

Eastern African Marine Ecoregion

Analysis of socio-economic root causes of biodiversity loss at four selected sites along Mozambique Coast

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Finally, we
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1. Introduction and Brief Summary

This study examined socio-economic causes of biodiversity loss at four sites in Mozambique coast: Quirimbas Archipelago, Zambezi Delta, Bazaruto Archipelago and Maputo Bay-Matutuine. These sites are distributed throughout the different large ecological units of the coast of Mozambique. Their degree of development is different, but basically the main motivations for biodiversity loss are caused by the past (civil war) and present events (structural adjustment program) which contribute to the poverty of local human communities.

The main motivations for the biodiversity loss at the four Mozambican's sites are: (i) the extreme level of poverty of human populations which make them rely on the exploitation of natural resources for subsistence, (ii) the economic adjustment program implemented by the government, through which the country has been using the revenues obtained from exports and taxes to pay the foreign debt at expenses of investing on social infrastructures and development. This structural adjustment program has also promoted the decentralization of resource management and administration, but the country (iii) lacks qualified human resources an institutional capacity at the local levels, to implement resource management. (iv) There are inadequate policies and legislation regarding to management of fisheries; tourism and costal zone. Therefore, the lack of qualified human resources for management at local level has contributed to uncontrolled developments (tourism, agriculture, salt-works) and occurrence of illegal activities that contribute to loss of biodiversity.

Several proximate caused for the loss of biodiversity were identified, of which the most important are over exploitation of fish, shrimp and sharks stocks, the mortality of dugongs, dolphins and turtles, the destructive fishing practices, the over exploitation of benthic invertebrates, collection of shells and starfish for curio trade. The coral reef degradation, mangroves area loss, deforestation, changes an clearing of indigenous vegetation, pollution, reduction of shrimp, birds and mammal reduction, and over hunting of mammals and birds.

Over exploitation of fish and shrimp and sharks stocks is linked to local market demand that in the national context is driven by open an free access to artisanal fishing, the lack of capacity for law enforcement and lack of research and management capacity. The international demand for fishing products (European and Asiatic markets) has a very strong impact on this activity, which is also generate foreign exchange to the country.

The mortality of dugongs, dolphins an turtles occur due to intense fishing using non selective nets, but during this time, they have maganed to achieve a status of food delicacies in local context. The destructive fishing practices, like the use of dynamites, gill nets and small net mesh sizes and the overexploitation of benthic invertebrates, collection of shells and starfish are related to the lack of alternative means of subsistence of coastal communities.

Coral reef degradation is another threats to the biodiversity loss. The local root cause is high pressure of tourism. In the country, the uncontrolled tourism growth at southern Mozambique associated to tourism demand from South Africa, Zimbabwe, and other countries has a very strong impact on marine environment, due to lack of law enforcement and unknown carrying capacity. . The lack of alternative means of subsistence by local communities and regional market demand in the northern Mozambique has been driving the dynamite fishing in northern Quirimba area, because of lack of law enforcement in the country.

Mangroves have been decreasing at the sites, through harvesting for firewood and house building, but also because of economic activities such as conversion to salt work and

aquaculture plans at Zambezi Delta and Maputo Bay areas. In addition, regarding to Zambezi Delta, the improper upstream water management at the Dam is of concern. Those aspects are related to the lack of subsistence's alternatives of the local communities, unplanned licensing and allocation of concessions caused by lack of capacity of local institutions. At national and international level the high cost of acquiring of new technologies and alternative products contributes to the lack of action on this issue.

The reduction of the shrimp stocks, birds and mammals are provoked by changes of hydrological Cabora Bassa Dam at Zambezi river. This has a national dimension because of the importance of the river to maintenance of ecology of large fishing areas and because of the importance of the dam to the region. At the moment, there is lack of capacity to influence river management and lack of international agreement on water management and water quality control.

2. Description of focal areas

Mozambique is situated between latitudes 10°20' S and 26°50' S. Its coastline, of ca. 2770 km, is characterized by diverse habitats, including sandy beaches, coral reefs, estuarine systems, bays, mangroves and seagrass beds (Massinga and Hatton 1995). The coast can be divided into three main natural regions - the coral coast (the northernmost extending for 770 km), the swampy coast (about 978 km of length, between Angoche (16°14' S) and Bazaruto Island (21°10' S)) and the parabolic dune coast (the southernmost, with 880 km of length between Bazaruto and Potand od Ouro - with one additional type of limited occurrence, namely: the delta coast at mouth of Save and Zambezi Rivers (Tinley 1971; Massinga and Hatton 1997; Hatton MICOA and UICN 1998). The warm Mozambique current flowing southward determine the oceanography and climate of Mozambique coast, which is humid and sub-humid tropical (Tinley 1971). Geologically the coast is diverse, ranging from unconsolidated quaternary sands south of latitude 16°S but interspersed with heavier textured soils (alluviums) at the large river mouths (Tinley 1971), while north of latitude 16°S there are small Tertiary basalt with heavily faulted Cretaceous sediments (Tinley 1971).

Quirimba Archipelago

The Quirimbas Archipelago consist of 27 islands extending north-south for 240 km along the coast of Cabo Delgado Province (Telford et al. 1999). These islands are distributed into four districts: Palma, Ibo, Moçimboa da Praia and Quissanga, of which only Ibo district consists only of islands (Telford et al 1999, Wittington et al. 1998). Islands located north of latitude 11°51' S do not have permanent human settlement because they lack freshwater (MDN,1986).

The marine environment between the islands and mainland is shallow, has extensive banks and some reefs (MDN 1986). The seaward coast is very deep, just off the reef, because of a narrow continental shelf (MDN 1986). Most islands are undisturbed, due to absence or low human population density. The intertidal zone encompasses sandy beach and rocky shore habitats (Wittington et al 1998; Telford et al. 1999). Data from Southern Quirimbas reflect species richness in excess of 150 taxa belonging to five invertebrate phyla: Cnidaria, Annelida, Arthropoda, Mollusca and Echinodermata and intertidal molluscs comprised 89 species (Wittington et al. 1998). (Telford et al. 1999). Molluscs, annelid worms and decapod crustaceans notably inhabit sandy beaches and mangrove intertidal fauna is highly diverse

(Telford et al. 1999). The full array of marine invertebrates is typically well represented along the rocky shorelines (Telford et al. 1999).

Extensive areas of mangrove forest occur along the coast of mainland and at Ibo and Quirimba Islands, while other three islands of the Archipelago have small mangrove forests (Telford et al. 1999). Seven species of mangrove trees occur in the area: *Rhizophora mucronata*, *Sonneratia alba*, *Bruguiera gymnorrhiza*, *Xilocarpus granatum*, *Ceriops tagal*, *Lumnizera racemosa* and *Avicennia marina* (Wittington et al. 1998). Mangroves suffer from deforestation, mostly large trees.

Seagrass meadows consisting of 10 species occupy extensive areas off the west coast of the islands and the subtidal areas (Wittington et al. 1998). 204 species of seaweed were recorded for southern Quirimba Archipelago mostly associated with coral reef and rocky shores (Wittington et al. 1998).

The coral reefs of Quirimba Archipelago are classified as exposed fringing outer reef, vertical walls, coral gardens and bommie fields (Wittington et al. 1998). Fifty-five genera were recorded in Southern Quirimba shallow water reef that represents a high diversity (Wittington et al. 1998).

These reefs support immense biodiversity of both commercial and conservation significance and their degree of disturbance ranges from pristine condition to low impact and only small areas are heavily damaged by natural and human induced factors (Wittington et al. 1998). Fish species associated with sea grass meadows are very diverse comprising 249 species in southern Quirimbas, while reef fish comprised 375 species (Wittington et al. 1998).

Three species of sea turtles were observed in the area: green, loggerhead and hawksbill turtles they nest at some islands (Wittington et al. 1998). A dugong was reported to occur (Wittington et al. 1998), but humpback and minke whales and bottlenose and humpback dolphins were observed.

Zambezi delta

The Zambezi Delta stretches out in a triangle from the Mopeia District up the coast. In the north and in the South the Delta is limited by the Cuacula and the Mungari Rivers respectively. (Turpie et al. 1998, quoting Sweco 1982 and Timberlake 1997). The region is covered by alluvial plains, located 30 metres above the level of the sea waters (Turpie et al. 1998, quoting Dutton & Munguambe 1997). The average annual temperatures vary from 25 to 26°C, the rainfall between 900-1200mm, the humidity >70% (Barbosa et al 1998). The Delta receives high rainfall during the raining season, which is between January and April and low water quantities in the dry season, from October to November (Turpie et al 1998). The extension of the Zambezi Delta is approximately 18,000 km² (Turpie et al, quoting Sweco 1982). The Delta belongs to the districts of Marroumeu, in the Sofala Province, Chinde and Mopeia in the Zambézia province. The Zambezi River (one of the largest river of Africa) meets the Ocean at this location and determines the hidrological regime of this area.

The total human population of the 3 Districts of the Delta is 270,545 inhabitants. Marroumeu has 69,895 inhabitants, Mopeia, 71,535 inhabitants and Chinde, 129,115 inhabitants (INE 1999). The 70,000 families have a mean number of inhabitants of 5.4 - 6.2 people (Barbosa et al, 1998). Discrepancies were found in the sex distribution of the population.

According to the characterization of ETLAL/Loxton Hunting (1975), quoted by Barbosa et al. (1998), the plant communities of the Delta consist of Stratified Alluvium Communities, composed mostly by *Borassus aethiopum*, *Phoenix reclinata*, *Ficu spp*, *Kigelia africana*, etc., the Prairie and Aquatic prairie in the flood plains dominated by grasses *Hyparrhenia spp*, *Imperata cylindrica*, in the wetlands, and *Phragmites sp.*, *Thypha sp* e *Cyperus sp*, in the swamps, and *Setaria sp* in the most arid zones. Communities of *Hyphaene* occur in all sandy humid soils.

The mangroves of the Delta are of international importance. According to Saket and Matusse the mangrove area covers an area of 396,000 ha: 125,317 ha in Sofala and 155,757 in Zambézia (Turpie et al. 1998). In the dune forests species is dominated by *Diospyros sp.* *Euclea natalensis* and *Mimusops caffra*.

The fauna of Zambezi Delta is diverse. Anderson et al, 1990 and INPF-IUCN, 1997 c have presented an exhaustive characterization. In general, the presence of buffaloes, crocodiles, kudus, warthogs, reedbucks, sables, monkeys and oribis, eland, zebra, goats, hippopotamus, lions, leopards, bushbuck is notorious (DNFFB 1998 and Barbosa et al 1998).

The Delta, and particularly Lower Marromeu, has a several of species of water birds which makes the region of international importance including crane species.

Another remark in the Delta is the presence of fish and shrimp resources, which provides a very important socio-economic potential for the country. The regulation of water regime by the dams located at Zambezi River, in particular the Kariba and Cabora Bassa have a very important influence on the floodplain and marine habitats under influence of the Zambezi River.

Bazaruto Archipelago

The Bazaruto Archipelago is located in the Inhambane province and consists of five islands: Bangué, Magaruque, Benguerra, Bazaruto and Santa Carolina. The archipelago cover a total area of 15 605 ha. The Bazaruto and Santa Carolina islands are part of Inhassoro District while Benguerua, Magaruque and Bangué islands are part of Vilanculos District (DNFFB, 1998a.). The archipelago lies between latitudes 21°30'S and 22°10'E and longitudes 35°22'E and 35°30'E. Three islands of the Archipelago (Bangué, Magaruque and Benguerua) form the Bazaruto National Park and the total area is 15 000 hectares. The Bazaruto and Santa Carolina islands are classified as surveillance zones, including the Ponta São Sebastião, at the south of the Archipelago.

The archipelago supports an estimated population of 3500 inhabitants (Census 1998) distributed as Bazaruto, Benguerua, Magaruque and Santa Carolina while Bangué occasionally supports temporary fishing camps. The archipelago is predominating formed by fixed inland dunes and along the coast by mobile dunes, sandy soils and the island sandstones fringe shore.

The vegetation communities is diverse: pioneer vegetation at primary sand dunes, casuarines, swamps, swampy forest, prairie and savannah, thicket, thicket associated with sand dunes water on western site, *Dialium schlechteri* and *Julbernadia* forest, Climax Mesic Forest (Hatton et al, 1998; Reina, 1998). There are 7 freshwater lakes at Bazaruto Island and two lakes at Benguérua Island, which have low storing capacity and susceptible to faecal contamination.

Marine habitats consist of beaches (sea turtle nesting area), intertidal area (used by diverse migrant birds and waders), seagrass beds and coral reefs (DNFFB, 1998a; Hatton et al, 1998). Seagrass beds are extensive and located in subtidal area and part of the intertidal zones and the main species are *Thalassodendrum ciliatus*, *Thalassia hemprichii*, and *Zostera capensis* associated with *Halodule* and *Cymodocea*.

Rocks and rocky reef occur in the intertidal area of Santa Carolina Island and parts of Bazaruto and are inhabited by several species crustaceans, molluscs, fish and echinoderms. A total of 90-100 hard corals species, 27 species of soft corals and 268 reef fish species were recorded in the archipelago. Several other faunas yet not described are found associated with coral reef.

Mangroves are restricted to small areas and consist of the following trees species: *Avicennia marina*, *Rhizophora mucronata*, *Ceriops tagal*, *Bruguiera gymnorhiza* and *Sonneratia alba*. The largest mangrove occurs in Bazaruto Island at Zenguelemo, along the west coast.

Few relict indigenous terrestrial mammal species consist of Samango monkey (*Cercopithecus mitis*), Lesser Bushbaby (*Galago moholi*), Red Squirrel (*Paraxerus palliatus*), Red Duiker (*Cephalophus natalensis*), Bushbuck (*Tragelaphus scriptus*) and few species of rodents such as House Rat (*Rattus rattus*) (Hatton et al. 1998). Around 180 bird's species have been recorded in the archipelago (Reina, 1998), of which 36 species are waders (Kohler et al. 1996). Five species of Marine turtle occurs at this archipelago and are followed: Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*), Loggerhead Turtle (*Caretta caretta*) and Leatherback Turtle (*Dermochelys coriacea*). Large marine mammals species were recorded at Bazaruto Archipelago: Humpback whales, minke whales, dwarf sperm whale (*Kogia breviceps*) and false killer wale. In addition, 5 species of dolphins occurs in the area: spinner, humpback dolphins, bottlenose dolphins, common dolphins and spotted dolphins (Hatton et. al., 1998). The largest remaining population of the endangered dugong (*Dugong dugon*) along the East African coast has been recorded at archipelago (Guissamulo 1993).

The fish fauna of the Archipelago is diverse and rich. Over 2 000 species of fish has been recorded from the area. In addition crustaceans comprised 20 species and 57 mollusc species recorded for the area.

Maputo Bay – Matutuine

Maputo Bay and Machangulo area is located between latitudes 25°50' S and 26°40' S and latitudes 32°40'E and 33°E. This area consist of an extensive Bay (1200 km²), two archipelagos: Xefina Islands at the north west and Inhaca and Portuguese Islands at the northeastern part of the Bay, respectively and a 120 km long open coast exposed to the Indian Ocean, south of the Maputo Bay.

The human population in the Maputo Bay and Matutuine area is high. Maputo city has about 989.400 inhabitants, Matola 440927 inhabitants (INE 2001). In Matutuine district, the most important villages which may impact to the Bay are Belavista (14 272) , Machangulo (1770) and Zitundo (4175) (DNFFB 1997; GDP 2000), while an additional number within the Maputo Elephant Reserve the human population may consist of 1000 people (DNFFB 1997). At Ponta do Ouro, the Population is estimated to be around 2500 inhabitants (DNFFB 1997).

The Matutuine district, Maputo province, between 26°09'S, 32°54'E and 26°52'S, 32°08'E.

Part of the coast of the Matutuine is under control of Maputo Special Reserve area, this include the coastline bordered by Mangroves between Maputo River and Futi River in the South of the Bat as well as a long sandy shore exposed to the Indian Ocean, including all resources within a strip of 3 miles. Several scattered rocky shores occur along this coastline (Tinley 1971) and the marine environment consists of subtidal reefs with coral communities (Robertson et al. 1996).

Maputo Bay and Matutuine coast lie in the transition between temperate and tropical climate with hot, but not very wet summers and dry winters (Kalk, 1995). The Matutuine district, Maputo province, lies between latitudes 26°09'S and 26°52'S, 32°08'E and 32°54'E.

Rainfall occurs throughout the year, for over 80 days in summer and about 30 days in winter, but is rarely heavy and the mean annual average is 900 mm (Kalk 1995). Five rivers influence the environment off the western part of Maputo Bay, which is estuarine. The eastern Maputo Bay suffer less influence from the river, while the marine waters from the Matutuine coast do not suffer any river influence (Anonymous 1998; Kalk 1995; DNA unpublished data)

Water transparency, ranges from less than 1 m in the western Maputo Bay to about 10 m towards Portuguese Island, eastern Maputo Bay (Anonymous 1998). Off the open shore of Matutuine district, waters transparency is high throughout the year (Robertson et al. 1996). The Maputo Bay is shallow, depth varies from 1 to 20 m (Sousa, 1982). The open coast of Matutuine district is very steep, with depth increasing toward offshore. The 20 m isobath is located at less than a 1 km from shore ((Chart 46659-M, INAHINA) while the continental shelf extends to 9 - 12 km offshore (MDN, 1986).

The sediments in the subtidal area of the Bay varies from clay-silt to medium size sand, but medium and fine sands dominate most of the eastern part of the Bay (Cossa 1996; Achimo 2000). Offshore sediments off Matutuine coast are sandy (Cilek, 1989).

The width of the intertidal area range from 0.5 to 1.5 km wide surrounds Maputo Bay, mostly colonised by seagrass meadows. About 140 km² of Maputo Bay is covered by seagrass meadows (Anonymous 1998 composed in the Bay by 7 species while along the open coast of Matutuine only *Thalassodendron ciliatum* is found (Bandeira 1991). Mangrove swamps and trees surround > 80% of the coastline of the Bay (Macnae and Kalk, 1969) and cover an area of 143 km² (De Boer 2000).

Around 26 classes of marine invertebrates were identified for Inhaca. This includes 232 families and 965 species. 490 fish species are present in the Bay (Macnae and Kalk, 1969). Forty-five coral genera were identified at Inhaca coral reefs and 18 species of echinoderms associated with Indo-pacific coral reefs were recorded (Kalk 1995). The seagrass and seaweeds shelter numerous animals such as worms, sea cucumbers, molluscs, crustaceans, shrimps and fish. Twenty-five reef fish families were recorded for Inhaca Island (Kalk 1995).

At least five marine mammals species occur at Maputo Bay and Matutuine coastal waters, including the endangered dugong, two species of dolphins and two species of whales. Five marine turtle's species occurs at Inhaca and two breed aalong shore Loggerheard (*Caretta caretta*) and Leatherback turtle (*Dermochelys coriacea*).

The open coast of Matutuine district consist of sandy dunes and sandy shores, interspersed by 11 rocky points (Robertson et al. 1996). The marine habitats consist of sandy shores, intertidal rochy shores associated with rocky points and offshore reefs, which consist of beachrock relics lying parallel to and created by the retreating coastline.

At sandy beaches the dominant ghost crabs are *Ocypode ryderi* and *O. ceratophthalmus* and few crabs of the species *Ocypode madagascariensis* were recorded, while mole crabs *Emerita austroafricana* and whelks (*Bullia natalensis*) were also abundant (Robertson et al. 1996).

Intertidal rocky shores comprise about 13% of the coastline between Ponta do Ouro and Ponta Abril. The most common species of intertidal fauna and flora comprises 25 species including limpets, whelks, mussels, chitons, barnacles, zoanthids, sponges, ascidians and 37 species of seaweeds (Robertson et al. 1996). The shallow subtidal rocky reef form the benthic substrata for marine life, inhabited by three species of lobsters. Red baits and numerous mussels have patchy distribution. Subtidal oyster (*Saccostraea margaratacea*) (Robertson et al. 1996). The reef fauna consisted of 19 genera of hard corals, 10 species of soft corals, and several marine invertebrates (Robertson et al. 1996).

The percentage of soft corals range between 14% and 78%, while massive hard corals consist of 6% of coral cover. 200 fish species were recorded in the area, few occurring in the tidal pools, shallow water adjacent to rocky platforms and subtidal reefs. The subtidal reef fishes are the most diverse, comprising at least 150 species (Robertson et al. 1996).

3 Research Methodology

The purpose of the study was to identify, analyse and organize information on the social, economic, political and institutional factors driving biodiversity loss at four coastal areas of global importance in Mozambique: Quirimbas Archipelago, Zambezi Delta, Bazaruto Archipelago and Maputo Bay-Matutuine. Analysis examined issues at local, national and international levels and made recommendations.

The research began by preliminary identification and analyses of existing bibliography on biologic and socio economic aspects leading to biodiversity loss at each of the four sites. The proximate causes of biodiversity loss were identified, and then their root causes were further analyzed at local, national and international as well as the linkage between them

Then, initial hypotheses about causes of biodiversity loss in Mozambique were formulated as follows:

- Poverty of local population and the relative lack of subsistence means and economic alternatives drive to excessive use of marine and coastal resources in a way contributing to biodiversity loss
- Overexploitation of marine and coastal resources is in most cases driven by food needs and high income demand
- The relative high poverty of Mozambique, linked to the high foreign debt of the country and corruption limits the allocation of resources for improvement of capacity of law enforcement and control toward the sustainable use of marine and coastal resources
- :
- Bad economic conditions and lack of alternative employment (industrialization and commercial agriculture) of the rural interior areas/ vicinity areas of coastal zones made people immigrate to coastal areas were development result in increased and

high population density, which consequently increase the conflicts and competition over resource use and management

➤ Development actions (rapid tourism growth and industrial) in coastal areas influences biodiversity loss

➤ International market demand for some marine resources drives their over-exploitation
Based on these hypotheses and the results of the interviews, initial conceptual models were developed for each area. Then, the final revised conceptual model for Mozambique were developed Using comparative analyses of each model

The study was basically drawn from the revision of existing relevant literature (*see References*) and on the confrontation of the finding with oral sources. In general, literature on this subject is too little in the country. The bulk of it does not focus on socio economic aspects, but on biological ones.

In other to determine the extend of biodiversity loss quantitative and qualitative data were compared using census and statistical data from the website of National Institute Of Statistic, demographic census of 1987, and reports on aerial census of endangered species. Because quantitative data available are very limited the conclusions of the study were basically compile using qualitative data

The second way of gathering data was through interviews (*Appendix x*) and discussions carried out with relevant key persons. The questionnaires were done by the team with assistance of two student of Eduardo Mondlane University, who were pre-prepared on the issues and instructed to become familiar with the guide of questions developed by the team

About 16 persons were interviewed (*Appendix x*)- linked directly or indirectly to environmental, socio-economic, cultural, administrative, legislation and policy on coastal zone management issues in Mozambique.

The principal limitation of the study was the fact that all the interviews were limited to Maputo. Shortage of time and distance to achieve the four sites from Maputo did not allowed visits to the site for interviewing experts in the field.

This fact has occurred even here in Maputo, as many of the selected person were not available on the proposed dates. In these cases, we used a system of hand-over the questionnaires and we went to collect days after.

4. Main Findings

4.1 Local Context

Quirimbas Archipelago

Over fishing of sea grass beds and mangroves

Fishing is the principal economic activity in quirimbas archipelago, The archipelago is rich in marine resources a wide diversity of fish stocks, prawn, and extensive area of mangrove Most of the intertidal and sub tidal habitats are in good condition, except for the inhabited islands, fisher resources defined as under fished are mostly sea cucumber, shells, prawn, lobster, molluscs, while pelagic fish are under-used.

A sea grass fishery is carried out by subsistence fishermen, mostly to provide protein and the fishing intensity is high and represents at some areas a clear threat to the habitat and sustainability of the fishery (Wittington et al. 1998). Fishing at the seagrass areas using small mesh size seine nets and very small fishes, most juveniles at the areas nursing areas are captured and sold at local markets. Mud-crabs, *Scylla serrata*, in the mangroves and octopus in the tidal pools, are also exploited, but the intensity of exploitation is low and will not cause any significant impact (Wittington et al. 1998).

Prawn fisher is also important in some areas on the archipelago, but reports shows that these activity is decline due to a over-fishing principal by outside fishermen

Destructive fishing practices at reefs The reef fishery is limited to sheltered areas in the upper parts of the reef (Wittington et al. 1998). Therefore currently the fish biodiversity is under little threat, as most of the outer reefs are not exploited. There is a potential for reef damage caused by dynamite fishing and anchor type damage, in the northern Quirimba Archipelago (Telford et al. 1999). El Nino Phenomenon occurred in 1998 has also contributed highly to coral reefs degradation in this area (Schleyer, etall, 1999,p.10)

Subtidal invertebrate collection includes the collection of gastropod molluscs for the curio trade and sea cucumber for exportation (Wittington et al. 1998). A significant number of itinerant fishermen from Nampula and Cabo Delgado Provinces collected shells sold to commercial traders who export them to Europe (Telford et al. 1999). Shells appear to have been once abundant in the intertidal areas, suggesting that the exploitation of shell may have over-exploitates the resources in some localised reefs (Wittington et al. 1998).

Lobsters are also collected sub-tidally in the seagrass meadows, but the degree of exploitation may be intense and possibly capable of decreasing the population (Wittington et al. 1998).

*Destruction of turtle nests*Sea turtles nesting in the shore of some islands for nesting are killed, as evidenced by the presence of remains of turtles and often their nests destroyed by fishermen. Therefore, successful breeding is a rare event in the inhabited islands of the Archipelago.

Overexploitation of invertebrate's resources The impacts on sea grass consists of flat tramping by collectors in the intertidal areas and by dragging fishing nets in the shallower subtidal areas (Wittington et al. 1998). Areas located close to the inhabited islands and close to the mainland, which have been suffering intensive collection of benthic invertebrates, most molluscs collected to produce a delicacy sold to Tanzania and Pemba. In addition, most lobsters and sea cucumbers have been over-exploited in the area by commercial operators, some South Africans. In the past, this also posed a threat to the mangrove vegetation, which used to be cut for sea cucumber processing. A large number of illegal operators (from Tanzania) using SCUBA diving equipment were taking subtidal stocks of holothurians, while in the intertidal areas, women used to collect holothurias, but now this activity is sporadic due to reduction of stocks (Wittington et al. 1998).

Adult women and children collect several species of intertidal invertebrates daily for subsistence, of which bivalves are the most important staple food (*Pinctada* sp. and *Barbatia* sp.) (Wittington et al. 1998). The level of the exploitation varies according to the size of the intertidal area, distribution of sub-habitats and demographics of the island's human population and the scale of other resource use activities on the island (Wittington et al. 1998).

There were over 200 collectors in the 3 inhabited islands of Southern Quirimbas, and the arrival of collectors from nearby mainland, Nampula and Tanzania increases the human impact on these resources (Wittington et al. 1998).

Mangrove cutting Mangrove trees have been cut for building material and firewood and it appear so far to be sustainable activity in the islands with large mangrove stands (Wittington et al. 1998). Provided that the poverty is high and people do not have many alternatives to purchase building material and firewood from mainland, there will be an increased exploitation of mangroves stands located close to the inhabited islands and those from the mainland the terrestrial vegetation has been highly modified. One island, the Quirimba, was transformed into a large coconut farm; other threats to forest resources include excessive bush clearing near rivers and waterways due to expanding human population.

Poverty, isolation and lack of socio-economic infrastructures in inhabited islands at Quirimbas are the main local cause of biodiversity loss

The soils are rock and have poor, fertility. There is a historic food insecurity in quirimbas, were people live by eat wild fruits and marine resources

In the past trade of marine resources in exchange to cereals and cassava was a main source of income and subsistence. However continued long-term exploitation of resources and temporary increase pressure on the resources because of civil war inland collapsed the trade system

Limited commercial infrastructures, high transaction costs for travel (low volumes, poor quality and poor roads and limited processing facilities (freezing), are considered to contribute for low level of income of local and intense resource exploitation

Zambezi Delta

Loss of terrestrial vegetation

As mentioned about more than 100,000 people inhabit the Zambezi delta, with most people living at north of Zambezi Delta (Chinde and Mopeia), where the primary subsistence activities are agriculture.

Woodlands and grassland at floodplain areas have been suffering from intense human utilization, through deforestation for conversion into agriculture areas, cutting of trees for use as building material, firewood and charcoal which are sold to the markets at the villages. Job opportunities were for many years absent to the area because the sugar-cane industry and associated commercial sugar cane plantations were destroyed during the civil war, making subsistence and income generation rely on exploitation of natural resources. There is also production of timber from hardwoods collected at the woodlands which are sold to nearby markets. Regarding to production of timber, high levels of deforestation were caused by the type of license provided to commercial operator, which in the past was the annual license of cutting trees. This promoted the operator to cut as much trees as possible. It is also referred that most operators cutting are illegal and perform their activities through corruption of law enforcement officials.

Poor agriculture practices also contribute to the loss of vegetation. In wetlands, local communities develop agriculture for subsistence and it is estimated that 95% of families depend on this activity, growing maize, rice, millet, sorghum, sweet potatoes and cassava. The farming techniques involve burning which destroy forests and reduce soil fertility. About 68,867 ha of land are cultivated and the trade of agricultural products achieved US\$53, 2887.7 in 1997. Surplus from the agriculture sector is sold at districts of Marromeu and Luabo

Mangrove area loss. Mangroves are extensive along the Zambezi Delta at the margins of the river. The mangrove area in the Delta is estimated as 5500 ha (Triple et al. 1998) The mangrove area was expected to experience an increase because of increased salt intrusion caused by reduction of water flow by the Cahora Bassa Dam. However, reduction of water flow have also decreased the amount of flooded areas and therefore plant succession is taking place at the landward side through bush encroachment. Nevertheless, mangrove stands suffer other direct human impacts because of cutting for several reasons: acquisition of building material and firewood, construction of canoes, with most impacts taking place at the northern margin of the Zambezi river.

Conversion of mangroves to salt works and aquaculture plants, due to unplanned development and as an incentive for job creation

Conversion of mangrove areas into rice farms. This happened by opening drainage channels within mangrove areas for irrigation of rice farms using the water from the river.

Sedimentation is also another factor contributing to loss of mangrove areas. The regulation of water flow by the Zambezi Delta changed the pattern of sediment deposition, at the river mouth, thus limiting the quantity of salt water entering the channels. Some river channels have closed and consequently supply of water to some mangrove stands decreased.

Over hunting and Inadequate hunting techniques. During the war period and as result of hydrological changes of Cahora Bassa Dam and other developments in the areas, there was a deterioration of the floodplain habitats, which resulted in the decrease of large herbivores (including buffalos that decreased from 80000 to less than 5000 animal) Other large mammals have also decreased. During the civil war, most large wildlife were hunted to supply the army with proteins and there was also a poaching for trade of skins, ivory, etc.

However, local communities practice hunting for subsistence and commercial purposes as a tradition since the time when they were trading with Arabs, several centuries ago. Secondary forms of income generation and of obtaining of protein include hunting. Most unemployed males living in the flood plain practice hunting as a secondary activity that is used for food consumption and for trade. In addition, there is illegal poaching also taking place at the area to generate income through trade at the markets at Beira and other large villages (Chinde, Mopeia, Gorongosa, Inhaminga and Nhamatanda). Now, that the wildlife has

decreased, the impact of traditional hunting is much more severe, because it targets small populations of wildlife and uses destructive techniques.

Traditional hunters use destructive techniques that also include poisoning of meat and water and burning of grasslands to attract herbivores. Poisoning was carried out using the following trees: *Strychnos*, *Mundulea sericea* and *Albizzia versicolor*. In the region of Dande, populations of hyenas and lions decreased in the last 15-30 years.

Official hunting licenses issued are very limited. In 1997 there were only 37 hunting licenses issued. However, most licenses are issued without any previous assessment of the existing wildlife resources, and therefore, this can have a strong negative impact on the survival of wildlife.

Tourism activity in the Delta occurs at hunting concessions 12 and 14 and at the Marromeu Reserve. Last year there was evidence of hunting concession operators who were reported to exceed the issued quotas by DNFFB and because there is a weak control of their activities.

Reduced quantities of shrimp stocks and destructive fishing techniques. The juvenile shrimps use mangrove channels as nurseries and this happens during the wet season. Changes in the hydrology imposed by the water management system at Zambezi Delta have been causing problems with the offshore stocks of prawns at the Sofala Bank. The Zambezi river, is the most important in the region, being the largest contributor for the estuarine system at the Sofala Bank. The reduction of mangrove areas and disruption of the hydrology has been causing mortality of most juvenile shrimps, thus contributing to the reduction of stocks. In addition, the reduction of mangrove areas, sedimentation and water river flow, reduced the extent of fishing areas available leading to intensification of fishing at shrimp nursery areas. There are 1000 fishing licenses issued for Chinde, close to Zambezi river mouth, 30 at Mopeia and only 2 for Marromeu.

Most fishermen do not have nets, and the yield on fish traps has decreased. Therefore, they are using destructive fishing methods, like poisoning lakes and other small water bodies. These methods are not selective and kill fish of small size with no commercial value. Most poisoning takes place at floodplain areas. This has an effect on other species such as birds feeding on fish and some small mammals.

Reduction of bird numbers

Changes in hydrology caused by the Cabora Bassa Dam, have impacted on the quality and extent of habitats for water birds. This area is visited by migratory water birds and has been recognised as a place of international significance. It has been proposed for nomination as a Ramsar Site. However, hydrological changes have decreased most of the habitat quality along the southern margin of the Zambezi Delta, because most flood plains are not receiving the necessary amount of water. River management is not considering the supply of freshwater in quantities required for this. The Cabora Bassa Dam was built without an environmental impact assessment and there is a need now to consider its impact on downstream habitats.

The northern margin of Zambezi River, in the Delta has been profoundly altered by human activities and most suitable habitats for water birds are no longer available or their quality has decreased. This has had a very strong influence on bird populations at the Delta. Of significance to the Delta area is the status of wattled cranes population which has reacted strongly to hydrological changes. However, other bird species with very intimate relationships with wildlife like the cattle egret has decreased. The African skimmer, a bird very dependent on water level is among the species which are endangered in the area. Flamingoes, pelicans, storks, etc, comprise the bulk of birdlife which have been affected.

Bazaruto Archipelago

Demographic Trends The impact of human population on the environmental issues and resource use, has been severe during the civil war (1982-1992) when the area became a safety place to live, and consequently, the number of people increased from 1700 after independence, 1995, to 3,712 in

1989 and decreased to 2.707 in 1995 as are result of the return of many refugees to their homes (Dutton & Zolho, 1990,p34, and Raimundo, 1995, p.12) and increased to 3.500 In 1999 (Population Census- 1999)

The increasing of tourism development, from 4 lodges operating before 1992 to 7 including a campsite today. the primarily factor contributing to population grow and pressure About 90% of the total works are from mainland, Because local islanders lack proper education- and English skills- outsized / mainland people immigrate to the archipelago where they easily found employment

The continued exploitation of the islands of the Bazaruto Archipelagoby new developments threat posed by the tourism development on the archipelago leading to population growth and the actually informal uncontrolled settlement system as the new works settle them selves with their parents, leading to over fishing and over exploitation of forest and indigenous vegetation for fire wood, building materials, agriculture and also causes social disturbance

The development of new economic/ commerce infrastructures, the opening of roads and good conditions for circulate on the coastal area, linked to bad economic conditions of the population on the rural areas are also contributing indirectly to new immigration to the archipelago, a major number of people owning informal shops are mainland people and again their establish them selves on the islanders.

Over-exploitation of fishers and marine resource sArtisanal fishing is the primary livelihood and the main source of protein and income for more than 70% of total inhabitants. The species of high economic value are demersal and pelagic fishers (both small and large), lobster, crabs, sand oysters and sea cucumber.

Semi industrial and industrial fishing done by external fisherman for commercial purposes and recreational fishing done by tourists are other categories of fisher done in the archipelago,

Increasing number of fisherman and intensive daily netting of the bay area is having negative impact on the fishing population and at the same time significant reduction of fishing yields.

The number of registered , seine nets increased from 49 in 1989 to 64 In 1999 (Ramsay,1995,pg 19 & Mackie, C.S et al,1999,p7)

Apparently there is no limit of the number of licences that may be issued for artisanal fishing. In addition to this, the law allows fisherman to operate throughout the whole years with open access to all areas. Fisherman from the vicinity Inhassoro and vilanculos moving their operations to bazaruto principal during the co-laborative closed fishing seasons from vilanculos and inassoro. At this time the fisherman move their operation to Bazariuto where the closed season is not applied

The principal market for fish products for bazaruto is located in mainland. Lack of conservation system (Freezing) on the area (normal fish are dried) and lack of regular transport to put fresh fish on the market, cause devaluation of islanders fish products compared with mainlander. Because of the free market system prevailing in Mozambique, commercial enterprises and vendors tend to fix low prices for the fisher resources, principal the small fishes. To compensate for the deficit the islanders tend to increase the netting activity, or to turn over to fish larger species often on the reefs

As a result of market demand, local, national and international, analysed data shows that over the last years a significant decreases in the quantity and the size of lobster - 400 tonnes were exported to Maputo in 1990, compared with 40 tones in 1994 (Ramsay, 1995, p40)

Sea cucumber in the archipelago has over-harvested during (1980-1990) the time were the product were fetching high value on the international market, and the import decreased highly in 1988/89. The selling of this resource has had negative terrestrial environmental consequences on the archipelago, thus the processing system (boiling and sun- dry) increased harvesting of forest for firewood.

Poor agricultural practices and lack of diversified employment opportunities for the islanders only 10% of the total population are employed by the tourism industry in the archipelago, lives the fisher activity as the only mean of subsistence for all community including women which their involvement in fishing activity are increasing.

Destructive fishing practices: In Bazaruto, destructive fishing practices are related to the use of small nets size, gill nets, fishing and bad boat anchoring in coral reefs, sea grass beds.

Seine netting is the most fishing method used by artisanal fisherman. Only one net can provide employment to about 6 to 12 persons .The nets are very rudimentary and small, with less than 1.5 cm stretch size, and a central bag and the cod end of the mesh reduced, thus, the nets are less selective, catches juveniles and sea grass with are important to future fish production and the environment

Several Fisherman justified that they use small mesh size first because of lack of means to acquire appropriate gears, and because the most fish available in the bay are small size fish (Ramsay, 1995, p 45) as the fish stocks became rare, the fisherman are induced to use more selective nets to obtained more catches.

Lack of capacity to distributing / or provide in a small price appropriate mesh size by the fisher and government limits the government to enforce or prohibiting the use of small nets,

Gill nets, normal set in the deep channels for fishing and trap shark for exportation of shark fins, are one of the most bad fishing method used in archipelago because they catch endangered species such as dugongs, turtles, and dolphins causing the high mortality. Other factors influence the mortality of this species are spread boats, sewage discharge and changing surface rainoff

Coral reefs degradation The existence of tourism in the archipelago and the adjacent mainland area (Vilanculos and Inhassoro is based on the existence of coral reefs, and beaches.. Day trips to the reefs are common and most drives come from mainland putting, high pressure on the coral reefs

Although the real impact of recreational tourism activities on the coral reefs are not well known the principal cause of reefs degradation are related to excessive diving, fishing, bad anchoring and angling by tourists

Human activities on the reefs (Line fishing, spear fishing, collection of shells and starfish and harvest of lobster l for commercial purposes are the other main cause of degradation of the reefs on the archipelago

As a National Park, Coral reefs on the archipelago, is protected areas, but they are being used as an open access resource, this is due to lack of capacity to control and enforcement

Natural reasons are also highly contributing to coral reefs degradation, monitoring system done on the reefs in 1999, founded that extensive crown- of thorns starfish (COTS) between 1995-1996 damaged the (Schleyer,etall,1999,p.10)

Mangrove cutting and Clearing of vegetation Part of natural terrestrial habitats of bazaruto archipelago has been changed , by human activities

The great part of the forest was damaged due to slash and burns for agricultural, Because the area presents soils of low fertility to guarantee basic productivity and income, the women use the system of crop rotation. Each year new areas of natural vegetation are slashed and burned to accumulate ash for fertililization, compensation for poor soil nutrients and irregular rains.

The housing and firewood by boat construction (naval carpentry), using is the most important cause of mangroves destruction,

Local forest is also important source of native fruits and medicinal plants for the local people, native palm trees are use by islanders to extract wine, make hats, baskets straws and house roof. People collect also grass and rush for housing on swamp,

Institutional issue: The National Park, is managed at the national level, by the National directorate of protected areas at the Ministry of Tourism The Ministry of Fishers continue to be responsibly for the development of the fishery sector. Licenses, monitoring and enforcement for artisanal fishing are done at the local level (Distrital) by the maritime delegation, For semi-industrial and industrial fishing are done at the National level by the Natural directorate of Fishers. The archipelago is also under the jurisdiction of Imhabane Province and two districts (Vilanculos and Inhassoro) with the population of the archipelago are serviced by. All this institutions are making decisions and undertaking their activities separately, without consulting the park authorities

Although, there is a specific legislative framework developed for the area (Management plan, Park legislation and a proposal for extension of Park boundaries), this legislation is not approved yet, resulting in poor buffering of the area, week application and enforcement of this existing legislation, and continued open access to resources

Maputo Bay - Matutuine

Domestic and industrial pollution The human population in the Maputo Bay and Matutuine area is high. Maputo city has about 989.400 inhabitants, Matola 440927 inhabitants (INE 2001). In Matutuine district, the most important villages which may impact to the Bay are Belavista, Salamanga and Zitundo which have about which in total contribute with 12000 inhabitants (DNFFB 1997), while an additional number within the Maputo Elephant Reserve the human population may consist of 1000 people (DNFFB 1997). At Ponta do Ouro; the Population is estimated to be around 2500 inhabitants.

The population of Maputo and Matola City, at the western shore of the Bay, increased from 0.6 to 1.2 million inhabitants between 1975 and 1992, without substantial improvement of sewage and solid wastes disposal facilities (Massinga and Hatton 1997), causing intense marine water microbial pollution along the western portion of the Bay (Fernandes *et al.*, 1996).

Industrial pollution associated to port operation and factories also affected the western portion of the Bay (Fernandes *et al.*, 1986). However, the level agriculture based chemical pollution of the Maputo Bay caused by washed pesticides and fertilizers along the course of the four international rivers which discharge in Maputo Bay is unknown.

Reduction of fish stocks and habitat degradation Maputo Bay the second most important fishing grounds of Mozambique. Here, the fishing effort in terms of gill net fishing boats attained its maximum number (430 boats) between 1985 and 1992 (Sousa 1985; Premegi 1995) and decreased to 136 boats in 1996 (Tomás 1996), while semi-industrial shrimp trawlers decreased from 23 in 1992 (Guissamulo 1993) to 18 vessels in 1995 (Massinga and Hatton 1997). Both records of catches on prawns reveal a 75% reduction from 800 tonnes in 1973 to 200 tonnes in 1995 (Massinga and Hatton 1997). These decreases represent an over-exploitation of the fishing stocks and environmental degradation in the Bay.

Seine netting for pelagic fishes is carried out off the west coast of Inhaca Island, the Catembe area (south of Maputo city) and off Xefina Island. The number of boats involved on this fishery decreased from 20 in 1995 to 12 in 1996 off Inhaca Island.

Uncontrolled tourism – degradation of reefs a wide variety of tourism takes place in the Maputo Bay and Matutuine area. High-class touristic infrastructures are located at Maputo city and Inhaca Island, while the coast of Matutuine district is dominated by low class tourism, based on diving, fishing and capping resorts. The number of tourists visiting this area is unknown, but it is estimated that Ponta de Ouro (the most popular tourist area along Matutuine coast receives 10000 – 13000 tourists per year of which 72% practices scuba diving (Bjerner & Johansson 2001). The impacts on the reef and terrestrial habitats are high. The level of diving is very high and results in intense reef damage, which on average means 69 corals broken every day. Because there are few reefs of good condition (Techobanine, Malongane and Ponta do Ouro), this intensity of damage is uncontained.

Fishing along the Matutuine coast is only practiced at shoreline using gill nets and its intensity is low. However, recreational fishing by tourists is very intense (Hatton *et al.* 1991) and few South African commercial companies have been reported to store large quantities of fish caught during recreational fishing, possibly causing a depletion of demersal fish stocks. In addition, poaching trawlers fish close inshore during the night and can damage both fish stocks associated with reefs and demersal fish as well, but their origin is unknown.

Mortality of intertidal fauna Driving along the beach is illegal, but a common practice, which has been killing intertidal fauna: crabs and turtle nests (Robertson *et al.* 1996). The lack of capacity (personnel and vehicles) to improve control of these activities contributes for the destruction of sandy beach fauna. Only one delegate from the maritime authority exists at Ponta do Ouro, while the beach is 120 km long. The intertidal edible fauna (mussels, red bait and oysters) have low density and have been exploited along all the rocky shores (Robertson *et al.* 1996). During turtle nesting season driving along the beach also pose mortality risks to nests and newborn turtles. However, nests of marine turtles are also destroyed for consumption of eggs during the nesting season. This has impacts on the survival of the turtle population along the coast of Matutuine district and Inhaca Island. However, at Inhaca Island, the Marine Biology Research Station has a protection program and it appears that the Maputo Special Reserve also implements a similar program for turtle protection.

In the Bay, collection of invertebrates is intense, along mangroves, sea grass meadows and intertidal mud flats. Species of commercial importance comprise mud crabs (*Scylla serrata*), sand oysters (*Pinctada capensis*) and mussels (*Macrta cuneata*, *Meretrix meretrix* and *Tellina* sp.), (Bento and Guissamulo 1998; De Boer et al 2000; De Boer and Longamane 1996). However, in Maputo Bay about 77 species of marine molluscs have been collected for human consumption, most around Inhaca Island (De Boer et al. 2000)

In Maputo Bay, the artisanal fishery and the collection of invertebrates support the subsistence of poor households. It is estimated that the Bay has 5010 fishermen and 2183 women who collect invertebrates (MICOA 1998).

Mangrove cutting The status of mangroves in Maputo Bay is diverse. The mean decrease of mangroves is 8%, because while intense cuttings of about 44% occurred close to Maputo City, there were also expansions of mangrove areas at Machangulo and Inhaca Islands (De Boer 2000). Along Maputo Bay and Incomati River, mangroves suffer from deforestation, by several activities, which include, conversion to a large aquaculture farm for shrimps, conversion to salt works and deforestation for wood. Nevertheless, at some areas where effective protection has been granted (Inhaca Island), mangrove forest cover experiences an increase and improvement of their status. The same applies to area which were isolated during the war (Northern border of Maputo Special Reserve and Machangulo Peninsula (De Boer 2000).

Coastal erosion Coastal erosion is taking place on open coast of Matutuine, and results from uncontrolled and unplanned human settlement taking place in terms of tourist resorts, removing dune vegetation. Areas such as Ponta do Ouro and Ponta Mamoli and Cabo Santa Maria are those which have intense coastal erosion (Hatton et al. 1994). Beach driving also contributes for that because of their impact on the primary dune system which usually stabilises the dune. The open coast of Inhaca Island also suffers the same process, but the reasons here are due to historical human settlement, which have already been removed, at Ponta Torres.

4.2 . National context

National Economic policy Since 1987 the Government of Mozambique has been implementing Economic Adjustment Program which include Economic and Social Reforms in order to stabilize financially the country and launch the economy in a sustainable way, through reduction of inflation and macro-economic disequilibria. The reduction of state intervention on the economy of the country and increasing participation of the private sector.

Therefore, there have been four main aspects in the program: the fiscal reform, the monetary policy, privatisation of state owned companies and development of sectorial policies. Agriculture is a priority sector because it is the sector involves the majority of Mozambican population. The proposed activities in the sector are: (i) development of rural extension, (ii) improvement of techniques for storage of harvested staple crops, (iii) increase of the domestic period of food security, (iv) the development of rural market through investments on facilities that attract the private sector on the trade of cereals and other crops and, (v) the provision of goods and production material.

The transport and communications sector is also priority because the movement of people and goods is essential for development. The proposed activities consist of a program for maintenance and rehabilitation of roads between cities, districts, villages and localities and from production sites to the markets. In the industry sector the government intention is to develop the processing of agriculture products in order to replace imported products and stimulate exports.

The Government also intends to recreate the fund for assistance of economic rehabilitation (FARE) for assistance and promotion of creation of national business through credits for small scale enterprises on agriculture, fisheries, small industries and rural shops.

However, the foreign debt is the major constraint to the action of the state in several areas, forcing the government to direct the scarce resources to debt payment. The civil war destroyed most economic infrastructures reducing the revenues for the government and the high foreign debt reduces the capacity of the government to direct resources into all sectors of economy.

Therefore, because of its sensitive position as a poor country and with the obligation to pay the its foreign debt, the Mozambique economy is very sensitive on the fluctuations on international prices of main export products (cotton, timber, fish and crustaceans) and imports (mainly oil) as well as of the strong foreign currencies (US Dollar, SA Rand).

Currently, the world economy appears to be receding will also have strong impact on the Mozambique economic situation. Of particular importance is the fact that 60% of the state budget is financed by external donors, which are likely to influence therefore, the policy making decisions and also the sectors were the government may pay attention on their development strategy.

Population The population of Mozambique in 1997 was 157.2 million inhabitants and the estimated growth rate is 2.35% (INE 2001) of which 4.6 million live at coastal districts, and their density differ between districts and the largest concentrations are located at coastal cities and few other coastal districts (Moma, Manganja da Costa and Angoche) which have each more than 220 thousand inhabitants.

Poverty and the Poverty alleviation plan The majority of Mozambican population is illiterate and unemployed. It is estimated that between 1996-1997, over 60% of people in Mozambique lived on absolute poverty, which means hunger, illiteracy, lack of access to basic education, to drinking water, to minimum health facilities and to housing. The incidence of poverty is higher on rural areas (71%) compared to urban areas (62%), and regionally in the country it is severe in central region of the country compared to south and northern regions, but also between provinces which are close to the marine ecosystem.

The determinants of poverty in Mozambique are:

- Slow economic growth up the beginning of the 1990's;
- Poor education level of members of households of economically active age; specially among women;
- High rates of dependency in the households;
- Lower productivity of family farming;
- Lack of opportunity for employment inside and outside the agricultural sector;
- Poor development of infrastructure in the rural areas

The government has launched an Interim Poverty reduction Strategy paper (PRSP) which incorporates the Action Plan for the reduction of absolute poverty (PARPA). The goal is to reduce the current level of poverty of 70% to 50% in the next 10 years, with an intermediate level of 60% by the year 2004.

The specific objectives for the five years (2000-2004) consists at launching an integrated and coordinated program aimed at eradicating absolute poverty with the following specific objectives:

- Guarantee access to all children to primary education, with emphasis to rural areas and reduction of gender disparities in admission and school performance. Current enrollment rates will be improved through construction of new classrooms and training and recruitment of teachers.
- Promotion and improvement of provision of good quality and sustainable health care for the population.
- Integration of the most disadvantaged social strata into the development process
- Expansion of production capacity and improve productivity in the area of agriculture and fisheries, based on the development of small and medium producers.
- Improve the infrastructure network, access to clean water, housing and safe and sustainable energy sources and to communications

Therefore, because the program is still at its initial point, it is unlikely that it will reduce strongly the impact on biodiversity loss, as only as a long term objective it will be expected that people change their pattern of utilization of natural resources.

Commercial and Subsistence activities in the coastal zone The subsistence agriculture is the dominant activity along the coast of Mozambique, being practiced by 80% of the human population. The staple food crops at coastal areas consist of maize, cassava, beans (at dry areas), and rice (at wetlands) while sugar cane, copra and cashew-nuts comprise bulk of cash crops (MICOA and UICN 1998). The subsistence agriculture use rudimentary production techniques, it consists of consociation of crops and is often associated with small scale livestock production (sheep, goats, cattle and fowls), directed to self consumption and sale of surplus. However, the soils from coastal areas suffer an intensive utilization of soils which causes the loss of the low soil fertility, because of the poor agriculture techniques, limited fallow period, intense pressure on forestry resources including mangroves for firewood and building material, low maintenance capacity of irrigation and drainage systems (MICOA and IUCN 1998).

Small scale fisheries (artisanal) are secondary subsistence activity of the population at coastal districts, directed to exploitation of marine resources and during years of drought and hunger it becomes the alternative subsistence activity. It is an important source of income, employment, protein and settlement of population. Very traditional fishing techniques and gear are used (hand line, fish traps –gamboas, surface and bottom set gill nets, shark gill nets, fish traps for fish and crabs, seine nets, and spear fishing).

The fishing sector employs 104,636 fishermen distributed along 787 coastal fishing centers of which 61,037 use boats, 20,876 operates without boats and 22,723 are involved on the collection of invertebrates at intertidal areas (MICOA and UICN 1998). The number of boats recorded is 12,740 of which only 3 to 5% are motorised. The level of production is estimated between 80,000-90,000 tonnes per year, contributing to 60% of catches of the fishery sector (MICOA and UICN 1998).

The commercial fishery is operating in the country since 1965. There are currently 48 fishing companies with a fleet of 135 vessels of which 57 target on prawns, 44 tuna seine netters and 20 deep sea shrimp, 6 operating with bait-fish and two targeting on lobsters. The whole sector employs 5000 fishermen and the yield is of 70 million dollars (MICOA and UICN 1998).

The semi- industrial fishery is concentrated to Maputo and Beira, consisting of 70 companies with 47 shrimp trawlers, 25 boats practicing hand line and two using nets (MICOA and UICN 1998).

Tourism The tourism in coastal zone of Mozambique is very recent and was interrupted between 1976-1986. Since 1986 the government created incentive for the development of tourism through the creation of Tourism National Fund and by approving the National Policy for Tourism and Tourism Master Plans for several areas of the Mozambique coast. From 617 beds available in 1987, in 1988 the sector had in 1998, 5317 beds and it was estimated that by 2000 more 2000 beds would be available (MICOA and UICN 1998). Likewise tourists increased from 136 000 in 1994 to 550 000 in 1996, most from South Africa and Zimbabwe, most visiting the coastal zone. Tourism development is high south of Save River that comprises 73% of total accommodations. (MICOA and UICN 1998). The State has put a great emphasis on tourism development, by creating a ministry of tourism.

The state strategy for the development of coastal tourism is to promote investment of high quality, low impact tourism, to maximize the income. However, the pressure from neighboring countries (South Africa and Zimbabwe) and the lack of infrastructure along the coast have resulted in an influx of massive number of tourists with low medium income, resulting on the proliferation of low quality infrastructure along most of the southern coast of Mozambique.

Lack of human and logistic resources for law enforcement and inspection and corruption.

The change from the state monopolized economic and administrative system to the free market economy, led the country to alter its management systems. The process of administrative reform has initiated, but the country lacks human and material resources for a better law enforcement and control of illegal activities. Despite the initiation of the decentralization of the administrative process, most impacts on the use of resources take place at the level of administrative post, while managing and law enforcement capacity is only represented at the central, provincial and district levels (Hatton 2000). For instance, at the coastal areas, the fishery officials are represented at provincial level, maritime authorities have delegates down to district level, forest and wildlife are seldom represented at the district and administrative post level, tourism and environmental coordination are only represented at provincial level (Hatton 2000). All these sectors face serious logistic constraint, reducing their capacity to enforce law and control illegal activities. Tello et al. (1994) report references to a whole range of violations to laws and regulations which did not find a prompt response from the responsible state entities at Zambezi Delta. This therefore, contributes to the loss of biodiversity.

The concession of the licenses for exploitation of timber constitutes a national dilemma in the sustainable use of forest resources. Consider the following example which is to some extent illustrative. In an interview (1997) with a State official, in the District of Búzi, we have asked him about the timber potential in the district, to which he answered he did not know. However it was the same servant who was responsible for opining on the process of the concession of licenses at the provincial government level.

However, after the General Peace Agreement (1992) it was noticed, and it's still noticed, that the State officials were taking advantage of the previous situation created by the war. They did a little regarding their tasks of controlling and they allowed themselves to be bribed by the timber merchants in the control posts.

It is undeniable the fact that the Civil War (1979-1992) contributed to weaken the state capacity to intervene in the rural areas, specially on the timber merchants activities and in the movement of populations in the villages and cities.

Legal aspects of environmental management at Coastal zones.

The environmental legislation in Mozambique is new and inadequate for the current realities facing the coastal and marine resources of Mozambique. In 1995 the National Environmental Management Programme was approved. Since 1997 a number of laws environmental legislation has been approved. The Framework Environmental Law, the new Land Law, which recognizes the need to protect ecologically sensitive areas and to create protected areas, and the right of local communities over land and natural resources, thereby offering the possibility of involving rural communities in the management and conservation of natural resources. The new forestry and wildlife policy and strategy was adopted and recognizes the role of private sector and local communities in the management of protected areas and in 1999 the new Wildlife and Forestry Law was passed (Hatton 2000).

Despite an interest for developed by the government in adoption of legislation and policies for the environment, this is still a secondary topic and the sustainable use of environment is still not seen as an important fact for the development of the country. The emphasis on conservation of marine natural resources have not yet become a priority, except for few resources, such as shrimp, which have are commercially important, contributing to generation of foreign currency. Nevertheless, the government is promoting decentralization across provincial, district and municipal levels. This process is gradual, because the of current weak human resource capacity. Mozambique needs to embark upon a human resource development strategy in parallel with institutional strengthening and the rehabilitation of infrastructures and services (Hatton 2000). The inadequate practices constitute a national problem. Although the Government is making efforts in the interaction with the communities, through the extension work, agriculture practices with negative impacts on the forests and soil erosion are still common.

The sedimentation is also linked to deforestation. It gains the status of national cause as its linked to the effect of the Cahora Bassa dam. The absence of an environmental impact study for the 12nd major dam in the world (the Cahora Bassa) constitutes effectively a national problem.

There has also been an overlap of competences between the government bodies on the area of marine resource management. For instance the Ministry of Fisheries and the Ministry of Transport and Communications (through Services for Maritime Administration and Inspection –SAFMAR) share the control of activities within coastal areas and in addition, the Ministries of Tourism and of Agriculture and Rural Development also have a strong position on marine conservation areas (Hatton 2000). Therefore, this creates a situation where different institutions involved on law enforcement, resulting in conflicts regarding to law enforcement (Sosovele 2000).

4.3 . International Context

Mozambique attained its independence in 1975 and between 1975 and 1989, adopted a Socialist Political System, based on a state centralized and monopolized economy. At the time Rhodesia and South Africa supported a civil destabilization war, fearing the expansion of communism to their countries. This war destroyed the Mozambique economy. However, after independence, the most qualified people were Portuguese citizens who flee the country and therefore Mozambique had lack of adequately trained human resources. In 1985 Mozambique joined the World Bank and Monetary International Fund and in 1987 initiated a Macro-economic Structural Adjustment

Program, adopting a free market economy, which emphasize the role of the private sector in the economy, leaving the state with the regulating activities.

However, during the previous period the country had accumulated a very high foreign debit , which had to be negotiated with all bilateral and multilateral partners. As a result the country has been paying its debt, but because of the low income and lack of efficient money generation infrastructures (industry and services), it relies on agriculture and other natural resources to generate revenues through exports and services (The Economist Intelligence Unit 2001). The main exports of Mozambique consist of fish and crustaceans, timber, cotton, electricity and minerals (The Economist Intelligence Unit 2001).

The collapse of the socialist system world wide and the adoption of economic structural adjustment program controlled by the Monetary International Fund exposed Mozambique to international markets (Sosovele 2000). In addition, economic resolutions from the World Trade Organisation and other multilateral economic institutions effects the country. Of particular importance for the economy of Mozambique is the creation of conditions to attract and protect the direct foreign investment.

Mozambique is also a member of a regional economic organization SADC – Southern Africa Development Community - and this has been increasingly influencing the economy of the country – for instance Mozambique has been under pressure to remove custom taxes on importation for goods produced in the region. However, the fiscal system of the country still relies on revenues from the custom taxation system. South Africa is the largest supplier of goods to Mozambique and the main investor and, therefore, the implementation of the free trade agreement between SADC countries will create a large reduction on funds for the state budget, because the trade and services are the major activities in terms of volume (The Economist Intelligence Unit 2001).

The demand of fish and crustaceans for Spain, Japan and South African markets and in the past to Soviet Union has resulted in an intense exploitation of fishing resources, mostly shrimps and lobsters by joint venture companies established between Mozambique companies, but using fleet from foreign countries. Japan and the European Union have negotiated with the government the exploitation of further resources in exchange of further economic assistance for research in the fishing sector (The Economist Intelligence Unit 2001).

Some other marine resources such as shells, shark fins and sea-cucumbers are demanded by some international markets. The market for shells is located in Europe (Portugal and Holland) , while the market for shark fins and sea cucumbers is also high demanding for South Africa and Tanzania which in turn export these products to Asiatic markets, where they are viewed as delicacies.

The international market for hardwoods has increased and poses a pressure on timber resources of the country (The Economist Intelligence Unit 2001). The high demand of the timber in the international market leads to the country deforestation. In fact, coal, fire wood and timber from Mozambique are very appreciated by many countries.

In addition the country has to rely on foreign private investments for development, but the bureaucratic system in place to register a company is still a barrier against investments (The Economist Intelligence Unit 2001).

World wide tourism has become a very important economic activity and east and southern Africa have been one of the world tourism destination for game viewing and the recent trend also appoints to the development of cultural and marine based tourism. Although Mozambique has not benefited from this, in the during the socialist regime, it has become an has been an increasing opportunity for Mozambique because it also offers. The country was traditionally a tourist destination for South African and Zimbabwean tourists. Currently, Mozambique has been a destination for tourists from these countries and from Portugal (The Economist Intelligence Unit 2001). Countries around Mozambique has a large number of tourists and therefore, Mozambique suffer the high demand from this. Nevertheless, only Maputo City has the capacity to absorbs large number of tourists. In addition, since the end of apartheid, Southern Africa attracts the interest of large capital intensive investments (industries), promoted by the government incentives through the establishment of industrial duty free zones along the coast.

5. Conclusions

The study shows that all four sites are experiencing loss of biodiversity of marine and terrestrial habitats. There are large differences in terms of development of the areas: Quirimba Archipelago and Zambezi Delta are the least developed, Bazaruto Archipelago is intermediate because of existing tourist infrastructures while Maputo Bay- Matutuine represents the most developed area of Mozambique. Nevertheless, Even in Maputo Bay- Matutuine areas, there are extreme differences in terms of degree of development, where Maputo City is highly developed, while Inhaca and Matutuine have development level comparable to that of Bazaruto Archipelago.

Socio-economic causes of biodiversity loss are linked to the poverty of the human population at all sites, which make people rely on the exploitation of fishing resources and marine invertebrates for subsistence. Therefore, overfishing, overhunting, overexploitation of invertebrates, mangroves vegetation and coastal forests are important issues promoted by the lack of alternative forms of income generation. Most people in the country, at these sites live at absolute poverty.

The impact of the economic structural adjustment program initiated in 1987 was very strong, because most had to adapt to a very competitive form of life.

The government have passed several legislation (land law, framework environmental law, forestry and wildlife law and fisheries law) to regulate the use of the environment between 1990- 1999 and recognized the role of the local communities in the management of natural resources. However, the illiteracy of most people, and the lack of capacity for law enforcement and control in terms of human and logistic resources at local level (districts and administrative posts) are the driving forces toward lack of actions to halt violations in the exploitation of resources. However, at Provincial and National levels corruption is also taking place allowing the exploitation of resources.

There are also a number small and large investments taking place at remote areas of the country which lack the necessary environmental studies. Of particular significance is the development of commercial agriculture upstream which impact on marine pollution, the construction of salt works and shrimp aquaculture plants at Maputo Bay- Matutuine and Zambezi Delta, that causes loss of mangrove areas. International and national causes are linked with already in place infrastructures like the Cabora Bassa Dam, which represents an important asset for the development of Mozambique through production and supply of electricity. It was built at the time without the necessary studies to mitigate negative effects of downstream changes of hydrology caused by water regulation. Now, mangrove areas, bird and mammal populations and commercial shrimp stocks have decreased. Maputo Bay is one of the areas suffering a high fishing effort from commercial and artisanal fisheries, but all other sites (Quirimbas and Bazaruto Archipelagos, Zambezi Delta, at Mopeia and Chinde) are also affected by intense fishing by subsistence fishermen, which contribute to habitat degradation. The management actions in place are unable to control the depredation of fishing resources. These fisheries use destructive fishing methods, which range from use of dynamite at northern Quirimbas which damage the coral reefs supplied by Tanzanians traders, to the use of gill nets which by-catch sharks and marine mammals (dolphins and dugongs). An additional fishing method, using of small mesh size seine nets (at Quirimbas, Bazaruto and Maputo Bay - Matutuine) also causes high damage and loss of biodiversity at the seagrass beds.

Mozambique has a great potential for coastal tourism and the government sees this as an opportunity for income generation and job creation. However, at Maputo Bay- Matutuine area and Bazaruto Archipelago, tourism does employ few people from local communities because they lack the necessary skills and training and therefore, more people immigrate to the area increasing pressure on the natural resources. The uncontrolled tourism growth in areas with low capacity of law enforcement (Maputo Bay – Matutuine) is destructive for some components of the marine ecosystem. High intensity of dives, lack of code of conduct and beach driving is contributing to the

destruction of coral the reefs and sandy beaches at Matutuine. The collection of shells for exports and for sale as souvenirs has also a high-localized impact on the biological diversity of high tourism areas.

As the economy of the country depends on the exports of natural resources it is sensitive to demand and prices international markets. The fluctuation of prices of exports and the international market demands has a large influence on the level of exploitation of marine resources. Regional markets demands of commercial (sea cucumbers) and apparently non-commercial marine products (bivalves) contribute for the high depredation of marine resources.

In conclusion, the driving forces for the loss of biodiversity in Mozambique are the poverty of human population which is aggravated by the adoption of the economic structural adjustment program by the government. Through this program the country has been directing its financial resources to pay the foreign debt at expenses of development actions and upgrading of capacity of institutions involved on law enforcement.

However, several activities at the coastal zone have not been adequately controlled because of lack of and existing inadequate legislation and policies for economic activities at coastal zones and also linked to inland development which impact the coastal zones.

6. Recommendations

6.1 Local causes

Create Alternative Means of Subsistence

Investments must be made/promoted to provide of alternative economic activities either based on natural resources utilization which are compatible with biodiversity conservation. Several possibilities are listed and must be conducted after feasibility studies and discussion with local human communities in each site, as follows:

Fishing and harvesting of marine resources

- Introduction of new technologies to improve productivity based on the potential of the marine resources which are currently over exploited, such as , Fish farming, artificial breeding of sand oyster (Bazaruto), octopus fishing (Quirimbas), etc
- Encourage artisanal fisherman to use sustainable fishing methods through assistance in acquisition of compatible suitable gear, through micro-credit projects. (for example, use of line fishing to target highly valued fish to increase the income).
- Upgrade the fish processing methods to improve the quality of marine resources products sold at local, external and export markets
- Where is possible, revitalize the use of sustainable traditional methods of fishing and harvesting marine resources like, taboos, natural closed seasons, a traditional method for limitation of catch (ex: sand oyster using traditional baskets made from ilala palm).
- Create development opportunities (communication network, commercial agriculture, animal husbanding) at mainland (Bazaruto, Quirimbas) in order to promote migration of people from the islands and, reduce pressure on the resources, improve the competitiveness for market (to the benefit of locals)

Tourism

Most of the economic and financial revenue provided by tourism development in all sites are leaking out of the country and to the central government in Mozambique. Benefits to the focal areas and local communities is currently very low. Diversified economic income generation activities linked to tourism industry can be implemented:

- **Employment:** encourage tourism operators at Maputo Bay- Matutuine and Bazaruto to train local inhabitants to achieve the requirements to be contracted as employees, in order to generate income and reduce the current high degree of mobility and settlement of non-resident community to these sensitive conservation sites. Training must be directed to improve skills for provision of tourism services at hotels, lodges and campsites; as tourist guides (nature walks, drives) , management of community owned tourism business, etc
- Establish a revenue -sharing system to local community. This is a currently strategy used at protected areas and community based natural resources projects aiming at integrate community development and biodiversity conservation in Mozambique (pilot experiments have been implemented at Bazaruto, Tchuma-tchato, etc). These must be legitated. Emphasis should be given to lobbying at the central government level to create and /or approve legislation to allow that these revenues are directly canalized to local communities.

At the same time, empower and strengthen local communities to understand the link between the revenue sharing system and their active contribution to biodiversity conservation.

- Hand crafts making, using synthetic products - Many people are already doing this activity (Bazaruto, Maputo Bay, jewellery making, Quirimbas) as an additional activity for income- Training could be provided to help them acquire techniques to work synthetic material and sophisticated crafts skills to target the tourism market.

Deforestation and Agriculture

- Current agriculture practices at all sites yield very low returns and the habitats continue to be destroyed for food, building materials and for household subsistence. Introduction of new technologies to improve productivity and reduce the amount and rate of conversion of forests to cultivated land should be developed. Where possible people must be involved in restoration of vegetation. Selected areas must be identified for planting and cultivation of native/exotic fast growing trees to cope with the demand of firewood and building material, etc

Food delicacies – large marine vertebrate species captured as by-catch Dugongs, sea turtles and dolphins are captured as by-catch, but the populations have learned value their meat as food delicacies. Therefore, it is necessary to:

- Alter of legislation and enforcement of administrative measures to ban and regulate the use of fishing gear that is likely to catch these animals
- Educate the local population and fishermen through awareness campaigns where these animals can be used as flagships for conservation
- Stimulate the development of eco-tourism based on sightings of these species
- Involve local communities on conservation actions and sustainable utilization of the species
- Improve law enforcement measures and capacity for control of these species at local level

Local Market demand

Demand for environmental key species:

- Information and awareness should be provided to tourists to avoid buying corals, shells, starfish and other ecosystem species which are often captured and processed by local communities to sell as curios.

Demand for economic species (Foreign and local market)

- Fishing management measures should be enforced and local government authorities and community authorities should be involved in enforcement and control of exploitation activities.
- Limitation of licenses and fixation of quotas for all fishing sectors (both industrial and artisanal is necessary) are necessary. It is also necessary to bind the licenses to proper fishing site to reduce mobility of fishermen to high productive areas creating local over-exploitation.
- Species of apparent low economic value should also be managed

Unplanned licensing of salt work industries on mangroves

- The government must conduct environmental feasibility studies for development of small and large-scale salt works.

- The government must formulate integrated management plans and donation for different activities at mangrove areas to mitigate biodiversity loss.
- Consult management and scientific institutions prior to licensing of any salt work plant and make the plan available to all stakeholders (government at different levels)

High tourism demand and corruption

- Empower local and provincial institutions to stop development of tourism.
- Promote regular inspections of tourist infrastructures
- Improve the working conditions of the government officials
- Stimulate denounces of cases of corruption and prosecute violators
- Create special bodies consisting of communities and government and independent NGO's to investigate and deal with denounced cases of corruption in the tourist sector
- Stimulate all informal operators to register and upgrade their tourism infrastructures to embark on officially approved developments considering the local spatial development plan and activities allowed.
- Initiate studies to determine the carrying capacity of tourist infrastructures and activities at all relevant sites
- Develop spatial plans of development of tourist infrastructures at local levels
- Develop and publicize codes of conduct for coastal tourist activities.
- Improve road access between tourist areas along the coast.

Hunting of wildlife for traditional use (Traditional beliefs)

- Formulate and initiate awareness actions to local communities of the status of wildlife resources and negotiate measures to reduce their extinction.
- Develop co-management of resources (wildlife and other) with local human communities/ community authorities) and negotiate quotas to limit decimation of wildlife, but allowing the traditional actions to take place.
- Negotiate with communities through community authorities temporary suspension of use of wildlife to allow for recovery.

6.2 National causes

Open and free access to artisanal fishing and invertebrates

- Revise the fisheries, forestry and wildlife laws to allow the management of all fishing resources;
- Develop awareness actions to fishermen and local communities on the ownership and status of resources and the need of sustainable exploitation of resources
- Introduce and disseminate management actions such as limitation of licenses, fishing effort (days and closed season), mesh size, minimum allowed size, maximum number and spatial concentration of effort
- Introduce the need of payment of licenses for exploitation of all resources with commercial importance.
- Re-define the term subsistence fishermen and the kind of products that he is allowed to exploit
- Empower (training, authority) local administrative and community authorities to manage access to resources by local humans communities and develop management actions
- Charge penalties for violation of laws regarding protected species and protected areas
- Continue a process of creating new marine protected areas (Quirimbas) and create marine protected areas network.

Develop capacity to influence river/dams management

- Develop at watershed, committees involving all interested stakeholders (scientific communities, institutions, communities authorities) to discuss and achieve agreement on the water requirement and quality
- The government must stimulate and take actions/ produce legislation to ensure that river management actions are fully made to the benefit of all interested parties

Develop Incentives for rural development

- Rural development should be incentivated through financial and technical assistance to local communities for job creation and diversification of sources of income and reduce pressure on coastal vegetation
- Develop clear policies promoting the development agencies and private sector to establish at selected areas away from coastal areas, through fiscal incentives.
- Develop basic infrastructures (roads, shops, schools) at areas rural areas with potential to improve agriculture and identify markets for the products to alleviate pressure along the coast.

Create Alternative energy resources

- Clean sources of energy (gas and electricity, solar energy) should be provided at subsidized costs for the poor households living in the coastal areas
- Energy saving technologies must be disseminated to improve the efficient use of firewood and charcoal and reduce the rate of deforestation
- Where appropriate, measures to control or ban trade of charcoal and firewood to the cities must be adopted, while creating alternative sources of income for rural communities and disseminating the use of alternative supply of energy at cities.

Strengthen capacity for control and management of tourism, development at sensible areas and fisheries.

- Local administration and community authorities must be involved in the planning of the spatial development, awareness about the legislation and training on management of natural resources.
- Local administration and community authorities must be empowered to enforce laws and regulations.
- Co-management systems of fishing resources must be established to assure community involvement on decision-making and improved management of resources.
- The state must continue the process of decentralization of administration to empower the local authorities.

6.3 International causes

International demand for tourism

- The government must benefit from opportunity of tourism demand to promote sustained development of the tourism sector and monitor the impact of tourism demand to coastal areas.
- The government must develop detailed zonation and plan the carrying capacity of the areas for different tourist activities and license only allowed activities.
- The government must expand the law enforcement and monitoring process of the impact of current tourist practices and produce legislation and regulations to cope with any negative activities

- Immediate actions such as awareness and ban of unauthorized activities and destruction of illegal functioning tourist infrastructures must take place to stop degradation of environment.

High costs of introduction of new technologies and alternative products (mangrove loss and deforestation)

- The government must promote innovations to find alternative technologies to produce low cost products.
- The government must promote transfer of technology and the search of cheap markets for purchase of technologic products to face the problem of high costs of environmentally sound technologies.

Develop international agreements on water management and quality at Zambezi River

- The government must support studies and compile information regarding the water requirements and quality for the economic activities and habitat conservation of the ecosystems
- The government must set a goal to of achieving agreements with neighbouring countries upstream the Zambezi River regarding water flow and quality management through the appropriate water affairs institution.

6.4 Motivations

Economic adjustment program

The structural adjustment program is having high impact on the poor people who seek for subsistence by any means. Therefore, the following is recommended:

- The government should develop a parallel program to alleviate the impact of the system on the poorest people;
- The government must negotiate with multi-lateral organizations (world bank and Monetary international fund) the alleviation of the foreign debt of the country for allow the State to invest those funds for alleviation of poverty, for job creation and promotion of income generation which will increase the lifestyle of the poor communities living at the coastal areas;
- The government must seek support at the international community and promote private investment to offer job opportunities and diversification of income generation away from exploitation of resources;
- Attention must be given to the social status of poor human community inhabiting coastal areas by the government and development organizations to ensure that the natural resources and the potential
- International and local government organizations must develop lobbying policies at the international multi-lateral financial organizations to develop new policies regarding the structural adjustment programs in order to reduce their impact on poverty of the population.

Establish adequate policies and laws regarding to fishing resources, tourism and coastal zone management

- Compile data on law violations, gaps and problems regarding the marine resources utilization and identify problems in the legislation, which prevent mitigation actions to be carried out.
- Policies and laws regarding to exploitation of natural resources and to uncontrolled fishing and tourism at the coastal zone must be continuously revised to include identify new problems and gaps (international and local).
- Conservation based -organizations must develop actions to assist the government identify the necessary gaps and situations which may require revision of legislation.

Qualified human resources and institutional capacity

- Empower community authorities to carry out enforcement activities
- Establish collaborative management systems involving government, private sector, resource user groups and local communities
- Strengthen the awareness of community authorities on law and enforcement, sustainable resource use, protected species and habitats
- Continue the process of financial and administrative decentralization to empower the local authorities
- Train existing law enforcement officials and increase the human resources at law enforcement institutions

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