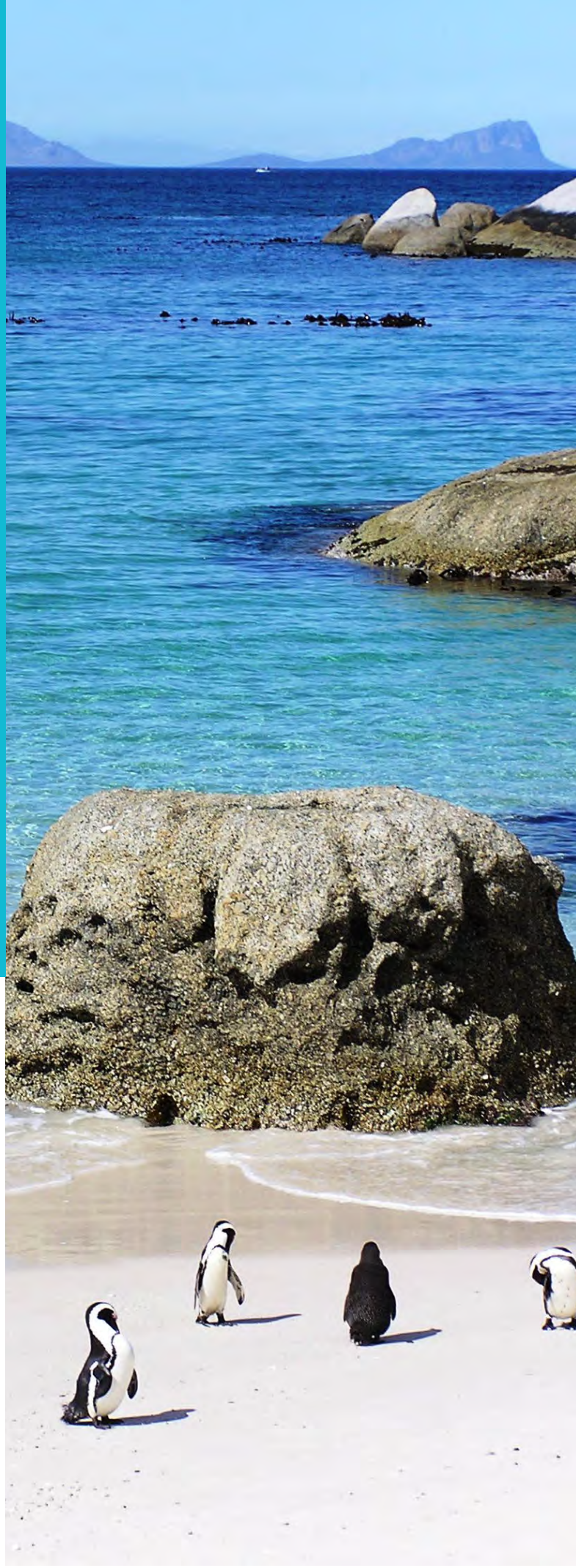
Chapter 9

Oceans and coasts

Ocean and coasts ecosystem services are important as they directly and indirectly impact on human livelihoods, food security and agriculture, trade and industry.

Chapter 9

Contents



9.1 INTRODUCTION

South Africa's Constitution makes provision for the protection, conservation and sustainable use of the environment. The ocean and coastal zones under South Africa's jurisdiction can be considered largely as wilderness areas and are in fact larger than the size of the country's land territory. The unique ocean current systems around the South African coastline are highly productive and display rich biodiversity. The available living and inert ocean and coast resources represent a significant economic and development opportunity for present and future generations of South Africans. This economic opportunity comprises both historical sectors, such as fishing and shipping, as well as significant new and emergent technologically advanced sectors relating to medicine, energy, mining and food production. Included in the jurisdiction of the oceans and coasts environment are the two sub-Antarctic territories of Prince Edward and Marion Islands and the exclusive economic zone (EEZ) that surrounds these islands.

Ocean and coasts ecosystem services are important as they directly and indirectly impact on human livelihoods, food security and agriculture, trade and industry. These services

range from planetary functions such as heat distribution, nutrient cycling, oxygen production, carbon dioxide absorption and influencing rainfall and weather patterns to the harvesting of fish and mining of oil, gas and other minerals. Knowledge and understanding of the oceans and coasts environments must also contribute to national planning by understanding and informing decision-makers of how the delivery of ecosystem services may vary or change over time. Monitoring changes in South Africa's ocean and coastal environment allows stakeholders and decision-makers to identify trends and emerging issues, and to develop responses to these changes where necessary. New research undertaken provides an opportunity to track how trends have developed since the 2006 SAEO, whilst simultaneously highlighting emerging issues within the marine and coastal environment arena. Key topics, issues and indicators have thus been identified based on the availability of information, as well as their suitability for providing a broader outlook on the status of South Africa's oceans and coasts.

Marine biodiversity, fisheries, tourism, infrastructure and the built environment within coastal areas have all been identified as sectors requiring specific interventions to ensure that the oceans and coastal environment continues to deliver goods and services to society. These sectors, amongst many others, form the basis for the complexity of oceans and coasts management, and must be monitored to identify rates and magnitudes of change and ensure the sustainability thereof.

Oceans and coastal resources in South Africa are vital for those local coastal communities that depend on them, and many of these communities live in abject poverty. These resources also hold significant value for a number of different sectors such as mining, fisheries, forestry and tourism. Most of these sectors also supply the global consumer markets (Wynberg & Hauck 2014).

Aspects of South Africa's coastal and marine resources, similar to international trends, are under threat. Longer term issues such as global warming and sea-level rise may also need to be considered (Burns *et al*. 1999).

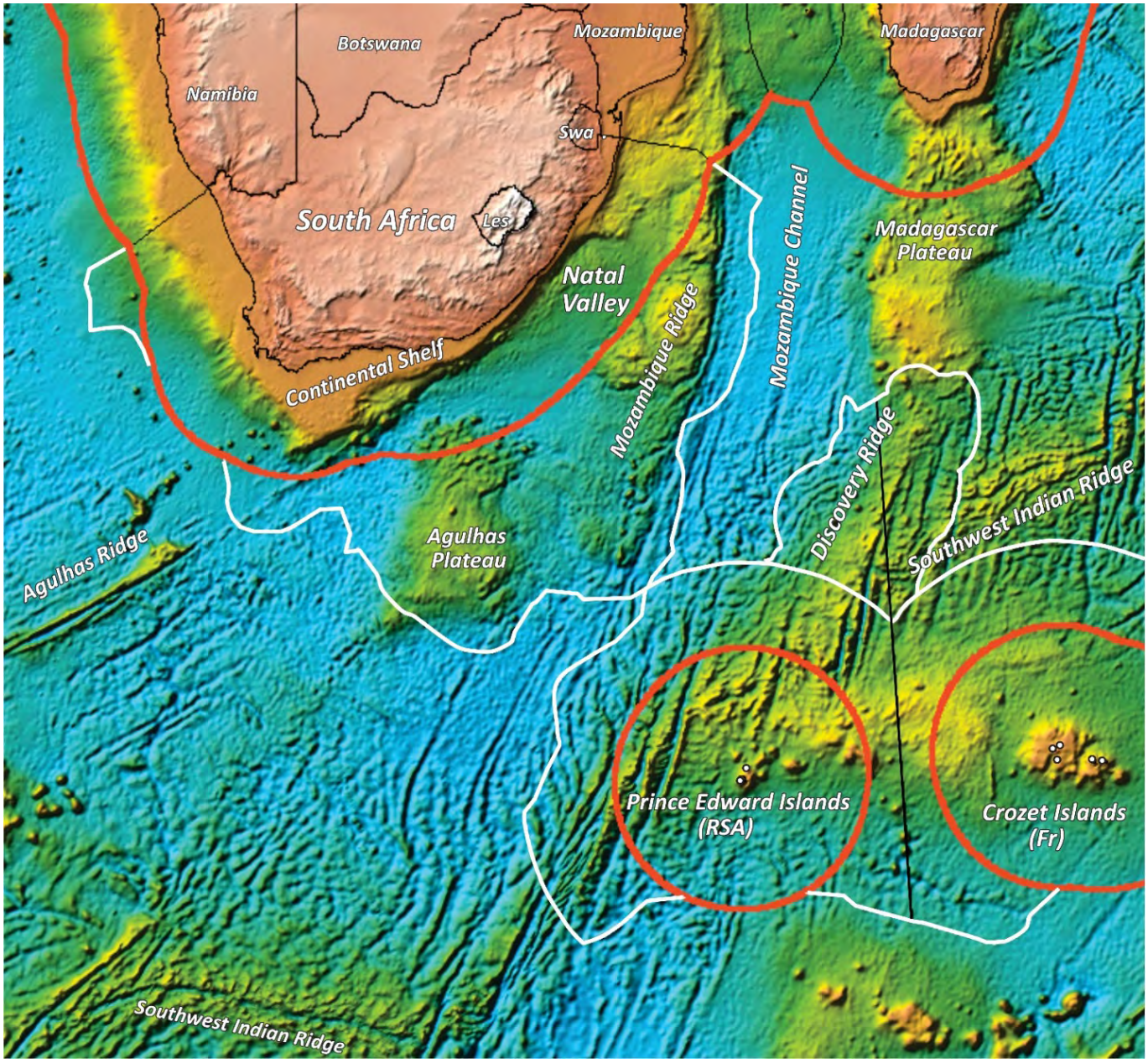
It is estimated that in South Africa 58 per cent of coastal and inshore ecosystem types, 41 per cent of offshore ecosystem types, and 43 per cent of estuary ecosystem types are threatened (DEA 2011a). Extractive or consumptive use of natural resources is identified as the most significant threat to South Africa's ocean and coastal resources (Driver *et al.* 2005). More recently the NBA Coastal and Marine Component identified the key challenges as over-exploitation of resources, substantial and unmanaged by-catch in some sectors, incidental seabird mortalities, habitat damage, concerns around food supply for other species and other ecosystem impacts of fishing (Sink *et al.* 2012). South Africa has implemented a range of mitigation measures to reduce seabird mortalities in the fishing sector. These, in addition to national reporting, are also reported at the multi-lateral Agreement on the Conservation of Albatross and Petrels (ACAP) to which South Africa is a party.

Aspects of monitored trends in the modification, degradation and use of marine and coastal resources mirror the decline reported on in the 2006 SAEO and require a combined public and private sector effort to reduce reported impacts on marine and coastal resources. These trends are not, however, reflective of a comprehensive monitoring against established baselines in ocean and coastal ecosystems. Such monitoring is currently being planned over the medium-term by the DEA and forms part of a number of initiatives to address impacts in the coastal and marine environment. Observed trends are discussed in more detail in the sections that follow.

9.1.1 The South African coastal zone

The understanding of what exactly the coastal zone comprises may vary depending on nations, organizations or individuals, and may also vary in seaward and terrestrial boundaries and at estuarine influences. Furthermore, they may refer to a relative term or even to absolute boundaries that can be mapped. Be that as it may, a uniform, national definition is critical to set the stage for practical and enforceable regulations that arise from a common understanding of the boundaries of the coastal zone. The ICM Act deals with the definition and legal status of the various spatial aspects that make up the coastal zone of South Africa (Map 9.1). These include:

- Coastal public property;
- Coastal protection zone;
- Coastal access land;
- Coastal waters;
- Coastal protected areas;
- Special management areas; and,
- Coastal set-back lines.



Map 9. 1: The coastal zone of South Africa

White outlined areas shown above illustrate SA Extended Continental Shelf Claim. The landscape of the ocean floor as revealed by satellite imagery. The blue areas depict the deep ocean floor (6,000 m deep) which is a vast plain cut by trenches and ridges which follow fault lines. The green and yellow areas depict enormous underwater plateaus and mountain ranges. South Africa's remote and tiny Prince Edward Islands are seen to be the peaks of underwater volcanoes on the flank of the SW Indian Ridge. Source: Petroleum Agency SA

9.2 UTILIZATION OF OCEANS AND COASTS

Oceans and coasts provide many valuable services and uses to South Africa. The following section provides an overview of both the extractive and non-extractive use of our oceans and coasts.

9.2.1 Extractive resource use: mining

South Africa's coastline is rich in mineral resources, and is predominantly mined for mineral sands and aggregates (UNOPS 2011). Some sand mining (Box 9.1), or sand winning, takes place along South Africa's coastline, with much of the existing activity being undertaken illegally, making it difficult to estimate its value (UNOPS 2011). In terms of heavy mineral sand mining, the mineral deposits in KwaZulu-Natal alone are estimated as potentially a very valuable resource (UNOPS 2011). According to the 2009 National Land Cover data, 554 km^2 of land in coastal districts is used for mining (SANBI 2009). The majority of mining activities take place in the Namaqua District in the Western Cape and in the Nelson Mandela Bay Metropolitan Area in the Eastern Cape. Mining areas were not previously reported on in the 2006 SAEO.

Internationally, the offshore exploration for hard minerals is on the increase and it is to be expected that the exploitation of South Africa's non-living marine resources will also increase. Deposits of two minerals important for the production of fertilizer (potassium and glauconite) are widely found in South Africa's EEZ. Currently, the costs of extraction remain prohibitive in the context of similar terrestrial resources. However, as terrestrial resources diminish and technology improves, these deposits may become economically viable.

In addition, there has been interest expressed recently in the mining of marine phosphate; however, the environmental impact of the mining processes considered has raised concerns.

Box 9. 1: Case study: Sand budgets, mining and impacts on sandy beaches

Sand mining in rivers and estuaries in the eThekwini area of KZN will have a dramatic effect on coastal erosion if alternative sources of sand are not found soon. Combined with climate change, the consequences to KZN's golden beaches could be similar to, and eventually exceed, the erosion suffered in the marine storm erosion event of 2007 (Theron *et al*. 2008).

In a study undertaken for the eThekwini Municipality, the Council for Scientific and Industrial Research (CSIR) found that the impact of both dams and sand mining could result in mean coastal erosion of more than 1 m per year. Combined with global climate change, increased sea-levels and sea-storms, the consequences in terms of coastal erosion could be severe. The total sand yield for the 18 eThekwini rivers was found to be between 480,000 to 720,000 m^3 per year. However, the 12 large dams on eThekwini's (Durban) rivers trap approximately one-third of the sand (excluding the silt portion) flowing into them. Sand yield is further reduced by about one-third by 31 both legal and illegal sand mining operations on eThekwini rivers. The total mined volume for the rivers in 2008 was conservatively estimated to be at least 400,000 m^3 a year. In total, the remaining sand yield is only a third of what it could be naturally. This means a 66% reduction in natural sand yield due to dams and sand mining operations. Furthermore, it has been demonstrated that the rivers most affected by sand mining will take a long time to recover even if sand mining is banned.

The study also included a resource economics analysis, adopting a cost-benefit approach, with sand being the basic and limited resource. The importance of this resource for both the construction industry and sustaining the character of eThekwini's (Durban) beaches is obvious. However, at current market prices, sand miners have no incentive to restrict their activities. In the absence of intervention, market prices will only increase when a scarcity of sand resources intensifies. If the full environmental and socio-economic costs of current sand mining are considered, then alternative sources of sand supply, such as dredging or non-riverine land sources, become more economically viable. Sand mining rates are already exceeding the natural regenerative capacity of the resource. For example, in respect to the Mkomazi River, more than three times as much value is potentially lost as a result of the sand being taken out of the system than is at present derived directly from sand mining. Further research is thus needed in terms of the trade-off between tourism and sand mining.

Source: Theron et al*. (2008)*

Offshore structures associated with mining can also be responsible for introducing alien species. Such complex structures provide habitat for many species and are often slowly towed from one position in the ocean to another, often across regions.

Furthermore, while there has been the traditional tension between mining and prospecting and the environment, South Africa has begun to address this through work such as the Biodiversity and Mining Guidelines published in 2013. Certain marine areas have restrictions on mining, namely proclaimed coastal and MPAs. However, although these areas protect 20 per cent of the coastline, they comprise less than one per cent of the EEZ and less than three per cent of the productive continental shelf seas, and thus there is an opportunity to increase the area under protection. The current situation sees a series of discussions being undertaken among the DEA, Mineral Resources (DMR) and Energy. In terms of these discussions, the DMR undertakes EIAs with potentially a greater role for the DEA in any appeals process.

9.2.1.1 Value of offshore mining in South Africa

The South African economy overall continues to benefit greatly from mining. The mining sector accounted for seven per cent of GDP and also employed about 459,000 people in 2006. The mining sector's total contribution to the South African economy was estimated at $25.9 billion in 2006 (Curtis 2009).

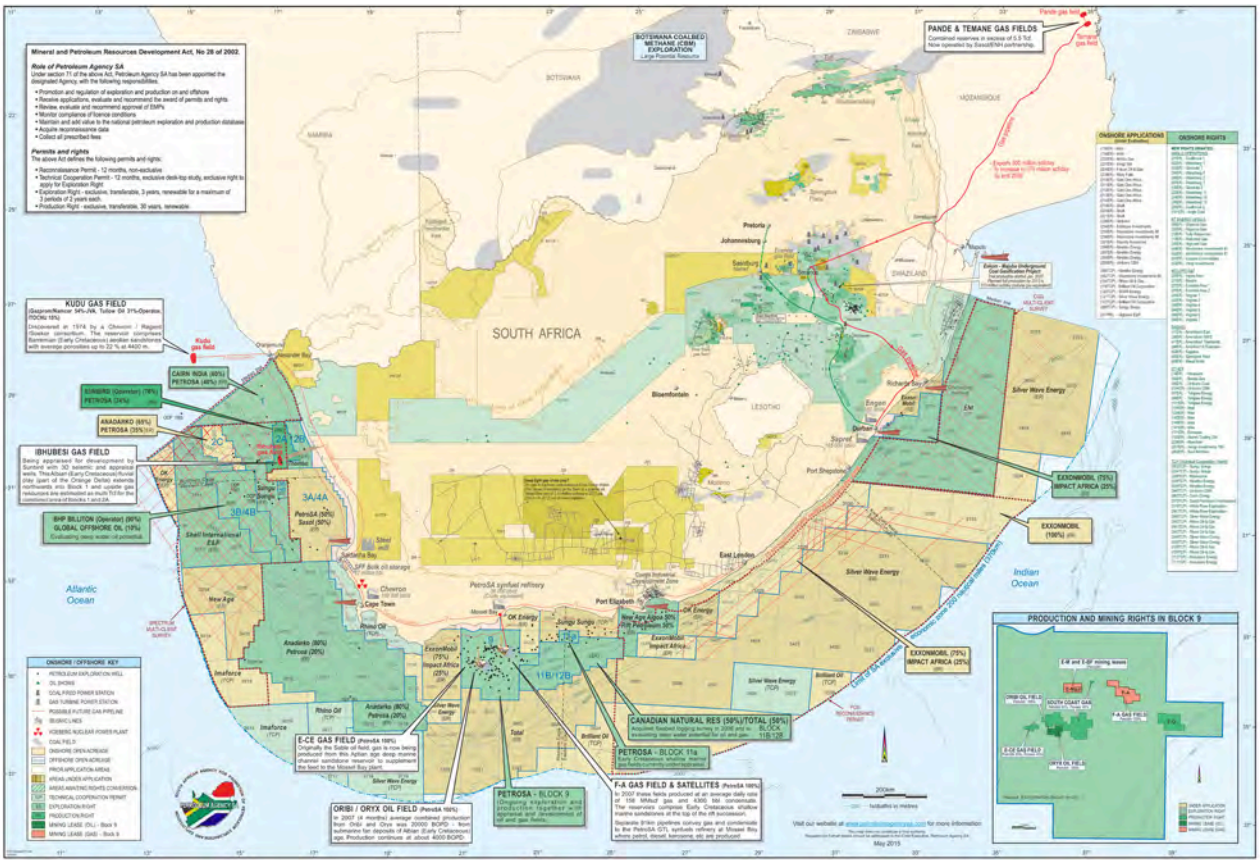
The production of offshore oil and gas (which is converted to liquid fuel) fulfils about seven per cent of South Africa's oil resources production. Approximately 69 per cent of South African crude oil is imported from elsewhere with the balance of about 24 per cent being obtained from coal using Sasol's synthol process of oil production (Atkinson & Skink 2008).

South Africa's total (terrestrial and marine mining) diamond mining industry is ranked third in the world (trailing behind Botswana and Russia) and was valued at an estimated US$1,700 million in 2005, contributing nearly 14 per cent of the world's diamonds. The marine diamond mining component also contributed about 0.0026 per cent to South Africa's annual GDP (Atkinson & Sink 2008).

9.2.1.2 Offshore mining in South Africa (oil and gas mining)

Oil and gas exploration has traditionally occurred mostly in the Karoo basin, and has expanded into the Eastern Cape, Western Cape and the Northern Cape coastal zones (Map 9.2) (PASA 2007). South African offshore mining exploration

has also been expanded more recently into the EEZ, which is seen as an area having further potential for the production of oil and gas. Over 300 wells have now been drilled within the South African EEZ; these wells have been drilled for the potential accumulation of oil and/or gas resources (PASA 2007).

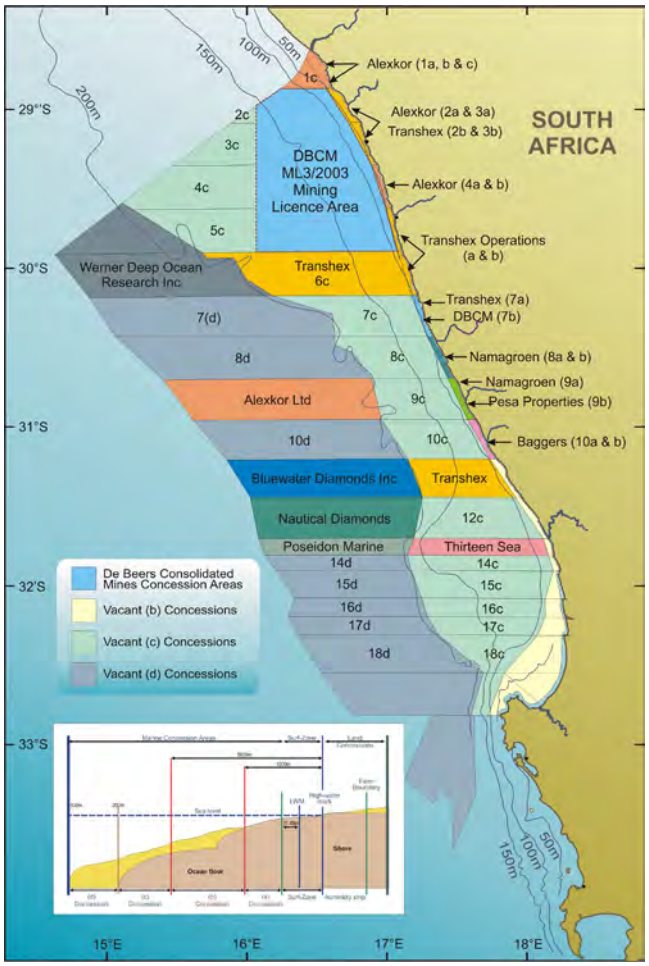


Map 9. 2: Offshore oil and gas exploration and license blocks in South Africa's EEZ
Source: PASA (2007)

9.2.1.3 Offshore diamond mining

Marine diamond mining originated from inland kimberlite pipes that transported deposits seawards via rivers and deposited the diamonds on gravel beaches along the South African West Coast. Most marine diamond mining occurs in the offshore Namaqualand concession zone which is the coastal region between the Orange and Olifants Rivers (Map 9.3). Such mining practices entail the removal of unconsolidated sediments (overburden) from the sea floor (Penney & Pulfrich 2004).

Source: Brian McMorrow



Map 9. 3: Map of the South African marine diamond mining concession areas, showing the position of the ML3/2003 mining license area
Source: De Beers (2009)

9.2.2 Extractive resource use: fishing and aquaculture

South Africa's fisheries sector can be described as presented in Figure 9.1.

9.2.2.1 Commercial fishing/harvesting

During the macro-reorganization of national government in 2010, the management mandate for fisheries moved from the then Department of Environmental Affairs and Tourism (DEAT) to the Department of Agriculture, Forestry and Fisheries (DAFF). The commercial fishing industry has seen a shift from annual and medium-term, to long-term fishing rights allocation for periods of between eight and 15 years across 22 fishing sectors in 2005/06. This was based on some core considerations, namely the applicant's empowerment or transformation credentials, a biologically determined and sustainable management framework, potential impacts on marine ecosystems, and opportunities for job creation, poverty alleviation and empowerment. Long-term rights in South African waters, which were 'South Africanized' when the rights of international fishing vessels were revoked in 2002, have been issued in 22 fishing sectors to over 2,900 right holders and to 1,788 vessels (WWF 2011).

South Africa's commercial fisheries are controlled via restricting the total amount permitted to be caught by the permit holder (total allowable catch - TAC), restricting the amount of effort (vessels, fishers or hours) applied to a particular fishery (total applied effort - TAE), or a combination of the two. This could include restricting vessel numbers or gear, crew numbers or sea days, or a combination thereof (WWF 2011). South Africa is, however, making progress in terms of adopting an ecosystem approach to fisheries management. Extensive research has been conducted on target species of the small pelagic fishery, in terms of community dynamics and the development of biological and spatial ecosystem indicators (Sink *et al*. 2012), to ensure maintenance and sustainable use of the healthy pelagic fish resources.

While the commercial fisheries industry is said to be well-managed, with current and reliable catch and research data collected annually, decades of over-fishing and other factors are impacting on the industry, with numerous species categorized as 'collapsed', and others as over-exploited (DAFF 2012, Sink *et al*. 2012).

In South Africa, there are 22 recognized commercial fisheries (Table 9.1), which generated an annual turnover of approximately R44,000 million from 583,000 tonnes of fish caught in 2009 (DAFF 2010a) and R80,000 million in 2010 (UNOPS 2011).

Revenue from commercial fishery exports in 2008 was estimated at R3.1 hundred million (DAFF 2010a). In 2009, South Africa exported approximately R560 million worth of fish and fishery products worldwide (TRAFFIC 2010, cited in WWF 2011). The squid fishery alone generates R500 million in foreign revenue per annum and is one of the country's most valuable fisheries (DAFF 2010b, cited in WWF 2011). The industry contributes approximately one-half per cent of South Africa's GDP (DAFF 2010b cited in WWF 2011). The central role that commercial fishing plays in the generation of capital and the sustaining of livelihoods is highlighted by the fact that the industry supports approximately 30,000 jobs directly and some 81,000 indirectly (UNOPS 2011).

The status of commonly caught, commercially important linefish species versus the status of South African marine resources generally is detailed in Figure 9.2 (WWF 2011) and is a further indication of the impact of the industry on these resources.

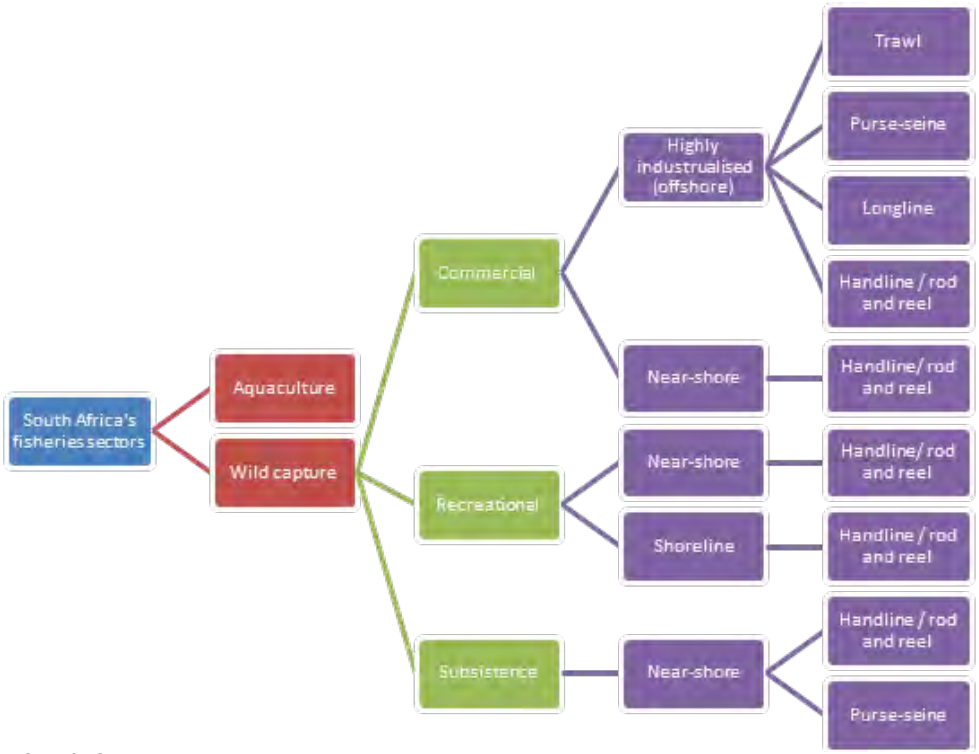


Figure 9. 1: South Africa's fisheries sector as at 2011
Source: Adapted from WWF (2011)

Table 9. 1: Recognized commercial fisheries in South Africa

The commercial fisheries of South Africa		
• Hake inshore trawl	• West Coast rock lobster offshore	• Tuna pole
• Hake offshore trawl	• Squid	• Abalone
• Hake longline	• Horse mackerel	• Seaweed
• Hake handline	• Patagonian toothfish	• Demersal shark
• Small pelagics	• KZN prawn trawl	• Traditional linefish
• South Coast rock lobster	• Tuna and swordfish longline	• White mussel
• West Coast rock lobster inshore		• Gillnet and trek net fishery
		• Oysters
		• Agulhas sole

Source: WWF (2011)

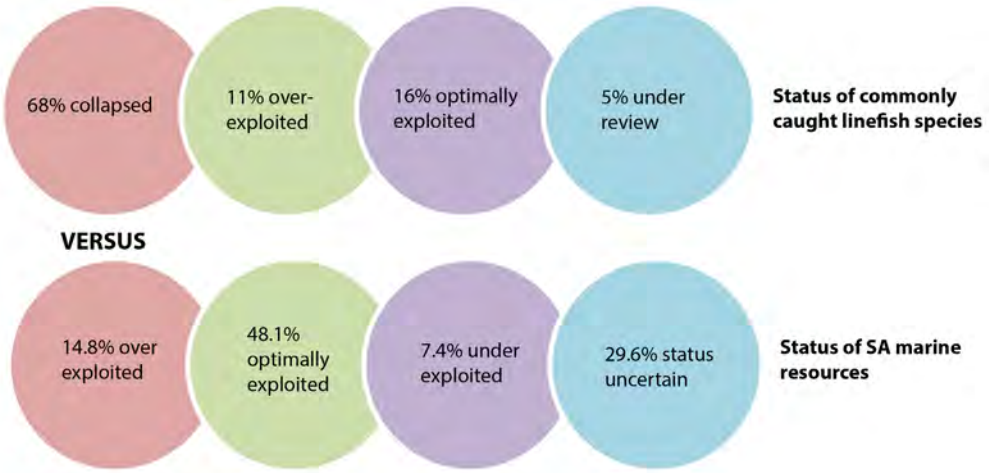


Figure 9. 2: Status of commonly caught linefish species versus the status of South African marine resources generally as at 2011
Source: adapted from WWF (2011)

The Food and Agriculture Organization (FAO) monitors fisheries resources by country according to capture production (i.e. amount of fish caught). Figure 9.3 provides data for South Africa from 1999 to 2008 for fish, crustaceans and molluscs in tonnes per year (FAO 2010).

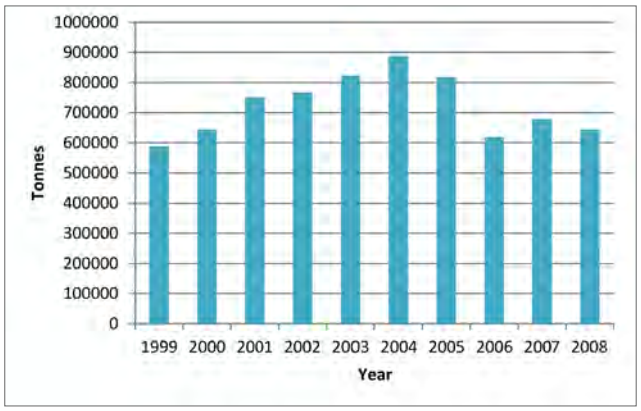


Figure 9. 3: Total catch production for South Africa for the period 1999 to 2008
Source: FAO (2010)

StatsSA tracks catches and the value of hake (*Merluccius paradoxis* and *M. capensis*) and West Coast rock lobster (*Jasus lalandii*), as these two fisheries account for approximately 80 per cent of the economic contribution to the South African commercial fisheries sector (StatsSA 2012).

Over the past two decades, there has been concern about the bycatch of seabirds, turtles and sharks in fishing operations, in particular in longline and trawl fisheries (Box 9.2). The incidental mortality of these species has been widely held responsible for the declining populations and threatened conservation status of several seabird species (e.g. Ryan *et al*. 2009).

Box 9. 2: Seabird bycatch

The ACAP came into force in 2004. At present, only 13 States, including South Africa, are party to the Agreement. Albatrosses and petrels are generally wide-ranging seabirds travelling to the waters of several national jurisdictions and across the high seas. Several species of albatross and petrel breed at South Africa's Prince Edward Islands (which comprises of Marion Island and Prince Edward Island) in the southwest Indian Ocean. Some of these, as well as other species of albatross and petrel, regularly visit South Africa's waters where they are at risk from South Africa's fisheries.

DEA and the DAFF have made substantial progress in assessing and protecting the conservation status of species listed by ACAP and in developing and adopting best practice measures to mitigate threats to albatrosses and petrels. There have also been substantive negotiations with Regional Fisheries Management Organizations to ascertain the level of and encourage mitigation of the seabird bycatch.

DEA, in conjunction with University of Cape Town, monitors South Africa's populations of albatrosses and petrels at its Prince Edwards Islands. An example relates to the wandering albatross, for which the Prince Edwards Islands hold nearly half the global population. There has been a long-term increase in numbers of wandering albatross at both Marion and Prince Edward islands (Figure 9.4). However, numbers at Marion Island decreased between 1998 and 2005, perhaps as a consequence of bycatch mortality. Bycatch mortality of seabirds in South Africa's fisheries has been substantially reduced in recent years, and numbers of wandering albatrosses at Marion Island have started to increase again.

DAFF is responsible for monitoring and implementing measures to mitigate bycatch mortality in South Africa's fisheries and reporting fishing effort and bycatch rates to ACAP. However, the absence of observer coverage on any of South Africa's relevant fisheries sectors after March 2012 (except for the joint venture tuna longline fisheries) poses a concern due to likely under reporting of seabirds killed in South Africa's various trawl and longline fisheries sectors.

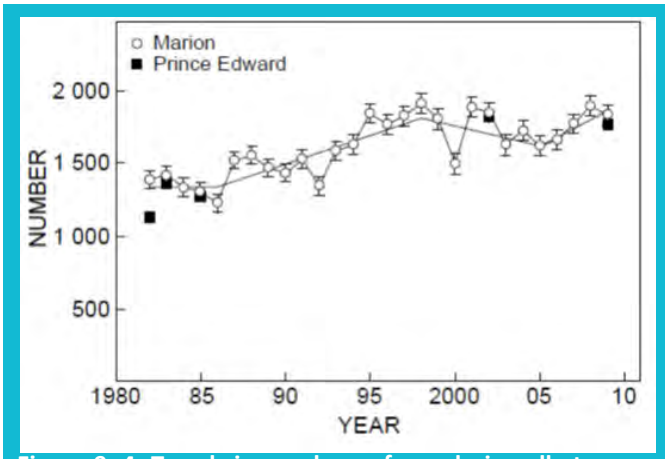


Figure 9. 4: Trends in numbers of wandering albatrosses breeding at South Africa's Marion and Prince Edward Islands for the period 1982 to 2009
Source: Ryan et al. *(2009)*

9.2.2.2 Subsistence harvesting

Subsistence fishers fish for or harvest resources such as line fish, mussels, abalone (*Haliotis* spp.), East and West Coast rock lobster and oysters for purposes of food security (Branch *et al*. 2002; DAFF 2012; Sink *et al*. 2012). Of the 30,000 subsistence fisher active on the South Africa coastline, 85 per cent target and harvest linefish (DAFF 2012).

More recently, DAFF (2010b) cited in WWF (2011), estimated that 147 fishing communities, 28,338 fisher households, and about 29,233 people are considered subsistence fishers, with 53 per cent of the traditional fishing communities country wide being classified as food insecure (WWF 2011). These fishers are now formally recognized through the Subsistence Fisheries Policy.

9.2.2.3 Aquaculture

Marine aquaculture, or mariculture, in South Africa focuses predominantly on three species, namely mussels, oysters and abalone, with seaweed cultivated as a food source for mariculture organisms. The production of marine finfish (species not detailed) is just entering the commercial market.

Marine aquaculture is an emerging fisheries sector in South Africa which is important as it can potentially take the pressure off wild populations that can then be successfully farmed. Aquaculture, however, can also have adverse effects if not managed correctly. According to DAFF (2011), marine aquaculture production increased by 5.59 per cent from 2000 to 2010 (Figure 9.5).

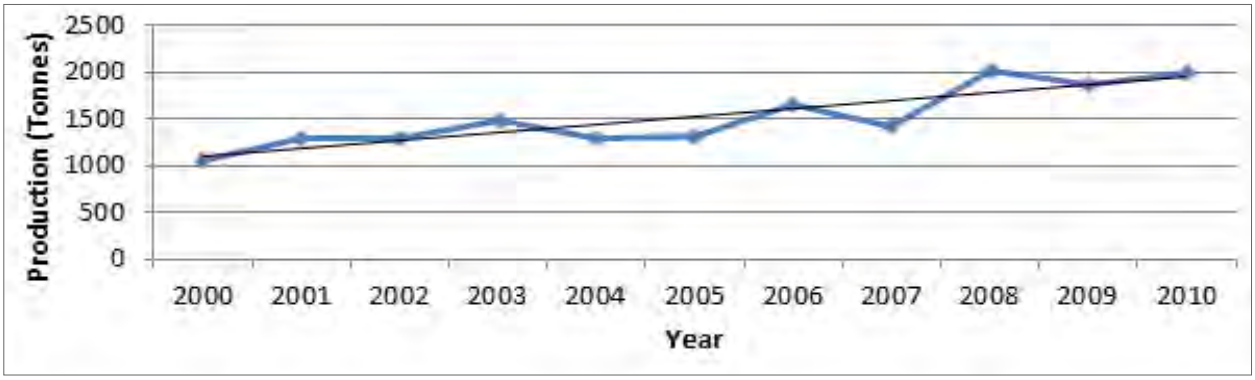


Figure 9. 5: Growth in production of the marine aquaculture industry from 2000 to 2010
Source: Adapted from DAFF (2011)

Marine aquaculture contributes approximately four per cent of the value of production of the fishing industry, which, while low in respect to international standards, is indicative of a growing sector. It is, however, faced with numerous obstacles, including the high energy and dynamic South African coastline (DAFF 2011).

In 2010, 41 permits were issued for marine aquaculture; however, only 33 farms were operating by the end of 2010, 22 of which are located in the Western Cape, 10 in the Eastern Cape, three in the Northern Cape and only one in KwaZulu-Natal. Abalone contributed 51 per cent of the total production.

The total value of the marine aquaculture sector was estimated at R378 million, increasing by 11 per cent from 2009 with abalone representing 94 per cent of this figure. During 2010, the marine aquaculture sector employed a total of 1,556 individuals on a full-time basis of which 35 per cent were female and 1,260 were historically disadvantaged individuals (DAFF 2011).

9.2.3 Transport

9.2.3.1 Ocean transport

An estimated 7,000 vessels pass around South Africa's coastline annually, of which many are laden tankers carrying in excess of 30 million tonnes of crude oil. Additionally over 9,000 ships visit South Africa's ports annually. Ninety-eight per cent of South Africa's exports are conveyed by sea. The turnover from South Africa's harbour activities in the 2009/10 financial year was R12.6 billion. South Africa recently acquired and installed 19 new container handling cranes in its ports. South Africa's commercial ports handle over 430 million tonnes of varied cargo types each year. Richard's Bay is South Africa's largest cargo volume port handling in excess of 80 million tonnes of cargo annually. eThekwini (Durban) is South Africa's busiest port in terms of value of cargo handled as well as the number of vessels docking per year, with expansion of the port currently being proposed. During the early 1990s, the South African merchant marine register was composed of about 120 ships. However, by 2010 the South African Maritime Safety Authority (SAMSA) marine register recorded no South African flag vessels.

9.2.3.2 Use of 4x4 (off road) vehicles in the coastal zone

South Africa has successfully implemented the Regulations of the Control of Use of Vehicles in the Coastal Zone in terms of the NEMA. The regulations have been in force since 2001, and were amended in 2004 (Government Notice Number R1426) and effectively ban recreational vehicle use in the coastal zone (specifically on beaches) by the general public. Various studies have shown that the state of coastal plant life and fauna, especially birds, has improved since the introduction of the regulations, and have also demonstrated that tourism has increased in certain popular areas such as St. Lucia and the adjacent iSimangaliso Wetland Park (a world heritage site) on the KwaZulu-Natal north coast. Regulations for the Control of Use of Vehicles in the Coastal Area were published in June 2014 (Notice R496 in Government Gazette 37761). The new regulations will include another vehicle access permit category for the construction and maintenance of infrastructure, in support of the National Infrastructure Development Plans, particularly the port expansions and maintenances.

9.2.4 Coastal development

South Africa's economy is evolving from one based on natural resource extraction and sale to one of manufacturing and services, and is increasingly dependent on port facilities for the export of processed goods. Much of the country's coastal development is centred around the eight large commercial ports situated at Saldanha Bay, Cape Town, Mossel Bay, Ngqura (Coega), Port Elizabeth, Buffalo City (East London), eThekwini (Durban) and Richards Bay, and are the centres of government initiatives such as the Spatial Development Initiatives (SDIs). The development in the coastal zone has become a driving force for environmental changes in the coastal zone landscape (Burns *et al*. 1999).

9.2.4.1 Municipal and industrial waste discharge

The discharge of waste water into the ocean environment in South Africa is generally comprised of municipal waste water (domestic sewage), industrial waste water and storm water flow. There are over 60 licenced pipelines which discharge effluent along the South African coast. In South Africa, disposal of sewage into the marine environment ranges from preliminary treated sewage secondary treated effluent discharges in the surf zone and estuaries, to untreated sewage from informal settlements occurring in storm water runoff.

Storm water runoff from urban areas is difficult to control or predict. It is heavily dependent on rainfall which is collected and channelled from non-porous surfaces into outlets and onto beaches or rocks. Both Cape Town and eThekwini (Durban) have over 100 storm water outlets in their immediate urban areas. The runoff often contains heavy metals, oil residues, nutrients and pathogenic microorganisms. The first storm water flow of the rainy season is normally the most contaminated. Large amounts of plastics are also introduced into the marine environment during storm water deposits.

9.2.5 Non-extractive use

9.2.5.1 Ecotourism

Since the mid-1990s, there has been a growing non-consumptive or ecotourism sector focusing mainly on boat-based whale watching and white shark cage diving. After an initial expansion period till 2002, effort levels have remained static until 2011 when policies and regulations dealing with the transformation and expanded sustainable use of resources in the non-consumptive (eco-tourism) contexts were implemented. This was guided by research on what could be considered sustainable use of these resources, and was accompanied by detailed permit conditions developed in active consultation with operators. Eco-filming of marine resources and protected areas is another activity that expanded substantially up to 2011 (Figure 9.6), and this requires research-based permit conditions to be developed for each application, as each film maker strives for an original innovative product.

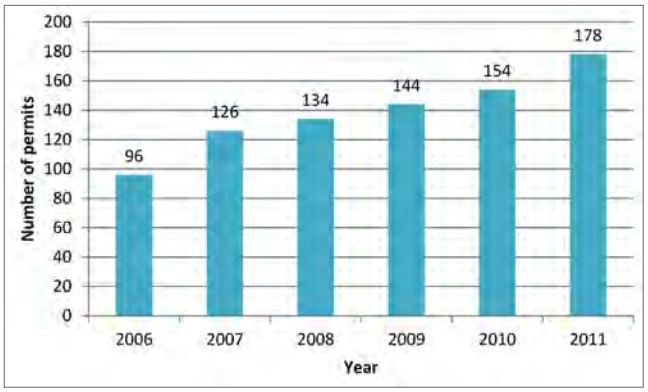


Figure 9. 6: Number of permits issued for non-consumptive ocean and coastal activities between the period 2006 to 2011
Source: DEA (2011b)

9.2.5.2 Social and cultural use

South Africans engage in a wide variety of consumptive and non-consumptive uses of marine resources and the marine environment. Coastal tourism has been estimated as generating approximately R13.5 billion to the South African economy annually. The true value to South Africa's citizens of enjoying access to and use of thousands of kilometres of pristine coastline is incapable of calculation. Recreational fishing is a popular activity in South Africa with more than 500,000 active sports fishermen. The value of recreational fishing is difficult to quantify but it contributes substantially to the South African economy. Diving is another popular recreational activity, as are sun-bathing, swimming and picnicking. Some religious groupings use the coastal environment for the performance of activities and ceremonies. Many South Africans also gather sea water for medicinal purposes. The imagery of the sea is deeply embedded in the beliefs, poetry and songs of coastal communities.

9.2.6 Emerging oceans and coasts uses

Ocean energy could potentially be derived from the various characteristics of the sea. For example, the rise and fall of waves could be converted into hydraulic pressure by mechanical compression devices. Such pressure could drive a turbine generator to produce electricity, while the tidal variation, sea current and different thermal (temperature) layers in the ocean could also be used for energy production. Various companies are testing systems internationally to develop technically viable solutions. Once technical reliability has been proven, cost-effectiveness in relation to other solutions will have to be established. The world's focus on the production of renewable energy includes initiatives such as offshore wind farms, tidal energy farms and even the use of the chemical composition of sea water to generate energy.

Initiatives are also underway to consider methods by which the ocean seabed can be used for carbon storage. Additionally, some concepts are motivating that the oceans be used for geo-engineering to reduce the effects of greenhouse gases and slow predicted climate change.

The exploitation of marine resources continues to expand in ways that are not always predictable. South Africa is a water scarce country and plans have been made to explore the large-scale use of desalinated sea water. Recently, there has been a significant increase in the aquaculture industry. Marine tourism has also increased significantly, particularly in areas such as boat-based whale watching and shark diving excursions.

Many countries are prioritizing the research of technologies aimed at resource exploitation, deep sea exploration and marine biology. Focussed research is also being conducted on marine reproduction technologies, fine processing of marine biological resources, exploration and extraction of marine pharmaceuticals and the exploitation of chemical resources in sea water.

A further emerging issue, and in addition to the impact of marine litter on marine mammals, is the impact of underwater noise as the number of seismic surveys increases (mainly in the context of prospecting for oil and gas below the sea

floor). Mitigation is taken up in the EIA Record of Decision (RoD) conditions by having observers on board survey vessels and the vessel having to stop the survey when marine mammals are sighted along or close to the vessel track.

9.3 MODIFICATION, DEGRADATION AND LOSS OF MARINE AND COASTAL RESOURCES

This section details factors contributing to the modification, degradation and loss of marine and coastal resources.

While South Africa's coastline and ocean are largely in a good environmental state, there are a number of areas of concern. These areas of concern include higher pollution levels around coastal metropolitan areas, the impact of pollution and reduction of fresh water flow through our estuaries (together with extractive pressure), leading to deteriorating environmental health and the risk of oil spills on our coastline, coastal waters and islands.

9.3.1 Pollution

9.3.1.1 Oil pollution

South Africa is positioned along one of the world's busiest shipping routes with over 120 million tonnes of oil and bunker fuel carried aboard ships each year. This, combined with harsh oceanographic conditions along the coast, renders the country especially vulnerable to accidental oil spills.

In addition to the indicators discussed below, volume, frequency and distribution of oil spill incidents were considered as an indicator of the impacts of point source pollution on the ocean and coastal environment. Unpublished material received from the DEA indicated modest volumes of oil spilt between 2001 and 2006 (DEA 2011b). Figure 9.7 illustrates the recorded volumes of oil spills as 19,135 litres in 2001, 21,368 litres in 2003, 5,574 litres in 2004, 19,564 litres in 2005 and 4,352 litres in 2006 respectively (DEA 2011b).

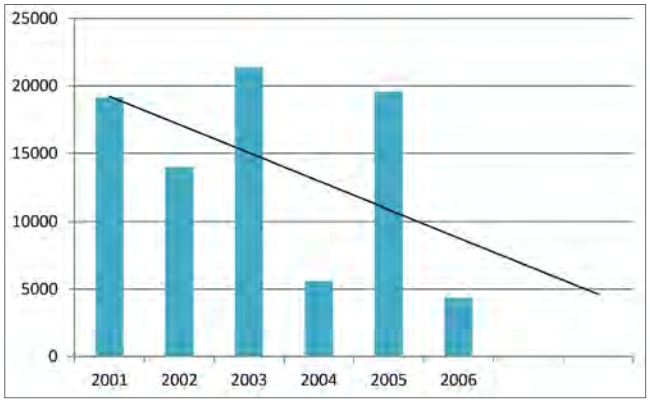


Figure 9. 7: Recorded quantities of spilt oil in litres
No data was recorded for 2002 therefore, the graph represents an average for this year.
Source: DEA (2011b)

Volumes were previously reported on collectively in the 2006 SAEO. A direct comparison is therefore not possible. Although no major incidents have occurred since the 2006 SAEO, accidental oil spills associated with ship casualties and offshore installations will continue to remain a cause of concern, as one such event can decimate seabird colonies, amongst other similar effects. Of further concern to the DEA is the tendency for vessels to discharge oily wastes in contravention of international conventions and domestic legislation. Deliberate operational discharges are observed from time to time, but an accurate estimate of total volumes discharged in South Africa's EEZ cannot be ascertained, due to surveillance limitations.

The DEA has invested resources into oil spill preparedness and response at national and regional level, including the development of regional contingency plans, and investment in additional specialized response equipment. Since 2007, South Africa partook in the Global Environment Facility/World Bank Marine Electronic Highway Project, which provided assistance to the States of the Western Indian Ocean Region in the field of contingency planning and emergency response training. In 2012, the DEA, working in collaboration with the SAMSA and the DoT, initiated a process to update the country's National Contingency Plan.

In 2006, South Africa requested the International Maritime Organization to declare a portion of its southern waters as a Special Area under the International Convention for the Prevention of Pollution from Ships, in order to protect wildlife and the marine environment from ship-based operational oil discharges. The proposal was accepted resulting in an area of approximately 1,500 km in length, and 35 to 135 nm wide, being granted Special Area status. The Special Area came into effect in August 2008.

The DEA conducts regular aerial surveillance for oil pollution. This is complemented by maritime patrols carried out by the South African Air Force. Furthermore, SAMSA operates a long range identification and tracking system to track vessels up to 1,000 nm from South Africa's coastline to monitor ships for possible illegal pollution.

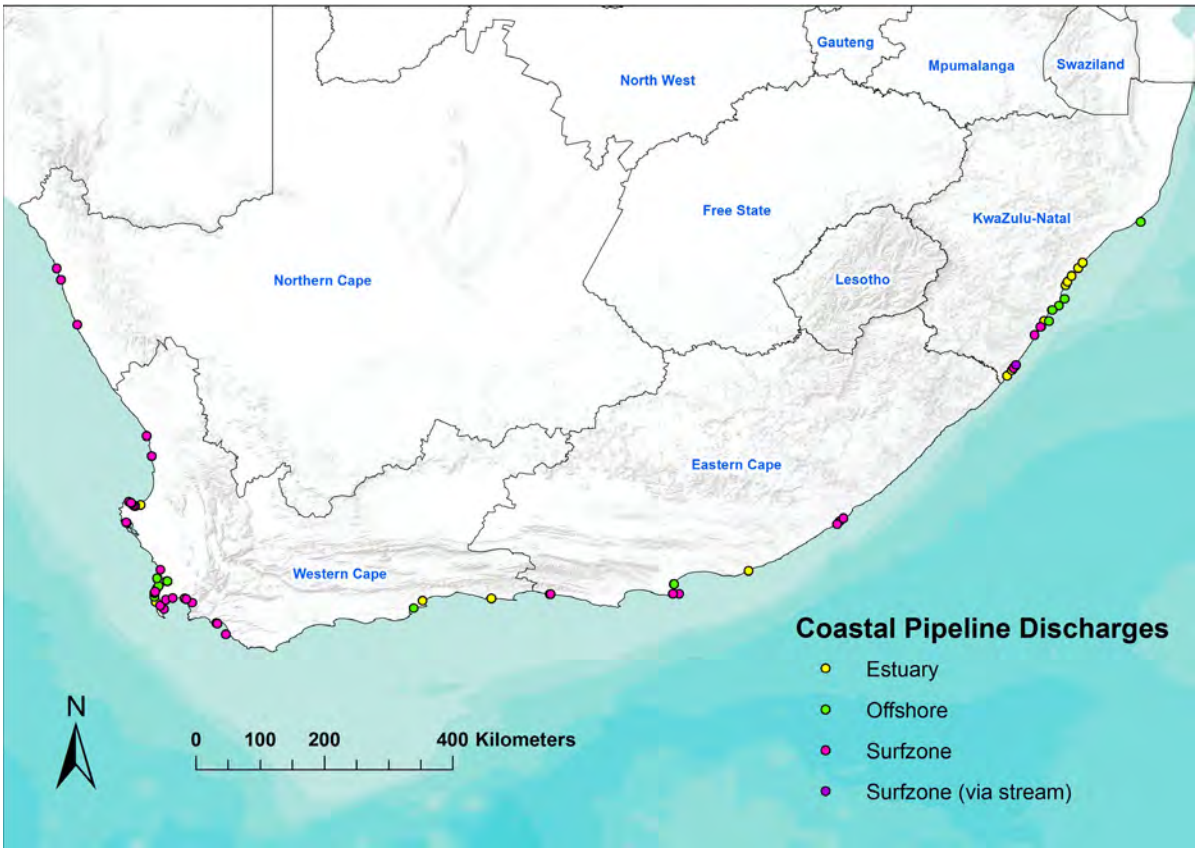
9.3.1.2 Wastewater discharges into the coastal environment

Prior to the commencement of the ICM Act, the responsibility for regulating wastewater disposal into coastal waters rested with the DWS. Under the ICM Act, such disposal now requires a coastal waters discharge permit from the DEA. The new legislation has prompted the DEA to review South Africa's prevailing policy on coastal wastewater disposal. This process is scheduled for completion in 2014 and will be followed by

the development of new regulations. At the time of reporting, the Department was in the process of developing a coastal research programme that would, among others, address the need for long-term monitoring of priority areas threatened by wastewater pollution.

Wastewater generated as a result of human activity and consumption is released or discharged into the coastal and marine environment as a free ecosystem service in terms of waste assimilation. In 2008, the DEA reported that approximately 287 million cubic meters of wastewater per annum is discharged into the marine environment from land-based sources (DEAT 2008). This figure, however, is based on data sourced in 2004, and was reported in the 2006 SAEO. At the time of writing, complete data for the period 2006 to 2011 could not be obtained. A trend cannot therefore be reported on in this report. However, it is generally acknowledged that marked increases in coastal populations since 2004 have certainly resulted in further significant increases in domestic sewage and municipal wastewater discharge volumes to sea (Sink *et al*. 2012).

The type and distribution of the various discharge points per coastal province are depicted in Map 9.4.



Map 9. 4: Distribution of coastal outfall discharge points in South Africa as at 2011
Source: DEA (2011b)

The total number of surf-zone discharge points in 2006 was reported as 67, which has increased to 75 (DEA 2011b). Currently there are surf-zone discharge points in the Western Cape (39), KwaZulu-Natal (21), Eastern Cape (12) and Northern Cape (3) (DEA 2011b).

Wastewater discharged into South Africa's marine environment comprises mainly of municipal wastewater (often also including trade effluent), effluent from fish processing operations, wastewater from chemical works, refineries and other industries, and cooling water (Sink *et al*. 2012). Whilst many offshore marine outfalls are monitored, a large number of surfzone and estuarine discharge points are not monitored. Since 2010, the responsibility for regulating coastal effluent disposal was transferred to the DEA from the DWS. There is a need for the DEA to source reliable data on the volume and characteristics of such discharges and to put in place measures to ensure that all discharges are monitored effectively.

Desalination has been identified as an emerging issue and is a potential source of oceans and coastal pollution for which data, such as the number of plants in operation and the amount of brine disposed, needs to be collected to determine future trends and assess potential impacts.

9.3.1.3 Other pollution and waste

Human activity generates vast amounts of litter, which often collect in ocean and coastal environments and negatively affects their health. It causes diseases, injures and kills birds, fish, marine mammals and other animals by entanglement, drowning or starvation, and impacts on the ecosystems they depend on for food and shelter. Litter compromises human health by threatening food supply, tourism and economic activities, as well as compromising the ability of marine ecosystems to adapt to the impacts of climate change by placing further pressure on an ocean already facing transformation due to rising sea-levels, warming water, and changing ocean chemistry (Ocean Conservancy 2009).

The annual International Coastal Clean-up, which is the largest volunteer pollution clean-up effort in the world, represented by 104 nationalities, celebrated its 25th anniversary in 2011

(Ocean Conservancy 2011). South Africa, with 106,253 volunteers, is ranked seventh in terms of participation in this initiative. Table 9.2 gives a global perspective on the types of commonly occurring marine litter between 1986 and 2011.

Table 9. 2: Top ten marine litter items collected worldwide between 1986 and 2011, ranked according to volume collected and shown as a percentage of the total debris collected per item

Rank	Litter item	Number of litter items	% of total litter items
1	Cigarettes/cigarette filters	52,907,756	32
2	Food wrappers/containers	14,766,533	9
3	Caps/lids	13,585,425	8
4	Cutlery	10,112,038	6
5	Beverage bottles (plastic)	9,549,156	6
6	Bags (plastic)	7,825,319	5
7	Beverage bottles (glass)	7,062,199	4
8	Beverage cans	6, 753,260	4
9	Straws/stirrers	6,263,453	4
10	Rope	3,251,948	2
TOTAL - Top 10 litter items		**132,077,087**	**80**
TOTAL - Litter items worldwide		**166,144,420**	**100**

Source: Ocean Conservancy (2011)

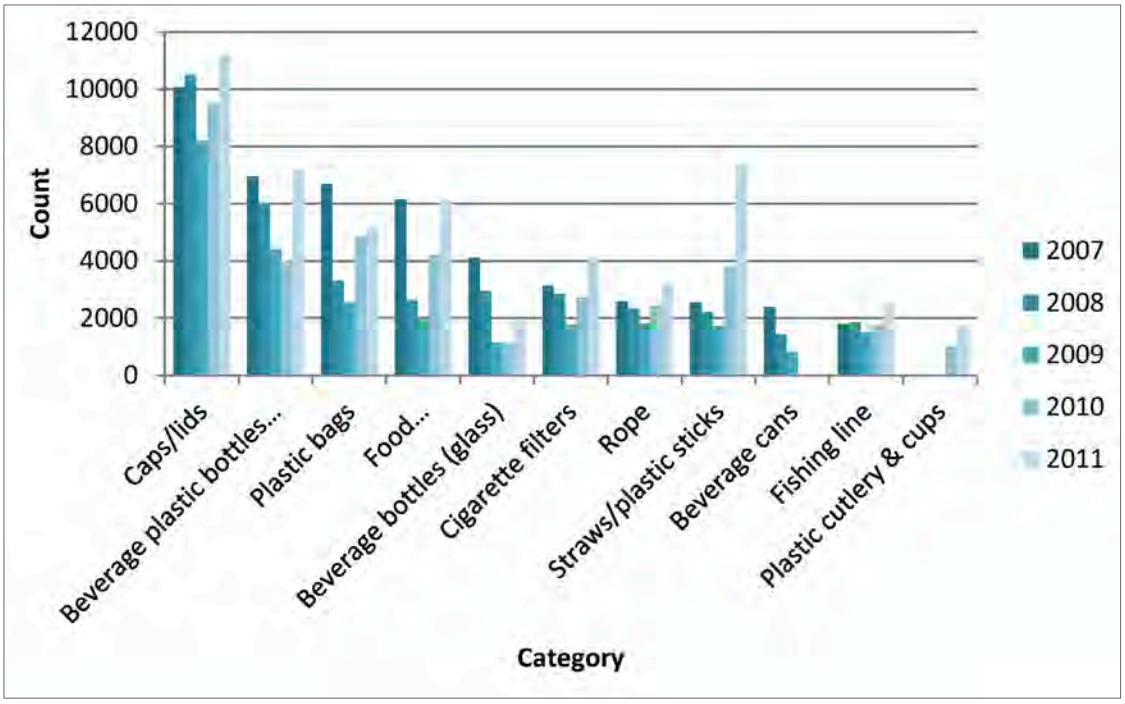


Figure 9. 8: Count of litter collected during the annual beach clean-up for the period 2007 to 2011 for the Eastern, Northern and Western Cape
Source: Plastics SA (2011)

Figure 9.8 shows the amount of litter collected during South Africa's annual beach clean-up per coastal province between 2007 and 2011, except for KwaZulu-Natal for which data was unavailable. Plastic items remain the top debris category in South Africa.

9.3.2 Dredging and dumping

The dredging and dumping of port sediment are identified as activities that have a significant impact on the ocean and coastal environment. Such impacts cause loss and/or disturbance of habitat and biodiversity through physical smothering or chemical contamination of disposal sites.

South Africa currently has 11 designated dredged material disposal sites located near port cities and coastal towns where dredging often takes place, as dredging is a necessary aspect of routine port maintenance. According to data sourced from (DEA 2013a), there has been an increase in this activity (Table 9.3). Most of the material was generated as a result of port maintenance dredging operations. The trend is likely to increase as South Africa's ports undergo further expansion to grow the economy and boost competitiveness with other African ports (DEA 2013a).

Table 9. 3: Volume of dredged material disposed of into the marine environment from 2006 to 2011

Year	Dumped (in cubic meters)
2006	1,343,589
2007	1,348,740
2008	2,815,090
2009	3,725,775
2010	2,770,624
2011	3,360,714
TOTAL	**15,364,532**

Based on unpublished raw data based on clients dumping reports received.
Source: DEA (2013a)

The disposal of dredged and other materials at sea is also governed under the ICM Act and in line with the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter at Sea 1972, to which South Africa is a Party. Under the ICM Act, all dumping at sea is prohibited with the exception of the following substances below, which are nevertheless subject to prior assessment, before they can be approved for dumping:

- Dredged material;
- Sewage sludge;
- Fish waste, or material resulting from industrial fish processing operations;
- Vessels and platforms or other man-made structures at sea;
- Inert, inorganic geological material;
- Organic material of natural origin; or,
- Bulky items primarily comprising iron, steel, concrete and similarly non-harmful materials for which the concern is physical impact, and limited to those circumstances where such wastes are generated at locations, such as small islands with isolated communities, having no practicable access to disposal options other than dumping at sea.

In 2011, the DEA commissioned a scientific study to develop a mechanism for assessing the quality and suitability of dredged material proposed for marine disposal. The National Action List, as it is called, was published in August 2012 and is now applied to all dredging permit applications.

Not all of South Africa's designated dump sites are monitored for potential impacts. There is a need for the DEA to develop a clearer strategy in that regard. There is also a need for studies that would make recommendations concerning the sustainability of current sites, and the need for and selection of new dump sites.

9.3.3 Invasive alien species

The introduction and spread of alien invasive species into marine environments is a concern, particularly those that have been introduced largely by shipping and the discharge of ballast water. In addition, developing sectors such as marine and estuarine aquaculture (whilst presenting a partial solution to the problem of over-exploited resources) pose environmental challenges in terms of their potential impact on the environment, including the introduction of and farming with alien species.

Invasive alien species in coastal and marine areas cause harmful impacts to indigenous and endemic biodiversity. This chapter focuses on the marine and coastal invasive alien species and detail on other invasive species can be found in Chapter 7: Biodiversity and Ecosystems Health.

The most important mode of alien invasive species introduction takes place via shipping, with hull fouling and ballast water contributing to 50 per cent and 37 per cent of introductions respectively (Sink *et al.* 2012). Other pathways of introduction are mariculture and petroleum infrastructure, whilst historically ship-boring and solid ballast (both associated with wooden ships) were more prevalent pathways (Sink *et al.* 2012). Table 9.4 shows marine alien invasive species recorded in South Africa.

Table 9. 4: Marine alien invasive species recorded in South Africa from 1992 to 2010

Species	Common name	Year of first record
Balanus glandula	Pacific barnacle	1992
Carcinus maenas	European green crab	1983
Ciona intestinalis	Sea vase ascidian	1955
Crassostrea gigas	Pacific oyster	2001
Metridium senile	Feather-duster anemone	1995
Mytilus galloprovincialis	Mediterranean mussel	1979
Sagartia ornate	Brooding anemone	2002
Semimytilus algosus	Bisexual mussel	2010

Source: Adapted from Sink et al. *(2012)*

According to the NBA Coastal and Marine Component (Sink *et al.* 2012), the majority of invasive alien marine species occur on the West Coast of South Africa, with ports and harbours around the country forming hotspots for the introduction of invasive alien species. In spatial terms, temperate species originating from the northern hemisphere predominate on the West and South Coasts, while species from the southern hemisphere occur largely on the East Coast (Mead *et al.* 2011, cited in Sink *et al.* 2012).

Apart from posing a serious threat to coastal and marine biodiversity, invasive alien species can also have serious economic impacts through their detrimental effect on commercial fisheries stocks, including mariculture (Sink *et al.* 2012). In addition, damage to marine and coastal infrastructure, such as shipping and pipelines and the resultant costs of repair and maintenance, can further increase the economic impact of invasive alien species (Sink *et al.* 2012).

9.3.4 Climate change

Areas that will (and have begun to) bear the brunt of the impacts of climate change are sensitive and dynamic ecosystems found where terrestrial and oceanic forces meet. These include the coastal zone, and one of the key projected and wide-ranging climate change impacts, amongst others, is sea-level rise (Breetzke *et al.* 2011; Mather 2012). Sea-level is rising around the South African coast, but there are regional differences (Table 9.5). The West Coast is rising by 1.87 mm per year, the South Coast by 1.47 mm per year, and the East Coast by 2.74 mm per year (Mather *et al.* 2009) (Box 9.3).

Table 9. 5: South African sea-level rise rates from 1957 to 2009 for various stations

Station	Years of record	Sea-level change (mm per year ± 1 standard deviation)
Simons Town	1957-2007	+1.58±0.22
Mossel Bay	1958-2009	+0.33±0.35
Knysna	1960-2009	+1.81±0.54
Nelson Mandela Bay (Port Elizabeth)	1978-2009	+2.52±0.77
Buffalo City (East London)	1967-2009	+2.30±0.93
eThekwini (Durban)	1971-2009	+2.70±0.05

Source: Mather (2007); Mather (2012); Mather et al. *(2009).*

In addition to the impacts listed above, further impacts for coastal areas include (DEA 2011c) and in most cases have already been experienced:

- Flooding and coastal erosion which will result in the loss of coastal infrastructure (including breakwaters, roads, public coastal amenities), habitat and ecosystem goods and services. Predicted rises in sea-level may further exacerbate these impacts (DEA 2011c);
- Vulnerability along the coast is set to increase with increased frequency and intensity of coastal storms, which includes seasonal cyclone activity on the East Coast. Estuaries are particularly vulnerable. These impacts will be further exacerbated by increased coastal development, and inappropriate land and catchment management (Mather 2012);
- Increase in the temperature of the world's oceans. Decadal sea temperature changes have been reported for both the inshore and offshore marine environments around South Africa (DEA 2010b). Shannon and O'Toole (2003, cited in Mather 2012) found a warming of surface waters along the West Coast of 0,7 °C between 1920 to 2003 (average of 0,1 °C per decade). Rouault *et al.* (2009, cited in Mather 2012) found a higher temperature increase in the Agulhas current, averaging 0,2 °C per decade between 1985 to 2006. In conclusion, seawater temperatures of both the Indian and Atlantic Oceans are on the increase (Mather 2012); and,
- Ocean acidification is also emerging as a potential issue in the management of oceans. Increased ocean acidification is likely to result from oceans absorbing increased atmospheric carbon (Government Gazette No. 35783 2012).

Intact coastal ecosystems can play an important role in ecosystem-based adaptation to climate change, which focuses on managing, conserving and restoring ecosystems to buffer humans from the impacts of climate change. For example, coastal ecosystems such as dunes, mangroves, kelp beds and saltwater marshes provide direct benefits to humans by helping to protect settlements and infrastructure against sea-storms. In many cases ecosystem-based adaptation can work hand in hand with engineered adaptation responses (NBA 2011.) See Chapter 7: Biodiversity and Ecosystem Health for a discussion on the value and role of healthy ecosystems.

Box 9. 3: Anticipated impacts and responses to climate change in coastal areas as detailed in the National Climate Change Response White Paper

The significant impacts of climate change on the marine and coastal environment require concerted collective action from South Africans, and the Climate Change Response White Paper 2011 proposes the following actions in mitigation of these challenges:

- Ensure that national, provincial and municipal coastal management plans incorporate relevant climate information and geographic information systems, and adopt a risk-based approach to planning that anticipates the consequences of the continued migration of communities into high risk coastal areas;
- Take account of the potential impact of sea-level rise and intense weather events, such as storm surges, on infrastructure development and investment in coastal areas, particularly in terms of the location of the high-water mark and coastal set-back lines that demarcate areas in which development is either prohibited or controlled;
- Protect and rehabilitate natural systems that act as important coastal defences, such as mangrove swamps, offshore reefs and coastal dunes;
- Develop disaster risk management plans that take into account the potential consequences of climate change along the coast, particularly the increased incidence of extreme weather events; and,
- Support ongoing research to determine the impacts of climate change on artisanal fishing communities and livelihoods in coastal areas that are directly connected to coastal and marine resources and identify appropriate responses.

Source: DEA (2011c)

9.4 PROTECTION AND MANAGEMENT

9.4.1 National Biodiversity Assessment: marine and coastal component

The marine and coastal component of the NBA 2011 is a landmark assessment that needs to be read in conjunction with this report. It classifies, maps and assesses ecosystem threat status and protection levels of habitats, comprehensively reviews pressures, overviews the state of knowledge and identifies gaps and research priorities.

9.4.2 Coastal development planning

Urban development is identified as a land use class in the 2009 National Land Cover dataset (SANBI 2009). There are high levels of urbanization in coastal provinces. Nelson Mandela Bay (Port Elizabeth) is the exception but its status as a metropolitan city will ensure continued growth and resultant urbanization.

Chapter 5: Human Settlements shows how urban areas in South Africa are continuing to experience population growth and urban expansion. Most recent estimates indicate that approximately 30 per cent of South Africa's population live within 60 km of the coast (UNOPS 2011).

9.4.3 Port development

South Africa has eight commercial ports which are operated by the Transnet National Ports Authority (TNPA), one of five operating divisions of Transnet SOC Ltd, *vide* the National Ports Act 2005 (No. 12 of 2005) (Transnet 2010). Three of South Africa's commercial ports are located in the Western Cape, three in the Eastern Cape, and the remaining two in KwaZulu-Natal. An increasing trend in throughput at these ports is evident through an analysis of TNPA port statistics (Table 9.6).

Table 9. 6: Total cargo handled at ports of South Africa in metric tonnes from 2003 to 2009

Category handled	Year	Metric tonnes
Total (Bulk and break)	2003	171,600,000
	2008	185,100,000
	2009	188,000,000
Gain from 2003 to 2009		1,640,000

Source: Transnet (2012)

9.4.4 Recreational coast water quality guidelines

A lack of data and information relating to water quality at swimming beaches will add to the challenges experienced by coastal municipalities in their task of maintaining safe beach water quality.

In response to this, and in order to ensure the effective management of coastal water quality to acceptable standards for recreational use, the 1995 South African Water Quality Guidelines for Coastal Marine Waters were updated in 2012. These guidelines set a range of target values for selected water quality properties or indicators and allow municipalities and the public to both manage and assess the suitability of coastal waters for both contact and non-contact recreational use (DEA 2012a). Recommended target values are detailed in Table 9.7, adapted from DEA (2012a).

Table 9. 7: Recommended target values as detailed in the South African Water Quality Guidelines for Coastal Marine Waters

Indicator	Recommended target
Objectionable matter • Matter	• Water should not contain litter, floating particulate matter, debris, oil, grease, wax, scum, foam or any similar floating materials and residues from land-based sources in concentrations that may cause nuisance; • Water should not contain materials from non-natural based sources which will settle to form objectionable deposits; • Water should not contain submerged objects and other subsurface hazards which arise from non-natural origins and which would be a danger, cause nuisance or interfere with any designated/recognized use; and, • Water should not contain substances producing objectionable colour, odour, taste, or turbidity.
Physio-chemical indicators • pH • Temperature	• The pH of water should be within the range 5.0 to 9.0 assuming that the buffering capacity of the water is low near the extremes of the pH limits; and, • For prolonged exposure, temperatures should be in the range of 15 – 35°C.
Microbiological indicators • *Enterococci* • *E. coli* • *Clostridium perfringens*	• ≤185 counts per 100ml (95 percentile) is considered sufficient or fair and a minimum requirement; • ≤500 counts per 100ml (95 percentile) is considered sufficient or fair and a minimum requirement; and, • Geometric mean ≤5 counts per 100 ml.

Source: Adapted from DEA (2012a)

Municipal capacity constraints are recognized and could hinder the short-term implementation of these guidelines (DEA 2012a).

9.4.5 Coastal protection

As a result of various factors, including climate change and the associated increased storminess, as well as historically poor planning decisions, South Africa is facing an increasing need to defend its coast to varying degrees using various methods, from seawalls to re-created and re-vegetated dune cordons. Three metropolitan municipalities, namely Cape Town, eThekwini (Durban) and Nelson Mandela Bay (Port Elizabeth) are actively engaged in a 'hold' or 'defend the line' adaptation strategy along their shorelines in order to protect high-value infrastructure (Table 9.8). Shoreline defence is set to increase over time.

A further statutory response to the perceived impacts of climate change in the coastal zone is the adoption of a retreat strategy through the designation of coastal setback lines in terms of the ICM Act.

Table 9. 8: Percentage of coastline defended in the City of Cape Town, eThekwini and Nelson Mandela Bay municipalities as at 2011

Municipality	Approximate length of coastline	Length of coastline defended	% of coastline defended
City of Cape Town (*Source: D. Collenbrander*)	307 km	20.0 km	8.0
eThekwini (*Source: A. Mather*)	96 km	20.6 km	21.3
Nelson Mandela Bay (*Source: D. Anderson*)	102 km	14.4 km	14.1

9.4.6 Estuaries

There is a growing recognition that estuaries are under ever-increasing pressure (Figure 9.9) from anthropogenic activities, which has significant negative implications on their ability to provide goods and services (Forbes & Demetriades 2010). These natural resources require protection, continual advancement, avoidance of further loss and rehabilitation.

The pressures that estuaries face can be attributed to three primary sources, namely, from activities that take place in and around the estuary, changes to the flow of fresh water into the estuary, and detrimental land use practices throughout the catchment that feeds the estuary. As a result, estuarine areas often bear the brunt of the cumulative impact of pressures from all three of these sources (Driver *et al*. 2012).

One response to the growing pressures and the decreasing quality of estuaries, and as is required in the draft Estuary Management Protocol detailed in the ICM Act, is to develop Estuary Management Plans as a tool to regulate activities and address issues. Of South Africa's 256 functional estuaries, 12 have finalized Estuary Management Plans, 12 have Estuary Management Plans in draft stage and seven have Estuary Management Plans in the process of completion (DEA 2013b). While neither KwaZulu-Natal nor the Northern Cape have

formally approved Estuary Management Plans, they have three and one in draft stages respectively.

In some cases, estuaries are legally protected in terms of NEM:PAA. Figure 9.10 shows the protection levels of South Africa's estuary ecosystem types (Driver *et al.* 2012).

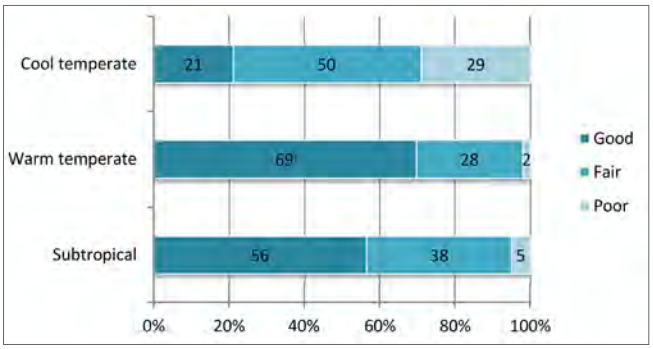


Figure 9. 9: Condition of cool temperate, warm temperate and subtropical estuaries as at 2011
Source: Driver et al. *(2012)*

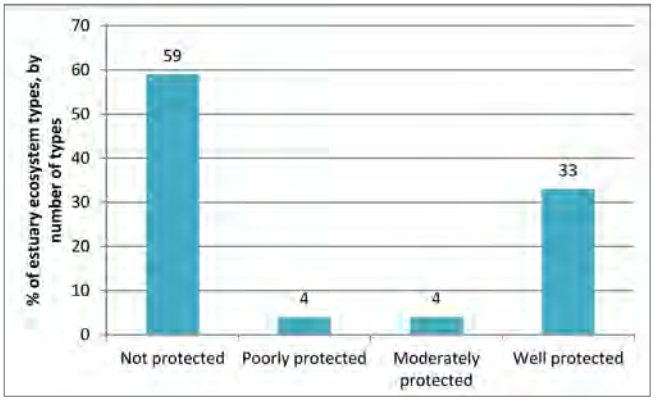


Figure 9. 10: Ecosystem protection levels of South African estuaries as at 2011
Source: Driver et al. *(2012)*

9.5 RESPONSES

9.5.1 National legislation and policy

Co-ordination of coastal and marine management is vested in the Branch: Oceans and Coasts of the DEA (previously part of the Marine and Coastal Management Branch of DEAT), with much responsibility for coastal aspects devolved to coastal provinces and municipalities.

South Africa promulgated the ICM Act in February 2009, which is a dedicated, area-specific legislation aimed specifically at managing the complex coastal and marine environments, as well as addressing past injustices by placing ownership of South Africa's coast with its citizens and promoting sustainable access to the coast and the free ecosystem goods and services it provides (Celliers *et al.* 2009).

The ICM Act is a SEMA under the umbrella of the NEMA, and promotes integrated coastal management as a management philosophy. The ICM Act also gives effect to South Africa's obligations on the prevention of marine pollution by the dumping of wastes and other matter at sea in terms of the provisions of the London Convention and London Protocol.

Currently, the implementation of the ICM Act is a priority and aspects such as set-back lines, coastal management programmes and coastal access are high on the agenda of provinces and local authorities. Amendments to the ICM Act were proposed in the National Environmental Management: Integrated Coastal Management Amendment Bill, published via Government Gazette No 840 of 2011.

Other key legislation governing the management of marine and coastal environments in the country are the MLRA and the NEMA Environmental Impact Assessment (EIA) Regulations (Government Notices R544, R545 and R546).

In 2012 the DEA published the Green Paper on the National Environmental Management of the Oceans. This is the initial phase in the discussion and development of national policy on oceans environmental governance.

9.5.1.1 Co-operative governance

Chapter 5 of the ICM Act (Institutional Arrangements) makes provision for the establishment of structures that promote and drive co-operative coastal governance in South Africa. Co-operative governance is essential to successful ICM, as it promotes integration between government and civil society, as opposed to the traditional top-down approach to coastal management. It requires coastal municipalities to develop CMPs. Five of 52 municipalities have developed such programmes: eThekwini (Durban), Eden, Umhlatuze and West Coast District Municipalities, as well as the KwaDukuza Local Municipality. The cities of Cape Town and eThekwini (Durban) prepared coastal strategies prior to 2008.

9.5.1.2 National expenditure to Integrated Coastal Management

The estimate of national expenditure in respect to oceans and coasts indicates a growth (from 2006/2007 to 2009/2010) of approximately 52 per cent and 46 per cent for the Marine Living Resources Fund (National Treasury 2010a). Provinces have seen a steady increase in project-specific funding for managing coastal resources.

9.5.1.3 Responding to threats to the marine and coastal environment

In order to respond properly to the threats to the marine and coastal environment and ensure legislated responsibilities are met, research actions directed at managing the sustainability of various activities and minimizing risks to the environment through better knowledge and understanding of ocean and coastal ecosystem functioning is being undertaken.

Research into coastal issues has, and is, being carried out by a wide range of organizations including government departments (at all levels), academia and research organizations. The DEA Branch Oceans and Coasts is mandated to play a lead role to meet the needs of recent legislation. Certain new functions are now the mandate of the DEA such as the permitting and monitoring of outfall discharge points, as well as other land-based sources of marine pollution. Also within the DEA

mandate are permitting and monitoring of dredging and marine dumping. Here monitoring activities are generally carried out in terms of permit conditions or RoDs, but the DEA has an oversight role to ensure compliance with standards. Marine litter is a historic and growing concern. Litter is a particular challenge as these items can have frequent negative impacts on marine mammals such as whales and seals. The DEA has addressed this by establishing a specialized Whale Disentanglement Unit.

In addition to direct measurements of water quality, it is very valuable to use biological indicators of marine ecosystem health in order to be able to see how wild creatures are experiencing the environment. Ecosystem components with long time series are best and these include apex or top predators such as seabirds, sharks and seals, as well as a few whale and turtle species. Seabird data are particularly valuable as they cover the whole coast. Mussels also act as bio-accumulators and the DEA conducts a Mussel Watch programme to determine levels of heavy metals. These activities are complemented by spatial investigations into the biodiversity of our marine and estuarine environments such as the NBAs of 2004 and 2011 lead by SANBI. These highlight what type of environments and species are being impacted by pollution and other factors leading to habitat loss, as well as extraction. Such spatial analyses extend to all levels of biodiversity (small to large) that occur within our marine and coastal bioregions and their habitats.

9.5.2 Monitoring and reporting

In 2011, the DEA launched the National Ocean and Coastal Monitoring and Research System which was designed to enhance understanding of climate change and its impacts, and to contribute toward coastal spatial-planning and pollution monitoring. The system will ultimately consist of a complex set of technologies proposed to monitor ocean conditions and coastal water quality in near-real time and will allow decision-makers to:

- Respond efficiently in protecting coastal communities from natural disasters;
- Identify conditions that are dangerous for existing and new marine-dependent industries;
- Assist in planning for long-term sea-level rise;
- Provide important data to respond more effectively to oil spill disasters; and,
- Identify hotspots of poor coastal water quality.

9.5.2.1 State of the Oceans reporting

As part of the National Ocean and Coastal Monitoring and Research System, the DEA has produced a series of in-house biannual reports that propose to establish general principles (for example, annual cycles) and long-term trends, and to provide an overview of recent marine environmental conditions that may be of relevance to the management of South African marine resources (DEA 2011d). These reports are compiled using data from a variety of sources, including web sources, satellite sensors, the SAWS, coastal and moored instruments and research cruises. Key variables recorded that are considered to be of particular significance include sea surface temperature observations, dissolved nutrients and low dissolved oxygen concentrations.

9.5.2.2 Mussel Watch

Mussel Watch is a global scale voluntary monitoring programme which operates in South Africa as well as in Europe, the United States of America and some Asian countries, and whose purpose is to assess contamination of coastal waters by monitoring the concentration of selected chemicals in the flesh of mussels and oysters. Mussel Watch is currently operated in the Western Cape and in KwaZulu-Natal. In KwaZulu Natal, this contributes to the eThekwini marine outfalls monitoring programme.

9.5.2.3 Marine protected areas

South Africa has 23 gazetted MPAs which account for a total of 23 per cent of the South African coastline, with nine per cent consisting of no-take zones (Sink *et al*. 2012). Only 0.4 per cent of the EEZ is currently included in a MPA (DEA & SANBI 2009). The current protection of the marine and coastal environment has been assessed to be inadequate and has led to the development of the NPAES in 2008, which aims to achieve cost-effective protected area expansion for ecological sustainability and increased resilience to climate change (DEAT 2008). During 2013, Prince Edward Island was promulgated as a new MPA. This significantly contributes to the extent of ocean space under protection, and places South Africa among a limited number of countries that are well positioned to meet the marine and coastal protected area requirements of the United Nations Convention for Biological Diversity.

Coastal protection has since advanced from a total of 21.47 per cent (9.14 per cent no-take) of South Africa's coastline in 2004 to 21.75 per cent (9.26 per cent no-take) in 2011 through the proclamation of the Still Bay MPA. This was further increased to 23.17 per cent with the addition of the Amathole MPA (Sink *et al*. 2012). By 2013, planning included the addition of 88 km to the inshore marine protected area network (including 59 km in no-take zones), 52,500 km^2 to the offshore marine protected area network in South Africa's mainland EEZ, and 23,300 km^2 to the offshore marine protected area network in the Prince Edward Islands EEZ (DEAT 2008).

9.5.3 Ecosystem-based management

South Africa has recognized the value of an ecosystem based approach to oceans and coasts management. In order to meet the objective of protecting all aspects of the marine ecosystem, South Africa has 23 gazetted MPAs which account for a total of 23 per cent of the South African coastline, with 11 per cent consisting of no-take zones (SANBI 2011 in DEA 2012b). Only 0.4 per cent of the EEZ is currently included in an MPA (DEAT 2009). The current protection of the marine and coastal environment has been assessed and has led to the development of the NPAES in 2008, which aims to achieve cost-effective protected area expansion for ecological sustainability and increased resilience to climate change (DEAT 2008).

In addition to implementing the ecosystem based approach nationally through MPAs, South Africa has sought to develop working relationships with neighbouring coastal countries in oceans and coasts management. This is achieved through participating in large marine ecosystem science and management programmes. On the West Coast, South Africa participates in the Benguela Current Commission, which

at present is in an interim phase while the already signed Convention is expected to be ratified shortly by the three participating countries: South Africa, Namibia and Angola. On the East Coast, South Africa participates in the Agulhas Somali Current Large Marine Ecosystem programme. The Continental Large Marine Ecosystems programmes generally fall into the Abidjan and Nairobi Conventions, which are directly focussed on oceans and coasts management. South Africa is also an active participant and member of the Convention for the Conservation of Antarctic Marine Living Resources.

While South Africa has a long history as a member of the United Nations Intergovernmental Oceanographic Commission (UNIOC), it is also a member of the newly created Africa Sub-Commission of UNIOC. This co-operation will provide an enhanced information base for marine environmental management.

9.5.3.1 Planned monitoring initiatives

The DEA has recognized that there needs to be a National Oceans and Coasts Water Quality programme to assess the state of the marine environment and provide efficient access to such environmental information. Establishing a coherent national data set and monitoring programme is planned over the next few years to achieve these objectives. Similarly the DEA has planned to engage stakeholder national departments to collate oceans and coast reporting information for the commercial and municipal sectors that use the marine environment. Furthermore the EIA processes for minerals and energy developments are under review by the respective Departments and a draft EIA policy to facilitate sustainable development of the aquaculture industry has been developed.

9.5.4 Ocean and coast programmes

In order to deal with the range of challenges facing the coastal environment in a co-ordinated (integrated) manner, the ICM Act mandated the formation of co-operative structures such as the Provincial Coastal Committees , and the prescribing of tools such as the National Estuarine Management Protocol, to guide the development of formal estuarine management plans. There has already been considerable progress in the formation of the Provincial Coastal Committees and in the development of over 25 draft estuarine management plans, and the finalization of the estuarine management protocol.

Parallel to these issues, there is a need to understand and respond to disasters such as oil spills and storms of high intensity. Due to global warming, the risk of such events and the associated scale of inundation and erosion are increasing. These concerns have encouraged the DEA to build research capacities in coastal research, namely research into vulnerability of different parts of the coastline to hazards from the ocean. Increased and erratic rainfall and an increase in tropical cyclones can lead to effects far inland as well. Severe estuarine flooding may result when the coast is impacted by both land (rivers) and the sea. The research needed here

includes ocean and atmospheric science as well as physical, biological, and economic vulnerability aspects of the coast.

In addition, there are a number of government and non-government initiatives aimed at improving oceans and coasts environmental management and awareness. These are briefly described below.

9.5.4.1 Blue Flag

The Blue Flag Programme, implemented in South Africa by the Wildlife and Environment Society of South Africa (WESSA), with participating local authorities under the DEA's CoastCare initiative, is run by the Foundation for Environmental Education (FEE), an international non-government, non-profit organization. The programme works towards sustainable development of beaches through strict criteria dealing with water quality, environmental education and information, environmental management, and safety and other services. The programme aims to ensure that beaches are clean, safe and environmentally friendly, and to educate communities about the need to care for our coastline. See www.blueflag.org.za for further details.

The Blue Flag Programme is voluntary and in an international branding tool. Local governments along the coastline may choose whether or not to subscribe to its standards. South Africa was the first country outside Europe to be granted Blue Flag accreditation for its beaches (WESSA 2010).

9.5.4.2 Working for the Coast

Working for the Coast is an initiative established under the CoastCare Programme and uses poverty relief funding from the DEA Expanded Public Works Programme to provide employment and training for unemployed people in coastal communities to create and maintain a cleaner and safer coastal environment (DEAT 2001).

Some activities undertaken as part of the Working for the Coast initiative are:

- Cleaning coastal areas on a regular basis of all litter and to recycle this material as appropriate;
- Assisting with the maintenance of public facilities;
- Rehabilitation of coastal ecosystems;
- Assisting with access control; and,
- Serving as information and tourist officers.

Between 2006 and 2011, a total of R189,646,371 was allocated to various Working for the Coast programmes by the DEA (DEA 2011e).

9.5.4.3 Southern African Sustainable Seafood Initiative (SASSI)

On a global scale fish stocks are in decline, and in some cases have collapsed entirely due to unsustainable harvesting and fishing practices. In response to this situation, the Southern African Sustainable Seafood Initiative (SASSI) was formed by the WWF-SA in 2004 in an effort to promote awareness around the dire state of world fisheries and to determine ways to improve the sustainability of current and future fishing and harvesting practices. The three primary objectives of SASSI are:

- The promotion of voluntary compliance with the law through education and awareness;
- A shift of consumer demand away from over-exploited species to more sustainable options; and,
- The creation of awareness surrounding issues of marine conservation (SASSI 2011).

Initiatives that have been implemented and proved to be successful include the consumer pocket guide, conscientious seafood consumer Diner Card, SASSI seafood database, SASSI 'mobi site', and the FishMS service.

9.5.4.4 South African Network for Coastal and Oceanic Research

An additional organization that promotes the generation and communication of knowledge of marine and coastal resources and environments for improved decision-making and management intervention, is the South African Network for Coastal and Oceanic Research (SANCOR). SANCOR is a non-statutory body that provides a forum for interaction, collaboration and communication about scientific matters in marine and coastal areas, as well as co-ordinating and integrating activities in these areas by stimulating inter-disciplinary and inter-institutional collaboration (SANCOR 2011). SANCOR also contributes to the development of marine and coastal policy and acts as a conduit between national and international funding agencies and researchers (SANCOR 2011).

9.5.4.5 Research funding

Levels of funding and the recognition of the importance of coastal and marine research is an indicator similar to that which is described for the DEA's Human Capital Development (HCD) Strategy. In addition to HCD, the ability of a nation to undertake primary or fundamental research is critically important for evidence-based decision-making (Box 9.4). The pillars of ICM include the generation and availability of defensible scientific data and information, and co-operative governance.

Box 9. 4: Two examples of the growth in oceans and coast research: West Indian Ocean Marine Science Association (WIOMSA) and the Applied Centre for Climate and Earth System Science (ACCESS)

An example of this research is the growth and outcomes of the West Indian Ocean Marine Science Association (WIOMSA) which has generated a body of research that is showcased at a symposium of more than 450 people annually. This has grown from an initial grouping of approximately 100 people in 2001. The growth and development of SANCOR, the National Research Foundation (NRF) and the DST funding for coastal and marine programmes are also indicators of this positive shift. Data from funders i.e. WWF, show the growing levels of support for research in the coastal and marine domain.

The Applied Centre for Climate and Earth System Science (ACCESS) is a consortium of several agencies, research councils, research programmes, universities and research groups who have combined efforts to deliver a range of outputs aligned to the DST Global Change Grand Challenge (GCGC;http://globalchange.grandchallengeonline.org). ACCESS is a platform for integrated and end-to-end research and education, services and training, outputs and outcomes related to the opportunities and challenges emanating from a varying and changing environment, collectively referred to as Earth Systems Science. ACCESS (www.access.ac.za) provides an opportunity for unprecedented co-operation across a range of disciplines and reflects the inter-connected nature of the Southern African Earth System. ACCESS and other GCGC initiatives, such as the Global Change, Society and Sustainability Research Programme, includes a significant coastal and marine component and is a good example of the growing prominence of climate change research which extends into the coastal and marine domain.

Source: DST (2012)

The trends in research funding in South Africa are illustrated in Figure 9.11.

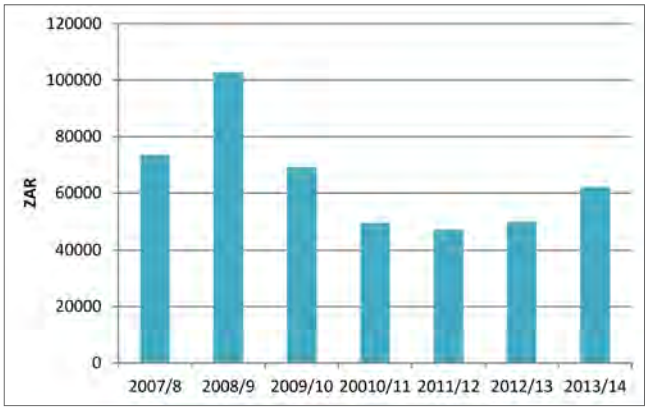


Figure 9. 11: Expenditure estimates of oceans and coastal research by DEA for the period 2007 to 2014 in Rands per million

Source: National Treasury (2010b)

9.5.4.6 Extractive resource use and aquaculture

In order to ensure the conservation and sustainable use of marine biodiversity, South Africa introduced new legislation between 1998 and 2004 following an extensive consultative processes. In particular, there was the MLRA (1998), NEM:BA and NEM:PAA of 2003 and 2004 respectively. These frameworks allowed for the recognition of all fishery sectors and provided tools to address the declines in stocks and degradation in habitats, as well as to take cognizance of matters such as distributional shifts likely due to climate change. As with most countries in the world, fisheries resources and biodiversity have been under considerable pressure from extractive activities, as well as habitat degradation, for several decades. This has resulted in lower populations of a number of exploited fish species, and research indicates that the viability of some species was in crisis.

A particularly powerful provision in South African environmental policy and legislation is the allowance for the declaration of MPAs in which biodiversity (including vulnerable life stages such as breeding fish) could be protected either partially or fully. In order to guide implementation of such legislation, research-based policy and strategic documents followed, notably the NPAES (2008), the National Biodiversity Framework, and the NBAs of 2004 and 2011. These allowed for a knowledge-based approach regarding the declaration of MPAs and the quantification of their benefits.

Regarding overall fisheries management, this was supported by the development of policies dealing with commercial fishery sectors since 2001 and for the subsistence/small-scale fishery sectors over the period 1998 to 2001 and from 2006 to the present. In addition, more species have received protection based on their specific vulnerability (for example regulation on red steenbras (*Petrus rupestris*). The development and implementation of these regulations have been the responsibility of the DAFF since 2010. Implementation of an MoA between the DEA and DAFF (signed in 2010) allows for increased co-operation in resolving matters regarding both sustainable use and conservation. An important example is an Ecosystem Approach to Fisheries (EAF) which considers not only the viability of exploited populations but also other effected components.

Illegal harvesting or poaching is a threat to sustainable use and orderly implementation of access rights to resources. This is matter which occurs on a variety of scales from poaching of coastal resources (by both individuals and crime syndicates) to deep sea illegal fishing activities in our mainland EEZ, as well as on occasion in the EEZ of our sub-Antarctic Islands. Mandatory observers on larger vessels have helped to improve compliance. The manner in which illegal activities are addressed needs to take into account the type of resource, the scale of the poaching, as well as its location. Such activities within MPAs are of particular concern as they undermine the protected area's ability to fulfil their purpose. Combined approaches by the DEA, DAFF and various MPA management agencies, as well as ongoing operations by single organizations are important. The administrative side of ensuring that proper permits are in place for exports (including CITES permits where applicable) also enables improved compliance. The finalization and implementation of a new small-scale fisher policy is viewed as an important step in securing community support for better compliance.

The development and implementation of various marine aquaculture policies have also been the responsibility of the DAFF since 2010, including a policy on Ranching in the Marine Environment. The DEA has developed an EIA policy specifically for the aquaculture sector in order to allow for better planning and expansion of the sector whilst safeguarding the environment.

9.6 EMERGING ISSUES

A number of emerging issues that drive change in global and South African ocean and coastal environments have been identified. These include:

- The realization of some of the predicted risks and impacts of climate change in coastal areas and the importance of continued measuring and increased resilience going forward;
- The impacts of unsustainable resource use such as sand winning and dune mining, and the associated issues around lease agreements and land tenure;
- The continued need to support the recovery of overexploited and threatened resources, prevent the further introduction and spread of invasive alien species and expand and strengthen South Africa's MPA network in keeping with international direction;
- The largely unquantified impacts of desalination which is emerging as an increasingly important technology in water-scarce coastal regions;
- Access and accessibility to coastal resources, and the need to balance sustainable and managed access with the rights of citizens to gain access to the coast and oceans;
- The growing prominence of the green economy and the need to position our oceans and coasts in our (blue-) green economy and to continue to endeavour to fully understand how they function;
- The realization of the impacts of pollution and fulfilling the international commitment to tackling poor coastal water quality;
- Appreciating the value of our national ocean and coastal assets and the development of the National Policy on the Environmental Management of the Oceans by the DEA which will influence ocean conservation and resource utilization;
- The potential emergence of so-called 'dead zones' in our oceans where oxygen levels are so low that marine life cannot be supported;
- Management of the high seas outside national jurisdiction, including aspects of geo-engineering and carbon storage;
- Opportunities offered by the ocean and ocean space for power generation; and,
- Emergence of offshore mining as a significant pressure in the marine environment, including expansion of petroleum activities and new applications for bulk seabed mining for phosphates (Sink *et al*. 2012).

9.7 CONCLUSION

The 2006 SAEO concluded that the ocean and coastal environment of South Africa was in a moderately healthy state in relation to international trends at the time. Five years later, there has been considerable focus and investment in creating appropriate policy and legislative conditions, which has positively influenced several aspects of marine and coastal environments.

These aspects over last five years have included, amongst others, the expansion of MPAs, the creation of operational estuarine management plans, the implementation of the Working for Coasts programmes, improved implementation of the ecosystem approach to fisheries, the establishment of water quality guidelines, the creation and implementation of species management plans and a significant increase in the spend of ocean and coasts research and monitoring. Real gains from these initiatives have been a decrease in seabird mortalities, increases in some island bird populations, improved management of sensitive estuarine habitats and species, and an increase in the understanding of marine ecosystem functioning and biodiversity distribution. Some aspects of the health of our oceans and coasts continue to experience apparent deterioration. Pressures on the oceans and coasts ecosystems are mostly as a result of increased anthropogenic pressures such as pollution from land-based sources and resultant decreases in water quality. Estuaries are examples of habitats that may be susceptible to such pressures. This includes the continuing trend of increased numbers of peoples residing in coastal areas.

There has been progress on the development and the implementation of a more fully representative and broader approach to oceans and coast environmental management. This is evident in actions to better realize the principles of the National Environmental Management Act. Mechanisms to achieve this are through the on-going increased implementation of the ICM Act and the development of policy on oceans' environmental management. Significant progress is also being made in the participation of a wider regional approach to marine ecosystem management, through the participation in Large Marine Ecosystem Programmes and regional conventions.

The proposed increase in the protected areas network for South Africa's oceans and coasts will contribute to improved environmental management. This expansion should ideally include both coastal areas and deeper ocean areas to promote the integrity of ecosystems. Legislative and institutional responses to drivers of change in ocean and coastal areas have continued the positive trend noted in the 2006 SAEO. Most significantly, ICM has been legally established as the management paradigm for sustainable coastal development with the enactment of the ICM Act in 2009, the establishment of lead agencies for coastal management in all four coastal provinces, and the steady increase in project-specific funding for managing coastal activities since 2006.

Improved management measures, including the development and implementation of ocean- and coastal-specific co-operative governance structures and ICM specific tools, such as coastal setback lines, show a positive trajectory and should start to address the reported deterioration, and improve the overall state of, the ocean and coastal environment.

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