

MINISTRY OF ENVIRONMENT AND NDU

NAIROBI CONVENTION

National Status Report

on the

Marine and Coastal Environment

REPUBLIC OF MAURITIUS

OCTOBER 2007

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Chapter 1: General introduction

The Republic of Mauritius has an Exclusive Economic Zone (EEZ) of 1.9 million km². The coastline of Mauritius is 322 km long. It is almost fully encircled by coral reefs, 150 km long and enclosing a lagoon area of 243 km². Breaks occur in the reef on the southern and western coasts where there is no continental shelf and at river mouths where the high influx of fresh water prevent growth of coral reefs . There is no true continental shelf - the water reaches a depth of 3000 metres at about 3 km from the coast (MoE & NDU 2005) .

The climate is between tropical and subtropical with a cyclonic season of about 5 months starting from December to May . The wind blows mostly from the South East and the water temperature of the ocean varies between 22 and 28°C. The tide variation is weak and is in the order of 0.5 m.

The productivity of the oceanic water around Mauritius is estimated to be 5 TC /Km²/year, which is low compared to the water surrounding the Seychelles group of islands which registered 200- 300 TC/ KM² /year ((SOE, 1991) .

The Republic of Mauritius include Main island Mauritius , Rodrigues, Agalega and St Brandon . The main island of Mauritius is surrounded by 49 offshore islets.

Rodrigues is an island district of the Republic of Mauritius and volcanic in origin. It is situated at latitude 19° 43' south and longitude 63° 21' east 320 nautical miles east of Mauritius. It covers an area of 110 km² and is the smallest and oldest island of the Mascarene Archipelago. The island is mountainous in topography, with its highest peak rising to 400 km and is completely surrounded by a fringing coral reef of a length of 90 km enclosing a wide lagoon .

Agalega comprises of two sandy cay islands covering 21 km² surrounded by 100 km² of coral reef, with a lagoon of 25-100m wide.

St Brandon shoals comprises 55 low-lying islets and sand cays covering 3 km² within a 100 km long coral reef system, and a shallow water area extending over several thousand km (Management Plan for St Brandon 1998) .

This report gives an overview of the state of the coastal and marine environment in Mauritius. This review was carried out in the context of the 5th Conference of parties for the Nairobi convention scheduled for November 2007 in South Africa.

Chapter 2: Coastal Ecosystems

Mauritius has an extremely rich coastal zone consisting of near shore wetlands and mangroves, lagoon coral, fringing coral reef and all their associated marine life. Mauritius being a small island state, depends largely on this coastal ecosystem for its tourism industry. Most of the hotels are coastal based. Moreover, the fishermen population residing in the coastal area get their daily livelihood from fishing activities. The good health of this coastal ecosystem is also very important as it provides leisure activities to the population and tourists who visit the country.

All these marine ecosystem components are interrelated: wetlands provide a natural buffer, controlling surface water run off to the lagoon by neutralising pollutants, nutrients and sediments which might damage the lagoon eco-system; mangroves provide a habitat for juvenile fish; invertebrates; and the fringing coral reef protects the coastline of Mauritius from the waves coming from the open ocean and is pivotal to the ecology of tropical oceans.

The freshwater biodiversity of Mauritius is mainly contained within some 90 rivers and rivulets (Map of Mauritius and Rodrigues Y682 (DOS 529) of 1983)), several man-made reservoirs such as Midlands Dam and Mare aux Vacoas, natural lakes such as Grand Bassin, Bassin Blanc Crater lake, ponds and marshy areas /wetlands.

(i) Coastal terrestrial habitats

Mauritius has an area of 1,865 km², of which 30% is considered forested. The area of good quality native forest, (i.e. that with more than 50% native plant cover, Page & d'Argent 1997), is estimated to cover less than 2% of the island (NEAP 1999, MWF unpublished). The rest consists of plantation forestry, deer-ranches or highly degraded vegetation invaded by alien plant and animals species. As a result Mauritian biodiversity is amongst the most threatened in the world.

Fifteen vegetation types have been classified (Vaughan & Wiehe 1937), varying in species composition and structure, and ranging from coastal sand dune vegetation to cloud forest. Remnants of some vegetation types are concentrated in the Black River Gorges National Park in the south west, the Bambous Mountain Range in the south east and the Moka-Port Louis Ranges in the north west. There are also some isolated mountains which are important e.g. Corps de Garde, Trois Mamelles and Le Morne Brabant, and several offshore islands with remnants of coastal and mainland diversity.

Table 1 : Native diversity of selected groups in Mauritius, with respective total number of extinctions. Numbers in brackets indicate the number of endemic species.

	<u>Number of native species</u>	<u>% species endemic</u>	<u>Number of extinct species</u>	<u>Number of extant species</u>
Angiosperms¹	671 (311)	46%	77 (42)	594 (269)
Mammals²	5 (2)	40%	2 (1)	3 (1)
Birds²	30 (24)	80%	18 (15)	12 (9)
Reptiles²	17 (16)	94%	5 (5)	12 (11)
Butterflies³	37 (5)	14%	4 (1)	33 (4)
Snails⁴	125 (81)	65%	43 (36)	82 (45)

1. Page & D' Argent 1997; 2. Cheke, A. S. & Hume, J. P. *in press*; 3. Williams 1989; 4. Griffiths & Florens *in prep*.

The native biodiversity is now confined mostly to the south-western region of the island, a few other remote areas on mountain ridges and on offshore islets.

However, the remaining areas of native vegetation still hold a great diversity of plant species and are of great conservation value. About 700 species of indigenous plants occur in Mauritius out of which about 300 are endemic (found only in Mauritius). To these should be added about 150 or more that are shared with the other islands of the Mascarenes, Réunion and Rodrigues. There are 8 endemic genera and three endemic flowering plant genera in Rodrigues. A high proportion of the endemics (about 40%) are threatened or endangered by either introduction of exotic plants which compete with them in their natural habitat or are damaged by exotic animals preventing their regeneration.

The *pas géométriques* forms a narrow belt of state-owned land all around the coast. This is 81.21 m (250 French feet) in width, although there are several cases where the width is less than this, or it does not exist at all. Much of the *pas géométriques* is leased for campments (seaside holiday homes) and hotels. Beaches occupy a fairly large area around the island, but a substantial portion, especially in the south, are leased to adjacent estates. Other areas have been granted long-term leases for grazing and tree planting in place of land that has been forcibly acquired from private estates.

There are 635 ha of forest on the *pas géométriques* managed by the Forestry Service. This includes exotic plantations (mostly filao - *Casuarina equisetifolia*), lands leased for grazing and tree planting, as well as un-plantable or "to be planted" lands.

The 16 protected islets out of the 44 islets found around the mainland Mauritius, harbour species and habitats that have almost disappeared from the mainland. For example, seven of the remaining twelve species of reptile are restricted to islets, the last remaining areas of coastal ebony forest and palm-rich forest are found on Ile aux Aigrettes and Round Island respectively, and many of the northern islands have important seabird colonies.

Round Island is of exceptional biological importance because it is the largest area free of introduced mammals and reptiles. It supports the last remnants of the palm rich forest once characteristic of the northern plains of Mauritius. It is home to at least ten threatened native plant species and possibly eight species of native reptiles including six that are endangered - five of which are now restricted to Round island. The island is also an important seabird breeding ground most notably for the rare Round Island petrel (*Pterodroma arminjoniana*).

Serpent Island is an important seabird colony. This otherwise barren rock is home to the sooty tern (*Sterna fuscata*), brown noddy (*Anous stolidus*), lesser noddy (*Anous tenuirostris*), and a tarantula that has yet to be described scientifically.

Flat Island, Ilot Gabriel & Pigeon Rock lie to the north of Mauritius. Pigeon Rock is a volcanic plug, rising vertically out of the sea and is home to a seabird colony. Ilot Gabriel is a small island with coastal sand dune vegetation including the only known wild population of Baume de l'Ile Plate (*Psiadia arguta*). Flat Island is separated from Ilot Gabriel by a narrow lagoon and is the largest of the northern islets (253ha). In spite of its degraded nature, the islet is home to several species of reptile including the night gecko (*Nactus coindemirensis*) and the last refuge of the orange tailed skink (*Gongylomorphus sp.*). It

harbours a seabird colony and has remnant populations of some plant species that once formed part of the palm-rich forest. Although the palm-rich forest that used to cover **Gunner's Quoin** is very degraded, the island is important for several native species, including *Gagnebina pterocarpa* (acacia indigène), *Lomatophyllum tomentorii* (mazambron marron), *Dicliptera falcate* and *Cynanchum scorpusulosum*. The island is also used by seabirds for breeding and has an important population of *Nactus coindemirensis*.

Ile aux Aigrette has the best-preserved native vegetation cover of all the coralline islands and contains the last remaining patch of ebony-rich forest. The island is also a refuge for many rare plants, such as *Gastonia mauritiana* (bois de boeuf), *Diospyros egrettarum* (bois d'ébène) and *Sideroxylon boutonianum*. The island's vegetation has been restored over the last ten years, and now only requires periodic weeding. A population of pink pigeons and Mauritius fody have been established on the island.

The three islets **Ile aux Vacoas, Ile aux Mariannes & Ile de la Passe** are important historically due to their strategic position in defending the bay of Mahebourg, and the remaining buildings and ruins represent an important cultural heritage. Ile de la Passe has been declared an Historical Monument and is under the management of the Ministry of Arts and Culture. They also contain some remnants of natural coastal vegetation, and Ile aux Mariannes is rich in insect life (AGRER 2004).

(ii) Mangrove forests and coastal wetlands

There are 44 coastal wetlands in Mauritius (ICZM subcommittee unpublished report 2005). As defined under the Fisheries and Marine Resources Act of 1998, 'a wetland is (a) an area of marsh whether (i) natural or artificial; or (ii) permanently or temporarily with water which is static or flowing, brackish, or salty; and (b) includes areas of marine water'. Wetlands act as an interface between terrestrial and marine systems and play an important environmental and economic function – reducing erosion, acting as a nursery for fish stocks, protecting the coast and filtering runoff before it enters the sea.

Mangroves are inter-tidal salt tolerant plants growing mainly in coastal regions and are of direct environmental, economical and social values. They constitute an important asset to fisheries and the marine environment. Two species of mangrove, *Rhizophora mucronata* and *Bruguiera gymnorhiza*, grow around Mauritius. Over the years the extent of mangrove cover around the islands has significantly decreased (20 km² in 1987 and 14 km² in 1994) through cutting for firewood, for construction purposes and for providing boat passage. The Fisheries and Marine Resources Act, 1998 makes provision for the protection and the conservation of mangroves and stipulates that "**no person shall cut, remove, damage or exploit a mangrove plant or part of a mangrove plant except with the written approval of the Permanent Secretary**".

The Mangrove Propagation Programme was initiated in 1995, in Mauritius, and the main objectives of the programme were to restore denuded areas with mangroves and propagate them at places where natural regeneration was slow.

The mangrove propagation programme was implemented and both the indirect method (2-3 months seedlings raised in nurseries are planted) and the direct method (propagules are directly planted) were used for the propagation. The details of the propagation programme from 1995 to 2005 are presented in the table below:

Table 2: the mangrove propagation programme from 1995 to 2005 .

Sites	Period	No. of seedlings	Areas covered (m ²)	Survival rate
Providence to Baie du Cap (East/South)	June 1995 to June 1996	12,400	23,750	60-70%
Petite Rivière Noire to Le Morne (west)	June 1997 to Dec 1998	47,500	23,750	80-90%
Poudre d'Or to Roches Noire (North)	Feb 2000	40,000	20,000	70%
Providence, Bambous Virieux and Pointe du Diable (East)	March 2001 to October 2002	58,000	29,000	60%
Grande Riviere Noire (West)	April to May 2003	42,000	25,000	95%
Anse Petite Sable and Pte Brochus (East)	April 2004 to May 2004	14,000	7000	70%
Pointe Jerome/ Souillac	2005	900	1000	
Total		214,800	129,500	

Since 1995, a total of 214,800 of mangrove seedlings were propagated over an area of 129, 500m².

An Awareness campaign is conducted regularly to sensitize the public on the importance of mangroves. The following are also included:

- Distribution of pamphlets to school children and the fishermen community;
- Delivering of talks at community centres and at the Albion Fisheries Research Centre (during guided visits)
- Communication through mass media and press.

The mangrove propagation programme was in general successful and the overall survival rate was estimated to be around 78%. As mentioned above, a total of 214,800 of mangrove seedlings, which were propagated over an extent of 129, 500m², represented an area of 13ha. In addition to the 9.4ha of naturally existing mangrove swamps, the total mangrove cover in Mauritius is estimated at around **23ha** as to date.

There are also important tidal mudflats at river estuaries that are used as overwintering areas by migrating shorebirds. Around 1000-1200 migratory birds visit the most important wetland at Terre Rouge Estuary each year representing 11 regular species and 4-5 vagrant species (Bird survey count 1997, NPCS unpublished).

(iii) Coral reefs

The Western Indian Ocean is believed to have the highest marine biodiversity in the world. There are five types of reef around Mauritius:

Fringing Reefs occur in shallow water near to land, extending to depths of 15-45 meters. The coral reef encircling Mauritius and protecting it from the sea is a fringing reef. The seaward reef front is where virtually all scuba diving takes place in Mauritius. It is believed that the reef front remains in good condition.

Patch Reefs are found in relatively shallow water around Mauritius where the underlying seabed has at some time been close enough to the surface for corals to grow. Many patch reefs in Mauritius have been seriously impacted by pollution and physical damage. Blue Bay and Balaclava, the sites of the two marine National Parks, are good examples of patch reefs.

Atolls start at fringing reefs around volcanic islands, forming atolls as the island gradually submerges. The Mauritian offshore islands of the St. Brandon archipelago includes a group of 22 atolls.

Reef flats are formed as the fringing reef pushes steadily seaward leaving behind limestone areas that are eroded almost flat by the sea, and are essentially an inter-tidal zone. Reef flats do not occur around the island of Mauritius but are significant around Rodrigues where they are under severe pressure.

Barrier reefs are developed typically on the edge of a continental shelf. They may have an atoll-like geological history. Barrier reefs are found far from the main shoreline and are separated from the shore by broad and deep waters. These occur in the south east of the island.

A total 159 species of scleractinian corals (hard corals) have so far been recorded in the waters of Mauritius (Field Guide to Coastal Fishes of Mauritius, 2001 & Field Guide to Corals of Mauritius, 2002), and 1,656 species and 290 families of marine species have been recorded. Out of 340 species of fish which have been identified in the waters of Mauritius, 42 are of economic importance within the inshore area, with a different composition and relative abundance in the near shore waters of each island within the Republic. The effect of over-fishing of *Lethrinids* is apparent on the fringing reefs of Mauritius with a population explosion of sea urchins *Diapena sp.* and *Echinometra spp.* in evidence.

Seven species of *Penaeid* shrimps in Mauritian near shore waters have been identified as well as two species of deepwater shrimp. Other shellfish includes mussels, oysters, barnacles and clams. *Crassostrea edulis* is the endemic oyster. *Octopus vulgaris* is fished in the lagoons of Mauritius, Rodrigues, St. Brandon and Agalega.

Several species of sea stars and echinoderms are reported in the Mauritian waters. The coral predator *Acanthaster planci* {crown of thorn (COT)} is occasionally sighted on the fringing reefs.

(iv) Cliffs , rocky shores and calcareous limestone shore

The south from Souillac to Blue Bay as well as the region between Albion and Flic en Flac n the west have high to low cliffs. Reefs and lagoons are absent or poorly developed and oceanic waves generally are attenuated by natural rock revetment at the base of the cliff. Pocket beaches may form within natural coves formed as a result of natural erosion of cliffs.

The calcareous limestone shore are upraised calcareous limestone which are exposed indicating retreat of the sea with fluctuating sea level. These can be found at La Prairie and Ville Noire and Ile aux Aigrettes in the south and south east and at Balaclava in the north west (Baird ,2003) .

(v) Algae, sea grass beds, Sediment-/Soft-bottom habitats

Mauritius has a rich algal flora. Over 160 genera of marine algae have so far been identified from the coastal waters. The marine floristic records of Mauritius date back to 1875. The Mauritius herbarium has a collection of more than three hundred marine algae. Basket trap fisherman mostly uses algae as baits. Work on algal endemism has yet to be undertaken.

Over 36 species of seaweeds have been identified in Mauritian waters. Some species of seaweeds commonly found in Mauritius are *Enteromorpha*, *Ulva*, *Sargassum*, *Caulerpa sp*, *Padina* and *Halimeda*.

In Rodrigues, an inventory of marine biota from 94 stations within 31 sites in shore, lagoon and reef habitats was made. The work performed did not allow a totally comprehensive inventory to be made but investigations of the algae, corals, polychaete worms, shelled mollusks, amphipod and isopod crustaceans, echinoderms, bryozoans and fish were made. Species potentially new to science have been found within the bivalves, corals, fish, polychaetes, amphipods and isopods, with possibly over 30 species from the latter group as yet not described. The numbers of species collected per taxa are as follows: 493 fish species, 175 gastropod species, 104 species of algae, 109 bivalve species, 138 coral species, 74 species of echinoderms and 41 bryozoan species. For many of the taxa considered, Rodrigues appears to be less diverse than other locations in the region, with the notable absence of certain species common elsewhere in the area, factors possibly due to the small size of the island and the limited number of habitat types. In particular, only 2 species of *Halophila* sea grass are found in Rodrigues, while the larger species which form extensive beds (such as *Thalassia* and *Enhalus*) are entirely absent from the lagoon. Also absent are well developed mangrove forests. The absence of live-coral bearing molluscs was also noted, and may be due to the limited numbers of the massive *Porites* colonies with which the borers usually associate (Oliver and Holmes, 2001).

Chapter 3: Species of special concern and flagship species

(i) Marine mammals (dolphins, whales, seals, sea lions, dugongs, manatees)

Sea cows, once common in the lagoons of Mauritius are extinct, and marine turtles are rarely seen due to lack of undeveloped beaches, intense hunting pressure and predation by alien species. However, these still use Cargados Carajos, Agalega, Rodrigues and Tromelin shores for breeding. Seventeen marine mammal species have been recorded in Mauritian waters – mostly as they migrate to and from Antarctica to warm tropical waters for calving. Dolphins are encountered more frequently than whales, although the breeding and nursery grounds of the dolphins have not yet been located.

(ii) Sea turtles

Five sea turtles species are common in the Western Indian Ocean (WIO), namely the green turtle *Chelonia mydas*, the hawksbill *Eretmochelys imbricata*, the loggerhead *Caretta caretta*, the leatherback *Dermochelys coriacea* and the olive ridley *Lepidochelys olivacea*. Out of the five species 2 are commonly encountered in the shallow coastal waters of Mauritius, the hawksbill *Eretmochelys imbricata* and the green *Chelonia mydas*.

The population trends on both the species are not known but are believed to be declining. Information concerning their habitats and population dynamics is lacking. The knowledge of the location of nesting beaches and feeding habitats is also lacking. However, the nesting beaches for green and hawksbill turtles are found around St. Brandon, Agalega and the Mascarenes. The nesting peak is in summer. The foraging and feeding areas take place in seagrass, algae and reef around Mauritius, Agalega and St Brandon. The sea turtles are migratory species, foraging in one area and nesting in another.

The hawksbill has traditionally been exploited for its shell and eggs, the green turtle for meat, eggs, fat and leather. Turtle nests are threatened by storm and high seas and nesting beaches in general by erosion. Predation by crows and exotic mammals is also a threat. Other threats are pollution in general and various coastal developments works. (IUCN, 1996)

Sea turtles are protected species and the legal basis for its conservation and management is the ‘Fisheries and Marine Resources Act 1998’ that stipulates the following:

(i) ‘No person shall fish a turtle, turtle egg or a marine mammal without the written approval of the Principal Assistant Secretary’

(ii) ‘No person shall land, have in his possession for purposes of sale or supply or sell or offer for sale any turtle whether dead or alive or part of a turtle, turtle eggs, stuffed turtle without the written approval of the Principal Assistant Secretary’.

Presently there is no ongoing project on sea turtles at the Albion Fisheries Research Centre, Ministry of Agro Industry and Fisheries (Fisheries Division) . The Ministry of Agro Industry and Fisheries (Fisheries Division) is the focal point under the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their habitats of the Indian Ocean and South East Asia.

(iii) Shoreline birds

The Rivulet Terre Rouge Bird Sanctuary located in the north east of the island, near the Port Louis Harbour is a tidal mudflat that is used as overwintering areas by migrating shorebirds. Around 1000-1200 migratory birds visit this site each year representing 11 regular species and 4-5 vagrant species (Bird survey count 1997, NPCS unpublished).

Table 3 : Common birds found at Rivulet Terre Rouge Estuary Bird Sanctuary

	Name (English)	Scientific name	Name (French)	Country
1	Curlew Sandpiper	<i>Calidris ferruginea</i>	Becasseau Cocorli*	North U.R.S.S
2	Grey Plover	<i>Pluvialis squatarola</i>	Pluvier argente*	Toundra Eur.
3	Common Sandpiper	<i>Actitis hypoleucos</i>	Guignette*	Europe
4	Whimbrel	<i>Numenius phaeopus</i>	Courlis Corlieu*	Toundra Eur.
5	Ruddy Turnstone	<i>Arenarai interpres</i>	Tourne-pierre*	Eur. Arctique
6	Little Green Heron	<i>Butorides striatus</i>	Gasse	
7	Common Tern	<i>Sterna hirundo</i>	Sterne Pierre Garin*	Europe
8	Lesser Crested Tern	<i>Sterna bengalensis</i>	Sterne voyageuse*	Mer Rouge
9	Greater Sand Plover	<i>Charadrius leschenault</i>	Pluvier de Leschenault*	Eurasie S.
10	Ringed Plover	<i>Charadrius hiaticula</i>	Grand Gravelot*	Reg. Palaearct
11	Little Ringed Plover	<i>Charadrius dubius</i>	Petit Gravelot	Europe
12	Bar-tailed Godwit	<i>Limosa lapponica</i>	Barge rousse*	Alaska
13	Terek Sandpiper	<i>Xenus cinereus</i>	Barguette cendree*	U.R.S.S
14	Green Shank	<i>Tringa nebularia</i>	Chevalier aboyeur*	Reg. Palaearct
15	Sanderling	<i>Calidris Alba</i>	Becasseau Sanderling*	Haut Palaearct
16	Little stint	<i>Calidris minuta</i>	Becasseau minute	West Palaearct

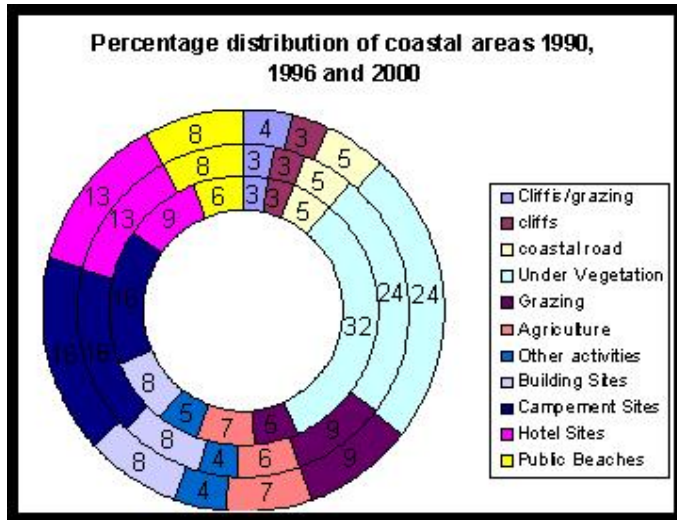
*these species are to be found regularly at Reunion Island at each season

Table 4 : The number of birds visiting the Rivulet Terre Rouge Bird Sanctuary from October 2005 to January 2007

Date	Number of birds recorded
October 2005	402
November 2005	580
December 2005	654
January 2006	675
February 2006	564
March 2006	418
April 2006	179
May 2006	161
June 2006	125
July 2006	200
August 2006	185
September 2006	170
October 2006	512
November 2006	584
December 2006	747
January 2007	450
February 2007	373
March 2007	2278
April 2007	1367
May 2007	305

Chapter 4: Coastal communities

Being a small island developing state, Mauritius is very vulnerable due to lack of resources. Through the years, the economy of the island has shifted from agriculture towards industrial development and now tourism development. The pie chart below, shows the percentage distribution of coastal areas from 1990 to 2000. It is very clear from the pie chart that the extent of coastal area under vegetation has decreased and that under hotels has increased.



(Source : Staking out the Future, 2004)

(i) Population dynamics (demographics, migration, etc)

As per the EPA the coastal zone in Mauritius is defined as

- (a) any area which is situated within 1 kilometre or such other distance as may be prescribed from the high water mark, extending either side into the sea or inland;
- (b) includes -
 - (i) coral reefs, reef lagoons, beaches, wetlands, hinterlands and all islets within the territorial waters of Mauritius and Rodrigues;
 - (ii) any estuary or mouth of a river and that part of a river, stream or canal which lies within 1 kilometre from the outermost point of its bank on the sea at high tide;
 - (iii) the islands of Agalega and Saint Brandon, and other outer islets.

However , given that the mainland Mauritius is a small island and all land based activities would have an impact on the coastal zone , the whole island is being considered as a coastal zone for the purpose of this report. Therefore, the 1.2 million inhabitants are basically considered as a coastal population.

The rate of natural increase of the population which was about 3% in the 60s has considerably dropped with family planning campaigns and greater awareness due to better education. During the last ten years, the population has grown at an average rate of 1.1% annually.

The latest figures as at December 2006 of the population of the Republic of Mauritius are as follows:

- Mauritius Mainland 1 219 220
- Island of Rodrigues 37 230
- Agalega 289
- St. Brandon None
- Tromelin Unknown
- Chagos Archipelago Unknown

The population of the Republic of Mauritius is growing from 1,186,873 in 2000 to around 1,486,000 in 2040, at an average annual rate of 0.56%. (CSO,2003). The projections also indicate a continuation in the process of ageing. The proportion of the population under 15 years of age will be decreasing from 25.7% (305,288) in 2000 to around 18.4 % (273,261) within the next 40 years. This is a direct consequence of the fall in fertility in the projected period. The proportion of the elderly aged 60 years and over is projected to increase from 9.1% in 2000 to around 23.5% by 2040. In absolute numbers, there will be around 350000 persons eligible for old age pension in 2040 against some 107500 in 2000, that is, more than three times in number. This corresponds to the high fertility cohorts born in the 1950's onwards who will be attaining their sixties during that period.

(ii) Access to social services (including healthcare, education, social security, water and sanitation, communications, political influence, etc.)

The role of education is to build a Mauritian Society made up of self reliant individuals able to take control of their own lives, to make their own choices and fulfil their own potential. Being a relatively young nation, with its human resource being its only key asset, Mauritius had no other choice but to heavily invest in education in order to gradually emerge from an isolated pin-point in the midst of the Indian Ocean to become a respected partner on the regional scale. With the current ongoing reforms, it is the aim of the country to now fully prepare itself to new international challenges and create the appropriate conditions conducive to lifelong learning.

Government capital expenditure on education represents 14% of total Government Capital expenditure. In March 2006, there were 1087 schools providing pre-primary education,290 schools providing primary education, 189 schools providing secondary education (70 state school and 119 private) , and 7 institutions delivering tertiary education . (CSO, 2005). In Mauritius, education is compulsory up to the age of 16.

Educational development has been a key component of economic and social progress in Mauritius. Government expenditure on education has risen to 12.7 % of total public expenditure . The youth literacy rate (15-24 years) is now 94%. 95% of children of primary school age go to school. But only 64% of those of secondary school age continue in school

and only 11% are in tertiary education. This presents a substantial challenge to the country for the future; how to increase secondary and tertiary education to the levels being achieved in the more developed countries. For example, whereas only 11% of young people are in tertiary education in Mauritius, in Bahrain there are 25% and in Barbados 39%. The rapid development of the economy with more specialisation and more dependence on technical content demands an increasing level of education which the facilities have not been able to supply.

The key factors in past achievements have been based on a number of factors including public and private partnership in school and community based developments and the maintenance of strong professional links with centres abroad.

Mauritius is also playing a pivotal role in regional education and educational development, through new forms of partnership involving the public sector, the private sector, local and international NGO's and civil society. These include medical and dental education, ICT, specialist professional training and development, University linkages with Australia, UK, France, India. The freer movement of labour across the region and through global partnerships will promote this trend. The ease of doing business with Mauritius is a key factor in attracting and sustaining such co-operation.

(iii) Gender equity

Women's rights to equality and non-discrimination dates back to 1945 with the signature of the Charter of the United Nations. This was the first international agreement to proclaim gender equality as a fundamental human right. Conscious of the need to enhance women's advancement and given their vulnerability in the globalisation process, Government has taken the commitment for actions that will lead towards their social, economic and political empowerment. Mauritius has signed the Convention on Elimination of All Forms of Discrimination Against Women (CEDAW) and has to report every four years on steps taken by the State to eliminate discrimination against women and promote their welfare and well-being.

The achievements made to enhance the status of women in Mauritius include legislative measures such as the enactment of the Protection from Domestic Violence Act, and the Sex Discrimination Act. The Equal Opportunity Bill figures high on the Government agenda, as a positive strategy to ensure the principles of non-discrimination against women and to achieve gender equality. In the Health Sector, it is worthwhile to note that the mortality rate of women has decreased and Mauritius is also one of the few countries in the African region with such a minimal mortality rate due to the consolidated public health care services, their ease of access, and an effective decentralized system.

Women's sexual and reproductive health has shown considerable improvement due to the prompt availability of contraceptive methods and vast sensitization campaigns. In the Education Sector, the enrolment rate for males and females has almost reached parity. With regard to the representation of women at decision-making levels, it is encouraging to note that women are getting more visible in the public sector. It has to be noted that more women are now participating in the political sphere. The National Assembly now comprises 12 elected women.

(iv) Economic status and resource use

Traditionally, the economy of Mauritius was based on agriculture with sugar cane as a cash crop. However, over the past two decades, industrial and tourism development have become major foreign exchange generators. The country has successfully sustained its economic growth with a gross national income per capita of USD 4,640 for 2005.

Government jointly with the Private sector is developing Mauritius into a regional seafood hub. The strategy of the seafood hub is focused on the development of value added fisheries and seafood related sectors including fishing, trans-shipment, storage and warehousing, light processing (sorting, grading, cleaning, filleting and loinning), canning, ancillary services (ship handling, bunkering, vessel husbandry, ship agency, ship building and repair).

To-date a One Stop Shop service is in place at the Trade and marketing Centre (TMC) in the free port area to facilitate the administrative procedures for loading/unloading/export of fish and fish products. It is also opened on Saturdays, Sundays and public holidays as from 9.00 to noon.

The Ministry of Agro-Industry and Fisheries along with other ministries/institutions and the Private Sector are working on other long term strategies, namely, the creation of an electronic platform for the delivery of clearances, promotional and marketing aspects, financing and fiscal incentives, flagging and licensing policy and surveillance of the EEZ.

Chapter 5: Economic activities

(i) Coastal tourism

Tourism is one the fastest growing industries in the world and as in many countries. Mauritius has also turned to tourism for economic development. In the past two decades, Mauritius has experienced an unprecedented boom in the tourism industry and has successfully targeted high quality, high spending tourists who are largely attracted by the vision of pristine lagoon water, beautiful beaches and high quality facilities. The island is essentially a sun, sea and sand destination. Therefore tourist activities having mostly concentrated in the coastal zone with over 90% of the hotels have a beach frontage.

In 2006 tourism receipts represented around 16 % of our gross domestic product while tourist arrival for the same year have reached 788 276.

The increase in high quality tourism would lead to the increase in number of coastal hotels and associated activities. Given the sensitive nature of the coastal zones, an Environment Impact Assessment (EIA) is required under section 15 of Environment Protection Act (EPA) 2002 for coastal hotels and extension of existing ones

At the end of March 2007, there was a total of 97 registered hotels in operation. The total room capacity for these registered hotels was 10,683 with 21,509 bedplaces . The room occupancy rate for all hotels for the first quarter of 2007 averaged 82% while the bed occupancy rate was 73%

“Large” hotels, i.e. well-established beach hotels with more than 80 rooms, numbered 42 (43% of all registered hotels). These "Large" hotels had a room capacity of 8,066 with 16,197

bed places, representing 76% of total room capacity and 75 % of total bedplaces. The average room occupancy rate for these hotels for the first three months of 2007 was 85% while bed occupancy rate averaged 76%

For the year 2007, the number of tourists arrival is expected to grow by around 11% to reach 875 000. According to the Bank of Mauritius, tourism receipts for the year 2007 will be around Rs 36 430 million (+14.1%).

(ii) Agriculture

The agriculture sector constitutes essentially of sugar production and has been the backbone of the Mauritian economy until the establishment of the EPZ. Arable land devoted to sugar production is gradually decreasing. In 2006, Share of Agriculture in the national economy was 5.5%. Besides sugar cane, the other activities namely livestock, food crops and fishing also contributed to the agricultural sector. From the data available in 2005, sugar cane, tea and tobacco contributed to 52% of the overall agricultural production; food crops and others 19%; livestock and poultry 14% and fishing 4%. (CSO, 2005)

The total quantity of fertilisers consumed and its breakdown by main nutrient components are shown in Table 6. The consumption of fertilisers for the year 2005 was 50 870 tonnes, a decrease of 1.7 % over the 2004 figure of 61 266

The major nutrients in these inputs are nitrogen (N), phosphorous (P) as phosphate and potassium (K) as potash. In 2005 those nutrients were distributed in the following proportions of the product weight: nitrogen 33 %, phosphate 20.0 % and potash 47 %. (CSO 2006)

(iii) Land use and forestry

There is very little use of native forest resources because there is so little forest left and the components are in general very rare. In 2005 the total forest area was 47,185 hectares, of which 22,185 hectares (47%) were state-owned and the remaining 25,000 hectares (53%) were privately-owned.

It is estimated that MRU 200m is spent annually by the country as a whole, in addition to external funding, on the conservation of forests and terrestrial of biodiversity.

In 2004, 6,858 m³ of timber and poles were produced from state forestlands. There was also some extraction waste wood, in the form of privet (*Ligustrum robustum* var. *walkeri*) and goyave de Chine (*Psidium cattleianum*) stakes. In 1995 the amount of wood used for cooking purposes was equivalent to 81,000 tons of petroleum products, meeting about 10.2% of local needs. By 2000 less than 5 % of fuel consumption was through firewood.

The introduced rusa deer from Java (*Cervus timorensis*) is mainly reared on extensive farms and estates for hunting purposes. The national herd is estimated to number about 70,000 deer. In 2004, 12,000 head, representing 480 tonnes of carcass, were shot during the hunting season (1 June to 30 September). This was valued at MRU 53 million.(Mauritius Deer Farming Cooperative Society Ltd, 2005). The meat is exclusively for the local market.

Introduced monkeys (*Macaca fascicularis*) are highly invasive and have deleterious effects on both native flora and fauna. Monkeys are caught from the wild or bred in captivity and

exported to laboratories and biomedical research institutions, mainly in Europe and America. In line with the CITES Convention, a voluntary annual export quota of 8000 wild-caught *Macaca fascicularis* has been fixed by the Ministry of Agro-Industry & Fisheries (MOAIF) to four companies. In addition, captive-bred monkeys are also exported. A contribution of 70 US\$ per head exported is credited into the National Parks and Conservation Fund (NPCF). This was increased to 70 USD in July 2004. Table 4 indicates the contribution to NPCF from 1995-2004. The trade provides an important incentive to control the pest in the wild and at the same time support various biodiversity conservation programmes.

Table 5 Number of monkeys exported from 1995 to 2004 and respective contribution to the National Park and Conservation Fund.

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of animals	5,410	6,084	5,998	5,578	7,263	7,870	7,050	5,731	7,740	7,621
Contribution to NPCF (million Rs.)	8.1	9.1	9.0	8.4	10.9	11.8	10.6	8.6	11.6	11.4

Many introduced fruit tree species have naturalised, or become invasive in the forests of the Mauritius e.g. *P. cattleianum* (goyave de Chine). The fruit is available for about four months of the year and guava picking is a popular Mauritian pastime. Fruit are also collected for sale but there are no reliable figures as to its economic significance.

Guided visits on quad bikes or jeeps to admire the scenery and introduced animals, or canoeing trips down rivers, and abseiling down waterfalls are amongst the activities available. The only ecotourism destination in Mauritius, at present, is the Nature Reserve of Ile aux Aigrettes. Proceeds from guided tours of the island are used for its restoration. 8,000 tourists visited the island in 2004.

The endemic palmiste blanc (*Dictyosperma album var. album*) is cultivated in plantations on marginal lands for their cabbage. This local trade is estimated to be worth 20 million rupees MRU (Govinden 2004). Although in the past the cabbages were exported (mainly to Reunion), this trade has stopped, as local demand from hotels and restaurants is greater than the supply. There is little harvesting of wild palms as the species are rare and hard to find in the wild.

A few families have earned their living for generations from the sale of traditional remedies using native species collected from the forest. However, this is a dying trade and much traditional knowledge passed down orally is being lost. In addition several of the plant species used are critically endangered, sometimes due to over harvesting.

A scientific survey funded by the Indian Ocean Commission estimated that there are about 100 native plant species with medicinal properties in Mauritius and Rodrigues (in addition to 500 introduced species). Other species have been found to contain active ingredients for herbicides and pesticides (Dulloo 1995).

Vacoa leaves (*Pandanus utilis*) are used by two communities for making baskets, mats and hats. Forest resources that are exploited illegally include ferns and orchids. The current market value of ferns is around MRU 150 per plant (NEAP 1999). Data on the number of species collected and their potential value are not available. Preservation of forest ecosystems is vital for the protection and conservation of soil and water.

From 2003 to 2005, the effective area under sugarcane has shrunk by 2534 hectares (-3.5%), to 71 583 hectares. During the same period area under tea plantation dropped to 670 hectares (-1.6 %) from 681 hectares and area under tobacco fell to 348 hectares (-8.2%) from 379 hectares.

(iv) Shipping and ports

The present port mainly includes the below listed marine facilities. Except for the Sugar Terminal, the Taylor Smith Repair Yard and the Caudan Waterfront Development, these facilities are directly controlled by Mauritius Ports Authority and cargo handling operations are carried out by Cargo Handling Corporation Ltd.

Bulk Sugar Berth belonging to the Mauritius Sugar Company Ltd, and almost exclusively used for sugar loading. The 200m long jetty is provided with a conveyor system and continuous sugar loader.

There are 4 berths used for the discharge of dry bulk chemicals for the fertilizer factory Mauritius Chemical & Fertilizer Industry Ltd (MCFI), and the discharge of cement, petroleum products and coal. Occasionally, also for general cargo and sometimes containers. Cargoes include mainly containers. Furthermore, LPG and cement are discharged here.

There are 3 quays are used for the discharge of products like black oil, wheat and maize, for loading of molasses, for cruise ships and for inter-island traffic (to Rodrigues and Reunion).

The Fishing Harbour at Trou Fanfaron has two quays of 160m and 185m. The Fishing Harbour is extensively used, and, consequently, Mauritian, Taiwanese and other fishing vessels can also be seen in other locations in the port. **The Fishing Harbour is considered to be one of the main sources of pollution in the port.**

Located at Trou Fanfaron, **the Taylor Smith Repair Yard**, is presently the only ship repair facility in Port Louis. The company undertakes ship repair and maintenance, including dry docking, mainly of Mauritian fishing vessels, MPA tugs and port crafts and French navy vessels from Reunion.

The Caudan Basin is the old port area which has been converted to a prestigious waterfront development with a hotel, restaurants, shops, housing, etc. The basin is still used for the fast catamaran passenger vessel to Reunion. Part of the development scheme includes the conversion of the Caudan basin to a marina.

The number of ships calling at Port Louis and the development of traffic up to 2005 is summarised below .

Table 6: The number of ships calling at Port Louis up to 2005

Year	Cargo vessels	Fishing vessels	Others	Total
2005	989	518	743	1,666
2004	1129	493	493	1,484
2003	1142	374	612	1,267
2002	1025	363	565	1,183
2001	902	461	565	1,185
2000	840	381	651	1,109
1999	875	344	562	426

The category “others” include ships which call at Port Louis for bunkering only, repair, cruise ships, yachts, etc. Port Louis harbour apparently has grown significantly and steadily since 1985.

The main sources of pollution in the Port Louis of harbour waters mainly consists of the following:

- (i) Oily waste
- (ii) Garbage

Foreign fishing vessels are the cause of major oil pollution of port waters, it is testified by various parties that fishing vessels, prior to taking to sea, for a shipping campaign, leave drums of used lubricating oil on the quay without any instructions or message. In view of the number of drums (about 10-15 per fishing vessel) and the limited space on the quay, this practice presents a pollution hazard as drums can fall into the harbour water.

Although the dumping of oil by fishing vessels cannot be completely excluded, a more likely cause for oil pollution of the port waters may also be land based sources, such as the effluent discharge by the oil companies as well as spent lubricating oil from garages generated by the city upstream. The fact that fishing vessels have spent lubricants behind in drums on the quay shows the willingness of the skippers of the fishing vessels not to pollute the port waters and the seas. The fact that they do not care about the disposal of the spent oil could, superficially, be an indication of an absence of awareness for the need of environmental care but it could just as well be attributed to the present absence of any reception facilities for oily waste.

Garbage is a frequent pollutant of port waters. Besides being the harbour Port Louis is also the capital city of Mauritius with a population of 220,000 people. As all the major commercial transactions occur at the doorstep of harbour waters, pollution is mainly caused by the influx of uncontrolled solid waste generated by the city upstream and carried downstream by two rivers and four manmade water ways ending at the harbour. These solid

waste are a nuisance to the harbour, causing negative impact on the marine environment and also damaging floating crafts.

These rivers which are always polluted with floating and submerged debris made up of some common domestic and industrial garbage are very anaesthetic. Despite rigorous control, these waterways serve as dumping spots for some citizens. There is a lack of environmental awareness of the general public, in combination of a certain inadequacy of garbage collection services within the city . In addition to quay, transshipment facilities, some fifty two (52) port based industries and utility companies operate in the port sector. However, these companies do contract out the disposal of their solid wastes .

On several occasions clean up actions have been initiated by the Mauritius Ports Authority. However it looks like it that such action although very positively intended yields a short term improvement of the state of port waters. The situation is quickly worsened during heavily rainy periods (December-April) and manual recovery is at time rendered practicably impossible. It is strongly felt that only the structural improvement on the land side to cater for loose garbage and a better availability of garbage collection system, coupled by an increase of public awareness will solve the problem of pollution of port waters.

Dust problems occur during unloading of certain fertilizers from ships for Mauritius Chemical & Fertilizer Industry Ltd. This is mainly attributed to the Mauritius Chemical Fertilise Limited to the light bordery product potassium chloride, KCL. The main problem caused by this dust development is a certain nuisance due to the presence of dust on the quay. However, no occupational or environmental hazards are associated with the handling of this product. It is further pointed out that potassium chloride is a natural component of sea water. Although it might cause a higher than normal concentration of the harbour water locally and temporarily, if wind blown into the water, this will dispense quickly and will not cause any harm to the marine environment.

Nevertheless, to reduce the nuisance of the dust development and the possibility of cross contamination of other products, it is recommended to take proper dust suppression measures, such as the use of unloading grabs with dust seals and the application of dust enclosures around conveying systems and dust collection equipment at conveyor transfer points.

The main possibility of one industrial emission is that of ammonia vapours from MCFI. No significant nuisance seems to be caused by such emissions, if any, in view of the predominant wind direction which is towards the sea.

It is seen by far that the main course of present pollution of the port water is constituted by land based source and we can only conclude that the implementation of MARPOL 73/78 will not significantly reduced the pollution of the water of Port Louis Harbour as pollution from marine activities makes almost no weight to the pollution caused by land based Table below shows summary of annual volumes of ship generated waste.

Table 7 : Annual volumes of ship generated wastes

Type of waste	2005	2010	2015
Oily waste			
Sludge (m ³)	1260	1284	1327
Lube oil (m ³)	240	258	281
Garbage (tones)	1372	1662	1922

The sludge volume includes the sludge generated by the ship yard.

(v) Aquaculture

Although fish culture in coastal marine fish ponds (barachois) was practiced since a long time for individual purposes, aquaculture as an organised activity was initiated only with the introduction of various species of tilapias during 1953-1957. However, culture of these fishes was not successful due to inherent problems with the tilapias (prolific breeding and stunted growth). The next species to be introduced for culture purposes were the giant freshwater prawn, *Macrobrachium rosenbergii*, in 1972 and the Indian major carps and Chinese carps in 1975 and 1976. The culture of the giant freshwater prawn developed in an industry producing 50 to 60 tonnes per year from 1992 to 1996 but thereafter decreased to around 30t per year. Culture of the carps was phased out in the nineteen-eighties due to its low acceptance by consumers because of too many bones in their flesh. A new crustacean species, the redclaw crayfish, *Cherax quadricarinatus*, was introduced in 1996. Its production was 1.6t in 2002. On the other hand, production of red tilapia, which was introduced in 1990, reached 68 tonnes in 1996 but decreased to 20.5t in 2002. Fingerling production of red tilapia in the country which went up to 1.2 million/yr in 1996 dropped to 370,000 in 2000. Overall production was in relation to demand and was more than in the previous three years.

Research on the occurrence of marine shrimp species in the lagoon was carried out in the nineteen-eighties and this led to the selection of the giant tiger prawn, *Penaeus monodon*, for culture development. Although its hatchery production was developed together with its grow-out culture in ponds as from 1988 onwards the culture of the marine shrimp has not developed into commercial production due to lack of appropriate space near the coast and low economic feasibility. However, in the context of resource propagation programme hatchery-produced seed of marine shrimps and sea bream fingerlings are being released in the lagoon for enhancing the natural stocks. Reproduction of the mud crab on an experimental basis is also under way.

Total aquaculture production is relatively small and was 36t in 2004, which, Aquaculture development faces certain constraints such as competition from imported products, high feeds costs and limited appropriate space and freshwater.

With the winding-up of activities of the private camaroon hatchery, the Ministry of Agro-Industry and Fisheries started to produce camaroon juveniles for distribution to small scale farmers as from 2002. Likewise the production of berri rouge fingerlings continued to cater for small scale fish farmers.

Research is presently underway on the acclimatisation of the giant tiger prawn, *Penaeus monodon*, for culture in fresh water.

Barachois were created following mostly the characteristics and undulations of the coastline . these water bodies all around the coast might have been first created during the French occupation of the island . The aim was to allow fish fingerlings to enter the area through the opening fitted with a small size grid. After some time they would grow big enough as to be unable to escape back to the outside lagoon. There are presently 33 barachois recorded n the official list of barachois. Out of which 21 are Government owned and 12 are privately owned. Some development can be envisaged in only 12 of the government owned barachois.

The remaining 9 barachois have no appropriate infrastructure and rehabilitating them will be beyond the means of any prospective farmer.

Culture methods in barachois can be extensive, intensive and semi intensive . In extensive culture fish have to rely on natural feed only. The intensive method comprises of culture in fish pens and floating cages, trays and bags. In semi intensive culture the fish are stocked at a lower density and made to be dependent on both natural and artificial feed .

Marine aquaculture in barachois has been carried out on a traditional basis since they were created. However, over the past few years, efforts have been made to introduce new culture techniques such as floating net cages and pens for the culture of red tilapia in seawater and the sea bream (gueuele pave) on a pilot scale in selected barachois. Results from trials of such techniques have not been encouraging.

A private company (Ferme Aquacole de Mahebourg) invested Rs. 80 million in the setting up of a marine fish farm of 8.5 hectares in the lagoon at Pointe aux Feuilles, Mahebourg. It is culturing red drum in floating cages with a potential annual harvest of 1000 tons of fish for the export market. Production in 2004 attained around 400 tonnes. Presently, the company is also putting its produce for sale on the local market. The company will put up a processing plant to be able to export to the EU.

(vi) Fisheries

Mauritius claims an Exclusive Economic Zone of around 1.9 million km² including its outer islands of Rodrigues, St Brandon, Agalega, Tromelin and Chagos Archipelago as center points. However, it has a limited shelf around the islands except for larger shelf areas on certain banks situated far to the north.

Fish is an important source of protein in the population diet and the per capita consumption of fish stands at 20 kg. The fisheries sector, like any other sector, has undergone fundamental changes and development in terms of technological advance and innovation. It accounts for 1% of the GDP and employs some eleven thousand people.

The Ministry of Agro-Industry and Fisheries generates revenues to the tune of 40 million rupees annually through the issue of fishing licences, import permits and sale of produce. The fish processing industry contributes some 2 billion rupees and calling fishing vessels in the port sector generates some 2.5 billion rupees to the economy. The local fisheries production amounts to some 900 million rupees. The balance of trade in the fisheries sector is positive.

Development of the fishing industry is encouraged through fiscal incentives, subsidies, access to credit, duty concessions and the promotion of the seafood hub by the Board of Investment.

The Ministry of Agro-Industry and Fisheries is conscious of the delicate balance to conserve the marine ecosystem and maintain fisheries development at sustainable levels while taking into account the interest of the fishing community and stakeholders of the fishing industry.

Main Fisheries

- Banks Fishery (lethrinids, snappers, groupers)
- Artisanal Fishery (lethrinids, snappers, groupers, octopus)

- Semi industrial fishery (snappers, groupers)
- Sports fishery (marlins, wahoo's, tunas)
- Amateur fishery (lethrinids, siganids, etc)
- Tuna fishery (tunas and associated species)
- Deep sea demersal fishery (orange, roughy and alfonsinos)
- Aquaculture (red drum & sea bream sp.)

2,383 fishermen were involved in the artisanal fishery in 2003 in Mauritius. They used 2,313 fishing boats, six to seven metres in length made of wood or fiberglass of which 90% were powered by outboard and inboard engines. Their total catch was estimated at 1,166 tonnes in the same year. In addition, it is estimated that 650 tonnes of pelagic fishes are caught by sports and recreational fishermen and about 300 tonnes by amateur fishermen. There were 1,981 fishermen registered in Rodrigues in 2004 and their estimated catch is around 1,600t per year.

Catch and effort data of the artisanal fishery are collected by a team of enumerators covering the 61 fish landing stations. A computer software, MAUCAS (Mauritius Catch Assessment survey), was designed with assistance from FAO for data entry and processing.

The landing sites are grouped in three state (North, East and West). Every week 5 sites are randomly selected from these strata and five enumerators are posted on each site to collect catch and effort data. These data are collected on selected hours on six days per week. Raising factors are used to estimate the catches and efforts for each stratum separately.

The catch and effort data of the artisanal fishery of Rodrigues are also collected and transmitted to AFRC regularly. About 2000 professional fishermen are involved in the artisanal fishery and the total landing is about 1400 tonnes annually.

The Fish Aggregating Device (FAD) associated fishery was introduced in 1985 to tap the migrating pelagic resources in the outer-reef waters of Mauritius and Rodrigues. At present there are 21 FADs in operation around Mauritius. About 300 fishermen are involved in this fishery and the catch has been estimated to be around 300 tonnes annually. The catch is composed of tuna, dolphin fishes, bill fishes and sharks. Recently a data collection system has been set up. Enumerators are posted at landing sites to collect catch and effort data on a daily basis from fishery fishing around FADs.

The most important supply of frozen fish to the local market comes from the shallow water banks namely Saya de Malha and Nazareth. Around 500 fishermen are employed in the sector which produces a total catch of about 3000 tonnes of frozen fish annually. The whole of the production is consumed locally.

Since 1992 the bank fishery is being managed through a licensing system and a catch quota system to protect the resource from being overexploited. In 2004 the Total Allowable Catch was established at 3,768 tonnes.

It is to be noted that the bank fishery is currently being exploited at a sustainable level and the present fishing effort should be maintained. However, two vessels have recently left the fishery to operate under the Malagasy flags.

Chilled Fish Fishery is practiced on the Northern Banks, Soudan Bank and St. Brandon area using handlines. Since 1995 all boats are being licensed. The Total Allowable Catch from

the Northern Banks to St Brandon has been set at 315 tonnes. Ten fishing boats are presently in operation in this fishery.

The Sword Fish Fishery is yet another pelagic resource which is being exploited since 1999. Both Mauritian and foreign surface longliners are licenced to operate in that fishery. In 2004 a total of 97 tonnes of fish was caught by Mauritian longliners.

Tuna fisheries which are of interest to Mauritius are the surface tuna fishery in the western Indian Ocean, the temperate tuna fishery aiming at the albacore tuna and the swordfish fishery. One Mauritian purse seiner operated in the surface tuna fishery as from 1979. It was joined by two other vessels stopped in 1995 and 1997. The third vessel was operated under a joint Mauritian-French joint venture as from 1997 but this company would up in 2000 and the vessel was disposed of in 2001. There is thus at present no tuna which is being landed from the surface tuna fishery by Mauritian vessels. A tuna cannery has been operational since 1972. It was replaced by a completely new one in 2000 with a capacity to process 185t of tuna per day or 45,000t per year.

The development of a semi industrial fleet for swordfish fishing is being encouraged. In 2002, three local vessels were licensed to fish in this fishery and a total of 45.8t of pelagic fishes were landed of which 55% consisted of swordfish.

Taking into account the quantity of tuna caught in the western Indian Ocean tuna fishing seems to be an area where one would have expected more local involvement but the cessation of activities of the existing fleet in 2000 points to a certain caution in this sector. However, as investment requirements in this sector are high, joint ventures should be encouraged.

It has been known for a few years now that a fishery for deep sea demersal fishes has developed in the Southern Indian Ocean. In fact the volume of such fish transhipped (apart from Patagonian tooth fish) in Mauritius was 3,746 t in 2002. Two vessels fished for deepsea demersal species under the Mauritian flag as from 2000 in the Southern Indian Ocean. Another deep-sea trawler joined this fishery at the end of 2001. Presently only one deep-sea trawler is in operation. The catch for 2004 is 1,900t.

Table 8: Fish production

Fishery	2002	2003	2004
Tuna	219	1,118	859,4
Banks	4,643	4,525	2,793.2
Deepsea Demersal	2,113	1,806	1,905.4
Coastal lagoon and Off lagoon	1,302	1,166	1,043.4
Sports	650	650	650
Amateur	300	300	300
Aquaculture	46	33	436.9
Rodrigues	1,404	1,664	1500
Total	10,677	11,262	9,488.3

The level of investment in Fisheries in Mauritius is as follows :

- Princes Tuna Co. Ltd invested Rs. 800 million in the modernization of its processing plant in 2001.
- The Thon des Mascareignes Ltd invested around one billion rupees in a new tuna loins factory and production started in June 2005.
- Pelagic Process Ltd invested Rs 50 million in a new factory for the processing of fresh/chilled fish.
- Casamar Ltd has invested Rs. 60 million in a net manufacture/repair factory.

Mauritius imports various fish and fish products for local consumption as well as a substantial quantity of frozen tuna for processing by the cannery. The bulk of the exports of fish and fish products comprise canned tuna with a small quantity of fresh fish.

In Mauritius, the development of the sea cucumber fishery for export purposes started in the year 2006 and the total catch of sea cucumbers from the lagoon amounted to 493 tonnes live weight. As at today, Mauritius has exported about 75 tonnes of dried sea cucumber worth Rs.30 Million. Due to the economic and ecological concerns, it is important to investigate the impacts of sea cucumber fishery and implement the best strategies to conserve this valuable marine resource for future generations. The Ministry has put a quota system for the exploitation of sea cucumber fishery with specific terms and conditions.

(vii) Mining (sand, salt, soil, metals, oil, gas etc.)

In Mauritius, no mining activities are carried out per se. However, extraction of sand and basalt in inland quarries and surface rock removal in agricultural lands are undertaken.

Sand extraction was practiced in the lagoons of Mauritius for numerous years. About 800,000 tonnes of sand used to be removed from the lagoon annually for use in construction. Owing to the devastating effects of this activity to the lagoon ecosystem, sand extraction was banned as from 1st October 2001. Sand miners were financially compensated and provided with training facilities for alternative jobs. Basaltic rock sand is now used for construction.

Chapter 6: Major human and natural impacts on coastal ecosystems

(i) Coastal and marine pollution

(a) Domestic and industrial pollution

The main point sources that cause pressures on the environment are the effluents from households, industries and hotels. At present 25% of the population is connected to a public sewerage system. 73 % of the population make use of on site disposal systems consisting of either cess pits or septic tanks followed by absorption systems. The remaining 2 % make use of pit latrines . It is planned that 50 % of the population will be connected to the public sewer system by 2015.

Most of the industries discharge their waste water into the sewer system. Those found outside sewerage areas have their own treatment plants or cart away to a public sewer system. Regular monitoring of the treated effluents is carried out by the Wastewater Management Authority (WMA). Those connected to the public sewer also submit their monthly results of analysis carried out by the private laboratories to the WMA.

The Wastewater (Standards for Discharge of Industrial Effluent into a Wastewater System) Regulations 2004 became operational on 01 January 2005. These regulations control the discharge of industrial effluents into the wastewater system through various tools – discharge permits, effluent standards, monitoring and reporting frequency, penalties, etc. The monitoring by the Wastewater Laboratory during the past year has shown that the most polluting industries are the food processing and associated industries – e.g. chicken processing plants, dairy products, etc. and dye houses. The results of monitoring carried out showed that the treated effluent quality from the industries complies in general with the required standards for discharge into the sewers.

The hotel sector is a large consumer of water. The treated wastewater is most often used for irrigation of the lawns on the hotel campus. This water eventually percolates in the ground and will reach the underground water table or leach out to the lagoon. In view of this, in 2003, the Ministry of Environment conducted an assessment to find out the performance of treatment plants in hotels with more than 75 rooms since these are recommended to possess a Wastewater treatment plant (WWTP) facility; the WWTP of 46 such hotels were assessed during the course of this study. It was noted that most of the WWTP in these hotels performed well while those that did not meet the requirements under the EPA were issued either Programme Notices or Enforcement Notices to upgrade their facilities for better treatment.

The volume of domestic wastewater treated in hotels, is about 5 000 m³ per day. The type of treatment is usually biological treatment with either activated sludge process or RBC followed by disinfection with chlorine and re-use through irrigation. From a monitoring exercise carried out over the period December 2006 to May 2007 by the WMA, 95 % of the hotels complied with the standards for use of treated effluent for irrigation

(b) Agricultural pollution

Agriculture occupies about 43% of the land area of Mauritius; about 90% of this land area is planted with sugar cane which provides a good soil cover to limit soil erosion and the remaining land is occupied with tea, tobacco and food crops.

The consumption of fertilisers for the year 2005 was 61,266 tonnes, a decrease of 3.5% over the 2003 figure of 63,507. The major nutrients in these inputs are nitrogen (N), phosphorus (P) as phosphate and potassium (K) as potash. In 2004 those nutrients were distributed in the following proportions of the product weight: nitrogen 39.2 %, phosphate 15.0 % and potash 45.8 %.

A multidisciplinary project on “Offsite movement of agrochemicals in tropical sugarcane production” was undertaken from 1997 to 2001 by the MSIRI in joint collaboration with the Queensland Department of Natural Resources and Mines, and the Australian Centre for International Agricultural Research. The results showed that the average amount ($\text{ha}^{-1} \text{yr}^{-1}$) transported in both River Cascade and River La Chaux catchments, located in the North West and the South East of the island respectively, and did not exceed 2 tonnes sediment, 10 kg N, 1 kg P, and 0.25 % of applied herbicides. Thus the non-point source contribution by sugarcane production is environmentally insignificant, and agronomically important.

Food crop production occupies around 7,553 ha (2004). The main food crop production zones in the coastal catchment areas lies along the eastern coastal belt. They comprise about 240 ha in the region of Belle Mare/Palmar and Trou d'eau Douce and some 35 ha on the sloping land in the region of Petit Sables, Grand Sables, Quatre Soeurs, Bambous Virieux. The main crops cultivated are onion, tomato, chilli and eggplant. Due to the sandy soil type of low fertility in these areas, vegetable growers depend heavily on inorganic fertiliser to sustain crop production.

The soil type in agricultural production zone in the eastern coastal catchments is of sandy loam type with low water retention capacity and high infiltration, which favours leaching of nutrients, especially with overhead sprinkler irrigation system. The water quality in Belle Mare/Palmar region has been degraded for some time due to high concentration of nutrients in the lagoon. This has led to severe eutrophication. Algae proliferation has been reported to be due to livestock farming on Palmar Livestock Breeding Station (G. Pyndiah). The nutrients (nitrates and phosphates) from the marshland around the farm must be leaching directly onto the public beach near the beachrock leading to algae growth in the lagoon. Another possible source of nutrients could be fertilisers used in the onion plantations near the beach.

A case of algal bloom was also reported in October 2005 at Bain Boeuf beach in the North of the island. Monitoring is being carried out by Ministry of Agro Industry and Fisheries (Fisheries Division) in collaboration with the Ministry of Environment .

(c)Coastal water quality

The coastal pollution problem in Mauritius is exacerbated by the hydrogeology of the volcanic substratum. Bacterial contamination of bathing waters and nutrients, water temperature, salinity, and Dissolved Oxygen were monitored at three different spatial and temporal scales along the coastline of Mauritius during 1997–1998 by the University of Mauritius . 29 sites were monitored during the study.

Total Coliforms, Faecal Coliforms, and Faecal Streptococci contamination reported during all surveys varied randomly (e.g., with maximum densities in the ranges of 346–2,020 TC, 130–2,000 FC, and 180–1,040 FS at one site) and at times exceeded the established EEC and Environment Protection Agency (EPA) standards for bathing water (e.g., in > 90% of samples). Computed FC: FS ratios were used to pinpoint human faecal matter as the main source of contamination.

Nitrate, phosphate and silicate concentrations in seepage water were high (3,600–9,485, 38–105, and 9,950–24,775 µg/L respectively) and a cause for concern when compared with levels (5–845, 5–72, and 35–6,570 µg/L respectively) in cleaner lagoon water samples (Daby *et al*).

The relationship of some dissolved trace metals (Al, Cr, Mn, Zn and Pb) with one another and to dissolved phosphate and nitrate in a freshwater aquatic system at Flic en Flac and Grand River North West (GRNW) in Mauritius is reported following trace metal determination using inductively coupled plasma mass spectrometry (ICP-MS) during the period 1996-98.

Concentrations of Trace Metals in GRNW and in Marshes at Flic en Flac. (Source: Environment International)

Contaminants	Concentrations (ng/ml)
Aluminium	<200
Chromium	<50
Manganese	<50
Zinc	<100
Lead	<50

The concentrations of six trace metals - chromium, nickel, copper, zinc, cadmium and lead (Cr, Ni, Cu, Zn, Cd, Pb) were determined in the freshwater system at Flic en Flac and upstream and downstream GRNW to assess the impact of hotel and industrial activities of the EPZ in Mauritius during 1996/7. The level of trace metals found upstream, downstream GRNW and in the marshes and rivulet at Flic en Flac were found to be below the recommended EEC maximum admissible concentrations and within the ambient drinking water quality standards in Mauritius.

The mean concentration of Cr (105 mg kg⁻¹), Zn (167 mg kg⁻¹) and Pb (14 mg kg⁻¹) in the sediments along St Louis River situated in an urbanized and industrialized area were well below the limits of 600, 2500 and 700 mg kg⁻¹ quoted for contaminated sediments adopted from the draft standards (24% clay and 10% organic matter by weight) from Netherlands during the period January – October 2000.

Cr, Zn and Pb were quantified using atomic absorption spectrometry from urban and rural estuarine sediments collected along the western coast of Mauritius during the period July 2001-January 2003. The mean concentration of Cr (225.4 mg kg⁻¹), Zn (107.0 mg kg⁻¹) and Pb (27.0 mg kg⁻¹) in sediments along the 6 estuaries were also below the limits from the draft standards mentioned above.

Mauritius still looks relatively uncontaminated but there is growing concern about heavy metal contamination in urban estuaries.

In order to assess the impacts which result from land based activities, a study was initiated in 1991 under the ‘Lagoonal Health and Coastal Pollution Project’ with the technical assistance from the ICOD with the aim to establish a baseline on the marine environment.

The objective of the monitoring was to study the state of the water quality characteristics and focus on the physico-chemical parameters of sea water namely: water temperature, salinity, pH, DO, nutrients (nitrate and phosphate) and COD.

The monitoring programme was continued with the assistance of JICA as from 1995 to 2000 and from then to date, the monitoring of water quality is being conducted under the Coastal Environment Research Project to study the evolution of the physico-chemical indicators of water quality. Regular field sampling is carried out for collection of water samples at 14 established sites around the island for laboratory analysis.

Since December 2000, a programme involving various laboratories was set up to monitor the coastal water quality from Baie du Tombeau to Pointe aux Sables. It was found that the coastal water quality was not fit for bathing and the area was prohibited to swimming. Moreover the region was found to be eutrophic and large volumes of algae were being produced in the lagoon in the year 2000. These were washed ashore every day causing odour, fly and aesthetic nuisances. The water quality in this region was being degraded by the presence of three short waste water outfalls namely Roches Bois , Bain Des Dames and Pointe aux Sables.

In 2003, a long sea outfall was constructed at Baie du Tombeau (located at 1.5 km from the shore and at 30 m depth) and the one at Roche Bois was decommissioned. After one year, it was found that the water quality at Baie du Tombeau has improved and now it is within the coastal water quality guidelines limits. Moreover, algal proliferation has drastically decreased and now the water is suitable for bathing. The outfalls at Pointe aux Sables and Bain des Dames have been decommissioned in January 2007. All the waste water are now being directed towards the newly constructed Montagne Jacquot sewerage treatment plant. The treated effluent is discharged via a 1.5 km long sea outfall at 30 m depth . Monitoring is ongoing for this region and it is expected that the sea water quality would improve and soon be within the guideline limits.

Physico-chemical monitoring of water quality at Ile aux Bénitiers, Bel Ombre, Bambous Virieux, Trou d’Eau Douce, Anse la Raie , Grand Baie, Blue Bay , Balaclava Pointe aux Sables, Bain des Dames , Baie du Tombeau , Port Louis harbour , Poudre d’Or and Trou aux Biches are carried out by the Ministry of Agro Industry and Fisheries (Fisheries Division) . The results showed that the water quality were generally within the Coastal Water Quality Guideline (CWQG) limits. The levels of nitrate ranged from <0.1 to 0.1 mg/l while those of phosphate was from <0.01 to 0.08 mg/l; COD values were less than 1.8 mg/l at most of the sites.

The levels of DO at all the sites monitored were within the CWQG limits, showing that the natural purification system and flushing are efficient to maintain the environmental equilibrium. Effects of coastal activities on water quality are quickly dissipated by dilution through natural water exchange (tides and currents).

Water samples were taken from river mouths at Grand River North West, Pointe Roches Noires, Grand River South East, Mahebourg, l’Escalier, Baie du Cap, Tamarin and Rivière

Lataniers to determine the levels of five trace metals, namely: copper, zinc, lead, cadmium and mercury and the levels of three pesticides, atrazine, diuron and hexazinone.

Trace metals zinc, copper, cadmium and lead were not detected in the water samples at any of the monitored sites. Pesticides atrazine, diuron and hexazinone were also not detected in the water samples.

The monitoring of the levels of Total coliforms and Fecal coliforms in seawater is carried out on a monthly basis at selected public beaches, namely Flic en Flac, Albion, Pointe aux Sables, Trou aux Biches, Mon Choisy, Le Goulet, Grand Baie and Blue Bay, Balaclava. Results of water analyses showed that the levels of TC and FC at the selected beaches and the two marine parks were within the CWQG limits for primary contact (TC<1000 colonies/100ml and FC<200 colonies/100ml) except at two stations at Pointe aux Sables where higher levels of TC and FC were recorded. Mean values for the level of TC and FC at most of the monitored public beaches are comparable to mean values obtained in the previous two years. However, the mean value at one of the stations at Pointe aux Sables improved in 2004.

(ii) Shoreline management and erosion

The Ministry of Environment and NDU has commissioned a study on coastal erosion around Mauritius in 2002 and the final report was submitted by the consultants, Baird and Associates in 2003. The main findings of the report are as follows:

- In most instances, the erosion that has been observed along the sandy shores of Mauritius is a natural and reversible process.
- Irreversible erosion is occurring and has the potential to become widespread along the sandy beaches of Mauritius.
- In almost all cases the wave height are reduced by 90 % in the process of crossing the reef.
- Although not optimal, the current health of the reef front and the reef flat is sufficient to maintain the natural level of wave protection.
- The lagoon corals and associated biological community were found to supply almost all of the sand that makes up the beaches. If this supply of sand is reduced or cut off, the beaches will eventually disappear, as the remaining sand slowly wears down and is lost through passes to offshore deposits.
- In addition to the removal of lagoon coral and water quality degradation another stress on the all important lagoon coral ecosystem throughout Mauritius is over fishing.
- The primary threat to the health and existence of beaches aside from the lagoon degradation, is encroachment of development. It is critical that there be no obstructions or interruptions to the free movement of sand across and along the dynamic beach zone.
- The native Mauritian coastal vegetation, consisting of creepers, shrubs and trees, has been nearly decimated and largely replaced by invasive filao (Casuarina) trees.
- The dunes have been exploited for its sand to be used as construction material. They have been trampled and compacted by vehicles and heavy pedestrian traffic. They

have also been levelled for development. These actions have greatly reduced the protective function of the dunes, increasing the erosion and flooding hazards.

The main recommendations concerned the implementation of a beach/ lagoon /reef restoration plan including the monitoring of the coastal systems, need to regulate the opening and closure of passes, address over fishing and destructive fishing practices, to establish more marine protected areas, implement a lagoon reef restoration project, implement policy on setback for construction of hard structures amongst others.

Following this study the Ministry of Environment and NDU set up an implementation Committee with the collaboration of all stakeholders concerned with the coastal zone management to implement the recommendations made by study . The sites that were prioritised for action namely Belle Mare, Flic en Flac , Riviere Des Galets and Grand Bay are being attended to . Follow up and monitoring of the beaches is also being carried out by the Ministry of Environment and NDU .

Moreover, in the EPA 2002, construction of rock revetments, groins, jetties, dredging of lagoons are scheduled activities that require an EIA. In the National Development Strategies (2004) , provision has been made that all new developments would have to respect a setback of at least 30 m from the high water mark for construction of hard structures and same has been included in the Planning and Policy Guidance, recommendations of which can be enforced legally.

(iii)Physical Alteration and Destruction of Habitats (PADH)

Forest clearance for agriculture and settlement began with the colonisation of the island in 1638 although selective logging for ebony (*Diospyros tessellaria*) started in 1598. Most of the forest cover had been lost by 1935, and the last major project of forest clearance occurred in the 1970s following a World Bank Funded scheme to replace native upland forest with plantation forestry based on pine. Despite these losses, habitat destruction and fragmentation continues to this day. There is a gradual conversion of forest to enlarge pasture areas for deer grazing. Development projects also pose serious threats. A proposed road project that would have resulted in the loss of 9 ha of forest, the possible extinction of 2 species of plant and disturbance to one of the most important areas for the Mauritius kestrel (GoM 2004), was stopped recently after 1.5 years of pressure from conservation stakeholders and the general public.

Over the years the extent of mangrove cover around the islands has significantly decreased (20 km² in 1987 and 14 km² in 1994) through cutting for firewood, for construction purposes and for providing boat passage. Since then actions have been initiated for replanting of mangroves by the ministry of Agro-Industry and Fisheries.

Corals have in the past been mined for limestone from the lagoons of Mauritius causing the destruction of shore reefs. Detail analysis of aerial photographs showed that irreversible erosion and long term erosion has been ongoing a Flic en Flac public beach for at least almost thirty years due to the absence of lagoon corals and the associated sand supply. The coral from this part of the lagoon was harvested for the lime industry and has never recovered (Baird 2003) .

(iv) Climate change

(v) Invasive species

Invasive alien species pose the most serious current threat to the remaining terrestrial biodiversity. At least 21 introduced species of mammal, reptile and mollusc are naturalised, more than 1,675 plant species have been introduced of which at least 20 plant species have been identified as particularly aggressive invaders (Mauremootoo et al 2003). Animals such as the rusa deer (*C. timorensis*), introduced in 1639, browse native shrubs, saplings and seedlings. Feral pigs (*Sus scrofa*), introduced in 1606, disturb the soil, disperse seeds of alien plants and have negative effects on native plant regeneration. Pig predation was also probably partly responsible for the extinction of several ground-nesting endemic species such as the dodo and the giant tortoises. They may also affect ground-dwelling invertebrates. Javanese macaques (*Macaca fascicularis*), introduced at the turn of the seventeenth century, damage unripe native fruits and eat the eggs and chicks of native birds (Carter and Bright 2002). Rats (*Rattus rattus* and *R. norvegicus*), also predate on eggs and chicks (Safford and Jones 1998), reptiles and invertebrates and are notable seed predators (Cuddihy and Stone 1990). Predation by a range of alien species appears to pose a very serious threat to the survival of endemic snails, which are often taken by rats and tenrecs (*Tenrec ecaudatus*) and the carnivorous rosy wolfsnail (*Euglandina rosea*) (Griffiths et al., 1993).

A diverse suite of invasive alien weeds is threatening all the remaining native forests. The worst species include goyave de Chine (*Psidium cattleianum*) and privet (*Ligustrum robustum subsp. walkeri*). A recent arrival is liane cerf (*Hiptage benghalensis*), an aggressive invader of lowland dry forests. These species, and many more, out-compete native plants for space, light and nutrients and quickly come to dominate the forests throughout the island.

An Invasive Alien Species committee was created in 2003 in order to advise sectors on issues relating to invasive alien species. A grant of 1 million MRU has been allocated under the Environment Investment Programme (EIP2) to establish a strategy and action plan on invasive alien species for Mauritius.

Mauritius ratified the Convention on Ballast water management in 2005. The Ministry of Land Transport and Shipping is the Focal point for this Convention. A technical Committee has been set up at that Ministry with the Ministry of Environment and NDU , the Ministry of Agro Industry and Fisheries, the Mauritius Oceanography Institute amongst others to look into the issue. A port baseline survey is under preparation whereby an inventory of the fauna and flora in the port area would be carried out. To date there is no data on marine invasive species.

Chapter 7: COASTAL GOVERNANCE

- (i) **Tools** (describe existing tools for coastal planning, governance and management, how well they are currently implemented, and their socio-economic and ecological impact; including MPAs, ICM planning, EIA, economic evaluation instruments, etc. Make clear reference to the specific themes of the previous chapters 1 to 6; i.e. ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts. Look at problems and opportunities and give examples of best practise, successes and failures).

The second National Environment Strategies was adopted in 1998. Provision was made for the implementation of an Integrated Coastal Zone management project as one of the priority projects under the National Environment Action Plan (NEAP 2) and the setting up of an ICZM division at the Ministry of Environment and NDU . Same was set up in 2000. This division is responsible for the coordination of the various activities with the relevant stakeholders in coastal zone planning and management. Moreover, in the EPA 2002, part VII deals with the coastal and maritime zone management. Provision has been made for the setting up of an ICZM Committee comprised of governmental Institutions as well as NGO's, parastatals and private organisations which are important stakeholders of the coastal zone.

The Objectives of ICZM Committee are to:

- develop an integrated management plan;
- coordinate regional and international projects;
- monitor coastal water quality and coastal resources including wetlands;
- conduct and recommend studies on Beach Erosion and propose measures for its control;
- make recommendations for the upgrading of recreational facilities;
- coordinate the management of islets and outer islands;
- make recommendations on guidelines for coastal construction;
- propose oil spill contingency planning and sensitivity mapping; and
- generally make recommendations to the Minister on the Management and protection of the coastal zone.

The ICZM Committee meet on a regular basis and to date a policy on setback from the high water mark , an ICZM plan for the region for Bel Ombre and St Felix, an inventory of the wetlands in Mauritius, identification of new spaces along the coastal zone for proclamation as public beaches, possible alternatives to popular beaches have been drafted and are being

implemented. The preparation of the ICZM framework (strategy, policies and plan) is in pipeline.

Part IV of the EPOA 2002 deals with EIA process. It lays down the requirement for an EIA , submission to the Ministry , consultation with public , processing up to the award of licence. As such the EIA process is a legal requirement. As per the EPA 2002 , construction of hotels and renovation of existing ones in the coastal zone , construction of rock revetments, jetties, marina development, development in wetlands are scheduled activities that require an EIA .

The National Development Strategies was adopted in 2005 by the Government. It is a land use planning tool which defines the different zones of development (tourism, industrial, residential, agricultural) and also gives guidance on the type of buildings and setbacks to be provided. This is a guiding document used for new developments. The recommendations are being implemented at local level through Outline Schemes .

- (ii) **National laws and regulations** (Explain processes for legislation, decision-making and regulation, and means of enforcement with reference to the following section on institutions. Make sure that all laws/regulations are included that bear any reference to the specific themes of the previous chapters 1 to 6; i.e. the ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts. Attach actual legal documents or access details.)

The Mauritius Environmental Law is scattered in various sectoral laws. The Legal Regulatory Framework is summarised under the following five headings each of which outlines the relevant statutes.

- 1) Sections of the criminal law dealing with environment,
- 2) Statutes dealing with the Physical alterations and destruction of habitats (PADH),
- 3) Statutes dealing with ship pollution not directly linked with (LBS&A),
- 4) Statutes dealing with (LBS&A),
- 5) Statutes dealing with oil spillage.

The Environment Protection Act 2002 (EPA 2002) is the main statute dealing with the protection and enhancement of the environment as amended recently by GN 57/2005 whereby some existing enactments were declared environmental laws.

- 1) **Criminal offences directly or indirectly relevant to pollution under our criminal code and the criminal code (supplementary) Act** are listed below:
 - a) Section 353- Damaging goods ...using corrosive liquid,
 - b) Section 354-Damaging crop,
 - c) Section 355-damaging tree
 - d) Section 356-damaging agricultural product
 - e) Section 358- poisoning animal

- f) Section 359-killing of animal maliciously
- g) Section 364-flooding of road or property
- h) Section 365-damaging property by fire
- i) Section 366-failing to notify of infected animal
- j) Section 367-allowing infected animal to communicate with others
- k) Section 368-permitting contagious of disease
- l) Section 59(Suppl Act) -causing explosion likely to endanger life
- m) Section 63(Suppl Act)-damaging inhabited ship or building
- n) Section 64(Suppl Act)-damaging uninhabited ship or building
- o) Section 65(Suppl Act)-placing or throwing explosive with intent
- p) Section 69(Suppl Act)-shipmaster may search for explosives

2) **Statutes dealing with physical alterations and protection of the habitats (PADH)**

Existing Legislations related to the protection of the Fauna and Flora in the Convention Area are listed below:

- a) Maritime Zone Act 2005
- b) Wildlife and National Park Act 1993
- c) Fisheries and Marine Resources Act 1998
- d) Female Sea Turtles (Prohibition of Import) Regulations 1950
- e) Fisheries (Gill Net Prohibitions) (Rodrigues) Regulations 1983
- f) Fisheries (Reserved Access) (Rodrigues) Regulations 1984
- g) Maritime Zones (Fishing licences) Regulations 1978
- h) Fisheries and Marine Resources (Toxic Fish) Regulations 2004
- i) Pleasure craft (restricted activity and speed limit) Regulations 1998
- j) Blue Bay Marine Park – Proclamation 15/1997
- k) Balaclava Marine Park – Proclamation 14/1997
- l) Environment Protection Act 2002
- m) Fisheries and Marine Resources (Vessel Monitoring system) Regulations 2005
- n) National Coast Guard Act
- o) Fisheries (Reserved Areas) (Rodrigues) Regulations 1984
- p) The Beach Authority Act 2002
- q) The Tourism Act 2004
- r) Forest and reserve Act

- s) Rivers and Canals Act 1863
- t) Regulations related to collection of solid waste

3) Combatting Air Pollution including climate change, sea rise, radioactive substance and destruction of ozone layer

Since the signing of the Nairobi Convention, Mauritius has constantly reviewed and made amendments to its legislation in order to be in conformity and in compliance with articles of the Convention. Until recently, numerous changes have been noted, precisely with the coming into operation of the

- a) Fisheries and Marine Resources Act 1998,
- b) Environment Protection (Standard for Air) Regulations 1998,
- c) Environment Protection Act (EPA) 2002,
- d) Chemical Weapon Convention Act 2003,
- e) Biological and Toxin Weapon Convention Act 2004 and
- f) Dangerous Chemical Act 2004.

In Mauritius there are other legislations that regulate, prevent, reduce and combat air pollution and any discharges into the environment and they are listed and summarized as follows:

- a) National Coast Guard Act, established the National Coast Guard a specialised body of the public force acting under the command of Commissioner of Police to safeguard and enforce any law relating to security of state, protection of maritime zones and detection and prevention of any illegal activity within the Maritimes zones including air among others.
- b) Chemical Weapons Convention Act 2003 prohibits any use, production, stockpile or retention of any chemical weapons.
- c) Biological and Toxin Weapons Convention Act 2004 prohibits the use, production, stockpiled or retention of biological and toxin weapons.
- d) Chemical Fertilisers Control Act 1981 controls the selling of chemical fertilizers and its composition in Mauritius.
- e) Radiation Protection Act 1992 controls radiation sources, radioactive substances, its importation in the country and also measure in relation to storage of radioactive material.
- f) Fisheries and Marine Resources Act 1998 as amended by Act 21/02 and 10/05 respectively regulates and controls the fishing methods in maritime zone in compliance with international conventions and agreements whereby fishing with poisonous substance and explosive are prohibited.
- g) Maritime Zone Act 2005 sets out the legal statutory territorial sea, internal, historic and archipelagic waters which extends to air space over the archipelagic waters. It also provides for regulations for the exercise of controls in contiguous zone. This Act has been amended to enable Mauritius to honour its obligation and to be in conformity with the United Nation Convention on the law of the sea (UNCLOS).

h) Dangerous Chemicals Control Act 2004 aims:

- o at controlling and regulating dangerous chemicals and its emissions by establishing a Council to advise and make recommendations to the Minister on matters relating to dangerous chemicals,
- o set up a board to consider application for the grant of licences and permits under this Act.
- o Implement enforcing agencies to verify compliance with this Act.

i) Environment Protection Act 2002:

Section 40 prescribes standard to protect quality of air resources so as to promote public health and welfare and the development and the productive capacity of the human, animal or plant life'. The standards prescribed under the Act makes provisions for minimum air quality and controls the concentration of substance, atmospheric pollution originating from energy and industrial sources and sets out standard for emission from mobile sources causing or contributing to air pollution or endangering public health and welfare.

j) The Environment Protection (Standards for Air) Regulation 1998 sets up the national environmental standards for the emission of pollutants in the atmosphere and all factories in Mauritius has to comply with the standards. The following is the national environmental standards for ambient air and the measuring methods –

4) Statutes dealing with land base sources and activities

Existing Legislations relating to land based pollution

- a) The Waste Water Management Authority Act 2000
- b) The Fisheries and Marine Resources Act 1998
- c) Rivers and Canals Act 1895
- d) Ground Water Act 1982
- e) Ground Water regulation 1973
- f) Pesticides Control (Restricted Pesticides) Regulations 1982
- g) Local Government (Public Beaches) Regulations 1992
- h) Local Government (Dumping and Waste Carriers) Regulation 1997
- i) Black River District Council (Collection and Disposal of Reuse) Regulations 1997
- j) Grand Port/Savanne District Council (Collection Disposal of Refuse) Regulations 1995
- k) Beau Bassin/Rose Hill (Disposal of Refuse) Regulations 1996
- l) Curepipe (Disposal of Refuse) Regulations 1993
- m) Port Louis (Collection and Disposal of Refuse) Regulations 1996

- n) Quatre Bornes (Disposal of Refuse) Regulations 1991
- o) Vacoas/Phoenix (Environnemental Sanitation) Regulations 1995
- p) Environment Protection (Effluent Discharge Permit) Regulations 2003
- q) Environment Protection (Standards for hazardous Wastes) Regulations 2001
- r) Environment Protection (standards of Effluent for use in irrigation) Regulations 2003
- s) Environment Protection (Standards for Effluent discharge into the Ocean) Regulations 2003
- t) Environment Protection (Effluent Discharge Permit) Regulations 2004
- u) Guidelines for island surface water Quality
- v) Guidelines for Coastal Water Quality
- w) Guidelines for Irrigation Water Quality

5) Statutes dealing with ship pollution indirectly linked with (LBS&A)

Article 5 of the Nairobi Convention puts an obligation on the contracting parties to take all appropriate measures to prevent, reduce and combat pollution of the marine and coastal environment caused by discharges from ships and to ensure effective implementation of international rules and standards. The existing legislations are:

- a) Merchant and Shipping Act 1985
- b) Environment Protection Act 2002
- c) Merchant Shipping (Civil Liability for Oil Pollution Dangerous and International Fund)
- d) Merchant Shipping (Registration of Ships) Regulation 1994
- e) Merchant Shipping (Safety of Life at Sea) Regulations 1993
- f) Ports Act 1998
- g) Port (Operations and Safety) Regulation 2005
- h) Maritime Zone Act 2005.
- i) Marine Pollution Bill

6) Statutes dealing with oil spillage.

- a) The Environmental Protection Act 2002 : Part V of the Environmental Protection Act (2002) makes provisions for spill and environmental emergencies. It calls for prescription of procedures for cleanup and removal operations in the event of a spill as well as for disposal of the pollutant and associated activities.
- b) The Ports Act 1998 : The Port Louis Harbour Oil Spill Response Plan covers the limits of the Port, as defined by Schedule (Section 2) of the Ports Act 1998. By virtue of Sections 32, 63 and 68 of the Ports Act 1998, the Port Master is

empowered to take command and control of any emergency in the harbour. The Port Master will represent the Mauritius Ports Authority in the Oil Spill Command Group.

- c) The Maritime Zones Act 2005 : Maritime Zones Act 2005 is in accordance with Article 56 of UNCLOS. (United Nations Convention on the laws of the sea) provides for the protection and preservation of the maritime environment – S.15 (a) (b) of the Act. Mauritius has in the Exclusive Economic Zone (EEZ) “*sovereign rights to explore and exploit, conserve and manage natural resources*”.
- d) *The Marine Pollution Bill* : *The Bill has incorporated the OPRC 90.*

(iii) **Institutional framework** (Outline all relevant institutions from a national to municipal/local level and their geographical focus. Outline what laws/regulations that governs them, current and planned projects/programmes/interventions, and public access to these institutions. For each institution make clear reference to the specific themes of the previous chapters 1 to 6; i.e. the ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts Contact details for each organisation should be clearly stated).

The relevant institutions in Mauritius from national/local level responsible for coastal zone management in one way or the other are as follows :

(a) The Ministry of Environment and NDU :

The Ministry is responsible for the environmental matters and coastal zone . This Ministry was set up in 1989 and the first EPA was promulgated in 1991. This act was revised in 2002 and is now being updated. A Department of Environment headed by a Director of Environment has also been created under the Ministry of Environment. The Director of the Environment is responsible for the enforcement of the environmental laws. The Director issues programme notices approval notice, enforcement notice, variation notice, prohibition notice and stop order against any person who breaches environmental laws.Under the EPA there are several committees that have been set up for the control and monitoring of environmental matters , these are :

- The National Environment Commission is a committee with Ministers as members and is chaired by the Prime Minister. It has among other functions to –
 - ✓ set national objectives and goals and determine policies and priorities for the protection of the environment;
 - ✓ review progress made by public departments on any aspect of environmental management projects and programmes;
 - ✓ ensure coordination and cooperation between public departments, local authorities and other government organizations engaged in environmental protection programmes.
- The National Network for Sustainable Development is chaired by the Minister of Environment and is a forum for discussion and consultations and its matters such as:

- ✓ harmonization of the various sectoral, economic, social and environmental policies and plans operating in the country;
- ✓ harmonization of the interests of proponents and promoters generally and the aspirations of user and society in the field of built-up environment and usual pollution; and
- ✓ development and implementation of an integrated approach to pollution prevention and control.

The Police de l'Environment set up under EPA 2002 is a specialized unit of the Mauritius Police Force, which provide assistance to the Director in the enforcement of environmental laws.

The National Environmental Laboratory (NEL): NEL is an integral part of the Department of Environment (DoE). NEL is also known as the analytical arm of the above mentioned Ministry and its role is to carry out environmental monitoring through collection of samples for laboratory testing and reporting.

(b) Ministry of Agro-Industry & Fisheries ;

The Ministry of Agro-Industry and Fisheries ensures the sustainable development and management of fisheries resources, conservation and protection of living aquatic resources and the marine environment in the waters of Mauritius . Its objectives are:-

- to ensure the proper implementation of government policies in respect of fisheries and marine conservation;
- to provide the legal framework and mechanisms for the management and protection of marine living resources;
- to promote responsible fisheries;
- to promote the welfare of fishermen;
- to ensure the contribution of fisheries to national socio-economic development;
- to ensure an adequate supply of fish to the population;
- to support and strengthen national research capacity for fisheries development and management and conservation of marine biodiversity; and to ensure that Mauritius cooperates regionally and internationally for the development management and conservation of marine living resources and the promotion of responsible fisheries.

The Albion Fisheries Research Centre is the technical arm of the Ministry of Agro-Industry and Fisheries. It was constructed and equipped with Japanese assistance between 1981 to 1995. The Centre is divided into 7 divisions namely: Fisheries Research Division, Aquaculture Division, Marine Sciences Division, Marine Parks and Reserves Services Divisions, Fisheries Management Division, Fisheries Planning Division and Fisheries Protection Services Division.

The objectives of the Centre are:-

- to carry out research, monitoring surveys and studies needed for the sustainable development and management of marine living resources (fish stocks, coral reef etc.);
- to provide support services to stakeholders of the fishing industry (including those involved in aquaculture development);
- to provide advice to policy makers on matters related to the management and development of marine resources and the conservation of marine environment including the creation of marine parks and reserves in accordance with the provisions of the Fisheries and Marine Resources Act and the Environmental Protection Act; and
- to act as a focal point for collaborative research and management as regard regional and international fisheries and marine living resources.

(c) Mauritius Oceanography Institute (MOI)

Mauritius is a party to the United Nations Convention on the Law of the Sea which commits the country to adhere to international policy on conservation of living resources of the high seas. The coastal and ocean territory of Mauritius holds an immense potential for development which could play a vital role in the future economic well being of the country. Recognising the importance of the marine development, Mauritius called for a strong oceanographic institute to capitalize on this development potential. With this objective in mind, the Mauritius Oceanography Institute (MOI) was officially established in January 2000. One of the major responsibilities of the MOI is to monitor the marine environment around Mauritius and the Outer Islands and advise Government on coastal and marine policies that will maintain the health of these coastal and oceanic waters.

The objectives of Mauritius Oceanographic Institute are as follows :

- Formulation, implementation and coordination of scientific programmes relating to the protection, exploration and development of marine living and non-living resources in the maritime zones of the Republic of Mauritius.
- Provide support services to stakeholders of the fishing industry including those involved in aquaculture
- Provide advice to policy makers on matters related to the management and development of marine resources and the conservation of marine environment including creation of marine parks and reserves in accordance with the provisions of the Fisheries and Marine Resources Act 1998 & EPA 2002.
- Act as focal point for collaborative research and management as regard to regional and international fisheries and marine living resources.

(d) Agricultural Research & Extension Unit (AREU).

The Agricultural Chemistry Divisions of the Ministry of Agriculture is involved in the detection and measurement of pesticide residues in water. The Agricultural Research & Extension Unit (AREU) is training farmers to make judicious use of pesticides and to pay due attention to the environment. They are encouraged to scout for pests and use only pesticides when absolutely necessary and as a last resort. More use is now made of hot water seed treatment and resistant varieties to minimise the reliance on pesticides during crop cycle.

(e) The Tourism Authority

This Authority was established in 2004 and has as objective to –

- optimize the social, economic and environmental benefits to Mauritius from tourism;
- to promote sustainable tourism industry in Mauritius.

(f) The Mauritius Ports Authority :

The Mauritius Ports Authority (MPA), formerly known as the Mauritius Marine Authority (MMA) was originally established in 1976 and following a reform programme, the MA was renamed under Ports Act 1998 as Mauritius Ports Authority. Among other objectives, the MPA has also a duty to safeguard the protection of the environment and prevent any type of the pollution within the Port. PART XII of the Ports Act 1998 lists out the provisions to prevent pollution and protect the environment as well as other sections such as Section 144 and Section 150 of Ports Acts.

(g) The National Coast Guard

The National Coast Guard is a specialized unit of the Police Force and is responsible for the enforcement of law relating to the protection of the Maritime Zones, including the seabed, the flora, the reefs, the beach and the coastline.

(h) The Central Water Authority has the power to preserve water resources for potable use in Mauritius.

(i) The Wastewater Management Authority (WMA)

The WMA is responsible for the wastewater sector. The WMA operates and maintains all public sewerage infrastructures on the island and collect wastewater charges from properties connected to the public sewerage system. The objects of the Authority are as follows:

- Be responsible for the waste water sector in Mauritius and to carry out , monitor, supervise, maintain, manage and control wastewater works.
- Promote the treatment and reuse of waste water
- Conduct and undertake research and studies for the implementation and development of projects relating to the waste water sector.
- Ensure the generation of sufficient resources from tariffs and finance the operation, maintenance and depreciation costs of wastewater systems, sewerage and sewage treatment installations
- Ensure the proper functioning, inspection and maintenance of house sewers and wastewater systems.
- Control and monitor pollution, private sewers and the use of equipment in relation to wastewater systems.
- Advise the Minister on any matter relating to the management of wastewater.

(j) The Ministry of Local Government and Local Authorities have the responsibility for the collection of waste over the island.

(iv) **Civil society, private sector, research/education institutions, CBOs and NGOs** (outline all relevant non-governmental organisations/institutions from a international to municipal/local level, explain their mandate and geographical focus, current and planned projects/programmes/interventions, and public access to these organisations. Contact details for each organisation should be clearly stated. For each organisation make clear reference to how they address the specific themes of the previous chapters 1 to 6; i.e. ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts).

(v) **Institutional framework and legislation for international and transboundary cooperation** (Outline international/regional institutions and organisations, and transboundary issues and collaborations within coastal governance/management; including supporting agreements/conventions/legislation. Explain operative processes, means of enforcement. Contact details for each organisation should be clearly stated. Attach actual legal documents or access details in appendix. Make clear reference to how organisations/legislation addresses the specific themes of the previous chapters 1 to 6; i.e. ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts).

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(vi) **Interactions, gaps and overlaps in coastal governance** (give a summary overview of the coastal governance legislative and institutional network with reference to all the local, national and international legislation, regulations, institutions and organisation described in the previous sections. Identify interactions, gaps and overlaps in addressing the themes of the previous chapters 1 to 6; i.e. ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts. Explain how institutions/organisations/projects/programmes/initiatives are linked and interact, collaborate, coordinate and communicate. Look specifically at communications, and provide a concise summary of their access to and preferred means of communication, e.g. websites, mailing lists, personal networks, notice boards, posting of meetings, etc. Examine problems and opportunities and give examples of best practise, successes and failures. Identify obstacles, needs, opportunities and incentives for improved coordination and collaboration.)

Legislations in Mauritius have incorporated the recent international environmental principles and requirements such as the polluter pays principle, precautionary principles, sustainable development, the establishment of environmental crimes, dispute resolution, key institutions, EIA rules and processes and free access to environment information among others.

There are many institutions in Mauritius which enforce LBS & A. There is a need to harmonise the existing legislations and existing institutions in order to reduce overlapping of power and efficient enforcement of environmental laws in the field of LBS & A.

The Environment Protection Act gives power to the Minister of Environment to prepare an integrated coastal zone management plan which shall be used for coastal zone planning, management and development. Since now no such management plan has been prepared. There has been massive development in the coastal zone without proper planning which is giving rise to several environmental problems such as coastal erosion, pollution problems and so on in different coastal zones. The present government's policy is to increase the number of tourists with a target of 2 million tourists by 2015. There is therefore an urgent need to establish a comprehensive ICZM framework for the planning of the coastal zone.

The LBS/A legislations are scattered in different sectors. There is a need to harmonise the existing legislations and to bring amendments to them to be in line with new international environmental principles.

- Strengthen the enforcement capacity of enforcement agencies (training/sensitization, provision of equipment, increase in human resources (3 years)).
- More training to be provided to encourage artisanal fishers to move off lagoon to fish around FADs and to encourage entrepreneurship by fishers (on-going).
- More FADs need to be set up (2006 – 2008).
- Continue with sensitization program for fishers (ongoing)
- Set up programme for analysis of data related to fishing pressure in the heavily exploited areas (2 years).
- Set up a programme for assessing the effect of net fishing in the lagoon (3 years).
- New regulations for amateur fishers to be elaborated and submitted to SLO (2006).
- Provide loans on softer terms (including loan guarantees) to registered fishers (on-going).

Possible constraints

- Limited human resources and equipment (for enforcement)
- Limited financial resources. As regard setting FADs, funding from IFAD will no longer be available as from April 2006, and
- Difficulty in repayment of loans by fishers encouraged to move out to FADs.

- (vii) **Institutional framework** (Outline all relevant institutions from a national to municipal/local level and their geographical focus. Outline what laws/regulations that governs them, current and planned projects/programmes/interventions, and public access to these institutions. For each institution make clear reference to the specific themes of the previous chapters 1 to 6; i.e. the ecosystems, species of special concern, coastal populations,

economic activities, human and natural impacts Contact details for each organisation should be clearly stated).

- (viii) **Civil society, private sector, research/education institutions, CBOs and NGOs** (outline all relevant non-governmental organisations/institutions from a international to municipal/local level, explain their mandate and geographical focus, current and planned projects/programmes/interventions, and public access to these organisations. Contact details for each organisation should be clearly stated. For each organisation make clear reference to how they address the specific themes of the previous chapters 1 to 6; i.e. ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts).
- (ix) **Institutional framework and legislation for international and transboundary cooperation** (Outline international/regional institutions and organisations, and transboundary issues and collaborations within coastal governance/management; including supporting agreements/conventions/legislation. Explain operative processes, means of enforcement. Contact details for each organisation should be clearly stated. Attach actual legal documents or access details in appendix. Make clear reference to how organisations/legislation addresses the specific themes of the previous chapters 1 to 6; i.e. ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts).

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- (x) **Interactions, gaps and overlaps in coastal governance** (give a summary overview of the coastal governance legislative and institutional network with reference to all the local, national and international legislation, regulations, institutions and organisation described in the previous sections. Identify interactions, gaps and overlaps in addressing the themes of the previous chapters 1 to 6; i.e. ecosystems, species of special concern, coastal populations, economic activities, human and natural impacts. Explain how institutions/organisations/projects/programmes/initiatives are linked and interact, collaborate, coordinate and communicate. Look specifically at communications, and provide a concise summary of their access to and preferred means of communication, e.g. websites, mailing lists, personal networks, notice boards, posting of meetings, etc. Examine problems and opportunities and give examples of best practise, successes and failures. Identify obstacles, needs, opportunities and incentives for improved coordination and collaboration.)
- (xi) **Stakeholder participation in coastal governance** (analyse to what extent and how different stakeholders from outside and within the coastal populations participate in the governing process; how are they organised and on what levels can different groups impact decision-making? what groups have most impact on decision-making and what groups are most affected by decision making? are there marginalized groups within coastal populations who are excluded in any way from the governing process and why? what are the existing structures for public access and participation in governance?)

Fishermen

Developers

Ngos

Chapter 8: Conclusions and recommendations

- (i) **Main findings of the report** (Look at problems and opportunities and give examples of best practise, successes and failures. Identify gaps and needs in information, communication, coordination, legislation, institutional and management structures etc.)
- (ii) **Proposed interventions** (Give recommendations for interventions in response to the previous section and within the framework of national priorities as contained in national poverty reduction strategies; national development plans; or any other national planning instruments; with clear references and pointing out any gaps that may be contained in existing national strategies)
- (iii) **ICM planning for the future** (make recommendations for future ICM planning based on conclusions and recommendations made and within the framework of national priorities as contained in national poverty reduction strategies; national development plans; or any other national planning instruments; with clear references and pointing out any gaps that may be contained in existing national strategies)
- (iv) **Poverty reduction strategies in coastal and marine planning** (Analyse how poverty reduction strategies can be integrated in to coastal management and governance)
- (v) **Way forward**

The ICZM Division under the aegis of the Ministry of Environment needs to be reinforced in terms of more technically qualified human resources in order to be able to comply with the Environment Protection Act. Legislations should be developed to address issues related to coastal zone management including planning, development, utilization, exploitation and enforcement. Training needs to be provided to sustain the skills and number of experts to cover the country as a whole at national and local levels.

There is a need to develop a public, private, and community partnership for cost effective beach conservation, national environmental education, awareness programme and beach improvement.

There is a need to cultivate environmental responsibility in school children. National Environmental issues should be woven into the teaching curriculum. Environmental clubs in schools and colleges should be set up to allow the youths to be aware of the local environmental problems and to propose solutions. Environmental studies should be made a compulsory module for all arts and science undergraduate degree courses at the tertiary level.

The Local Authorities should play a role in the pollution control and environmental protection at the local level.

There is a need to encourage the rational use of environmental resources by making the polluter bears the consequences of their activities and at the same time encourage them to adopt a cleaner production.

The collection and dissemination of environmental information should be decentralized and made accessible to the public.

There is a need to introduce an Environmental Reporting Award to recognize companies which adopt ISO Standards, Voluntary Global Reporting Initiative Guidelines on

Sustainability reporting, public environmental reporting and comply with all existing environmental legislations.

There is a need to create a prosecution unit at the Ministry of Environment in order to speed up investigation in respect of environmental offences and prosecute those cases before the Court of Law and to follow up actions.

Acknowledgements

References

References should be divided by chapter. All information and data (including maps) cited in the report should be clearly referenced with author, date, and access details. As the report itself needs as focussed and brief as possible it is important to make sure that this is compensated with an extensive list for reference material; hence, as many relevant documents/materials as possible, even though they may not be cited in the report, should be included in the reference list with clear access details. It is highly essential that access details stated are updated, detailed and correct, as some documents may be required for archiving purposes.

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- (i) *The IUCN species survival commission – A Marine Turtle Conservation Strategy and Action Plan for the Western Indian Ocean – IUCN, 1996;*
- (ii) *Status of Sea Turtle Conservation in the Western Indian Ocean – UNEP 1996.*

Appendices

- (i) Report methodology (outlining how the report was compiled, sources and selection of information etc.)
- (ii) Coastal and marine information sources (where to source reports, maps, and other information, and how contacts to expertise; list relevant websites, mailing lists, networks, notice boards, posting of meetings, etc.)
- (iii) Maps
- (iv) Laws and regulations (if the actual documents are included otherwise the references should be clearly stated in the reference section)
- (v) Other appendices (other relevant information and data that does not fit in the actual report)

A GIS was developed to integrate data on the distribution of biodiversity, environmental factors governing distributions, human activities such as fishing and MPA planning. The GIS provides a useful tool to establish the conservation and sustainable use of the island's marine resources (Chapman and Turner, 2001).