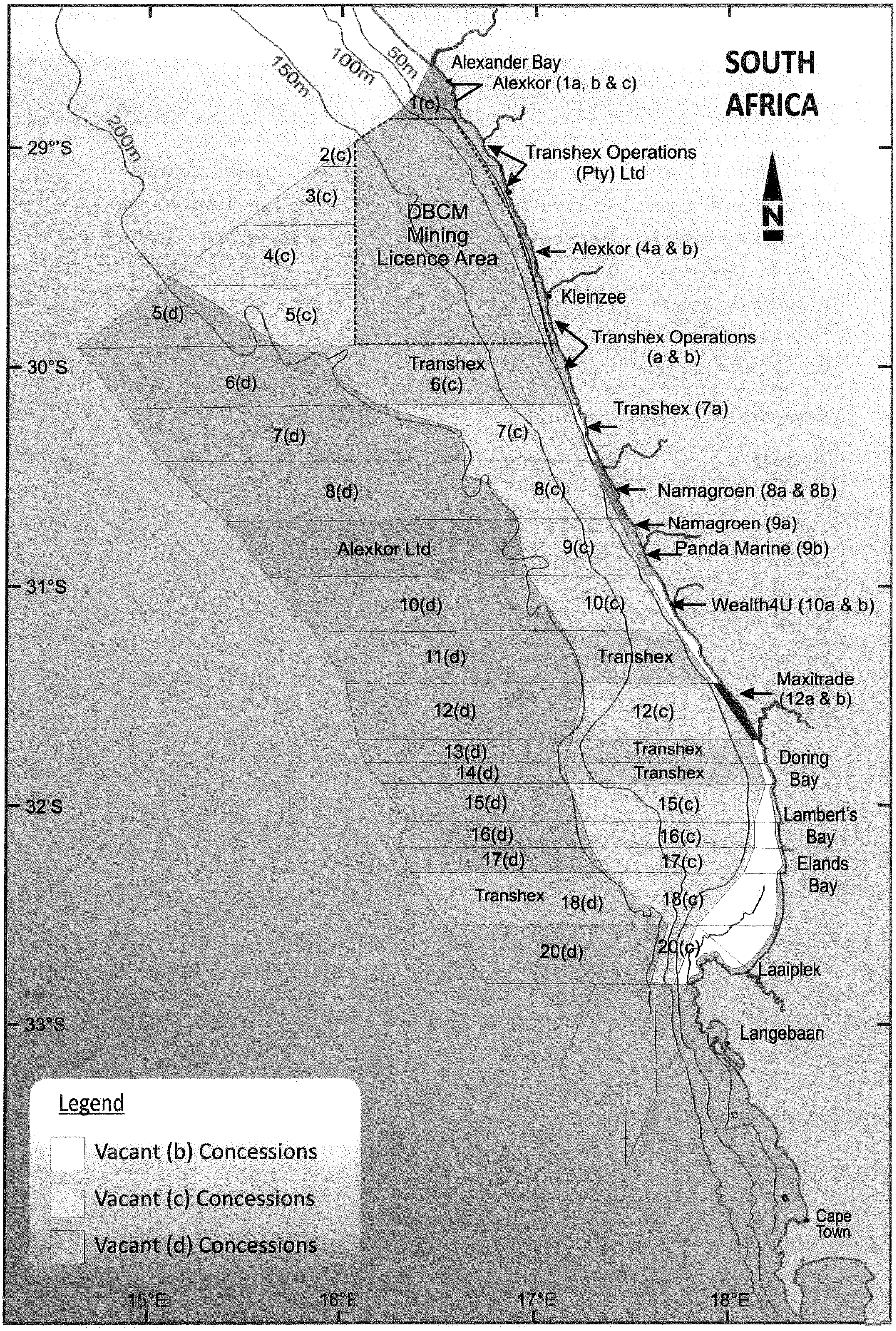

Figure 4.26: South African Diamond Rights Holders off the west coast (compiled by De Beers, 2011).

Table 4.9: Offshore diamond concession holders in and around the proposed study area.

Block	Concession holder			
	a	b	c	d
1	Alexkor Diamond Mines	Alexkor Diamond Mines	Alexkor Diamond Mines	-
2	Alexkor Diamond Mines	Trans Hex Operations	De Beers Consolidated Mines	-
3	Alexkor Diamond Mines	Trans Hex Operations	De Beers Consolidated Mines	-
4	Alexkor Diamond Mines	Alexkor Diamond Mines	De Beers Consolidated Mines	-
5	Trans Hex Operations	Trans Hex Operations	De Beers Consolidated Mines	Vacant
6	Trans Hex Operations	Trans Hex Operations	Trans Hex Operations	Vacant
7	Trans Hex Operations	De Beers Consolidated Mines	Vacant	Vacant
8	Namagroen Prospecting	Namagroen Prospecting	Vacant	Vacant
9	Namagroen Prospecting	Panda marine	Vacant	Alexkor Diamond Mines
10	Wealth 4 U	Wealth 4 U	Vacant	Vacant
11	Vacant	Vacant	Transhex	Vacant
12	Maxitrade	Maxitrade	Vacant	Vacant
13	Vacant	Vacant	Transhex	Poseidon Marine
14	Vacant	Vacant	Transhex	Vacant
15	Vacant	Vacant	Vacant	Vacant
16	Vacant	Vacant	Vacant	Vacant
17	Vacant	Vacant	Vacant	Vacant
18	Vacant	Vacant	Vacant	Transhex
20	Vacant	Vacant	Vacant	Vacant

4.1.4.5 Prospecting and mining of other minerals

(a) Heavy minerals

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

(b) Glauconite and phosphate

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

Prospecting permits for glauconite and phosphorite have been applied for three offshore areas between Cape Town and Saldanha. The co-ordinates of such prospecting is shown in Figure 4.27 and Table 4.10. On technical and economic grounds glauconite and phosphate are not being considered for mining at present.

(c) Manganese nodules in ultra-deep water

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

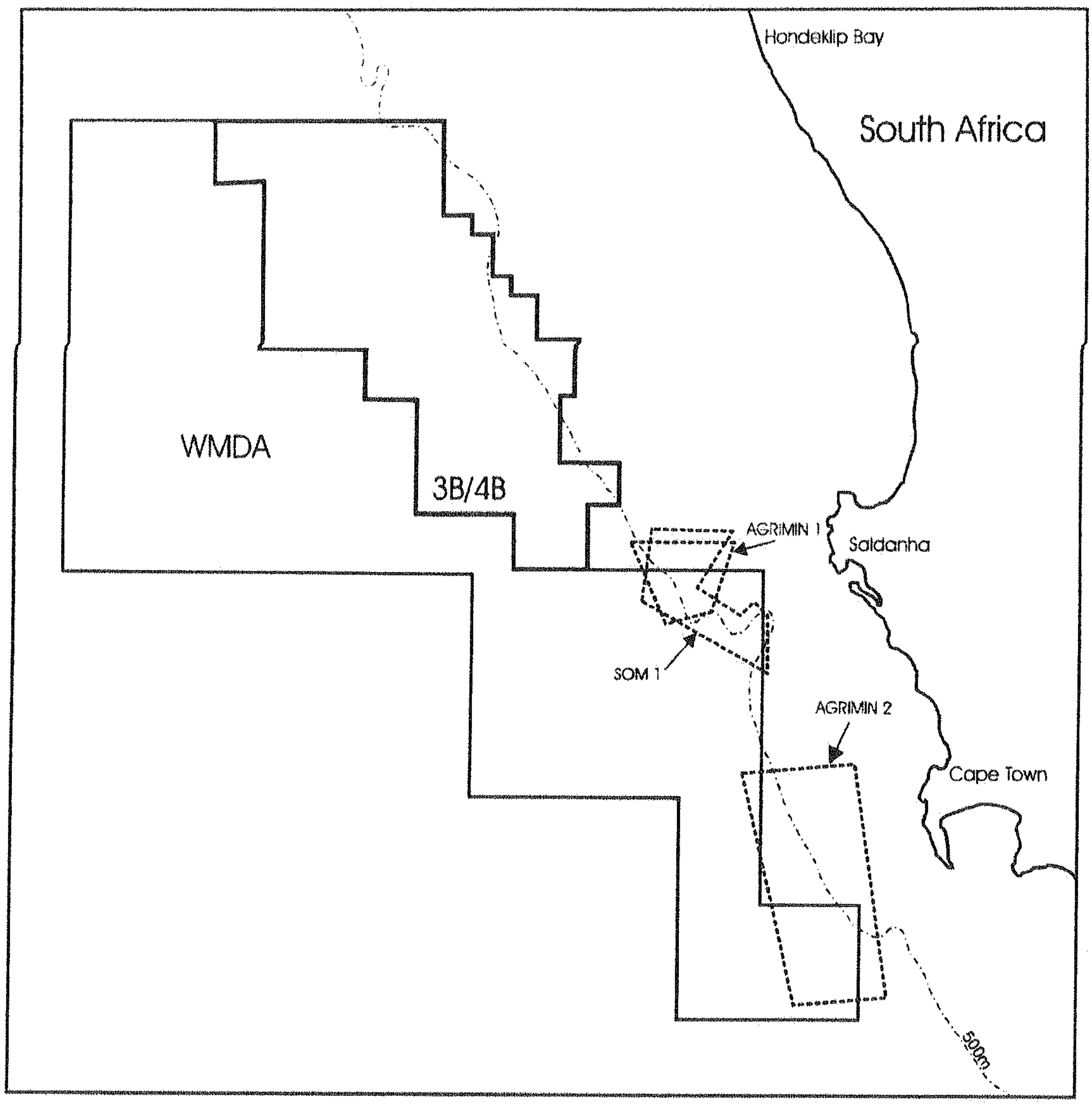

Figure 4.27: Location of glauconite and phosphorite prospecting areas (Agrimin1, Agrimin2 and SOM1).

Table 4.10: Limits of prospecting blocks for glauconite and phosphorite within the West Coast region. In each case the block is a polygon of points labelled A, B, C, D, etc.

Block Title	Corner points	Latitude (S):	Longitude (E):
Agrimin1	A	32° 49' 40.11"	17° 19' 57.12"
	B	32° 49' 39.93"	16° 44' 23.13"
	C	33° 17' 40.92"	17° 01' 11.70"
	D	33° 13' 59.88"	17° 07' 59.99"
Agrimin2	A	33° 56' 23.4654"	17° 27' 23.9975"
	B	34° 54' 31.9601"	18° 07' 40.2233"
	C	34° 53' 59.5830"	18° 27' 34.4074"
	D	33° 55' 43.0337"	17° 57' 58.6973"
SOM1	A	32° 49' 39.00"	16° 50' 9.66"
	B	33° 10' 24.74"	16° 53' 29.30"
	C	33° 40' 00.00"	17° 50' 00.00"
	D	33° 23' 30.00"	17° 50' 00.00"
	E	33° 19' 00.00"	17° 24' 00.00"
	F	33° 29' 00.00"	17° 41' 00.00"
	G	33° 16' 00.00"	17° 41' 00.00"
	H	32° 49' 00.00"	17° 20' 08.08"

4.1.4.6 Other

(a) Anthropogenic marine hazards

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

(b) Undersea cables

Two telecommunication cables (SAT-1 and SAT-2) from western Europe are laid on the seafloor approximately on the 3 000 m isobath. They run up the Cape Canyon to land at Melkbosstrand, north of Cape Town. Although SAT-1 is abandoned, SAT-2 (a fibre-optics cable) is functional. There is an exclusion zone applicable to the telecommunication cables one nautical mile each side of the cable in which no anchoring is permitted.

(c) Archaeological sites

Over 2 000 shipwrecks are present along the South African coastline. The majority of known wrecks along the West Coast are located in relatively shallow water close inshore (within the 100 m isobath) (see Figure 4.28). Wrecks older than 60 years old have National Monument status.

(d) Ammunition dump sites

Details of ammunition dumped at the ammunition dumpsites on the West Coast are given on the respective SAN charts.

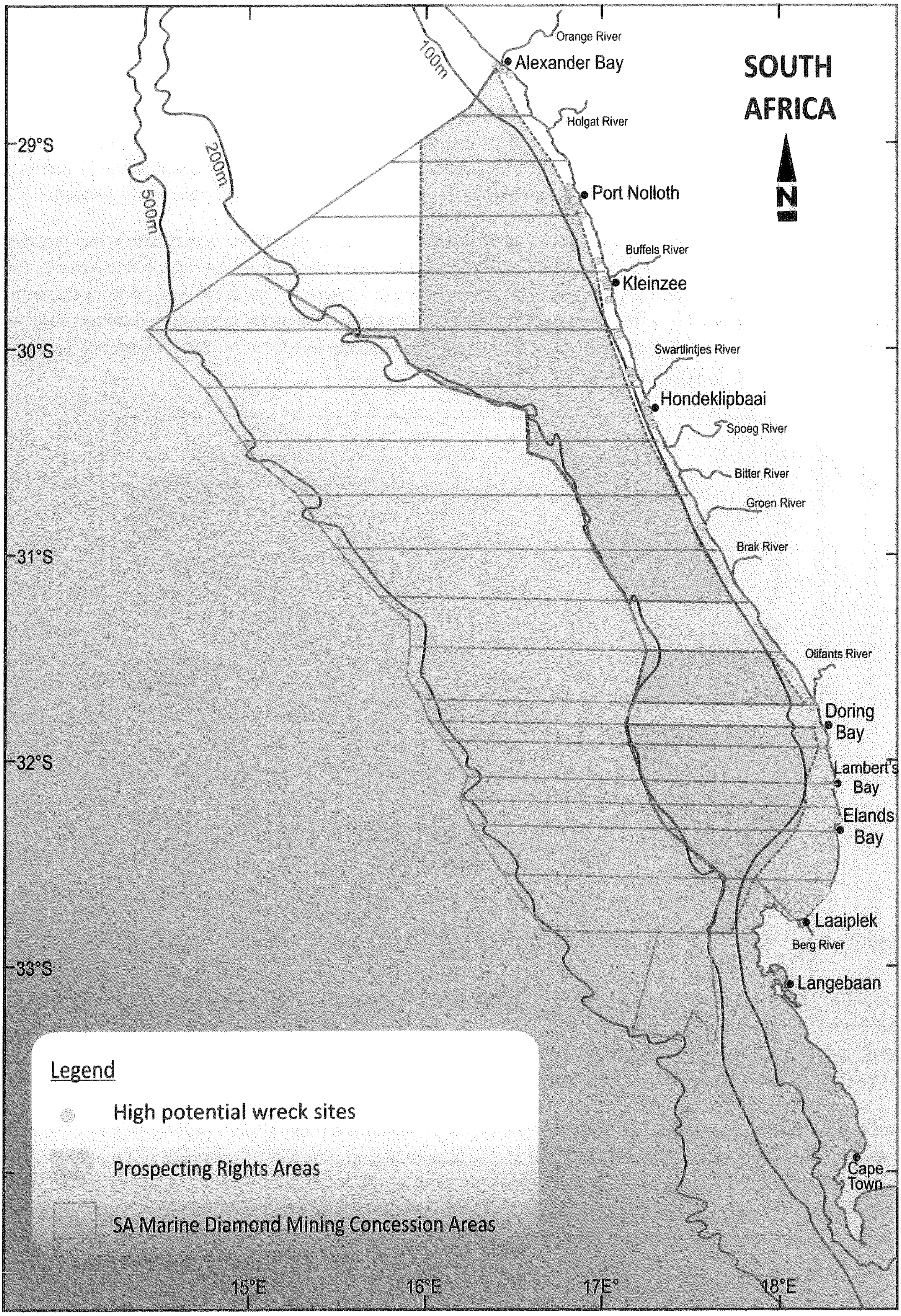

Figure 4.28: Known and presumed positions of shipwrecks along the South African west coast (from Lane & Carter, 1999).

4.2 MARINE PROTECTED AREAS

4.2.1 NEARSHORE REGION AND SHORELINE

The National Biodiversity Spatial Assessment Report (NBSA) (Lombard and Strauss 2004) provides a useful context within which to place the proposed study area. The NBSA is a spatial assessment of the conservation status of selected marine biodiversity patterns in South Africa at a national scale. It addresses a subset of marine species and broad scale intertidal and subtidal habitats within South African waters.

South Africa is divided into five bioregions, of which the Namaqua Bioregion, within which the proposed project area falls, forms one distinct component (Figure 4.29). It is a cool temperate region that extends from Sylvia Hill in Namibia to Cape Columbine. The rationale for the break at Sylvia Hill just north of Lüderitz is that the area constitutes the northern edge of a large upwelling cell. This break is supported by seaweed and invertebrate data and for intertidal and subtidal habitats (Bustamante and Branch 1996; Bolton and Anderson 1997; Emanuel *et al.* 1992; Engledow *et al.* 1992).

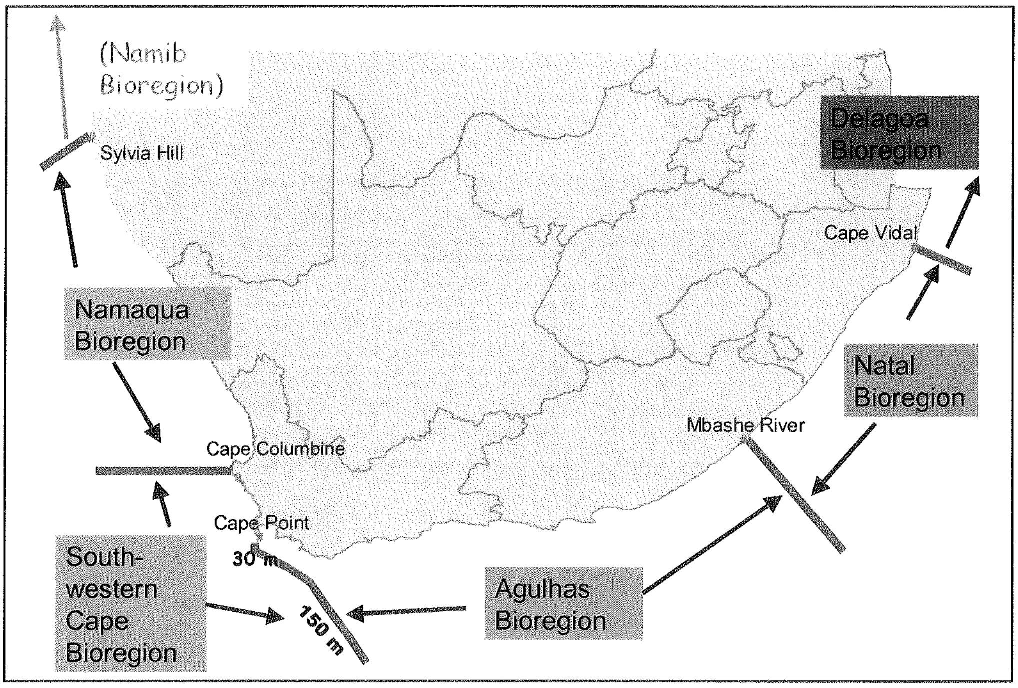

Figure 4.29: The five bioregions defined by the NBSA study (Lombard and Strauss 2004).

The NBSA study analysed available data on rocky shores, mixed shores, sandy beaches, pebble beaches and boulder beaches and identified areas of high value / irreplaceability (Figure 4.30). The proposed Namaqua Marine Protected Area (MPA), which is located between the Spoeg and Groen Rivers and extends to the edge of the EEZ, is located within the study area.

Two coastal habitat types that dominate the Namaqua bioregion are rocky shores (approximately 53% of the coastline) and sandy shores (about 37%). Mixed shores make up a further 9%. Pebble or boulder beaches are very rare in the Namaqua bioregion, making up less than 1% of the coastline (Lombard & Strauss 2004). The offshore Namaqua Bioregion benthic environment, which is dominated by muds and sands is not well studied, and is regarded by Lombard and Straus (2004) to have a high biozone priority status[2].

[2] Biozone priority status is a measure of the priority status for conservation intervention based on its protection status and threat status (Lombard and Strauss 2004).

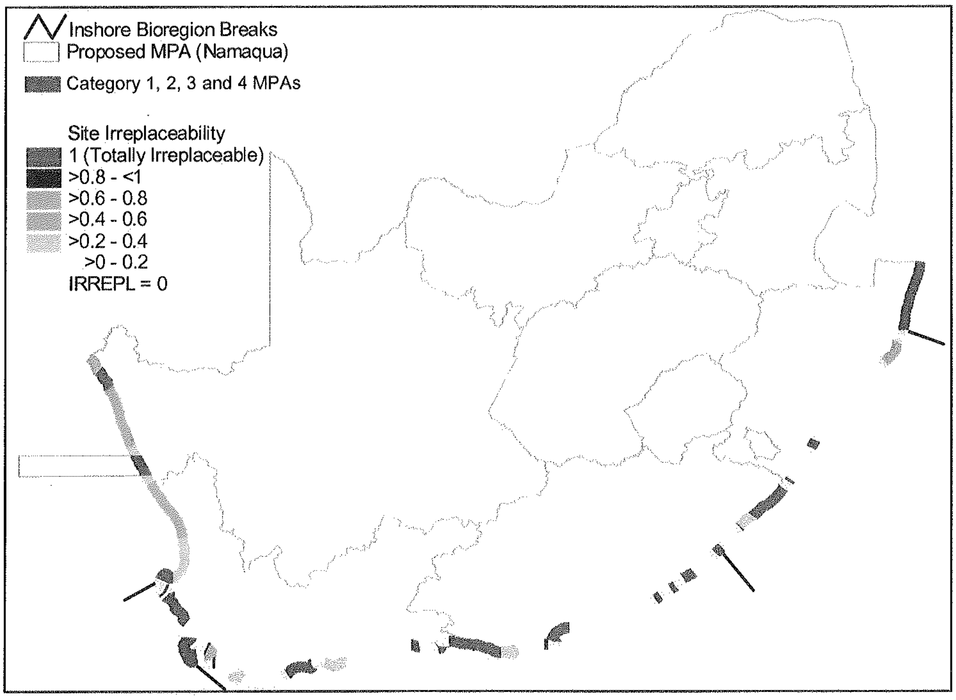

Figure 4.30: Irreplaceability analyses for intertidal habitats, in 50 km strips around South Africa, per bioregion (Lombard and Strauss 2004).

4.2.1.1 Proposed Namaqualand Marine Protected Area

The Department of Environmental Affairs invited comment on a "Notice of intention to declare the Namaqualand Marine Protected Area under section 43 of the Marine Living Resources Act, 1998 " which was published in Government Gazette No 26050 dated 17 February 2004. The proposed Marine Protected Area only overlaps concession areas 8c and 9c and although not yet promulgated it is important to consider the future plans for promulgating a marine protected areas in this region.

De Beers Marine is partnering with the World Wildlife Fund for Nature (WWF) and the South African National Biodiversity Institute (SANBI) in the Offshore Marine Protected Areas (OMPA) Project. This project aims to facilitate the development of a representative Offshore MPA network that has broad support from the various offshore marine use sectors and is based on the best available scientific information, for the persistent conservation of South Africa's offshore biodiversity and the wise use of offshore marine resources.

4.2.2 COASTAL REGION OCEANOGRAPHY

This section briefly describes the oceanography of the coastal region of the West Coast.

4.2.2.1 Rocky shores

Approximately 54% of the West Coast (west of Cape Agulhas) is rocky shore. Over 80% of this rocky shore comprises exposed rocky headlands, the balance being wave cut platforms (Jackson and Lipschitz 1984). The biota of the rocky shores of the study area is classified as cool temperate and forms one of the four main biogeographic provinces of southern Africa. Rocky shore faunal diversity is low although biomass may be high (Branch and Griffiths 1988), while floral diversity and biomass are high (Bolton 1986).

The fauna of rocky shores of the West Coast show distinct up/down-shore zonation into five zones including:

1. The *littorina zone* (also known as the supralittoral or splash zone) extends from the highest reaches of spring high tide to the normal high tide level. This area is dry much of the time, but is sprayed with salt water during high tides. It is only flooded during storms and extremely high tides. It is so named because of the dominance of small periwinkles of the genus *Littorina*. On the west coast the dominant periwinkle is *Littorina africana*. The red algae *Porphyra capensis* is the only notable floral representative of this zone.
2. The *upper balanoid zone* (also known as the upper-eulittoral, high tide or high intertidal zone) is flooded only during high tides. This zone is usually dominated by large numbers of barnacles. However, although barnacles such as *Tetraclita serrata* and *Chthamalus dentatus* are present in the Namaqualand bioregion, the limpet *Patella granularis* (and to some extent *P. granatina*) is by far the most common animal species. The green alga called "sea lettuce" (*Ulva* spp.) is the most common floral representative found in this zone.
3. The *lower balanoid zone* (also known as the mid-eulittoral zone) is flooded twice a day. It is the first zone in which algae is well represented (Branch & Griffiths 1988). The red algae *Gigartina radula, Gigartina stiriata, Aeodes orbitosa* and *Champia lumbricalis* as well as the brown alga *Splachnidium rugosum* occur in this zone, whilst the limpet *P. granatina* is the most common faunal species. The tubeworm *Gunnarea capensis* may form distinctive colonies in this zone along the southern parts of the Namaqua bioregion.
4. The *cochlear / argenvillei zone* (also known as the lower-eulittoral zone) is covered and uncovered twice a day with salt water from the tides. Along the Namaqualand coast, the zone is dominated by very dense aggregations of the limpet *P. cochlear* in the south and *P. argenvillei* in the north. Depending on the local conditions, the black mussel, *Choromytilus meridionalis* is also present, and can completely displace the limpets along rocky shores exposed to strong wave action. The Mediterranean mussel (*Mytilus galloprovincialis*) appears to be displacing the black mussel along the Namaqualand coast, in turn. The definitive flora in this zone is coralline encrusting algae.
5. The *intertidal zone* can be divided into the sublittoral fringe, infratidal zone and sublittoral zone. In study area the region stretching from the low tide level to, and including, the kelp beds is considered to be the sublittoral zone. Along the central Namaqualand coast this zone is dominated by the Mediterranean mussels, rock lobsters, sea urchins and various red algae.

A number of predatory species are associated with the fauna found along the rocky shores of the central parts of the Namaqualand coast. Theses include the whelks such as *Natica tecta*, *Nucella cinulata* and *N. dubia*; the starfish *Marthasterias glacialis*; tidal pool fish such as the klipvis *Clinus superciliosus*; the common octopus *Octopus vulgaris* and seabirds, primarily the African oyster catcher *Haemaptopus moquini*. The African oyster catcher is listed in the South African Red Data Book as "Near-threatened". Scavengers such as the shore crab *Cyclograpsus puncatus* and the kelp gull *Larus dominicanus* are also common along these shores.

A list of the marine macro-fauna and flora likely to occur on rocky shores in the study area is presented in Tables 4.11 and 4.12, respectively.

Table 4.11: Expected common rocky shore-associated macro-fauna from the central Namaqua Bioregion.

Descriptive group	Species	Common name	Zone
Amphipods	*Hyale grandicornis*	Seaweed amphipod	Intertidal
	Temnophlias capensis	Louse amphipod	Intertidal
Barnacles	*Austromegabalanus cylindricus*	Giant barnacle	Intertidal
	Chthamalus dentatus	Toothed barnacle	Intertidal
	Notomegabalanus algicola	White dwarf barnacle	Intertidal
	Octomeris angulosa	Eight-shell baracle	Intertidal
	Tetraclita serrata	Volcano barnacle	Intertidal
Bivalves	*Gregariella petagnae*	Half-hair mussel	Intertidal
	Mytilus galloprovincialis	Mediterranean mussel	Intertidal
Brittlestars	*Amphioplus integer*	Port Natal brittlestar	Intertidal
	Amphiura capensis	Equal-tailed brittlestar	Intertidal
Chitons	*Callochiton castaneus*	Broad chiton	Intertidal
	Chaetopleura papilio	Hairy chiton	Intertidal
	Chiton nigrovirescens	Brooding chiton	Intertidal
	Ischnochiton bergoti	Ribbed-scale chiton	Intertidal
	Ischnochiton textiles	Textile chiton	Intertidal
Crabs	*Cyclograpsus punctatus*	Shore crab	Intertidal
	Plagusia chabrus	Cape rock crab	Intertidal
Hermit crabs	*Paguristes gamianus*	Pink hermit crab	Intertidal
Hydroids	*Eudendrium spp.*	Bushy hydroids	Intertidal
	Lytocarpus filamentosus	Smoky feather hydroid	Intertidal
	Obelia dichotoma	Obelia	Intertidal
Isopods	*Cirolana hirtipes*	Grooved cirolanid	Intertidal
	Cirolana undulate	Crimped cirolanid	Intertidal
	Deto echinata	Horned isopod	Intertidal
	Ligia dilatata	Sea slater	Intertidal
	Notasellus capensis	Hairy isopod	Intertidal
	Sphaeramene polytylotos	Button isopod	Intertidal
Limpets	*Helcion pectunculus*	Prickly limpet	Intertidal
	Patella argenvillei	Argenville's limpet	Intertidal
	Patella cochlear	Pear limpet	Intertidal
	Patella granatina	Granite limpet	Intertidal
	Siphonaria capensis	Cape false limpet	Intertidal
Keyhole limpets	*Diodora parviforata*	Conical keyhole limpet	Intertidal
	Fissurella mutabilis	Cape keyhole limpet	Intertidal
Lamp shells	*Kraussina rubra*	Ruby lamp shell	Intertidal
Nudibranchs	*Melibe rosea*	Cowled nudibranch	Intertidal
Periwinkles	*Nodilittorina Africana*	African periwinkle	Intertidal
	Tricolia capensis	Pheasant shell periwinkle	Intertidal
Polychaete worms	*Arabella iricolor*	Iridescent worm	Intertidal
	Dodecaceria puchra	Black borer worm	Intertidal
	Eunice aphroditois	Wonderworm	Intertidal
	Euphrosine capensis	Plump bristleworm	Intertidal
	Gunnarea capensis	Cape reefworm	Intertidal
	Lysidice natalensis	Three antennae worm	Intertidal
	Platynereis dumerilii	Comb-toothed nereid	Intertidal
	Polydora spp.	Blister worms	Intertidal
	Pseudonereis variegata	Musselworm	Intertidal
	Thelepus spp.	Tangleworms	Intertidal

Descriptive group	Species	Common name	Zone
	Timarete capensis	Orange thread-gill worm	Intertidal
Sea anemones	*Actinia equine*	Plum anemone	Intertidal
	Anthopleura michaelseni	Long-tentacled anemone	Intertidal
	Anthothoe stimpsoni	Striped anemone	Intertidal
	Bunodactis reynaudi	Sandy anemone	Intertidal
	Bunodosoma capensis	Knobbly anemone	Intertidal
	Pseudactinia flagellifera	False plum anemone	Intertidal
Sea cucumbers	*Pentacta doliolum*	Mauve sea cucumber	Subtidal reefs
	Pseudocnella insolens	Red-chested sea cucumber	Subtidal reefs
Sea spiders	*Tanystylum brevipes*	Compact sea spider	Intertidal
Sea squirts	*Botrylloides leachi*	Ladder ascidian	Subtidal reefs
	Botryllus magnicoecus	Star ascidian	Subtidal reefs
Slipper limpets	*Calyptraea chinensis*	Chinese hat limpet	Subtidal reefs
	Crepidula porcellana	Slipper limpet	Subtidal reefs
Sponges	*Hymeniacedon perlevis*	Bread sponge	Intertidal
Starfish	*Patiriella exigua*	Dwarf cushion star	Intertidal
	Pteraster capensis	Brooding cushion star	Subtidal reefs
Teleost fish	*Caffrogobius nudiceps*	Barehead goby	Intertidal
	Chirodactylus brachydactylus	Twotone fingerfin	Intertidal
	Chorisochismus dentex	Rocksucker	Intertidal
	Clinus agilis	Agile klipvis	Intertidal
	Clinus heterodon	West coast klipvis	Intertidal
	Clinus superciliosus	Super klipvis	Intertidal
	Diplodus sargus	Blacktail	Subtidal reefs
	Ephinephelus marginatus	Yellowbelly rockcod	Subtidal reefs
	Muraenoclinus dorsalis	Nose-stripe klipvis	Intertidal
	Pachymetopon blochii	Hottentot	Subtidal reefs
	Scartella emarginata	Maned blenny	Intertidal
Turretshells	*Clionella sinuate*	Ribbed turretshell	Intertidal
Unsegmented worms	*Golfingia capensis*	Peanut worm	Intertidal
Whelks	*Burnupena catarrhacta*	Flam-patterned burnupena	Intertidal
	Cymatium cutaceum	Furry triton	Intertidal
	Nucella cingulata	Girdled dogwelk	Subtidal reefs
	Nucella dubia	Common dogwelk	Intertidal
	Nucella squamosa	Scaly dogwelk	Subtidal reefs
Winkles	*Oxystele variegate*	Variegated topshell winkle	Intertidal

Table 4.12: Expected common rocky shore-associated macro-flora from the central Namaqua Bioregion.

Descriptive group	Species	Common name	Zone
Brown algae	*Chordariopsis capensis*	Cord weed	Intertidal
	Family Chordariaceae	Furry slime strings	Intertidal
	Scytosiphon simplicissima	Sausage skins	Intertidal, subtidal
	Splachnidium rugosum	Dead man's finger	Intertidal
Encrusting algae	*Leptophytum foveatum*	Thin coralline crust	Intertidal, subtidal
Green algae	*Cladophora flagelliformis*	Cape cladiphora	Intertidal, subtidal
Red algae	*Aeodes orbitosa*	Slppery orbit	Intertidal
	Aristothamnion collabens	Aristocratic plume weed	Intertidal, subtidal
	Caulacanthus ustulatus	Spiky turf weed	Intertidal
	Ceramium capense	Cape ceramium	Intertidal, subtidal

	Ceramium diaphanum	Beaded ceramium	Intertidal, subtidal
	Ceramium obsoletum		Intertidal, subtidal
	Ceramium planum	Flat fern ceramium	Intertidal, subtidal
	Champia lumbricalis	Earthworm champia	Intertidal
	Gigartina stiriata	Twisted Gigartina	Intertidal
	Grateloupia doryphora	Rippled ribbon-weed	Intertidal
	Grateloupia filicina	Tattered rag weed	Intertidal
	Gymnogongrus complicatus	Complicated gymnogongrus	Subtidal
	Iridaea capensis	Spotted iridaea	Intertidal
	Nothogenia erinacea	Hedgehog seaweed	Intertidal
Red algae (cont.)	*Plocamium cornutum*	Horny plocamium	Intertidal
	Plocamium rigidum		Intertidal
	Porphyra capensis	Purple laver	Intertidal
	Pterosiphonia cloiophylla	Red feather weed	Intertidal, subtidal
	Schizymenia obovata	Orange sheets	Intertidal
	Trematocarpus flabellatus	Comb-fan weed	Intertidal

4.2.2.2 Sandy shores

Approximately 46% of the West Coast comprises sandy beaches. Apart from the larger bays such as St Helena Bay, the sandy shore within the study area is exposed to strong wave action.

There has been little work on sandy beach ecology between Walvis Bay and St Helena Bay (Branch and Griffiths 1988). The invertebrate fauna is cool temperate, and relatively consistent throughout the region (Field and Griffiths 1988). Sandy beaches have no stable substrate for plant attachment and consequently have little or no primary production. Major nutrient input into Benguela beaches arise from beach cast kelp wrack and upwelling-related coastal phytoplankton in the nearshore region. Macrofaunal species are generally primary or secondary consumer and can be divided into four major trophic groups, including air breathing scavengers, aquatic particle feeders, aquatic scavengers and predators.

The South African sandy beach up/down-shore environment can be divided into a number of zones (Brown and MacLachlan 1990) (Figure 4.31) including:

1. The *supralittoral zone* runs from the foredunes to the high water drift line. The sand remains mostly dry. The dominant force disturbing the substrate in this zone is the wind. The zone is populated by insects and air-breathing crustaceans.
2. The *littoral or intertidal zone* extends from the high tide drift line down to the low tide mark. This zone is flushed periodically by the changing tide, and the sand is generally damp. The dominant force in this zone comes from the swash. No macro-flora grows in this zone, especially on an exposed beach. Near the drift line, air-breathing crustaceans such as the pill bug isopod *Tylos granulatus* or the beach hopper amphipod *Talorchestia capensis* are common, as well as some oligochaete worms, usually found under rotting beach cast seaweed. Further down the beach, isopods such as the right-angle beach louse *Eurydice longicornis* and the wide-foot beach louse *Pontogeloides laticeps* typify the mid-shore region. Also common to this region of the zone are polychaete worms such as *Scolelepis squamata.* While the white sand mussel *Donex serra* occurs in certain instances, it apparently is not found in the Port Nolloth region. In the lower reaches of the intertidal zone, including the sublittoral fringe, the common organisms are the surf mysid shrimp *Gastrosaccus psammodytes* and a ubiquitous gastropod scavenger, the finger ploughshell *Bullia digitalis.*
3. The *surf zone* starts below the low water level. In the surf zone the sand substrate is always saturated, and experiences strong wave action and currents. The sand bed is generally in a state of mobility in this zone. The macro-fauna found in this zone are much the same as that which occurs in the

sublittoral fringe, with some species of amphipods present. Micro-flora in the form of diatoms can be an important component in this zone, migrating between the water column during the day and the sandy substrate at night. High densities of these diatoms can result in semi-stable formations of foam in the inner surf zone.

4. The *transition zone* occurs between the turbulence of the surf zone and the more stable outer turbulent zone. This is the region across which the wave break line will range, depending on the prevailing weather conditions.
5. The *outer turbulent zone* is typified by a return to stability after the turbulence of the surf zone. The currents are weak compared to the surf zone, and although the effects of wave surge are apparent, the sandy substrate is stable enough to be colonised by macro-fauna including amphipods and other small crustaceans, tube-building polychaetes such as *Nephys* spp., delicate cnidarians and anemones such as *Anthopleura michaelseni.*

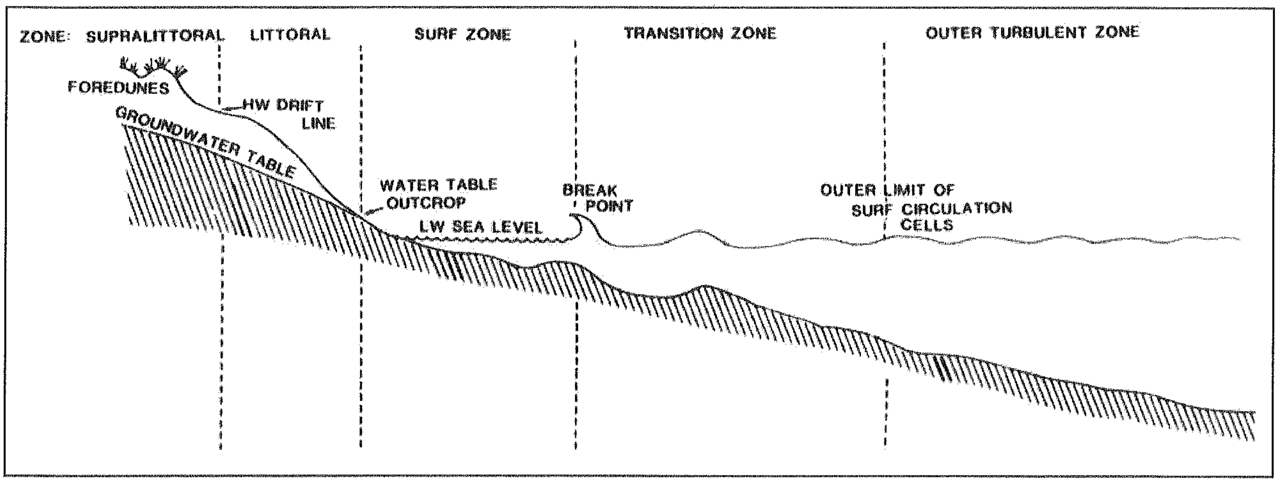

Figure 4.31: Generalised scheme of zonation on sandy shores (Modified from Brown & MacLachlan 1990).

The three-spot swimming crab *Ovalipes trimaculatus* is probably the only resident predator on the sandy shores along the central Namaqualand coast. The rest of the organisms that predate on the intertidal macro-fauna originate from outside of the sandy beaches. Birds are the most important predators when the shores are exposed during low tides; fish are most important when the shores are submerged during high tides. On exposed beaches the migratory sanderlings *Calidris alba* and white-fronted plovers *Charadrius marginatus* are the most common bird species, but African black oystercatchers *Haematopus moquini*, kelp gulls *Larus dominicanus*, Hartlaubs gulls *Larus hartlaubii*, turnstones *Arenaria interpres* and curlew sandpipers also visit the sandy shores of Namaqualand. The galjoen *Dichristius capensis* and white steenbras *Lithognathus lithognathus* are representatives of the predatory teleost fishes in the region, as is the blue stingray *Dasyatis chrysonota* for elasmobranch fishes. There have also been reports of the west coast sole *Austroglossus microlepis* occurring in the sheltered embayment during periods of warmer water temperatures.

A list of the marine macro-fauna likely to occur on sandy shores in the study area is presented in Table 4.13.

Table 4.13: Expected common sandy shore-associated macro-fauna from the central Namaqua Bioregion.

Descriptive group	Species	Common name	Zone
Amphipods	*Ceradocus rubromaculatus*	Red-striped amphipod	Intertidal
	Talorchestia capensis	Beach hopper	Intertidal
	Urothoe grimaldii	Burrowing amphipod	Intertidal
Bivalves	*Donax serra*	White mussel	Subtidal
	Dosinia lupinus orbignyi	Heart clam	Subtidal
	Venerupis corrugatus	Corrugated venus clam	Subtidal
	Venus verrucosa	Warty venus clam	Subtidal
Brittlestars	*Ophioderma wahlbergi*	Serpent-skinned brittlestar	Subtidal
Crabs	*Ovalipes trimaculatus*	Threespot swimming crab	Intertidal
Elasmobranchs	*Dasyatis chrysonota*	Blue stingray	Shallow neritic
Isopods	*Eurydice longicornis*	Right-angle beach louse	Intertidal
	Pontogeloides laticeps	Wide-foot beach louse	Intertidal
	Tylos granulatus	Pill bug	Intertidal
Keyhole limpets	*Dendrofissurella scutellum*	Saddle keyhole limpet	Intertidal
Mysid shrimp	*Gastrosaccus psammodytes*	Surf mysid	Subtidal
Ploughshells	*Bullia digitalis*	Finger ploughshell	Intertidal
	Bullia laevissima	Fat ploughshell	Subtidal
Polychaetes	*Euclymene spp.*	Bamboo worms	Intertidal
	Lumbrineris tetraura	False earthworm	Intertidal
	Nephtys spp.	Nephthys sandworms	Intertidal
Sea anemones	*Anthopleura stephensoni*	Violet-spotted anemone	Shallow neritic
Sea cucumbers	*Roweia fraunfeldii*	Horseshoe sea cucumber	Subtidal
Sea pens	*Virgularia schultzei*	Feathery sea pen	Shallow neritic
Sea urchins	*Spatogobrissus mirabilis*	Heart urchin	Subtidal
Shrimps	*Palaemon peringueyi*	Sand shrimp	Intertidal
Teleosts	*Lithognathus lithognathus*	White steenbras	Shallow neritic
	Lithognathus mormyrus	Sand steenbras	Shallow neritic
	Liza richardsonii	Mullet	Shallow neritic

4.2.2.3 Kelp beds

Kelp beds are the dominant sub-littoral reef communities along the west coast of southern Africa (Branch & Griffiths 1988). The dominant kelp species in the central Namaqualand region is the split fan kelp *Laminaria pallida*, replacing the sea bamboo *Ecklonia maxima*, which is the more common shallower water kelp species along much of the south and west coast of South Africa. The kelp beds occur in shallow water to depths of about 30 m. Epiphyte and macrophyte algae species are associated with the kelp beds are presented in Table 4.14.

The shallow kelp beds are colonised by relatively few faunal species, with diversity increasing on their deeper, seaward fringes (Branch & Griffiths 1988). Examples of the types of organisms associated with the kelp beds are presented in Table 4.15. The faunal species include grazers such as the sea urchin *Parechinus angulosus*, limpet *Patella compressa*, kelp louse *Paridotea reticulata* and amphipods; and filter feeders including mussels, sponges, ascidians and barnacles. Carnivorous species are also represented, including anemones, whelks, starfish, fish and crustaceans (including the most important predator in the ecosystem, the west coast rock lobster). Several of these species also occur on sublittoral rocky shores, and are described in Section 4.2.2.1.

Table 4.14: Kelp bed-associated macro-flora from the central Namaqua Bioregion.

Descriptive group	Species	Common name	Type
Brown algae	*Desmarestia firma*	Acid weed	Under-storey
Red algae	*Botryglossum platycarpum*	Platycarpum	Under-storey
	Carpoblepharis flaccida	Flaccid kelp weed	Epiphyte
	Epymenia obtuse	Broad wine-weed	Under-storey/Kelp holdfasts
	Gigartina clathrata	Clathrata	Under-storey
	Hymenena venosa	Veined oil-weed	Under-storey
	Neuroglossum binderianum	Veined tongue	Under-storey
	Pachymenia carnosa	Red rubber weed	Under-storey
	Phyllymenia belangeri	Corrugated red algae	Under-storey
	Polysiphonia virgata	Kelp fern	Epiphyte
	Suhria vittata	Red ribbons	Epiphyte

Table 4.15: Kelp bed-associated fauna from the central Namaqua Bioregion.

Descriptive group	Species	Common name
Bivalves	*Aulacomya ater*	ribbed mussel
Bryozoans	*Membranipora tuberculata*	Membranous lace animal
Crustaceans	*Pilumnoides rubus*	Kelp crab
	Jasus lalandii	West coast rock lobster
Hydroids	*Obelia geniculata*	Thick-walled obelia
Isopods	*Paridotea reticulata*	Kelp louse
Limpets	*Patella compressa*	Kelp limpet
	Haliotis midae	Perlemoen
Sea urchins	*Parechinus angulosus*	Cape urchin
Teleost fishes	*Pachymetopon blochii*	Hottentot

4.2.3 ORANGE RIVER MOUTH RAMSAR SITE

The Orange River Mouth area is ranked as the sixth-most important coastal wetland in southern Africa in terms of the number of birds it supports and is used by water birds either for breeding purposes or as a stopover on migratory routes. Many birds depend on the area for food, as well as for shelter from the strong coastal winds. These factors have led to the mouth being declared a Wetland of International Importance under the Ramsar Convention. The sensitivity of the area needs to be considered when managing airborne logistics operations either from Alexander Bay or Oranjemund airports.

4.2.4 ANTHROPOGENIC ACTIVITIES

4.2.4.1 Mariculture industries

The following mariculture facilities can be found along the west coast of South Africa (O'Sullivan 1998; after MCM - http://www.mcm-deat.gov.za/):

- Alexkor Diamond Mines has an oyster (*Crassostrea gigax*) growout system in the seawater reservoirs employed by diamond processing plants south of Alexander Bay, while a similar facility for oysters, perlemoen and the red seaweed *Gracilaria gracilis* can be found at Kleinsee.
- A permit has been granted for perlemoen (*Haliotis midae*) ranching within a 100 km long 0 to 20 m deep zone north and south of Port Nolloth. Oysters are also grown at Port Nolloth.
- Oysters and perlemoen are grown in Kleinsee.
- A perlemoen aquaculture operation at Hondeklip Bay.
- Abalone, oysters and finfish are grown in Jacobs Bay.
- Abalone, mussels, seaweed, oysters, clams and scallops are grown in Paternoster.
- Oysters and seaweed are grown in St Helena Bay.
- Mussels, oysters and finfish are grown within Saldanha Bay.

4.2.4.2 Recreational utilisation

Coastal recreation along the West Coast may be either consumptive or non-consumptive.

Consumptive recreational uses involve people collecting material from the sea for their own use. Recreational anglers (Brouwer, Mann, Lamberth, Sauer and Erasmus 1997) and divers (Mann, Scott, Mann-Lang, Brouwer, Lamberth, Sauer and Erasmus 1997) target linefish from either a boat or the shore, while shore-based divers also target perlemoen and West Coast rock lobsters. Rock lobsters are also exploited recreationally from boats with the use of hoop nets. The majority of recreational exploitation of marine resources occurs from inshore waters, and is not substantial compared to activities along the South and East Coasts.

Non-consumptive recreational uses of the marine environment include watersports, nature watching and beach recreation. Recreational practices are mostly undertaken near coastal settlements, and are largely practised for their aesthetic value. Recreational sites are listed by Jackson and Lipshitz (1984).

Although few resource economic studies exist for South African marine recreational use, the value of recreational coastal use and tourism should not be underestimated.

4.2.4.3 Marine outfall/intake pipes

Thirty-four outfalls and 17 intakes are located along the West Coast of South Africa. An important pipeline intake/outfall is the Koeberg Nuclear Power Station; a thermal outfall, discharging warmed cooling water into the cooler coastal waters rather than a chemical effluent. A two nautical mile marine exclusion zone exists offshore of the nuclear power station.

5. IMPACT DESCRIPTION AND ASSESSMENT

This chapter describes and assesses the significance of potential impacts related to the proposed prospecting activities in the identified study area. All impacts are systematically assessed and presented according to predefined rating scales (see Appendix 4). Mitigation or optimisation measures are proposed which could ameliorate the negative impacts or enhance potential benefits, respectively. The status of all impacts should be considered to be negative unless otherwise indicated. The significance of impacts with and without mitigation is also assessed.

Specialist input was provided in order to address the likely effect of the proposed prospecting activities on marine benthic fauna (see Appendix 3). In addition, this EIA used as a basis the key issues identified from similar previous EIA studies for projects on the West Coast. The project team have assessed the relevance of these issues to this project.

5.1 IMPACT OF THE VESSEL

5.1.1 DISCHARGES/DISPOSAL TO THE SEA

Discharges to the marine environment include deck drainage, machinery space drainage, sewage, galley wastes and solid wastes from both the sampling and survey vessels.

5.1.1.1 Deck Drainage

Description of impact
Drainage of deck areas may result in small volumes of oils, solvents or cleaners being introduced into the marine environment.

Assessment
Oils, solvents and cleaners could be introduced into the marine environment in small volumes through spillage and drainage of deck areas. The potential impact of deck drainage on the marine environment would, therefore, be of low intensity across the prospecting area over the short-term, and is considered to be of **VERY LOW** significance with or without mitigation (see Table 5.1).

Mitigation
The following measures are recommended for mitigation of deck drainage discharges from the vessel:

- Deck drainage should be collected in oily water catchment systems;
- Training and awareness of crew in spill management could minimise contamination;
- Low-toxicity biodegradable detergents and reusable absorbent cloths should be used in cleaning of all deck spillage; and
- All hydraulic systems should be adequately maintained.

Table 5.1: Impact of deck drainage from vessels.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Highly Probable	Highly Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None

Nature of Cumulative impact	The nominal quantity of deck drainage that would enter the sea would not result in a cumulative impact.
Degree to which impact can be reversed	Fully reversible - deck drainage would be quickly dispersed and diluted by the high wind and wave energy of the offshore sea environment.
Degree to which impact may cause irreplaceable loss of resources	N/A
Degree to which impact can be mitigated	Very Low

5.1.1.2 Machinery space drainage

Description of impact

Small volumes of oil such as diesel fuel, lubricants, grease, etc. used within the machinery space of the vessel could enter the marine environment.

Assessment

All operations would comply fully with international agreed standards regulated under MARPOL 73/78. All machinery space drainage would pass through an oil/water filter to reduce the oil in water concentration to 15 parts per million, in accordance with MARPOL 73/78 requirements.

Concentrations of oil reaching the marine environment through drainage of machinery spaces are therefore expected to be low. The potential impact of such low concentrations would be of low intensity and limited to the sampling area over the short-term. The potential impact of machinery space drainage on the marine environment is therefore considered to be of **VERY LOW** significance with or without mitigation (see Table 5.2).

Mitigation

No mitigation measures are deemed necessary (assuming compliance with the Marpol 73/78 standards).

Table 5.2: Impact of machinery space drainage from vessels.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Highly Probable	Highly Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	The nominal quantity of machine drainage that would enter the sea would not result in a cumulative impact.	
Degree to which impact can be reversed	Fully reversible - machine drainage would be quickly dispersed and diluted by the high wind and wave energy of the offshore sea environment.	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.1.1.3 Sewage

Description of impact
Sewage poses an organic and bacterial loading on the natural degradation processes of the sea, resulting in an increased biological oxygen demand.

Assessment
The volumes of sewage wastes released from the vessel would be small and comparable to volumes produced by vessels of similar crew compliment. Wherever possible, contractors would be required to comply with the MARPOL 73/78 Annex I requirements. The high wind and wave energy is expected to result in rapid dispersal.

The potential impact of sewage effluent from the sampling vessel on the marine environment is expected to be limited to the sampling area over the short-term, and is therefore considered to be of **VERY LOW** significance with or without mitigation (see Table 5.3).

Mitigation
No mitigation measures are recommended.

Table 5.3: Impact of sewage effluent discharge from vessels.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Highly Probable	Highly Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	The nominal quantity of sewage that would enter the sea would not result in a cumulative impact.	
Degree to which impact can be reversed	Fully reversible - sewage would be quickly dispersed and diluted by the high wind and wave energy of the offshore sea environment.	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	N/A	

5.1.1.4 Galley waste

Description of impact
Galley wastes, comprising mostly of biodegradable food waste, would place a small organic and bacterial loading on the marine environment.

Assessment
The volume of galley waste from a vessel would be small and comparable to wastes from any vessel of a similar crew compliment. Discharges of galley wastes, according to MARPOL 73/78 Annex V standards, would be comminuted to particle sizes smaller than 25 mm prior to disposal to the marine environment if less than 12 nautical miles (± 22 km) from the coast and no disposal within 3 nautical miles (± 5.5 km) of the coast. The potential impact of galley waste disposal on the marine environment would be of low intensity and limited to the sampling area over the short-term. The potential impact of galley waste on the marine

environment is therefore considered to be of **VERY LOW** significance with or without mitigation (see Table 5.4).

Mitigation

Minimise the discharge of waste material should obvious attraction of marine fauna be observed.

Table 5.4: Impact of galley waste disposal from vessels.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Highly Probable	Highly Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	The nominal quantity of galley waste that would enter the sea would not result in a cumulative impact.	
Degree to which impact can be reversed	Fully reversible – galley waste would be quickly dispersed and diluted by the high wind and wave energy of the offshore sea environment.	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.1.1.5 Solid waste

Description of impact

The disposal of solid waste comprising non-biodegradable domestic waste, packaging and operational industrial waste into the sea could pose a hazard to marine fauna, may contain contaminant chemicals and could end up as visual pollution at sea, on the seashore or on the seabed.

Assessment

Solid waste would be transported onshore for disposal on land, and consequently would have no impact on the marine environment. Recycling would occur onboard and the solid waste would be sorted in separate containers before being taken to an appropriate onshore recycling facility. Specialist waste disposal contractors would dispose of hazardous waste. The potential impact of the disposal of solid waste on the marine environment is therefore **INSIGNIFICANT** (see Table 5.5).

Mitigation

No solid waste may be disposed to the marine environment and consequently no mitigation measures are required.

Table 5.5: Impact of solid waste disposal from vessels.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Zero	Zero
Probability	Probable	Probable
Confidence	Medium	Medium
Significance	**Insignificant**	**INSIGNIFICANT**
Cumulative impact	None	None
Nature of Cumulative impact	N/A	
Degree to which impact can be reversed	N/A	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.2 IMPACT ON MARINE FAUNA

5.2.1 SEDIMENT REMOVAL

Description of impact

During sampling activities sediment cores would be removed from the seabed. Benthic fauna typically inhabit the top 20 to 30 cm of sediment. Therefore, the cores would eliminate any benthic infaunal and epifaunal biota in the core footprints, resulting in a loss of some benthic biodiversity.

Assessment

The proposed Initial Deposit Assessment Phase would result in the removal of up to 300 core samples. This would equate to a total loss of sediment of 53 m^3 from the seabed. During the proposed Resource Delineation Programme up to 4 500 core samples may be taken, which would equate to a total loss of sediment of 799 m^3. Therefore the total volume of sediment to be removed from the seabed would be a maximum of 852 m^3 and would cover approximately 85 m^2 from the total sea area under consideration of 27 600 km^2.

Impacts on the offshore benthos as a result of sediment removal are considered to be of low intensity at a local scale (i.e. sampling locations). Full recovery is expected to take place within 1 to 5 years (i.e. short term), as the excavations would be refilled through sediment influx and recolonisation would occur through recruitment and immigration from adjacent areas. Therefore, this impact is assessed to be of **VERY LOW** significance (see Table 5.6).

Mitigation

No mitigation measures are possible.

Table 5.6: Impact of sediment removal on offshore benthic communities.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low to High	Low
Probability	Definite	Definite
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	The small area impacted by sediment removal during sampling activities would not result in a cumulative impact.	
Degree to which impact can be reversed	Irreversible – the removal of sediments and associated macrofaunal communities would be irreversible. However, the recovery of excavations through sediment influx and recolonisation will occur over the short term through recruitment and immigration from adjacent areas.	
Degree to which impact may cause irreplaceable loss of resources	Negligible considering the total surface area of seabed affected.	
Degree to which impact can be mitigated	No possible mitigation identified.	

5.2.2 PHYSICAL CRUSHING OF BENTHIC BIOTA

<u>Description of impact</u>
During sampling activities a 6 x 6 m frame would be placed on the seabed to hold the sampling tool in place. The frame's footprint would smother or crush epifauna and infauna, resulting in a reduction in benthic biodiversity. Crushing is likely to primarily affect soft-bodied species. Some molluscs and crustaceans may be robust enough to survive being temporarily smothered by the frame.

<u>Assessment</u>
The total area of seabed to be affected at each sampling site would cover an area of 6 x 6 m. Sampling activities would only take 1.5 hours to complete at each site, thus the duration of the impact is very short. It is expected that recolonisation would occur over the short term from adjacent undisturbed sediments.

The physical crushing of benthic biota would be highly localised, short term and of local extent. The significance of this impact is considered to be **VERY LOW** with and without mitigation (see Table 5.7).

<u>Mitigation</u>
The desktop study, previous geophysical surveys and the detailed geophysical survey should identify areas that are not suitable for sampling sites.

Table 5.7: Impact of crushing on benthic biota.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term (1.5 hours per site)	Short-term
Intensity	Low	Low
Probability	Highly Probable	Highly Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None

Nature of Cumulative impact	The total area impacted by the sampling frame on the seabed would not result in any cumulative effects.
Degree to which impact can be reversed	Irreversible – the loss of epifauna and infauna as a result of crushing would be irreversible. However, the recovery would occur over the short term through recruitment and immigration from adjacent areas.
Degree to which impact may cause irreplaceable loss of resources	Negligible considering the total surface area of seabed affected.
Degree to which impact can be mitigated	Very Low

5.2.3 NOISE ASSOCIATED WITH SAMPLING ACTIVITIES

Description of impact

During sampling activities, noise and vibrations from the SVC, as well as noise from the vessel, may have an impact on macrobenthic communities, fishes and marine mammals in the area.

Assessment

Noise measurements have been taken for the SVC and at a distance of 25 m from the tool the noise was measured at 160 to 180 dB re 1μPa. At a distance of 110 m from the tool the noise is typically 155 dB re 1μPa and 164 dB re 1μPa. The 1/3 octave analysis showed there was a 1/3 octave tone at 100 Hz and 125 Hz with harmonics at 200 Hz and 250 Hz (Hegley, 2010). Sound levels radiating from typical vessels range from 160 to 220 dB re1μPa at 1 m. Harmful / damaging levels of noise occur at levels greater than 220 dB.

Noise and vibrations generated during coring would, therefore, not be harmful or reach lethal amplitudes, even at the source. The noise generated would only be for a very brief period and would be within the noise range of an average size shipping vessel.

Any mobile marine fauna particularly sensitive to noise (e.g. dolphins, penguins and finfish species) would be expected to avoid the area once sampling commences. It is, therefore, likely that no direct impacts to these biota would occur during the sampling activities. There may be some temporary disturbance of benthic invertebrates in response to the vibrations, but this is likely to be at sublethal levels. The maximum radius over which the noise may influence is very small compared to the population distribution ranges of the potentially sensitive species. The potential noise generated by the vessel would be similar to that of any other vessel at sea. However, according to Pulfrich (2011) the proposed sampling activities would occur in shallower water than other transport vessels, which would restrict the propagation of low frequencies to within a few kilometres, thereby reducing the area over which the noise is heard.

The noise from sampling activities would be highly localised, of short term and of low intensity. The significance of impact is thus considered to be **VERY LOW** with or without mitigation (see Table 5.8).

Mitigation

No mitigation measures are considered necessary.

Table 5.8: Impact of noise associated with sampling activities.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term (1.5 hours per site)	Short-term
Intensity	Low	Low
Probability	Improbable	Improbable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	Due to the short duration of the noise emitted per site, any form of cumulative impact is highly unlikely.	
Degree to which impact can be reversed	Fully reversible – any disturbance of behaviour, auditory "masking" or reductions in hearing sensitivity that may occur as a result of ship noise or vibrations from the SVC would be temporary due to low sound levels at the source.	
Degree to which impact may cause irreplaceable loss of resources	Negligible	
Degree to which impact can be mitigated	No possible mitigation identified.	

5.2.4 NOISE ASSOCIATED WITH GEOPHYSICAL SURVEYING

Description of impact

The source levels produced by the geophysical survey acoustic equipment could affect marine mammal species in the surrounding area.

Assessment

The proposed equipment to be used (refer to Chapter 3) would probably be insufficient to result in auditory or non-auditory trauma to marine mammals in the region (Findlay, 2005). Sound levels from the acoustic equipment would range from 190 to 220 dB re 1 µPa at 1m. However, at source certain of the tools do produce sounds in the 220 dB range where exposure could result in trauma. Mobile species within the area would be able to flee and move away from the noise.

The noise from geophysical surveying would be localised, short term and of medium to high intensity. The significance of impact is thus assessed to be **low** without mitigation and **VERY LOW** with mitigation (see Table 5.9).

Mitigation

- Carry out visual scans around the survey vessel prior to the initiation of any acoustic impulses;
- Pre-survey scans should be limited to 15 minutes prior to the start of survey equipment;
- Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the mammal has vacated the area; and
- "Soft starts" should be carried out for any equipment of source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes.

Table 5.9: Impact of noise associated with geophysical surveying.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Medium to High	Low to Medium
Probability	Probable	Probable
Confidence	Medium	Medium
Significance	Low	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	No cumulative impacts are anticipated. Any impact is likely to be at individual level rather than species level.	
Degree to which impact can be reversed	Fully reversible – any disturbance of behaviour, auditory "masking" or reductions in animal hearing sensitivity that may occur as a result of survey noise below 220 dB would be temporary.	
Degree to which impact may cause irreplaceable loss of resources	Negligible	
Degree to which impact can be mitigated	Low	

5.3 IMPACT ON OTHER USERS OF THE SEA

5.3.1 POTENTIAL IMPACT ON FISHING INDUSTRY

Description of impact

Sampling activities and geophysical surveying could impact on some sectors within the fishing industry as a result of the stationary vessel at each sampling site and the presence of a survey vessel and equipment.

Assessment

Pelagic purse-seine

The prospecting area overlaps with the pelagic fishery. The concentration of pelagic purse-seine effort is the greatest inshore of the 100 m isobath, with effort increasing significantly towards the shallower portions of the study area. Activities in the southern portion of the prospecting area would impact on pelagic purse-seine fishing.

Demersal longline

On the West Coast, demersal long-liners may be found working between the 200 and 750 m bathycontours. Although the predominant areas of operation lie well to the west of the study area, isolated fishing events have been recorded in the prospecting area.

Pelagic long-lining (large pelagic species)

Majority of these fishing activities are located at some distance to the west of the prospecting area. However, occasional fishing events have been recorded closer inshore in the vicinity of the study area.

Tuna Pole (large pelagic species)

There is little commercial information available for the tuna pole fishery. However, this industry predominantly fishes off the 200 m to 500 m bathycontours, but some fishing does occur off the 100 m bathycontour. Fishing activities tend to be located in the vicinity of the offshore trawling grounds.

The potential impact of the proposed prospecting activities on pelagic purse-seine and demersal longline would be localised, short term and of high intensity. The significance of impact is thus considered to be **LOW** with and without mitigation (see Table 5.10).

The potential impact of the proposed prospecting activities on pelagic long-lining and tuna pole would be localised, short term and of low intensity. The significance of impact is thus considered to be **VERY LOW** with and without mitigation (see Table 5.10).

Mitigation

- Communication channels should be set up with the fishing industry, the Department of Agriculture, Forestry and Fisheries: Marine Resource Management (DAFF: MRM) and all other interested and affected parties. This would involve pre-sampling and geophysical survey notifications and regular updates on the sampling progress via email. Fishing industry associations should include: Association of Small Hake Industries, South African Deep Sea Trawling Industry Association, South African Pelagic Fishing Industry Association, South African Commercial Linefish Association, South African Tuna Association, Fresh Tuna Exporters Association, South African West Coast Rock Lobster Association, Shark Long-line Association. Interested and affected parties should include: South African Navy (SAN) Hydrographic office, the various concession holders and any other relevant users of the sea.

Table 5.10: Assessment of the potential impact of sampling and geophysical surveying on commercial fishing activities off the west coast.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Purse-seine and demersal longline		
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	High	High
Probability	Probable	Probable
Confidence	High	High
Significance	**Low**	**LOW**
Cumulative impact	None	None
Pelagic long-lining and tuna pole		
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Probable	Probable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	No cumulative impacts are anticipated.	
Degree to which impact can be reversed	Fully reversible	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	Very Low	

5.3.2 POTENTIAL IMPACT ON MARINE PROSPECTING / MINING

Description of impact

The proposed sampling and geophysical surveying could potentially exclude users undertaking marine diamond prospecting and mining activities in their relevant concession areas. Refer to Chapter 4, Table 4.9 for a list of the relevant concession holders.

Assessment

Diamond mining

The following companies hold concession rights off the west coast within the study area, namely: De Beers in sea areas 2c, 3c, 4c, 5c and Transhex in sea areas 6c, 11c, 13c and 14c. The proposed prospecting activities could potentially temporarily affect and disrupt activities in these sea areas.

No activities are currently taking place in the 'd' concession areas, located to the west of the study area. Concession areas 'a' and 'b' are located inshore of the study area and would not be affected by the proposed prospecting activities.

The impact of sampling activities and geophysical surveying on diamond mining activities would be localised, in the short term and of low intensity. The significance of impact is consequently **VERY LOW** with or without mitigation (see Table 5.11).

Other mining

Potential mining operations include minerals such as manganese nodules, agricultural minerals such as glauconite and phosphorite, and heavy minerals such as ilmenite and rutile. Manganese nodules enriched with valuable metals occur in water depths of over 3 000 m on the west, south and east coasts of South Africa and would, therefore, not be affected by the sampling activities. Prospecting permits for glauconite and phosphorite have been applied for in three areas between Cape Town and Saldanha. These areas are located further offshore than the proposed prospecting area and would thus not be affected. There is presently no extraction of heavy metals from sand mining within the marine environment in South Africa.

The impact of sampling activities and geophysical surveying on other mining activities would be localised, in the short term and of low intensity. The significance of impact is consequently **VERY LOW** with or without mitigation (see Table 5.11).

Mitigation

Any companies undertaking marine prospecting or diamond mining activities within the study area should be contacted prior to sampling and geophysical surveying in order to notify them of the planned activities.

Table 5.11: Assessment of impacts on marine mining / prospecting.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	Local	Local
Duration	Short-term	Short-term
Intensity	Low	Low
Probability	Improbable to Probable	Improbable
Confidence	High	High
Significance	**Very Low**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	Mining activities could possibly be delayed, as a result of the sampling activities and the geophysical survey, however, this would be in the short term. The vessel would also only be stationary for a few hours and may only affect other activities for a short duration. Therefore, no cumulative impacts are likely to result.	

Degree to which impact can be reversed	Fully reversible
Degree to which impact may cause irreplaceable loss of resources	N/A
Degree to which impact can be mitigated	Very Low

5.3.3 POTENTIAL IMPACT ON PETROLEUM EXPLORATION

Description of impact

The sampling activities and geophysical surveying could affect petroleum exploration activities overlapping with the study area, and vice versa.

Assessment

The proposed prospecting area overlaps with a number of petroleum exploration and production blocks, namely Block 1 (PetroSA (Pty) Ltd), Block 2A (Forest Exploration International (South Africa) (Pty) Ltd), 2B (Thombo Petroleum) and Block 3A/4A (BHP Billiton) (refer to Figure 4.25 in Chapter 4). The proposed sampling and geophysical activities could affect and disrupt activities in these blocks if exploration / prospecting activities coincide in the same area at the same time. However, the likelihood of this happening is low.

The impact on petroleum exploration would be localised, short term and of low to medium intensity. The significance of impact is consequently **very low to low**, without mitigation and **VERY LOW** with mitigation (see Table 5.12).

Mitigation

- Notify PetroSA, Forest Exploration International, Thombo Petroleum and BHP Billiton and its contractors, as well as any other operators, prior to the commencement of activities; and
- AuruMar should liaise with all petroleum exploration operators to ensure that there is no overlapping of activities in the same area over the same time period.

Table 5.12: Impact on petroleum exploration activities.

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

5.3.4 POTENTIAL IMPACT ON MARINE TRANSPORT ROUTES

Description of impact

The presence of the sampling and geophysical survey vessels could interfere with shipping in the area.

Assessment

The majority of shipping traffic is located on the outer edge of the continental shelf, which is located to the west of the proposed prospecting area. The inshore traffic of the continental shelf along the West Coast is largely comprised of fishing and mining vessels, especially between Kleinzee and Oranjemund (see Figure 4.23 in Chapter 4).

It is, therefore, unlikely that shipping transport routes would be affected by the proposed prospecting activities. The impact on shipping traffic is considered to be localised, of low intensity in the short-term. The significance of this impact is therefore assessed to be **VERY LOW** with and without mitigation (Table 5.13).

Mitigation

- Prior to the commencement of activities, AuruMar must notify relevant bodies including: PASA, South African Maritime Safety Authority (SAMSA), the South African Navy (SAN) Hydrographic Office, relevant Port Captains and DAFF: MRM. These bodies must be notified of the navigational co-ordinates of any location prior to commencement of such activities;
- The vessels must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. Lloyds Register, Det Norske Veritas). The certification, as well as existing safety standards, requires that safety precautions would be taken to minimise the possibility of an offshore accident. Collision prevention equipment should include radar, multi-frequency radio, foghorns, etc. The law also requires equipment and training to ensure the safety and survival of the crew in the event of an accident; and
- A Notice to Mariners should provide: the co-ordinates of the sampling area and an indication of sampling and geophysical survey timeframes.

Table 5.13: Assessment of interference with marine transport routes.

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

5.4 IMPACT ON CULTURAL HERITAGE MATERIAL

Description of impact

Sampling activities could disturb cultural heritage material on the seabed, particularly historical shipwrecks.

Assessment

The likelihood of disturbing a shipwreck is expected to be very small considering the vast size of the South African offshore area. A desktop study by JJ Boshoff (2009) was undertaken for concession areas 12c, 14c, 15c, 17c, 18c and 20c (as well as 7c to 10c as part of a previous study, J Visser, 2006) and concluded that there was a low possibility of finding historical shipwrecks in the area (see Appendix 8). However, the report did not rule out the possibility of unknown wrecks in the area. Majority of the shipwrecks are located along the coastline in shallow waters and it is less likely that historical wrecks would be found in deeper water. The desktop study and previous geophysical surveys would also identify subsea structures.

The impact on cultural heritage material would be at the national level, in the short term and of medium intensity. The significance of impact is consequently **medium**, without mitigation and **VERY LOW** with mitigation (see Table 5.14).

Mitigation

- The sampling sites should avoid any cultural heritage material identified during the desktop study and previous geophysical surveys for the area; and
- If any cultural heritage material is found during sampling activities the South African Heritage Resources Agency (SAHRA) should be notified immediately. If any material older than sixty years is to be disturbed a permit would be required from SAHRA.

Table 5.14: The assessment of the potential impact of sampling activities on heritage material.

CRITERIA	WITHOUT MITIGATION	WITH MITIGATION
Extent	National	National
Duration	Short-term	Short-term
Intensity	Medium	Low
Probability	Improbable	Improbable
Confidence	High	High
Significance	**Medium**	**VERY LOW**
Cumulative impact	None	None
Nature of Cumulative impact	No cumulative impacts are expected.	
Degree to which impact can be reversed	Irreversible	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	

5.7 NO-GO ALTERNATIVE

Description of impact

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

- Loss of opportunity to establish whether or not a viable offshore heavy mineral resource exists off the west coast of South Africa; and
- Lost economic opportunities related to costs already incurred in the initial prospecting phase.

Assessment

The potential impact related to the lost opportunity to further explore for heavy mineral resources on the west coast and maximise the use of South Africa's own resources should they exist is considered to be of **LOW to MEDIUM** significance (see Table 5.15).

Table 5.15: Assessment of impact related to No-Go alternative.

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

6. CONCLUSIONS AND RECOMMENDATIONS

AuruMar, as operator, is proposing to undertake prospecting activities over a 27 600 km^2 area within sea areas: 1c, 2c, 3c, 4c, 5c, 6c, 7c, 8c, 9c, 10c, 12c, 14c, 15c, 16c, 17c, 18c and 20c, off the west coast of South Africa. The proposed prospecting activities include the sourcing of heavy minerals, platinum group metals, gold and sapphire (gemstones).

CCA was appointed to act as the independent environmental consultant to undertake the necessary Basic Assessment and associated public consultation process for the proposed project. The Basic Assessment process was undertaken so as to comply with the requirements of the EIA Regulations 2010 promulgated in terms Sections 24(5), 24M and 44 of NEMA (No. 107 of 1998).

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

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

6.1 CONCLUSIONS

A summary of the assessment of potential environmental impacts associated with the proposed prospecting activities and No-Go Alternative is provided in Table 6.1.

All of the impacts associated with the prospecting activities would occur in the immediate vicinity of the vessel, would be of short term duration and of low to high intensity, and are considered to be of **VERY LOW** to **LOW** significance after mitigation.

The implications of not going ahead with the proposed prospecting activities relate to the lost opportunity to establish whether or not a viable offshore heavy mineral resource exists off the West Coast and the lost economic opportunities related to costs already incurred in the initial prospecting phase. This potential impact of the No-Go Alternative is considered to be of **LOW** to **MEDIUM** significance.

Table 6.1: Summary of the significance of the potential impacts associated with the proposed prospecting activities and No-Go Alternative.

Potential impact	Significance	
	Without mitigation	With mitigation
Vessel operations:		
Deck drainage into the sea	VL	**VL**
Machinery space drainage into the sea	VL	**VL**
Sewage effluent into the sea	VL	**VL**
Galley waste disposal into the sea	VL	**VL**
Solid waste disposal into the sea	N/A	**N/A**
Impact on marine fauna:		
Sediment removal	VL	**VL**

Potential impact		Significance	
		Without mitigation	With mitigation
Physical crushing of benthic biota		VL	**VL**
Noise associated with sampling activities		VL	**VL**
Noise associated with geophysical surveying		L	**VL**
Impact on other users of the sea:			
Fishing industry	Pelagic purse-seine	L	**L**
	Demersal long-line	L	**L**
	Tuna pole	VL	**VL**
	Pelagic long-line	VL	**VL**
Marine mining and prospecting	Diamond mining	VL	**VL**
	Other mining	VL	**VL**
Petroleum exploration		VL-L	**VL**
Marine transport routes		VL	**VL**
Impact on cultural heritage material:			
Impact on historical shipwrecks		M	**VL**
No-Go Alternative:			
Lost opportunity to establish whether or not a viable offshore heavy mineral resource exists off the West Coast and the lost economic opportunities related to costs already incurred in the initial prospecting phase.		L-M	-

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

6.2 RECOMMENDATIONS

6.2.1 COMPLIANCE WITH ENVIRONMENTAL MANAGEMENT PROGRAMME AND MARPOL 73/78 STANDARDS

- All phases of the proposed project must comply with the Environmental Management Programme presented in Chapter 7. In addition, vessels must ensure compliance with MARPOL 73/78 standards.

6.2.2 NOTIFICATION AND COMMUNICATION WITH KEY STAKEHOLDERS

- Notify PetroSA, Forest Exploration International, Thombo Petroleum, BHP Billiton and Transhex and its contractors, as well as any other operators, prior to the commencement of activities.
- AuruMar should liaise with all petroleum exploration operators to ensure that there is no overlapping of activities in the same area over the same time period.
- Prior to the commencement of activities, AuruMar must notify relevant bodies including: DMR, South African Maritime Safety Authority (SAMSA), the South African Navy (SAN) Hydrographic Office, relevant Port Captains and DAFF: MRM. These bodies must be notified of the navigational co-ordinates of any location prior to commencement of such activities.
- Communication channels should be set up with I&APs. This would involve pre-sampling and survey notifications via email (see bullet below). Key stakeholders should include:
  - Fishing industry (Association of Small Hake Industries, South African Deep Sea Trawling Industry Association, South African Pelagic Fishing Industry Association, South African Commercial Linefish Association, South African Tuna Association, Fresh Tuna Exporters

Association, South African West Coast Rock Lobster Association, and Shark Long-line Association);

> Marine mining / prospecting industry (Transhex); and

> Authorities (SAN Hydrographic office, DAFF: MRM, DMR, SAMSA and relevant Port Captains).

- Appropriate notices should be distributed timeously to mariners providing the following:
  1. the co-ordinates of the sampling and survey activities;
  2. an indication of the sampling and survey timeframes; and
  3. reports on the location of prospecting vessels.

6.2.3 DISCHARGES AND EMISSIONS

- Provide training and awareness to crew members of the need for thorough cleaning up of any spillages immediately after they occur in order to minimise the volume of contaminants washing off decks.
- Use low toxicity, biodegradable detergents and reusable absorbent cloths during deck cleaning to further minimise the potential impact of deck drainage on the marine environment.
- Collect deck drainage in oily water catchment systems.
- Undertake adequate maintenance of all hydraulic systems.
- Minimise the discharge of waste material should obvious attraction of marine fauna be observed.

6.2.4 VESSEL SEAWORTHINESS AND SAFETY

- The vessels must be certified for seaworthiness through an appropriate internationally recognised marine certification programme (e.g. Lloyds Register, Det Norske Veritas).
- Vessels should be equipped with collision prevention equipment including radar, multi-frequency radio, foghorns, etc. The law also requires equipment and training to ensure the safety and survival of the crew in the event of an accident.

6.2.5 GEOPHYSICAL SURVEYING

- Carry out visual scans around the survey vessel prior to the initiation of any acoustic impulses;
- Pre-survey scans should be limited to 15 minutes prior to the start of survey equipment;
- Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the mammal has vacated the area; and
- "Soft starts" should be carried out for any equipment of source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes.

CCA Environmental (Pty) Ltd
15 April 2011

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7. ENVIRONMENTAL MANAGEMENT PROGRAMME FOR SAMPLING AND GEOPHYSICAL SURVEYING

The EMP compiled for prospecting activities is set out in Table 7.1. Specific issues are addressed under each of the following sections:

7.1 EMP Monitoring and Performance Assessment
- 7.1.1 EMP compliance
- 7.1.2 EMP amendments
- 7.1.3 Financial provision
- 7.1.4 Closure

7.2 Natural Environmental Factors
- 7.2.1 Seismic surveying
- 7.2.2 Sampling
- 7.2.3 Air emissions
- 7.2.4 Pollution control and waste management
- 7.2.5 Dealing with emergencies / marine pollution

7.3 Socioeconomic factors
- 7.3.1 Communication with interested and affected parties
- 7.3.2 Presence of vessel / impact of prospecting activities on other industries
- 7.3.3 Heritage sites
- 7.3.4 Incidental loss of equipment
- 7.3.5 Location of oil and gas exploration wellheads
- 7.3.6 Inform relevant parties of survey completion

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

Table 7.1: Environmental Management Programme for proposed prospecting activities in various concession areas off the west coast of South Africa.

7.1 EMP MONITORING AND PERFORMANCE ASSESSMENT			
Item No.	**Action Plans & Control Measures**	**Responsibilities**	**Timing**
7.1.1 EMP Compliance	➢ Ensure that a copy of the EMP is onboard operational vessels. ➢ Conduct monitoring of EMP compliance ➢ Compile and submit EMP Performance Assessment Reports to the Department of Mineral Resources (DMR). ➢ Ensure compliance with the International Maritime Organisation's International Safety Management (ISM) Code developed for the proper development, implementation and assessment of safety and pollution prevention management in accordance with good practice.	Venture Manager, AuruMar	Continuous
7.1.2 EMP Amendments	➢ On an ongoing basis, identify and address new activities and remove obsolete ones, particularly when new or changed mining methods and/or equipment are used. If required, amend the EMP and submit to DMR for approval.	Venture Manager, AuruMar	When there is a change in scope
7.1.3 Financial Provision	➢ Ensure that the requirements of the MPRDA in terms of financial provision for remediation of environmental damage are met by: – Allocating operational costs to meet EMP requirements; – Maintaining adequate Protection and Indemnity (P&I) Insurance Cover to allow for cleanups in the event of oil spills and other eventualities; and – Providing sufficient funds to execute the environmental management plan in the event of premature closure or in then event that on closure the environmental management plan has not been successfully executed.	Venture Manager, AuruMar	Ongoing
7.1.4 Closure	➢ When applying for closure, submit the following documentation to the DMR: – A final layout plan; – A Closure Plan as contemplated in Regulation 62 of the MPRDA; – An Environmental Risk Report as contemplated in Regulation 60 of the MPRDA; – A Final Performance Assessment Report as contemplated in Regulation 55(9) of the MPRDA; and – A completed application form to transfer environmental responsibilities and liabilities, if such transfer has been applied for. ➢ Submit Performance Assessment Report to the Department of Environmental Affairs.	De Beers Consolidated Mines	Prior to closure application

7.2 NATURAL ENVIRONMENTAL FACTORS			
Item No.	**Action Plans & Control Measures**	**Responsibilities**	**Timing**
7.2.1 Seismic surveying	➢ Maintain sightings programme (including marine mammals, turtles, etc.) from operational vessels. ➢ Ensure that Geosurvey activities are conducted in compliance with the following: – Carry out visual scans around the survey vessel prior to the initiation of any acoustic impulses. – Pre-survey scans should be limited to 15 minutes prior to the start of survey equipment. – Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the mammal has vacated the area. – "Soft starts" should be carried out for any equipment of source levels greater than 210 dB re 1 μPa at 1 m over a period of 20 minutes.	Venture Manager, AuruMar	Ongoing
7.2.2 Sampling	➢ Avoid placing the support frame, where possible, on any identified shipwrecks and sensitive habitats, such as rocky outcrops, cold-water coral reefs and any other structural habitat feature. ➢ Calculate and report on annual and cumulative sampled area. ➢ Where possible make available data of a non-confidential nature to relevant agencies / regional or national programmes involved in biodiversity conservation / evaluation and management of marine ecosystems.	Venture Manager, AuruMar	Ongoing
7.2.3 Air emissions	➢ Ensure that contracted vessels comply with the MARPOL requirements with regards to exhaust emissions.	Venture Manager, AuruMar	Ongoing
7.2.4 Pollution control and waste management (of products disposed of: into the air (exhausts, CFCs and incinerators), to sea (sewage, food, oils), to land (used oils, etc, metals, plastics, glass, etc.)	➢ Ensure that contracted vessels: – Implement all applicable MARPOL standards for disposal of general waste, hazardous waste, organic waste (food waste and sewage effluent), greywater, sewerage, bilge water, incineration of shipboard waste and the maintenance of waste records. – Minimise the discharge of waste material should obvious attraction of fauna be observed. – Record types and volumes of chemical and hazardous substances brought on board during the prospecting programme (e.g. neon lights, fluorescent tubes, toner cartridges, batteries etc.) and destination of wastes. – Dispose of wastes generated during AuruMar operation through an acceptable recycling company or at a licensed landfill site. ➢ Ensure applicable crew is trained in spill management.	Venture Manager, AuruMar	Ongoing

7.2.5 Dealing with emergencies / marine pollution (owing to collision, vessel break-up, refuelling etc.)	➢ Ensure that contracted vessels: – Maintain all emergency procedures as legally required. – Adhere to obligations regarding other vessels in distress. – Where diesel, which evaporates relatively quickly, has been spilled, the water should be agitated or mixed using a propeller boat/dinghy to aid dispersal and evaporation. ➢ In the event of an emergency including fire, grounding or sinking, or collision, ensure that the approved Shipboard Oil Pollution Emergency Plan and Emergency Response Manuals are followed, which include: – Ensuring safety of personnel onboard; – Stabilising the ship and limit damages; – Containing the spill, if possible; and – Immediately reporting accidental spills to the relevant Authorities and Professional Bodies providing full details of the incident.	Venture Manager, AuruMar	Ongoing
	➢ In the event of an oil spill immediately implement emergency plans and notify (a) the Principal Officer of the nearest SAMSA office, (b) the DEA's Chief Directorate of Marine Pollution in Cape Town and (c) PASA. Information that should be supplied when reporting a spill includes: – The type and circumstances of incident, ship type, port of registry, nearest agent representing the ships company; – Geographic location of the incident, distance off-shore and extent of oil spill; – Prevailing weather conditions, sea state in affected area (wind direction and speed, weather and swell); and – Persons and authorities already informed of the spill. – Where feasible, provide facilities to rescue, stabilise, and fly oiled seabirds to SANCCOB for further rehabilitation.	Venture Manager, AuruMar	Per event
	➢ Notification to Transhex Operations of the occurrence of any Moderate or Major overboard spills during prospecting activities.	Venture Manager, AuruMar	Per event

7.3. SOCIOECONOMIC FACTORS			
Task No.	**Action Plans & Control Measures**	**Responsibilities**	**Timing**
7.3.1 Communication with Interested and Affected Parties	➢ Through normal maritime communication channels, Radio Navigation Warnings, Notices to Mariners and other notifications keep the following interested and affected parties updated on the prospecting activities: – Overlapping and neighbouring users with delineated boundaries in the oil & gas exploration & production industries and any prospecting and mining industries; – SAN Hydrographic Office (Silvermine); – Fishing industry (including Association of Small Hake Industries, SA Deep Sea Trawling Industry Association, SA Pelagic Fishing Industry Association, SA Commercial Linefish Association, SA Tuna Association, Fresh Tuna Exporters Association, SA West Coast Rock Lobster Association and Shark Long-line Association); – Government departments with jurisdiction over marine activities, particularly DEA, DAFF: MRM, PASA and DMR; and – SAMSA and local Port Captains.	Venture Manager, AuruMar	14 days prior to operations
7.3.2 Presence of vessel / impact of prospecting activities on other industries	➢ Liaise with BHP Billiton, Transhex, PetroSA, Forest Exploration International (South Africa) and Thombo Petroleum regarding prospecting plans, including information regarding location of operations, specific starting and finishing dates, as well as progress of operation.	Venture Manager, AuruMar	During Work Plan Preparation & Quarterly thereafter
	➢ Inform the West Coast Rock Lobster Sea Management Association if any activities are activated within the 100m contour line.	Venture Manager, AuruMar	Per event
	➢ Ensure that Vessel masters of contracted vessels record sightings of and interactions with other vessels to note potential conflicts over rights of passage and access to resources.	Venture Manager, AuruMar	Per event
7.3.3 Heritage sites	➢ Should any archaeological sites or historical material be identified during survey or sampling operations ensure that: - Position of the site is documented; - The Maritime Archaeologist at the South African Heritage Resources Agency, Cape Town and the Maritime Archaeology Unit of Isiko Museum, Cape Town are notified; and - Sampling in the immediate area to be avoided to prevent damage until feedback from the authorities is received.	Venture Manager, AuruMar	Per event

7.4.4 Incidental loss of equipment – obstacles	➢ Maintain hazards database listing the type of gear left on the seabed and/or in the mine/prospecting area with the dates of loss and locations and where applicable, the dates of retrieval. ➢ If requested, report these data to the relevant authority.	Venture Manager, AuruMar	Per event
7.5.5 Location of oil and gas exploration wellheads	➢ Ensure that location of wellheads is mapped on the prospecting database and that the necessary exclusion zone is applied.	Venture Manager, AuruMar	Prior to survey or sampling operations
7.5.6 Inform relevant parties of survey completion	➢ Inform all key stakeholders (see Section 7.3.1) that the sampling and survey vessels have completed operations as per normal maritime communication practice.	Venture Manager, AuruMar	Within two weeks of completion

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