

MNAZI BAY RUVUMA ESTUARY MARINE PARK

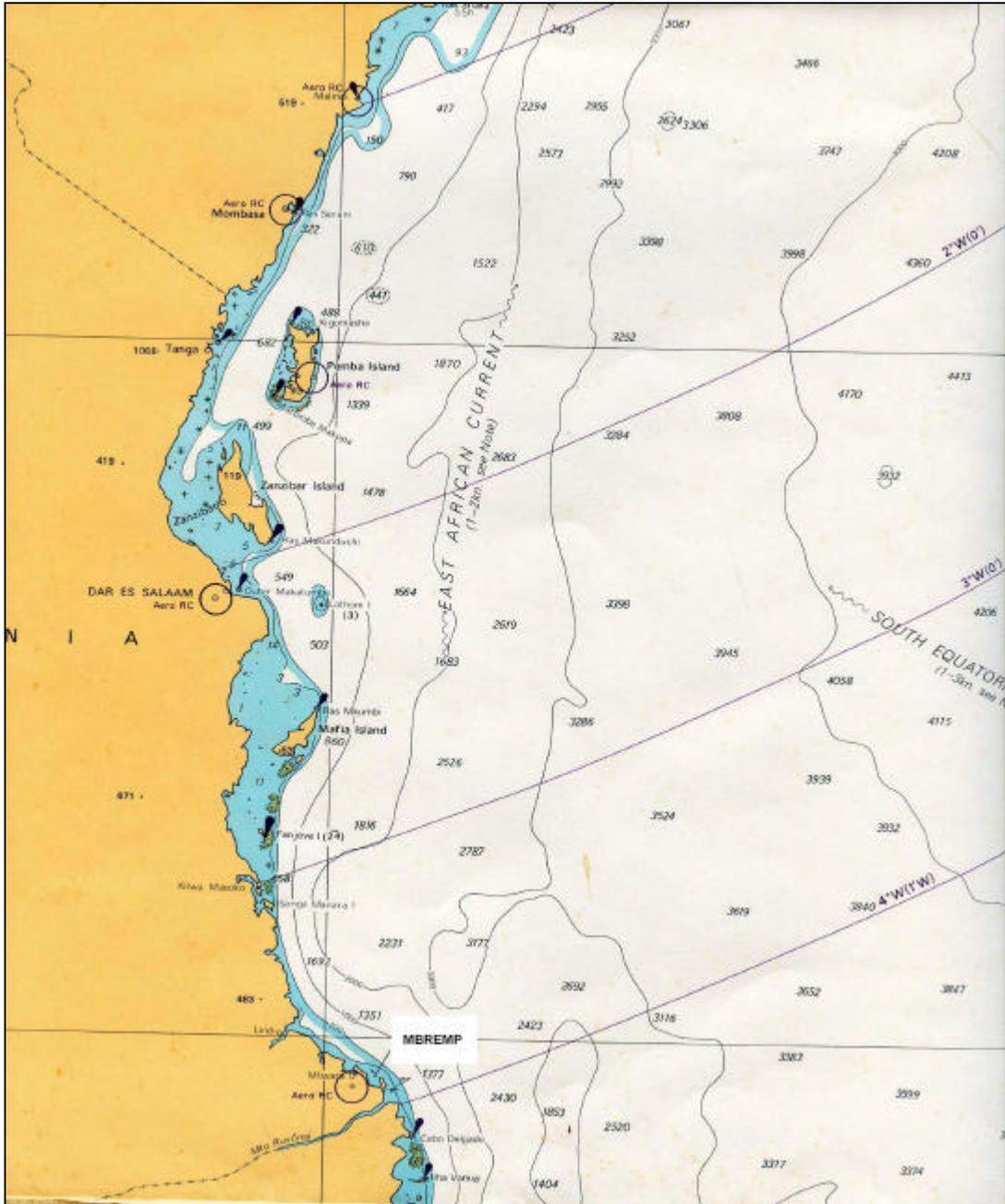
DRAFT GENERAL MANAGEMENT PLAN



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DRAFT



Map 1. Admiralty Chart showing the location of Mnazi Bay-Ruvuma Estuary Marine Park

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Chapter 1. Introduction

This chapter briefly introduces the purpose of the management plan, its intended audience, a short history of the development of the Mnazi Bay Ruvuma Estuary Marine Park to date, and the objectives of the Park.

1.1. Why a General Management Plan

This General Management Plan (GMP) aims to provide a framework for managing the Mnazi Bay Ruvuma Estuary Marine Park (MBREMP) over the next two years. In essence, it represents a form of contract between the authorities in charge of the management of the Park, the Warden in Charge and the Marine Parks and Reserve Unit (MPRU) on the one hand, and the communities that will be impacted by the management of the Park on the other. This GMP sets out the means and mechanisms for the conservation of marine biodiversity and the sustainable management of human activities in MBREMP. To this end, it contains management goals, with specified targets and objectives, and the appropriate management strategies that will achieve these goals.

The Marine Parks and Reserve Act No. 29 of 1994 provides that a Management Plan adopted after a Marine Park has been designated should include the following:

- a) A full description of the nature and location of the Marine Park;
- b) A description of the biological, environmental, geologic and cultural resources of the area, and use of the area by local residents;
- c) Detailed statements of its proposed objectives;
- d) A detailed account of the means and methods by which those objectives will be harmonized and carried out, including proposed activities, development and zoning;
- e) Description of local resident users, and other elements which distinguish between classes and categories to the which the descriptions apply; and
- f) Description of buffer zones surrounding a marine park, which may include terrestrial areas, tideland waters, submerged land, airspace and sub-soil.¹

The content of this management plan is the result of the process that was followed in its development. In many respects, the process that led to the development of this GMP is just as important as its contents, in that the stakeholders in the Park will be expected to play a key role in the actual management of the Park, particularly through their use of marine natural resources therein (see historical development of MBREMP, below).

1.2. Target Audience of the General Management Plan

The implementation of this GMP can only succeed if it is carried out by all the parties involved, including:

¹ By law, the buffer zone is defined as “an area of 800 meters outside and adjacent to a marine park boundary that serves as a cushion against impacts from activities outside the marine park.”

- The local communities impacted – it is imperative that a Kiswahili version of this Plan be prepared, widely distributed and explained in great detail;
- The Marine Park staff in Mtwara and anywhere they may be posted in the Park
- Other government staff involved in the management of marine parks in Tanzania
- Government staff involved in the broader field of natural resources management, including, but not limited to staff from the Fisheries Department and Forestry Department
- Investors who may have an interest in developing economic activities in MBREMP and in the buffer zone adjacent to the Park (including fisheries operators and tourism developers)
- Researchers, scientists and other technical experts working in related fields
- Other managers involved in marine protected areas in East Africa and around the world, including members of IUCN's World Commission on Protected Areas
- This GMP should also be made available to government staff in Mozambique who manage activities that may have a direct impact on MBREMP, particularly in the area immediately south of the Ruvuma Estuary.

1.3. Historical Development of the Mnazi Bay Ruvuma Estuary Marine Park

The area that is now Mnazi Bay Ruvuma Estuary Marine Park (MREMP, Map 2) was first identified as a priority area for the conservation of global marine biodiversity in a report published by IUCN – The World Conservation Union and the World Bank in 1995 (A Global Representative System of Marine Protected Areas, GBRMPA/World Bank/IUCN, 1995). Soon thereafter, the Government of Tanzania followed the recommendations of that report by identifying Mnazi Bay – Ruvuma Estuary as a priority for Marine Park designation. The preliminary social and environmental assessments carried out prior to gazettment (with a World Bank/GEF supported Block B PDF grant) showed that the area supports a complex and diverse system of coral reefs, mangroves and seagrass beds (Muhando *et al*, 1999). The assessments also showed that the communities living in the area, numbering almost 30,000, are economically poor and rely primarily on fishing and subsistence agriculture for their livelihoods.

A series of consultations were organised with the communities, which showed that there was general support for an initiative that would improve the condition of the resource base on which they depend. These consultations led to the adoption of the “Mtwara Resolution on Mnazi Bay – Ruvuma Estuary Marine Park” in April 1999, in which local communities (from 12 villages and five sub-villages) in the proposed park area, along with representatives from District, Regional and National level government, the private sector and non-governmental organisations, agreed to the designation of the area as a Marine Park. In July 2000, MBREMP was gazetted as a Marine Park, the second in

Tanzania after Mafia Island Marine Park (Government Notice No. 285, published on 4/8/2000).

The development of the Marine Park is being assisted through a UNDP/GEF and FFEM funded project, which was initiated by UNEP/GEF and FFEM in 2002 in order to assist the Government of Tanzania in "conserving a representative example of internationally significant and threatened marine biodiversity", with a parallel objective to "enable local and government stakeholders to protect effectively and utilise sustainably marine biodiversity and resources of the MBREMP". One of the main objectives of the project is thus to reduce pressure on the marine environment in order to achieve sustainable utilisation of the marine resources and conservation of the marine biodiversity (UNDP/GEF, 2000). The project is a partnership between the Marine Parks Reserve Unit (MPRU) of the Ministry of Fisheries, IUCN – The World Conservation Union, UNDP/GEF and FFEM (Fonds Français pour l'Environnement Mondial).

A series of biodiversity assessments of different habitats were carried out to establish baseline knowledge on mangroves, corals, intertidal areas and sea grasses and status of the marine resources. A socio-economic assessment was also carried out to establish an understanding of the social and economic context within which people living in the Park use and/or impact these marine resources. These assessments contribute to inform the development of the GMP, particularly a zoning plan and other conservation strategies.

With the understanding that the legitimacy of the GMP would be based on its development through close collaboration with the Marine Park's numerous stakeholders, two principal mechanisms for stakeholder input to the GMP were used: a village based environmental planning process to develop village based environmental action plans; and a series of consultative workshops for stakeholders. As a result of this process, ten villages have drafted environmental management plans (VEMPs) comprising natural resource profiles, zoning, byelaws, management systems/modus operandi, main aims, action plans monitoring and evaluation systems. These VEMPs will be incorporated and form the keystone of the GMP.

Finally, two stakeholder workshops were held in Mtwara to solicit the input of all the stakeholders impacted by the adoption of the GMP, a technical workshop on December 16 and 17, 2004, and a feedback workshop, where the first draft of the GMP was presented and comments were received, on January 7, 2005. As a result of these two workshops and the VEMPs process, this GMP truly reflects the views of the communities impacted by its enactment. Local participation will not be limited to the drafting plan of the GMP, but will continue throughout its implementation, including while the GMP is still in its draft form, over the two years after adoption by the Board of Trustees and the responsible Minister.

1.4. Unique Character of the Mnazi Bay Ruvuma Estuary Marine Park

The Mnazi Bay - Ruvuma Estuary Marine Park (MREMP) covers an area of 650 km², 450 km² of which are land, while the remaining 200 km² are marine, including mangrove forests, islands and coral reefs. MBREMP is thus unique in that its land to marine ratio is the highest in East Africa. In fact, when looking at the majority of marine parks around the world, the terrestrial boundary usually only extends to the high-water mark, and MPA managers are often hampered in their efforts in that they tend not to have jurisdiction over land-based activities that can have a significant impact on marine resources. The rationale behind incorporating such a wide area of land into the Park was to constitute a buffer zone and control human activities that impact the protected marine environment. The aim was also to ensure that local marine resource users would be included in the management and planning processes as required by *Marine Parks and Reserves Act (1994)*. However, incorporating this wide area of land also meant incorporating 11 villages, 3 sub-villages and a population of approximately 30,000 people. Furthermore, population densities around the Park are high (UNDP/GEF, 2000). Biophysical assessments of the area have shown that the marine environment is highly impacted by human activities, particularly by overfishing, destructive fishing and coral mining (Guard *et al* 1998, UNDP/GEF, 2000, Guard 2004, Obura 2004, Malleret 2004, Labrosse *et al* 2005) and mangrove forests already bear the mark of intensive use (Wagner *et al.*, 2004).

MBREMP is thus distinguished by two characteristics that set it apart from other marine parks:

- a) The land area is more than twice the marine area, and
- b) The management plan must take into account the wellbeing and livelihoods of 30,000 stakeholders who will be directly impacted by its implementation.

The importance of community participation and involvement is therefore probably among the highest compared to any other marine park around the world.

1.5. Purpose and Objectives of the Mnazi Bay Ruvuma Estuary Marine Park

The Marine Parks and Reserves Act of 1994, under Section 10, quite clearly sets up the purposes of designating a marine park:

1. To protect, conserve and restore the species and genetic diversity of living and non living marine resources and the ecosystem processes of the marine and coastal areas;
2. To manage the marine and coastal area so as to promote sustainability of existing resource use; the recovery of areas and resources that have been over-exploited or otherwise damaged and to rehabilitate damaged ecosystems;
3. To ensure that villages and other local resident users in the vicinity of, or dependants on, a marine park or marine reserve are involved in all phases of the planning, development and management of that marine park or marine reserve, share in the benefits of the operation of the protected area and have priority in the resource use and economic opportunity afforded by the establishment of the marine park;

4. To stimulate the rational development of under utilised natural resources;
5. To promote community oriented education and dissemination of information concerning conservation and sustainable use of aquatic resources in the marine park; and
6. To facilitate research and to monitor resource conditions and uses within the marine park.

In addition, as an outcome of the two stakeholders' workshops held in Mtwara in December 2004 and January 2005, the Park residents added their own objectives for the Park:

7. To ensure that any exploitation of non-living resources does not affect the aesthetic and natural value of the Park
8. To protect the cultural heritage of Park residents; and
9. To ensure that tourism in the Park remains sustainable.

The identification of these objectives, along with that of success criteria (see Chapter 8), will allow for the assessment of the effectiveness of the Park. In other words, the success of the management of the Park, and of the implementation of this GMP, depends on the extent to which these objectives are met.



Map 2. Mnazi Bay Ruvuma Estuary Marine Park showing bathymetry and habitat types

Chapter 2. Resource Description and Resource Use

2.1. Area and Location

The Mnazi Bay – Ruvuma Estuary Marine Park is located to the south of Mtwara City in southern Tanzania, including the last 45 kilometres of coastline, to the Ruvuma River forming the border with Mozambique. The Park covers 650 square kilometres (162,500 acres or 65,000 hectares) and includes the northern portion of the Ruvuma Estuary, Mnazi Bay and Sinde Bay to the headland of Ras Msamgamkuu. Within the boundaries of the Park are three islands, Namponda, Membelwa (or Mongo), and Kisiwa Kidogo, plus numerous small rocky islets.

The Government and people of the Mtwara region chose this area for development under the status of Marine Park for a number of reasons. These include that the area contains good representative examples of all the marine habitats found along the shores of Eastern Africa, it has highly productive and diverse fisheries that are important for the resident citizens, it holds promise for coastal tourism and has reserves of gas. The Park was gazetted in 2000 and is the second Marine Park in Tanzania formed under the Marine Parks and reserves Act, 1994. A recent analysis of the whole Eastern African Recent conducted by WWF and others concluded that the Park area and neighbouring northern Mozambique form a site of Global Importance in terms of marine biodiversity.

Between 2003 and 2004, the Tanzanian Government, with support from the Global Environmental facility (GEF), the United Nations, IUCN and a number of specialists, coordinated a series of studies to determine the present condition of the marine habitats within the Park. Other studies produced the maps (included here) that present the distribution of the main habitats and other features of the sea within the Park. Additional studies were undertaken on the status of turtles, whales, dolphins and dugong within the Park, as well as on fisheries and social and economic aspects. All the information gathered will be utilised in a consultative process to define the objectives and future operation of the Park under the General Management Plan (GMP). An on-going and more practical objective of the Park is to find ways to ensure that these resources will continue to benefit all citizens, their children and grandchildren.

Information on the natural environment and its biodiversity within the Park is essential to the development of a GMP in accordance with Part VII of the Marine Parks and Reserves Act (1994) and in line with contemporary thinking. Up-to-date baseline information on all habitats in the Park is the starting point from where a marine biodiversity monitoring programme will continue. The findings of this programme will provide data that contributes to the evaluation of the effectiveness of Park management. Such programmes also help the Park tie in with national, regional and international monitoring initiatives concerned with marine biodiversity.



Extensive surveys were carried out to assess the status of marine resources

Building on previous findings, the recent studies confirm that the waters of the Park are home to a great diversity of marine life, with features unique in Tanzania and the region. The mangrove forests of the Ruvuma River are healthy and robust and provide reproductive and nursery facilities to many fish and crustaceans. Open sand habitat is extensive and seagrass beds are variable, diverse, and luxuriant in places. Over 250 species of hard coral, a preliminary list of 400 fish and some 100 echinoderms are other salient findings from the assessments to date. This Biodiversity Status Report presents the most up-to-date summary of the natural history, its diversity, distribution and condition within the Mnazi Bay – Ruvuma Estuary Marine Park. The marine and coastal plants and animals found in the Park are there because of the climate, the physical features, influences of the Indian Ocean and the movement of the sea (tides and currents) and location of the Park along the coast of Africa. These topics are described briefly below.

2.2. Physical Features

2.2.1. Terrestrial components

The geology of the Park is based primarily of sedimentary deposits from the Jurassic and Lower Cretaceous (around 150 millions years ago). Within 100 kilometres from the coast begin the slopes of the Makonde Plateau rising to over 500 metres. The Makonde Plateau extends into Mozambique but is bisected by the Ruvuma River that flows from close to the shores of Lake Nyasa as well as from a large part of northwest Mozambique through its largest tributary, the Lugenda River.

Evidence of previous sedimentation can be seen in the western part of Mnazi Bay, where the cliffs near Mnete show eroded sedimentary layers. The southern portion of the Park, around the headland of Msimbati provides a rare example of sand dunes in Tanzania,

probably also accumulated over thousands of years. The vegetation associated with these 10-15 metre high dunes probably includes plants that are found nowhere else in the region.

A fringe of rocky limestone platform extends for about 25 kilometres along the outer perimeter of the Park starting from the Ruvuma Estuary east of Msimbati to Ras Msamgamkuu in the north, in two sections, interrupted by the Msimbati Channel. This feature was produced by past coral reef growth, mainly during the Pleistocene (less than one million years ago), but since elevated relative to sea level. The southern portion starts south of the villages of Msimbati with a patchy outline, then accommodating the Lijombe Lagoon, extending more intact to Ras Ruvula. The northern platform extends for 20 kilometres from Namponda Island on the north side of Msimbati Channel, onwards incorporating Membelwa Island to Ras Msamgamkuu.

Mnazi Bay and Sinde Bay

The western and central parts of Mnazi Bay and the smaller Sinde Bay to the north are predominantly sandy environments. Together these two bays cover an area of about 150 square kilometres. Their depths, or bathymetry, are very different. Much of Sinde Bay is sandy and intertidal, with only a few areas over 5-metre depth with the exception of the 25 metre-deep Kidogo Channel at the northern entrance to Mnazi Bay. Mnazi Bay is a much bigger and deeper bay by contrast. Most of it is less than 25 metres deep, especially in the northern portion, where the substrate is also predominantly sand. Towards the southern end, a distinctive line of three rocky or coralline patches extends for 6 kilometres from the shore towards Namponda Island. Of between 400-1,000 metres in width, these patches are formed by coral growth. The patch reef closest to Namponda is called Chamba cha Lusale, and is irregularly shaped, about 1,000 metres wide and with reef slopes extending to depths of 25 metres onto the sand bottom. The other two patches, Chamba cha Chumbo and Ilili, have rocky portions exposed during the lowest tides, and are also products of coral development, though to shallower depths of 9-16 metres. Scattered among these larger patch reefs, and numerous in the slightly shallower waters (5-9 metre depth) to the east of the Chamba cha Chumbo are small coral patches and boomies that have so far not been fully charted. One of the most distinctive and probably the largest is Matenga (nearest the Gas Well). The water in this relatively shallow southern Mnazi Bay area is generally more turbid than other parts of Mnazi Bay, probably due to inputs from three small mangrove creeks (from Rivers Mnazi, Lilindi and Mlamba) and the more muddy surrounding intertidal areas.

Tidal exchange and Msimbati Channel

During spring high tides the sea enters Mnazi and Sinde Bays and covers 80 square kilometres of intertidal areas. This seawater flows in from the Indian Ocean through three routes. The most obvious is through the 50-metre deep Msimbati Channel in the south, but also through two smaller gaps or 'mlango' in the northern part of Sinde Bay. When the tide is over half way up, the seas flood over the eastern reef platform along the islands

of Membelwa and Namponda. At highest speeds, the water flows through the Msimbati Channel at 4 metres per second or more.

The geophysical configuration of Msimbati Channel and southeast Mnazi Bay is unique in Tanzania. Here there exists a deep channel close to the open ocean, penetrating into a large, sheltered bay with scattered coral patch reefs growing from 30 metre depth. The southern side of the Channel extends for almost 5 kilometres of patchy coral growth quickly backing onto a sand beach. No other sites are known to house such a combination of geological and biological features. A few of the passes of Pemba Island are close, but their inner bays are far shallower than Mnazi Bay. In northern Mozambique, perhaps in the Quirimbas, there may be other deep channels of comparable scale. For Tanzania, the Msimbati Channel is a special site and for Mnazi Bay a vital link for the passage water exchange into Mnazi Bay. Some of that water has come across the Indian Ocean.

2.2.2. Indian Ocean, Current and Tides

Flowing across the Indian Ocean, starting from Australia, the Indonesian islands of Sumatra and Java, the South Equatorial Current (SEC) meets the coastline of Africa approximately at the border of Mozambique and Tanzania. When the current meets the shores of southern Tanzania and northern Mozambique the current divides with a large portion swerving northwards to become the East Africa Coastal Current (EACC). The smaller southern flow contributes to the Mozambique Current (MC). The north-flowing EACC is a steady current, strongest during the southern monsoon when surface currents can exceed 3 metres per second, especially when southerly winds are strongest.

This is significant for the African coastline because the waters that are brought across have come a long way. Certainly some of it has moved over 9,000 kilometres at speeds probably about 1 metre per second, thus taking over two months. Within the waters of the SEC are the eggs and juvenile stages of thousands of marine animals and plants that were produced among the mangroves, seagrass beds, rocky shores and coral reefs of Indonesia and Australia. Southern Tanzania and northern Mozambique are the first arrival points in Africa for these drifting species and the Park is therefore strategically located and is very important for the settlement and subsequent dispersal of marine organisms both north and south along the coast of East Africa. The location of the Park at this arrival point of the SEC is likely to result in higher diversities of certain animals and plants that have long larval or egg periods.

In most of Tanzania, including the Marine Park, the maximum tidal range is about 4.5 metres, occurring during spring tides (around new and full moon). At about 10:00 am, during the low water of spring tides, big changes are seen over the area of Mnazi and Sinda Bays. Over 70 square kilometres of sand and seagrass is exposed. Seawater visibility is low at times and comparable to the inshore turbid reefs at Dar es Salaam and Zanzibar.

2.3. Climate

Seasons

Like other parts of eastern Africa, the weather of southern Tanzania is dictated by the seasonally changing monsoon winds. During the northern monsoon, between November and March, high air temperatures (28-32 degrees Celsius) prevail and a few showers are normal. Winds are moderate to strong. The wet season lasts from April to May. Beyond June, into the southern monsoon, the climate is cooler and drier, but the consistently strongest winds are normally experienced during this season, slowing down to November. Cyclones in this part of the Indian Ocean occur between January and March, mainly in Madagascar and the Comoros Islands. Fortunately for the people of the Mtwara Region, during the cyclone season, rarely is there any impact other than occasional days of strong winds.

Rainfall and sediments

Rainfall is generally low, usually between 500-1,000 millimetres per year and most of it falling over a short period, maybe during May. Within the Park the Ruvuma River is the largest source of freshwater. During the wet season, waters from the Ruvuma River flood across the narrow sand causeway linking the Msimbati Peninsula. In Mnazi Bay, there is only one small river near Mnazi village, and some seasonal streams drain upland areas to the west.

Prolonged wet season showers swell the volume and strength of the Ruvuma River and all its tributaries, increasing erosion and washing sediment into the Ruvuma River and out to sea. The much smaller Mnazi River in the southwest of Mnazi Bay will also carry loads of sediment during flood period. The waters of Ruvuma Bay at times seem like reddish-brown paint due to the amount of sediment. No figures exist, but bad agricultural practices within the catchment area may be making the situation worse by adding sediment to the flood. From the Ruvuma Estuary, the sediment-laden waters spread north along the Msimbati Peninsula. The other location where suspended sediments exist is at the southern end of Mnazi Bay. Limited exchange with the Ruvuma Delta and four creeks with seasonal streams have created an area where waters are generally turbid over a muddier seabed.

Seagrasses, seaweeds and corals need light for growth and reproduction, and too much sediment in the water can totally block sunlight from reaching the seabed. Prolonged deposition of sediments where before there was none, can rapidly kill sessile marine life on the seabed. The resident fish population will probably also leave. Sediments in water usually mean there are nutrients as well, which can be beneficial to local productivity, especially of plankton and seaweeds. For the Park, there is no knowledge on patterns of sediment movement.

El Niño

In late 1997 and early 1998, the seawater along the east coast of Africa became warmer than average by 2-3 degrees Celsius. This caused the hard corals on the reefs to lose their symbiotic algae, which leads to dis-colouration and whitening or bleaching. The bleached corals can survive for several months but if the high water temperatures continue, many coral colonies die. The rise in water temperature is a global phenomenon that has been called the El Niño event, usually starting at around the end of the year. During the El Niño of 97-98 many coral reefs in the Indian Ocean suffered with the death of many coral colonies. In certain parts of Tanzania, Kenya and Seychelles over 70% of corals died.

2.4. The Natural Environment

A summary of the status of the marine and coastal biodiversity, its distribution and general condition is presented in the following sections, beginning with the coastal dunes and beaches, shorebird populations, mangroves and muddy shores, seagrass beds, rocky shores, shallow subtidal habitats, coral reefs and fish populations.

Sand dunes and beaches

The impressive sand dunes of Msimbati are over 15 meters high, extending about 3 kilometres along the coast. Such a formation is a rare feature along Tanzania's coastline. The specialised vegetation community associated with these dunes is likely to be unique to the country thus contributing to the special status of the Park. The dunes and dune vegetation may also attract specific communities of birds and insects that would not be found anywhere else.



MBREMP is home to some unique sand dune habitats

Sand beaches are common within the Park and occur in two main regions. The eastern shores of the Msimbati Peninsula, including Lijombe to Ras Mivinjeni and around Ruvula as far as the Police Post, covering about 12 kilometres. Strong currents between Lijombe and Ras Mivinjeni are creating visible beach erosion problems with loss of coconut plantations. More sheltered sand beaches are present for about 15 kilometres along western parts of Sinde and Mnazi Bays. Vast expanses of open sand are also exposed during low tides in central parts of Sinde Bay and between Namponda and Membelwa Islands. These areas greatly too contribute to diversity of habitats in the Park.

Animals living in the sand beach environment normally seek protection from the sun by digging holes or living under washed up seaweeds and other debris. In the Park, ghost crabs, sand crabs, sand hoppers, and butterfly shells (*Donax* spp.) are the more obvious inhabitants of these sandy habitats. Although not normally visible, other molluscs and polychaete worms live below the surface. Some of these are food for wading and shorebirds, such as Crab Plovers, Whimbrel and Yellow-billed Storks.

Beaches are very important for nesting turtles. Greens and Hawksbill turtles are known to nest inside the Park, and the other recorded species are Olive Ridley, Leatherback and Loggerhead turtle. Under Tanzanian and international law all species are protected and should not be harmed or disturbed. Important nesting sites for the turtles are the beaches of Litokoto and Kingumi in the Ruvuma Estuary, and the shores of Msimbati and of Msangamkuu. Most nesting is between April and August, though Green turtles have nested in February. Based on the number of nests reported, only 30 female turtles live inside the park. The female turtles usually return to the same beaches from which they hatched, at night to dig a pit and bury about 100 eggs, refilling the hole with sand. After about 60 days the baby turtles hatch and must immediately take to the sea where they will feed and grow for 40 years before the females return to lay eggs again in the beaches of the Park. Green turtles feed on seagrass, while the other species also eat seaweeds, sponges and jellyfish.

Shorebird populations

Birds are an important and easily visible component of almost all protected areas in the world. Bird identification is relatively simple, requires non-expensive equipment, and bird data can be used as an indicator of the condition and diversity of the habitats in which the species feed or live.

So far, 180 bird species have been recorded inside the Park, but the area has not been thoroughly studied and the true number of species could be greater. The Mafia Island Marine Park reports about 160 bird species and Mikumi National Park has over 400 species of birds.

Among the birds, many groups exist, and it is the shorebirds that Mnazi Bay is most famous for. This is a group of very visible birds that includes the herons and egrets and smaller birds called waders (usually grey to brown with long legs). The more commonly seen birds on the beaches and mudflats are the Dimorphic Egret (both colour phases),

Black Herons, Grey Herons, Crab Plovers and Whimbrel. Up to 3,000 Crab plovers have been seen in the past, during the northern monsoon season when these birds visit to feed before flying to northern Europe to breed. In January 2004, on the shores of Sinde Bay over 1,000 Crab Plovers were seen as a single flock. The mangrove forests of Namponda and Membelwa Islands provide important roosting sites for waders as well as feeding and breeding areas for other birds.



During the northern monsoon period, in February 2004, about 80 Yellow-billed Storks were seen roosting along the northwestern shores of Namponda Island in a small mangrove stand, and on rocky islets on the southwestern side of Membelwa Island. Feeding was observed during low tide at numerous sites through the inner bays. These Storks are common throughout Tanzania but not normally seen in such numbers on the shore depending on marine as their food source, thus the Park populations may be unique. Yellow-billed Storks are also present in the Watamu Marine Park of Kenya.

Although shorebirds are an important feature of the biodiversity of the Park, other types of birds exist. For example, this area is the first record in East Africa for the Shy Albatross. The Masked Booby and Peregrine Falcon are also recorded here. On the mainland, in neighbouring shrub forests, farmland and plantations, Red-eyed Doves, White-bellied Sunbird, Pied Crows and Black Kites are present, the latter commonly seen on beaches near fish landing sites. The diversity of birds noted for the Park is definitely worth promoting. The Indian House crow has not so far been seen in the Park or even Mtwara. It is important for the natural bird population that this pest is kept out of the Park and ideally the whole Region.

Over the wide flat areas exposed during low tides, such as around Mnara wa Gas in southern Mnazi Bay, groups of 80 women and children collect bivalves and other invertebrates for food and sale while wading birds feed on other marine life the tide has exposed. Both humans and birds continue with their business, it seems without disturbance of either.

Mangrove forests and muddy shores

Mangrove forests are important habitats with great ecological and socio-economic value. In Mtwara, as in most parts of Tanzania, mangroves are a source of firewood, charcoal, building poles and materials of boat construction. These forests and the animal life they support can also be a great tourist attraction.

There are about 70 square kilometres (or 7,000 hectares) of mangrove forest in the Park, accounting for almost 10% of the mangrove forests of Tanzania. All nine main species are present. Recent mangrove forest studies examined 181 sites within the Ruvuma Estuary plus 93 sites within the Mnazi Bay area, including the islands of Membelwa and Namponda.

The largest single mangrove forest stand is located in the northern portion of the Ruvuma Estuary. Within this Ruvuma mangrove forest, the best-developed areas are adjacent to the Ruvuma River itself. In these areas, between the Litokoto and Lidengo Rivers, the forests are best developed with healthy mixed stands of mature trees that include the *Heritiera littoralis* - a species that has suffered greatly in the Rufiji Delta forests. In terms of density and tree size, measured by basal area, this area of the Ruvuma forest (with a basal area of 1,015 square centimetres per square metre) rivals the better parts of the Rufiji delta forest (basal area 1,261 square centimetres per square metre).



When viewed from a map or the air, the Ruvuma Estuary gives the impression of having four main tributaries or creeks. Closer inspection reveals that the northern three are tidally fed by seawater and that only the most southern creek of Chikomolela and Litoko are regularly influenced by freshwater. This influence is noted in the southern portion of the Estuary where, combined with river-borne nutrients from the Ruvuma River, accounts for the better development of the southern portion of the forest.

Marine animal life in mangrove forests limited to a few specialist species tolerant of very muddy conditions, desiccation and seasonal freshwater flooding. About 15 species of crustacean and mollusc are documented and 20 species of fish are reported from capture in the Ruvuma forest. Notable examples include the mud crab *Scylla serrata*, penaid prawns, fiddler crabs *Uca* spp. and mud snails *Terebralia palustris*, the mullet *Valamugil saheli* and the seven-spot herring *Hilsa kelee*. Unidentified monkeys have been heard in the forest.

Mangrove forests are also present in a narrow band along many parts of the south and west shores of Mnazi Bay. The Islands of Namponda and Membelwa have well-developed mangrove forest much closer to the ocean, with less mud substrate and freshwater input. This makes these islands fairly unique, because especially on Membelwa, mangroves are present on the sheltered western shores and on the more exposed east coast. This juxtaposition of island, mangrove, narrow shallow seagrass bed, rocky reef crest and reef slope is a feature of the Park that exists in few other areas.

The land immediately behind the mangrove forests of the Park is generally bare because of the amount of accumulated salt. These areas are flooded far less frequently and only a few specialist plants such as sedges and *Salicornia*. These barren saline flats cover about 4 square kilometres (400 hectares). Seaward of the mangroves, in most parts of the Park, extends a gently sloping mud flat that usually becomes colonised by seagrass lower down the shore, extending into the subtidal.

Seagrass beds

Recent studies with detailed sampling at 30 sites in five areas (Ras Mivinjeni, Mnara wa Gas, Sinde, Membelwa and Mnete) and one subtidal site (at Sea Safaris) have shown that both the intertidal and subtidal seagrass beds are in good condition with luxuriant growth and high diversity. Nine species of seagrass are present in the Park.

Seagrasses need soft substrate for rooting and light. Seagrass beds are present inshore of the reef crest along much of the eastern shores of Msimbati Peninsula, but less along the Ruvula Peninsula. There is a 1,000 metre wide, tidal expanse of thick, healthy seagrass beds along the northern end of the Msimbati Peninsula. In this area, the shaggy-leaved *Thalassia hemprichi* dominates the seabed. The tip of the beach is known as Mivinjeni, also noted by a cluster of *Sonneratia alba* mangrove trees. Extending west down the parallel shores of the Ruvula Channel, the seabed steeply slopes with only small patches of subtidal beds of *Thalassodendron* and *Syringodium*. The southern Mnazi Bay area is mostly soft bottom with large amounts of mud and silt. Seagrass beds are thinner but

extend from middle shore to subtidal depths, dominated by *Thalassia hemprichi* and *Cymodocea rotundata*. The western shores of Mnazi and Sinde Bays support well-developed seagrass beds along most of their length, beginning about 200 meters from the beach, and in places extending into the subtidal. Thicker and more luxuriant beds, about 500-1,00-metre width, mostly of *Thalassia hemprichi* also exist inside the 20-kilometre rocky reef crest along the seaward side of Namponda and Membelwa Islands. These beds are similar to those on Ras Ruvula.

Within the seagrass normally exists an animal community that includes mobile molluscs such as Cowries (*Cypraea* spp.) plus various buried bivalves, mobile sea cucumbers, starfish, sea urchins and crustacea such as crabs and shrimps. Many of these animals as well as some fish lay egg masses on the seagrass and algae within seagrass beds.

Members of the phylum Echinodermata are common members of the seagrass community, but are also found in rocky and coral reef habitats. This exclusively marine phylum comprises over 400 species in the western Indian Ocean, and includes the sea cucumbers, starfish, brittlestars, the spiny sea urchins and feather stars. The echinoderms were the mobile taxa most comprehensively studied and serve as an indicator of the biodiversity of the Park.

About 100 species of echinoderm have been reported from the Park so far, but the number should be about double this. Around the shores of Mnazi bay sea cucumbers were noticeably found only in low numbers (30 species) than would be expected for the richness of habitats. This is probably because of the active sea cucumber fishery currently taking place in the Park. Further studies should increase the total number of echinoderm species to 150-200, with 40 sea cucumbers.

Rocky shores

Inside the Park, rocky shores are found in three different forms. The Pleistocene cliffs of the Islands of Membelwa, Namponda, Kisiwa Kidogo and associated islets support upper shore rock habitats. In this environment, a few small red seaweeds can exist in the shady crevices, with characteristic residents being snails of the genus *Nerita*, rock oysters *Crassostrea cucullata* and the light-footed *Grapsus tenuicrustatus*. On the western shores of Membelwa the base of these cliffs and islets extend onto the second form of rocky substrate, the intertidal rocky flats punctuated by shallow rock pools. This stretch extends for some 500 metres, with some smaller patches around Namponda and Kiswa Kidogo. Common inhabitants include cerith snails and the red-eyed rock crab, with the red seaweed *Gracilaria salicornia* firmly fixed on rocky edges. The third form of rocky substrate is the reef crest; a 100-200 metres wide band of mostly bare rock scattered with fixed and loose boulders. The reef crest is found along most of the outer reef platform for about 25 kilometres, starting with the upper parts of Kipwa Kidogo and Kipwa Kikubwa, then the outer edges of Lijombe Lagoon onwards to Ras Ruvula, and beyond to the passes near Ras Msangamkuu. The stones and boulders provide a special daytime refuge to various species of mobile invertebrate (e.g. crabs, shrimps, snails, starfish, sea

cucumbers and brittlestars) as well as sites for egg-laying, especially for octopus and gastropods such as the seashells of the genus *Cypraea*. Smaller examples of the reef crest also occur in the more sheltered reef outcrops of Chamba cha Chumbo and Iili inside Mnazi Bay.

Shallow subtidal habitats

This section is the first one covering the aquatic environment, a realm that a few scientists and many fishers explore, but one that some people inside the Park have never observed. What goes on under the surface of the ocean can be documented, measured and monitored. The life of the marine animals and plants can be followed and ways can be found to increase the productivity of the seas. In many cases, this can simply be achieved by decreasing the destructive influences.

The shallow subtidal area of the inner bays of Mnazi and Sinde are generally bare sand, Sinde Bay especially. Along the shallow edges seagrass beds are common, and in deeper sites patchy seagrass beds occur. Towards the southern end of Mnazi Bay coral outcrops are common. Towards Msimbati Channel the depth rapidly increases and a complex patch reef (Chamba cha Lusale) extends from near the surface to 30 metres or more. The southern portion of Mnazi Bay supports numerous small, shallow-water patch reefs.

Coral reefs

Recent studies have confirmed that coral reefs within the Park have a more diverse hard coral community than most sites in East Africa. This high diversity is probably due to the complex range of habitats in close proximity that is a feature of the Park. The count from 2003 surveys is 258 species in 59 genera from 15 families. The comparable Mafia Island site hosts about 270 species, and locations in Kenya about 225 species. The coral fauna is typical with the Acroporidae (fragile, mostly branched forms) and Faviidae (honeycombed solid dome colonies) the most well-represented families (65 and 64 species, respectively). The abundance of coral genera vulnerable to bleaching, such as *Acropora*, *Stylophora* and *Seriatopora* was notable, given their widespread mortality during the El Niño in 1998. From 22 sites surveyed in November 2003, four reef zones were identified:

- **Outer fore reef slopes** along much of the outer perimeter, extending over 30 kilometres from the Msimbati Peninsula, past Namponda, Membelwa as far as Ras Msamgamkuu. In the south, includes the fragmented patch reefs of Kipwa Kidogo and Kipwa Kikubwa, as well as the shallow coral patches and outcrops in Lijombe Lagoon.
- **Msimbati Channel** with deep, sheltered, high current reefs extending on the southern banks for about 5 kilometres.
- **Patch reefs** within the Mnazi bay or lagoon - including and deep reefs of Chamba cha Lusale, as well as Chamba cha Chumbo and Matenga and the smaller coral patches in the muddy environment of the southern end.
- **Outer shelf** northwest of Msamgamkuu point.

The fore reefs, channel and lagoon patch reefs between them provide a variety of depth zones and structures. Where this is not impacted by destructive fishing practices there is high topographic complexity and reef growth. On these reefs the seabed composition was dominated by hard corals, with an average cover of 30%. Soft corals and rubble accounted for about 18% each. Localised high levels of algal growth or rubble are seen, indicative of past destruction.

All the reef types and their physical conditions contribute to the diversity of coral communities in the Park. Within each environment, specific coral communities are able to survive and develop. For example, corals that are found in the clean waters offshore of Membelwa Island will be different to corals growing in the more muddy waters of southern Mnazi Bay near Mnara wa Gas. The cover of both hard and soft corals, new recruitment and the development of coral species assemblages (e.g. *Acropora* staghorn beds, deep-water communities and others) suggest the Park ecosystem has a high productive capacity.

In 1999, the reefs of Mnazi Bay were included in the national coral reef monitoring network by scientists based at the Institute of Marine Science (University of Dar es Salaam), from CORDIO (Kenya), and with volunteers from Frontier-Tanzania. Studies to assess levels of reef damage from coral bleaching and death following the seawater temperature rise during the El Niño of 1998 has showed that the reefs of Mnazi Bay were significantly impacted with declines in coral cover of 30-50%. Following that event, average hard coral cover was 25-30%. It was noted that there was good potential for coral recruitment. Evidence of coral mortality from the El Niño event of 1998 is still apparent, though recovery through re-growth and colonisation by new larvae of hard and soft corals has been high and robust. This demonstrates a high resilience of the Mnazi reefs to seawater warming.



Coral reefs are critical ecosystems for numerous species of fish

Fish diversity and populations

On coral reefs inside Mnazi Bay fish densities were generally low and similar to that of heavily fished reefs off Dar es Salaam and Zanzibar. About 400 species of fish have been identified, an estimate based on reports from numerous studies using landed catches (including from the Ruvuma River), underwater visible identification and examination of underwater images.

The species richness of fish is high comparable with species lists from the Mafia Island reef systems to the north (where 400 species were also reported), but not higher than numbers reported from other parts of East Africa where detailed investigations have taken place. In the Watamu Marine Park of Kenya for example, 1,300 species are reported. From only 3 square kilometres in the Chumbe Island Coral Park (CHICOP) of Zanzibar, 370 species have been identified. In the mid 1960's, the small Kitutia Reef, now within the Mafia Island Marine Park, yielded 192 species. Following comprehensive studies, the known number of fish species in the Park is likely to increase to beyond the 1,000 species mark.

Of note among the fish fauna at many sites studied was the absence of top carnivorous species such as groupers, emperors, snappers, and barracuda. Herbivorous fish were also almost totally lacking from the reefs, such as parrotfish, surgeonfish and rabbitfish. Fish that form schools too were absent. These are all indicators of heavy fishing. In contrast to the many positive aspects of the biodiversity within the Park, the fish community appears highly degraded, a situation made more serious because the overall fish size was also generally too small, indicating high capture of immature and adults. On reefs protected from fishing because of rough sea conditions, the abundance of fish was higher, at times exceeding 2,000 per 250 square metres. By comparison, in the sheltered areas with easy access to fishers such as in the lagoon and Msimbati Channel, densities varied between 20 and 150 per 250 square metres.

Pelagic fish species such as tunas, kingfish and jacks are caught at the entrance and inside Msimbati Channel. During some of the year the Torpedo Scad (*Vibua ngozi*) dominates the catches. This fishery may be unique in Tanzania. Furthermore, the presence in deeper waters of large schools and predatory fish such as sharks suggests high levels of productivity of the ecosystem. This is encouraging and supports the belief that with sensible fishing practices, fish numbers can increase and yields maintained.

Summary of Biodiversity Features

Mangroves – Expected species are present: *Avicennia marina*, *Xylocarpus granatum*, *Rhizophora mucronata*, *Ceriops tagal*, *Sonneratia alba*, *Bruguiera gymnorrhiza* and *Heritiera littoralis*, but *Lumnitzera racemosa* and *Pemphis acidulal* are not reported.

Seagrasses - Nine species were found: *Thalassia hemprichi*, *Halodule uninervis*, *H. wrightii*, *Halophila stipulacea*, *H. ovalis*, *Thalassodendron ciliatum*, *Cymodocea rotundata*, *Cymodocea serrulata*, *Syringodium isoetifolium*. A tenth species, *Zostera*

capensis was reported but no specimens found. The long, blade-like *Enhalus acoroides* typical of sandy slopes and high currents has not been seen.

Macroalgae – The few older studies on seaweeds revealed about 50 species in the Park, split between 29 green, 14 brown and 16 red seaweeds. Some studies have not yet been completed and it is certain that the number of seaweeds will increase, probably to several hundred species.

Coral – Recent detailed studies have greatly improved coral identification and the current total for hard coral species is 258. More surveys are likely to increase this number to closer to 300 species.

Crustacea - The present collection of less than 20 species serves only as an introduction to this large group. Notable examples include the spanner crab *Ranina ranina*, the freshwater prawn *Macrobrachium* sp. (from Ruvuma River), and the mantis shrimp *Natosquilla investigatoris* (washed in the 100s of thousands over a few days, beginning March 22, 2004).

Molluscs – This group potentially holds 600 or more species likely to be found in the Park. Among the snail-like gastropods, 400 species might occur. For this reason, the genus *Cypraea* was selected as an indicator of the group. These are generally large, easily identified and conspicuous shells, collected from numerous sites throughout the Park. The collection includes 17 species, of a total known from Tanzania of about 55 species. A more dedicated search is certain to reveal more species. Together with bivalves from seagrass samples, the mollusc collection includes 30 species.

Echinoderms - So far, about 100 species have been found in the Park. These include, from the following classes: 24 sea urchins, 20 starfish, 30 sea cucumbers, 27 brittle stars and 3 feather stars. The collection includes about 170 specimens, mostly of species that occur in the intertidal zone, with only a few collected from the subtidal. A fuller study will certainly add more species.

Fish - Over 400 species identified. Among these are about 150 genera from 50 families. A detailed fish study, particularly focusing on the more cryptic families, is likely to increase this number to a more realistic 1,000 species.

Birds – There are 180 bird species recorded for the Park area so far, and further research is certain to increase this number.

Marine Mammals and Turtles – Five species of turtle, Humpback and Sperm Whale and three species of dolphin are reported. No extensive marine mammal study has been conducted to date.

Several other taxonomic groups exist of animals large enough to be visible that are also well represented in the Park. In particular the sponges, tunicates, polychaete worms, soft

corals and myriad groups of small shrimp-like crustaceans. Between these at least 1,000 species can be added to the overall tally for the Park.

Productivity and Resilience

The complex structure of Mnazi Bay, with deep-water patch reefs, deep strong-current Msimbati Channel with high water exchange may contribute to the high biodiversity and productivity of the area. These qualities likely contribute high ecological resilience to the reefs of the Park, supporting its robust recovery from the El Niño-related bleaching of 1988, and potentially high recovery from destructive fishing practices. The high cover and diversity of corals at depths beyond the impacts of bleaching and dynamite fishing are likely to act as a refuge or reserve for supply of larval recruits to damaged areas.

2.5. Local Population and Businesses

Within the Park are 12 villages with a population of 30,000. According to United Nations figures for the year 2000, the average income is less than \$100 per year. This human population has long utilised the marine resources from Sinde and Mnazi Bay, and mangrove forests of the islands of Membelwa and Namponda, and of the Ruvuma Estuary. Fishing by men, octopus gathering, and the collecting of live sea shells and sea cucumbers by women and children are the main activities that affect the aquatic portion of the Park. Some of the fishing gears that are used are destructive to the environment. Fishing using dynamite is reported to have finished in 1997. One fish species noted during the present studies and being fished seemingly exclusively by certain fishers from Ruvula Peninsula is that for the carangid Torpedo Scad (*Megalaspis cordyla*). Gillnets and possibly hook and line are used to catch large number of this species.

Terrestrial income-generating activities include horticulture of cashew and fruits, livestock husbandry and small businesses or trade. Arable farming is seasonal and limited by generally poor soil conditions, increasing dependence on the marine environment. The city of Mtwara is located just north of the Park, and is a significant port and provincial urban centre, with increased shipping and development forecast. The tourism sector has recently begun to emerge as a viable contribution towards development. The challenge for that industry is to select the most appropriate, and sustainable, style of tourism, with the greatest rewards to the local economy and least negative social and environmental impacts.

Decisions on the style of tourism, of the carrying capacity of tourism are needed to guide this development of this sector. Many coastal tropical areas have witnessed booms in coastal tourism with many negative social and environmental consequences. The Park is well placed to participate in the tourism sector and to assist in sharing the experiences gained from this sector by the authorities on Zanzibar and Mombassa.

Natural gas was found in the southern part of Mnazi Bay several decades ago, and plans are now being formulated to extract the gas and supply a methane-burning generator. The objective is to make the area self-sufficient in electricity. In August 2004, processed methane gas from the five wells around Songo Songo Island was supplied for the first

time, via a 200-kilometre pipeline, to Dar es Salaam for power generation. The strict environmental and social standards imposed during the two-year construction period reduced negative impacts to a minimum, despite the numerous and sensitive coral reefs within the operation area. The development of the Mnazi Bay gas reserves should continue and do so with minimum negative social or environmental impact, generating significant economic benefits to the region and beyond.

DRAFT

Chapter 3. Management Issues

The recent biodiversity and socio-economic studies have highlighted the importance of the marine biodiversity of the Park on a national and regional scale, as well as its significance to the local inhabitants. The productivity of the waters of the Park, yielding fish, molluscs, sea cucumbers, lobsters and octopus, is linked to the integrity of the various marine habitats, in particular the coral reefs, sandy shores, seagrass beds, and the extensive mangrove forests of the river delta. The studies have also described a number of threats to this unique environment from human activities manifest through the following main operations: the collection of invertebrates (mostly from the lower intertidal zones) fishing (using a variety of gears and techniques), coral mining and mangrove harvesting. The threats can be organized as follows:

- Natural resources management issues, and
- Socio-economic management issues

3.1. Natural resource issues

3.1.1 Fishing pressure and unregulated fishing

Fisheries in Tanzania are legally defined under three categories: artisanal, semi-industrial and industrial (Tanzania Fisheries Act, 2003). These categories are described as follows:

Artisanal: ‘...small-scale and not commercially oriented, using relatively small amounts of capital and in which fishers have usually a traditional involvement with fishing’;

Semi-industrial: ‘...small-scale, commercially oriented, using small amounts of capital but without traditional involvement’;

Industrial: ‘categories of fisheries that are of large scale, commercially oriented and which employ advanced technology’.

Within MBREMP, the main fisheries fall under the artisanal and semi-industrial categories. Artisanal fisheries are dominated by fin-fish fishing from small boats and the collection of shellfish and other invertebrates, primarily by women and children. The boat-based fisheries could arguably fall under both artisanal and semi-industrial categories. A large proportion of the fishers, although probably with a tradition of fishing in the area are in fact commercially oriented, even if that is partly opportunistic in the sense that if fish suitable for marketing are caught then they are sold, otherwise the catch is eaten.

An Occupational Structure Analysis recently prepared for IUCN/MPRU reported that: ‘*The strongest dependence on marine resources (that is sole income source) is found in Msimbati, Mkubiru, Mngoji (Mnazi Bay sea front village) and also Tangazo (Ruvuma Estuary mangrove village). The highest numbers of households involved in fishing were found in Msimbati, Mngoji and Tangazo. Msimbati comes out as the main marine product trading centre (Malleret and Simbua, 2004).*

A very useful summary of the diversity of gears and fishing practices was presented in ‘A socio-economic baseline assessment of the Mnazi Bay - Ruvuma Estuary Marine Park’ (Malleret, 2004) and a modified version of this is included here in the table below.

Table 3.1. - Summary of Fishing Gears and Practices in MBREMP (after Malleret, 2004)

Gear	Daily pattern	Monthly patterns and seasonality	Main species
Nets (2.5"-7")	-Day and Night -Going at low tide and coming back high tide -6-7hours at sea	All year Peak season: NEM, MAT	Grunters; Pursemouth; Jacks; Mullet; Tuna; Red Snapper; Groupers; King fish; Milkfish; Shark; Wolf-herring
Nets (< 2.5")	-Day and Night	All year Peak season: NEM MAT	Mackerels; Prawns; Small mullets; Half-beaks; Emperors; Sardines
Juya	-Day	All year Peak season: NEM	Small barracuda; Emperor; Half-beaks; Mackerel; Sardines
Tandilo	-Day, evening, and night (full moon particularly) -May be done twice in a day -Done at low or high tide depending on the area - 2 to 4 hours spent.	All year Peak season: NEM Best: spring tide	Anchovy; Small herrings; Sardines; Silver Silago
Beach seine	-Mainly Day -Low tide -May be done twice	All year Best: Spring tide	Emperor; Jacks; Anchovies; Herrings; Synodontidae; Sardines
Handline	-Day and/or night- day only when boats do not permit -High or low tide depending on areas -Once or twice a day 5 to 7 hours	All year Peak season: NEM, MAT	Mullet; Jacks; Snappers; Pursemouth; Grunter; Shark
Traps (few) (Mainly in Mkubiru Mngoji Mitambo Kilambo)	-Day (difficult in windy days) -Low tide -Once or twice depending on tide	All year Peak season: NEM	Emperor; Parrot fish; Goat fish; Rabbit fish; Catfish (R); Small tilapia (R); Prawns (R)
Tidal weir (few mainly Kilambo, Msimbati)	-Day -Low tide check -Once or twice depending on tides	Mainly SEM Best: Spring tides	Prawns
Spear gun (Msimbati)	-Day time -Low tide	All year Peak season: MAT	Jacks; Grouper; Squirrel Fish
Spear, Hand, diving (Sea cucumbers)	-Day and night (with pressure lamps) -Not every day -Low tide for hand collection -Any tide for diving	Mainly in SEM No diving: when river high (muddy waters in Mkubiru)	
Spear, Hand (Octopus)	-Day or night -Low tide	All year Mainly: Springs	

NEM: Northeast monsoon
SEM: Southeast monsoon
MAT: Calm period in between monsoons.
E: Estuary

In addition, the following information was collected from fishers and household surveys (Labrosse et al 2005):

- They highlighted the importance of fishing for 1) subsistence 2) for trade, demonstrating a high dependency on marine resources. Any monitoring programme, should consider, using consumption indexes as an indicator of households fishing activities.
- High variability of Catch Per Unit Effort (CPUE), which cannot be explained by the variables of the fishers' survey.
- The importance of finfish in the catches and shellfish and crabs as second rank, therefore monitoring and management options should give priority to these two groups of seafood.
- Tandilo (mosquito net) is one the third most frequently used gears, and nyavu (beach seine) the second. Both are illegal. Gears used by fishers are more diversified, probably due to more diverse biotopes exploited and species targeted. Fishers seem also to be more selective than households.
- Fishing effort is more spread geographically for fishers than households. It can be suspected that the shoreline is the area most accessible and hence most impacted by fishing activities. Considering the high use of tandilo by fishers from households, this gear should be addressed specifically in the management strategy.
- Fishing grounds are generally distinct for each village, which greatly facilitates the implementation of Beach Management Units, as called for in the new Fisheries Act.

However, data on fishing effort, catch landed and biological stock assessments, which are all essential to enact sustainable fisheries management, are still lacking and/or inadequate. As a result, it is difficult at this stage to be too prescriptive given the lack of real depth of knowledge on what the fisheries, and the fishers, need. Other fisheries issues of concern include:

Shell and sea cucumber collection

Collecting on foot in the intertidal areas is conducted during the low tide, mostly on spring tide days. Bivalve molluscs (and a few gastropods) are collected in large numbers, mainly for food. Some larger bivalves are also collected for lime production. The collection of holothurians or 'maji ngoo' for export takes place at an intensity greater than in most other parts of Tanzania and many of the large species of sea cucumbers were notably rare. Concern exists that the collection of all these animals is being done at levels beyond the natural production rate.

Overfishing

The fish surveys show that many species of commercially important fish (e.g. groupers, snappers, parrot fish and emperor fish) were found only in small sizes, indicating that these species are being very heavily fished. The danger exists that with few individuals reaching reproductive age population growth cannot keep up with the removal by fishing. Consequently, overall catches of these fish species within the Park will decrease. The simple explanation is that too many fish are being caught. In the Park, numerous fishing gear types are used, from tiny mesh sizes of a few millimetres (such as mosquito nets) to monofilament nylon gill-nets and massive fish fence traps called 'wando'. This situation is not unique to MBREMP, and has been observed in Kenya, India and the Philippines. One way to rectify the situation is to set aside areas that are not fished, allowing individual fish to grow to maturity and reproduce. The young larvae will drift out of the closed areas to settle and re-populate surrounding areas. In addition, mature fish will move out to surrounding areas. Both these processes increase the numbers of fish in the overall area, and in turn, catches. Regulation of fishing gears such as through mesh size can also help.

3.1.2 Destructive fishing

Dynamite fishing in the Park has probably been the most destructive fishing technique in the past. The blast can cause immediate destruction of the coral on which the fish communities rely for shelter, reproduction and sources of food. The practice appears to have been phased out, but some isolated incidents were still reported. This practice is completely antithetical to the objectives of MBREMP and the national legislation banning dynamite fishing should continue to be implemented very strictly.

Dragging nets across the seabed in a manner known as beach-seining can be very damaging to sedentary marine life. Nets called 'kavogo' or 'juya' are used in this way and when used in coral areas can quickly destroy large areas of coral that will take decades to recover. In areas where fragile corals grow, this form of fishing can have similar impacts as those of dynamite blasting. Beach-seining is also illegal in Tanzania.

3.1.3 Endangered species

The extensive seagrass meadows and coral reefs of Mnazi Bay provide suitable habitat for sea turtles and marine mammals. However information on the current status, distribution and abundance of turtles and cetaceans (dolphins and whales) is limited, while the presence of dugongs is unconfirmed.

In April 2003, an assessment of the status of turtles, dugongs and cetaceans was carried out in MBREMP. The results of the survey confirm the importance of MBREMP as a feeding, breeding and nesting area for endangered green and critically endangered hawksbill turtles. The other three Western Indian Ocean species do frequent MBREMP waters but do not nest and are much less common. Although turtle sightings were still

said to be relatively frequent, populations were reported to have declined over the past 10-20 years due to accidental capture in gillnets, poaching of nesting females and eggs and habitat disturbance. At current rates of exploitation, it is possible that in another decade they will be locally extinct.

In Tanzania, turtles are officially protected under Section 7 of the Fisheries Act, No. 6 1970. Under this law, anyone found guilty of a first offence is liable to a fine of TSh 300,000 (USD 300) or a jail sentence of 3 years. The fine for a second offence is TSh 500,000 (USD 500) and 4 years imprisonment. Despite this legislation, few, if any, perpetrators are arrested and held accountable. Information gathered from Fisheries Officers in Mafia indicated that only one individual has ever been arrested (August 2000) but he was later released uncharged (Muir, 2003). In addition to Fisheries legislation, the Marine Parks & Reserves Act No. 29 of 1994 provides for the establishment of marine protected areas and the protection and conservation of coastal and marine life including turtles. Despite this, turtle populations have been declining rapidly due to poaching of nesting females and eggs, trade in tortoiseshell, captures in artisanal gillnets and commercial prawn trawlers, and disturbance of nesting beaches from tourism development and fisher camps (Frazier, 1980). Clearly, awareness of the legislation in place needs to extend to all levels of government so that existing penalties are exacted.



The main use of turtles is for meat, the trade of which is an important and lucrative local business. Dedicated turtle hunters operate on all the nesting beaches and pose a major threat. Foraging turtles are also hunted deliberately at Matanango and Nanano reefs off Msimbati. The wholesale market price for a turtle is between USD 10 - 40, depending on size. The retail value can increase to USD 60 once the meat has been cooked and portioned. Turtle eggs are harvested, mostly for domestic consumption, shells are occasionally sold and oil is sometimes used to cure ailments such as burns and rashes.

The regular (perhaps daily) capture and slaughter of turtles in gillnets was confirmed in most of the villages visited during turtle survey and subsequent coral reef surveys. This

threat, together with poaching of nesting females and their eggs, suggests that turtle populations in MBREMP are highly threatened, although baseline population data is lacking.



Turtle nests protection programmes in the Park have proven successful and must be maintained and enhanced

3.1.4 Coral mining

Inside the buffer zone of the Park, especially around Ras Msangamkuu, live coral has been broken off the seabed and transported to the shore where it is used to make lime. The main type of coral used is a slow growing massive (boulder) form species (*Porites* spp.) that is important in reducing wave action and provides the main framework of the reef. Continued extraction of these corals can destroy coral reefs and lead to increased erosion of the adjacent coastlines, as found in Sri Lanka and the Maldives, and this in turn reduces fish catches. The uncontrolled harvest of timber for kilns to burn the coral also leads to deforestation that can increase soil erosion further adding pressure to the marine environment within the Park from increased sediment levels.

3.1.5 Mangrove harvesting

For centuries, people inhabiting the area have used mangroves for firewood and building materials. Since human populations were low in the past and migration was limited, it is likely that most human uses of these mangrove resources were sustainable.

However, in recent decades, some types of resource use have been a threat to the health of the mangrove forest. Moreover, human populations in the MBREMP area have increased over the past decade and there is greater influence of human populations from other areas; thus, the pressure on mangrove resources has been increasing. There is now

heavier harvesting of mangroves for firewood, charcoal, building materials and boat making.

Besides mangrove harvesting, there are several other issues or problems which threaten the biodiversity in the MBREMP mangroves. These include clear-cutting, unsustainable fishing methods, harvesting of macro fauna, particularly edible shellfish and erosion.

While there is evidence of mangrove harvesting in many sites, so far, it still appears to be more or less sustainable in most areas. This is due to the large number of seedlings seen in most sites, which far exceeded the density of cut stumps. Moreover, in most places the harvesting has not left areas open to the extent that the conditions of the forest environment and soil properties could have changed significantly.

However, there are some areas of Ruvuma Estuary where harvesting seems to have exceeded the natural regeneration rate. In Mnazi Bay, high cutting pressure was observed at some sites. Considering the rapid growth of Mtwara's population and the dynamics of human movement, mangrove harvesting is potentially a significant threat, so steps should be taken to deal with this issue.

Erosion is perhaps the greatest issue in the Ruvuma Estuary. Erosion, which is brought about by four types of water movement (i.e., wave action, tidal movement, ocean currents and river flow, particularly during flooding), is largely a natural process that is often dynamically balanced with accretion of sediments in other places or at different times. However, when erosion exceeds accretion, it becomes an issue to be concerned about, particularly when it is exacerbated by human activities.

Erosion particularly affects the seaward half of Ruvuma Estuary and the Ruvuma River bank itself. This is due to the huge volume of water that must move from the upper reaches of the Estuary to the ocean within six hours, especially during spring tides. The situation is exacerbated during the rainy season due to flooding and rapid river flow. In several channels (Nganje River, Lugue River, Kingumi River) as well as along the Ruvuma River itself, several meters of riverbank have been swept away in recent years.



Coastal erosion can be a serious problem in some areas of the Park

It is likely that various human activities have caused an intensification of the problem of erosion. In particular, deforestation, construction and poor agricultural practices upcountry within the Ruvuma watershed area have undoubtedly altered rainfall patterns, severity of flooding and sediment loads. Another human factor is man's contribution to global warming through the green house effect.

3.2. Socio-economic issues: narrow income base for local communities

Because the Park is home to some 30,000 inhabitants, most of which depend to some degree on the exploitation of marine living resources, a great deal of attention must be paid to some of the constraints that may guide their activities. Dependence on marine resources (proportion of households involved in marine resources related livelihood activity, importance of marine related activities in the household's livelihood system) is an indicator of potential threats to marine resources. The more households are dependent on marine resources for their livelihoods, the more they are likely to be defensive about their activity, and reducing pressure on marine resources by zoning activities or banning certain gears without acceptable alternatives proposed may be difficult.

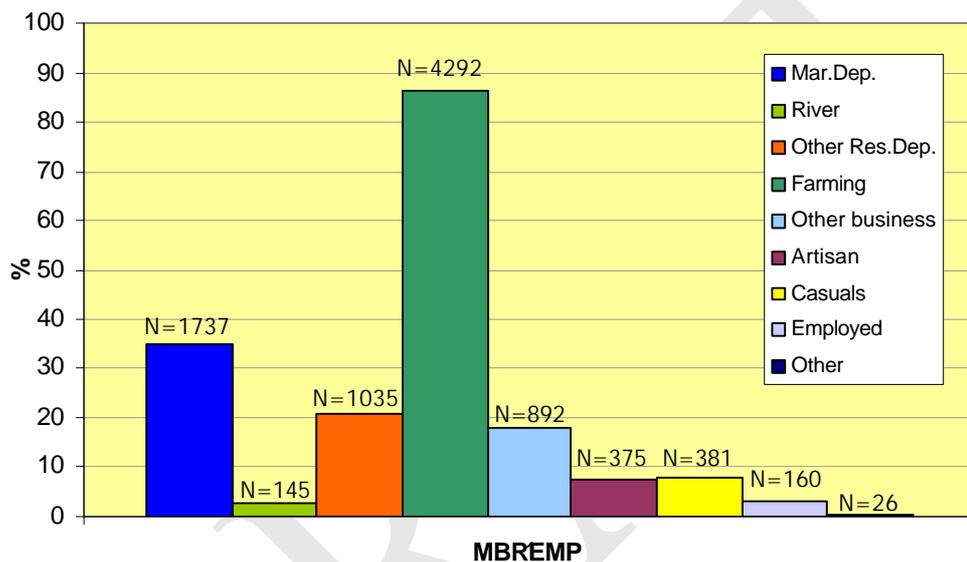
An occupational structure survey was carried out for the preparation of this GMP and showed that there is a wide array of activities carried out in the Marine Park. These include marine related activities such as fishing, seaweed farming, shell collecting, and trading fish, prawns, sea cucumbers and octopus. Other activities include river based fishing and river fish trading, other natural resource exploitation such as wood cutting

and trading (including mangrove wood), charcoal production, palm weaving, sea salt production, and farming for income or subsistence.

The occupational structure data, furthermore, shows that 35% of the Marine Park households are involved in marine resources associated activities (depend on marine resources at least for part of their livelihood), which is the second most important activity after farming.

Figure 3.1: Dependence on the different activity categories at the Marine Park level (excluding Nalingu)

(Source: Malleret, 2004)



Very few households rely on one activity only, thus the sum of households per type of occupations is higher than 4958 (100%). Each bar represents the proportion of households in the MBREMP who depend at least partly on each type of activity.

At the Marine Park level, findings show that on average household livelihoods are composed of 1.73 categories of activity. In order of importance these are farming (87% households), marine associated activities (35% - excluding mangrove harvesting), other natural resources associated activities (21% households), other business (18% households), artisans, casual labour, employment, river dependent activities and other.

However, this structure is not homogeneous across the Marine Park but varies according to villages. The villages could be grouped according to their geographic location, on the basis of their proximity to the sea, to the river, the mangrove area. This illustrates the relationship between the physical environments and livelihood activities. However, other aspects such as access to markets and infrastructure may also have an impact.

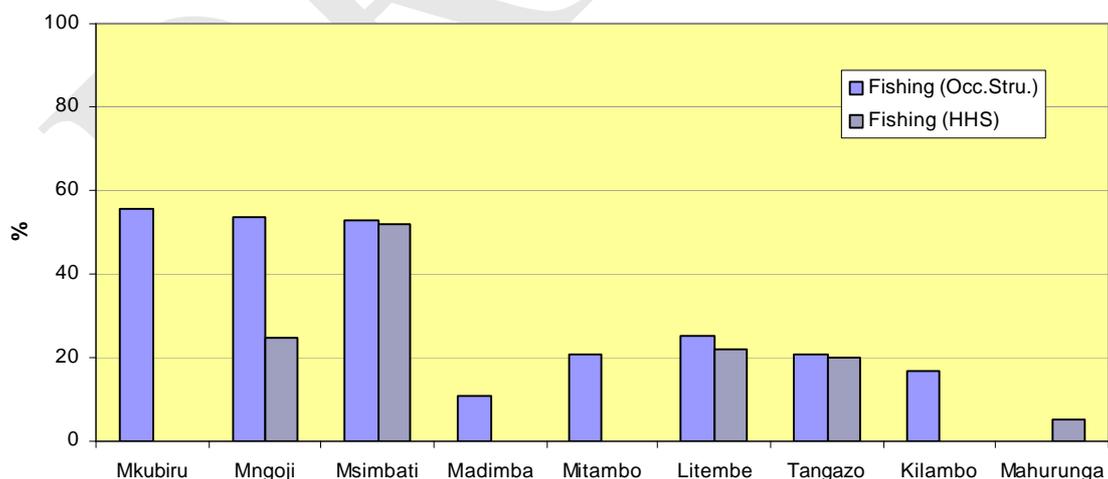
Villages can be grouped as follows:

- Sea bordering villages (Mkubiru, Nalingu, Mngoji and Msimbati). These villages represent 31% of the listed households, excluding Nalingu (see table 1)
- Mangrove villages (Madimba, Mitambo, Litembe, Tangazo and Kilambo). These villages represent more than half the households listed (52.6%, table 1).
- River villages (Kitunguli and Mahurunga), which represent 10.8% of the listed households.
- Other: Kihimika, which is, located the furthest from the sea, river or mangrove (5.5% of the listed households).

The proportion of households involved in marine resources associated activities (dependent on) are highest in sea bordering villages. More than 60% of their households are involved in marine associated activities (74% in Msimbati). However, in these villages farming is still one of the most important activities with 80% households farming in Mngoji. Msimbati and Mkubiru are the villages with the least farming households (60% and 61% respectively) within the Marine Park.

Fishing came out as one of the most important activities for the sea front villages and a number of mangrove villages both from the household survey and the occupational structure survey. It was found that a total of 25.6 % of Marine Park households depend or are involved in fishing (54% for the sea bordering villages households and 19% of mangrove bordering village households).

Figure 3.2: Percentage of households involved in fishing per village



Occ. Stru: findings from the occupational structure survey
HHS: Findings from the household survey.

In addition, the household survey showed that, at the household level, time commitment to fishing is high. Fishers fish on average 5 to 6 days a week and their days off are generally devoted to religious practices or gear repair and maintenance. Most fishers in seafront villages and Tangazo fish all year round. Most fishers in Litembe fish at least three quarters of the year. The household survey also showed that fishing is considered as the main source of income by the majority of fishing households surveyed except in Mahurunga despite the fact that a high percentage of these households do not consider fishing as a sufficient source of income to sustain the households.

Furthermore, many activities, which are directly related to fishing, would be impacted by any changes in fishing practices. The stakeholders impacted are included in the table below.

All the above suggests that the level of dependence on marine resources at the household and Marine Park levels is high, especially in seafront villages and Tangazo.

Consequently, any recommendations pertaining to the level or type of fishing must take into consideration the economic impact such displacement of activity would have, on the fishers and on all the associated stakeholders.

Table 3.2. Marine Park fisheries stakeholders (Source: all research components)

Stakeholders		Type of activity	Origin of stakeholder
Primary stakeholders	Fishers	Set Nets Hand lines/long lines Beach seines Spear guns Spear/hand diving Traps, Tidal weirs 'Tandilo' 'Juya'	Marine Park villages and outsiders- including from Mtwara, Ngao, Msamgamkuu...
	Shell fishers and traders	For shells, meat and lime	Marine Park villages
	Seaweed farmers		Marine Park villages (Nalingu, Mkubiru)
Secondary stakeholders operating in Marine Park villages	Traders, Agents, Exporters	Fish/ 'dagaa' (dry or fresh) traders	Marine Park villages and outsiders (as far as Newala, Tandahimba, Mahuta, Nachingea, Masasi...)
		Sea cucumber traders, agents and exporters	Marine Park villages (mainly Msimbati). Seasonally Chinese exporters base themselves in Msimbati.
		Octopus, lobster traders and agents	Marine Park villages. Agents collect in Msimbati and Namponda mainly.
		Prawn, lobster, crab traders	Masasi, Newala, Mikindani...
	Seaweed farmers	Agent for Zanzibar based Company	
	Boat builders		Marine Park villages
	Net menders		Marine Park villages
Secondary stakeholders Operating in Mtwara and outside the Marine Park	'Tajiri'	Rich boat and gear owners who employ crews to fish	Msimbati
	Consumers		Marine Park villages
	Agents	Shells (including opercula) Sea cucumbers, shark fins, swim bladders Fishmongers	10 in Mtwara 3 in Mtwara
	Gear sellers	2 shops	Mtwara
	Agent/Exporters	Buying depot (fish, lobster, octopus..) ice providers Shells (opercula and shell)	Mtwara but processing in Dar es Salaam an Mafia Mtwara
Institutions	Consumers		Mtwara and around, Newala, Masasi etc.
	MBREMP	Marine Park in charge of management	Main base in Mtwara but future base in Msimbati
	Fisheries Division	Fishing licenses	Main base in Mtwara
	Village Liaison Committee	Intermediary between MBREMP and villages	Marine Park villages
	Honorary rangers	Marine Park enforcement and monitoring	Marine Park villages
	VEMC	Control of resource use in at the village level	Marine Park villages
Village Councils	Control of fish and other marine product trade, outside fishers	Marine Park villages	

Chapter 4. Management and operational framework

The purpose of this section is to set up the means and methods by which the six objectives will be harmonized and carried out.

4.1. Guiding Principles

The following are a set of principles that should guide the implementation of the General Management Plan and the management of the Park. They represent the spirit of cooperation between the Park authorities and the communities that will be most impacted by its implementation

4.1.1. Ecological principles

4.1.1.a. Adoption of an ecosystem approach

The ecosystem approach and the precautionary approach are two of the tenets of the sustainable management of marine resources and both have become an integral part of international law. For instance, the Convention on Biological Diversity (CBD), to which Tanzania is a Party, recognizes these two elements are a key to the conservation of marine biodiversity. The two concepts are also part of the operational guidelines of the GEF, which is one of the major financial backers of this project. A marine park therefore cannot be expected to succeed unless it is based on the ecosystem approach and the precautionary principle.

The ecosystem approach requires that the management of resources be applied to ecosystems as a whole, rather than at single species. For instance, when looking at the management of mangroves, one needs to look at the crucial role that they play as nursery grounds for some species of fish. In addition, one needs to understand the linkages between mangroves, seagrass beds and coral reefs. So, in application of this principle, protecting a single reef does not really make sense unless mangrove and seagrass areas are also protected. The application of the ecosystem approach requires that biological realities be taken into account, as well as political considerations.

4.1.1.b. Incorporation of the precautionary principle

The precautionary principle requires that no exploitation activity be undertaken unless the biological consequences of that activity are evaluated and understood. This principle is particularly important when it comes to the exploitation of under-utilised resources (which under Law 29 of 1994 is one of the purposes of setting up a marine park). In practice, the implementation of the precautionary principle means that a new fishery should not be developed, and that an existing fishery should not be authorised, until the ecological consequences of this fishery, on the target stock but also on related species and ecosystems, are understood and deemed acceptable.

4.1.1.c. Adoption of an adaptive management approach

Inasmuch as the local communities were consulted in the development of the GMP, their participation will be required further when the Plan is implemented in its initial phase. The GMP will need to be fine-tuned and adapted to changing circumstances. As well, some of the strategies that are suggested below may need to be adapted to different villages, with different conditions, different sources of pressure and different levels of pressure on the marine resources. As a result, the GMP must be considered a work in progress, where the authorities and the local communities can both add to it, modify it and improve it in the next two years. The Plan is not a static document but it will evolve over the next two years, before it can be finalised after more input from all those affected.

4.1.2. Socio-economic principles

4.1.2.a. Adoption of an integrated management approach for multiple uses

It is very clear from all the studies that have been carried out that a variety of uses sustain the inhabitants of the Park, all of which are important for sustainable livelihoods. It is also clear that different activities are more prevalent in some areas and that a single approach will not be appropriate for all the villages. In some cases, the villagers are heavily reliant on fishing, whereas in others, farming dominates. The only way to address this multiplicity of circumstances is through an integrated multi-use approach, where zoning can address the particular local conditions. For instance, where the dependence on fishing is very high, a zone dedicated solely to local artisanal fishers could be appropriate. As well, in areas where sustainable tourism appears to be promising, no-take areas, or areas where the most destructive fishing methods are prohibited might make sense. Finally, areas where endangered species, such as marine turtles, are known to forage or nest might be off limits to other deleterious activities or to fishing activities where bycatch might be high. These zones will at first be designated on an experimental basis, incorporating the suggested zones included in the VEMPs and with thorough input from the local communities.

4.1.2.b. Collaborative management through community participation

It is now widely accepted that a Marine Park, particularly one that is home to almost 30,000 inhabitants, cannot possibly succeed without the full support of its local stakeholders. With an area of 650 km², the only change of success of the GMP is if those who are impacted are willing to comply with the management measures. In other words, the only chance of compliance is self-enforced, where the stakeholders see to it that the management measures are respected because they know that they will benefit in the long-term by ensuring the sustainability of the marine living resources.

All but one of the 11 villages have participated in the development of Village Environment Management Plans (VEMPs). These constitute a good base to build on, and embody the villagers' understanding of their marine and coastal resource situation, where the resources are located, and what needs to happen for those resources to be managed sustainably. They also include a first shot at a zoning scheme and, to the extent possible, the zones suggested are incorporated in the final zoning scheme, to the extent that they are compatible with the scientific data available and do not conflict with the zones suggested by other villages.

4.1.2.c. Equitable sharing of the benefits and costs of the Marine Park

Marine parks are, in essence, a balance between the level of protection afforded natural resources and the restriction of activities that may have occurred in the past or that were planned. The benefits of the Park are an increase in the value of the resources, whereas the costs are the value of extraction that is foregone. Costs of marine parks are often defined as opportunity costs, reflecting the revenue that was not collected when some resources were not exploited. The costs are therefore borne by the local stakeholders, most often fishers, whose activities are curtailed, sometimes temporarily, when an area is closed to fishing or when an efficient but destructive gear is banned. These costs are balanced by the benefits that are expected from the Park, and over the long run, the benefits are expected to far outweigh the costs that were borne.

From an equitable standpoint, however, it is of the utmost importance that those who have borne the costs, by agreeing to see their activities restricted, also be the ones who reap the benefits of the Park. For instance, it would not be fair if after the local fishers had borne the costs of fishing less, with more selective gear, or not fishing in some areas, they were not the ones who benefited from the increased biomass that is likely to result from the restrictions that were put in place. Consequently, the fishers must be assured that *they* will be the ones who benefit from improved fisheries, resulting from recovering fish stocks. This can be achieved through a number of ways, including restricting fishing over time to the local stakeholders only, for instance by banning visiting fishers/vessels from outside the Park.

In addition, as benefits flow from other activities, such as natural gas development or ecotourism, a share of these benefits must be set aside to compensate those stakeholders who have seen their activities curtailed. This is particularly important in MBREMP, where the revenue from the cash economy amounts to less than US D 100 per person per year. Given those circumstances, local fishers can hardly be expected to purchase less destructive gear (e.g. fishing nets with larger mesh size), but rather should benefit from gear exchange programmes, funded with the revenue generated by outsiders who exploit other resources in the Park (e.g. the ecotourism developers or the developers of the natural gas reserves).

4.1.2.d. Incorporation of gender balance considerations in decision making

The socio-economic assessments commissioned by MBREMP clearly show that women are extensively involved in the harvesting of marine living resources, and their involvement in the exploitation should be reflected in a parallel involvement in the management of the resources. Women make many household decisions that influence how and when the resources are harvested. Therefore, to make management decisions without incorporating gender balance considerations could be detrimental to the well-being of the villagers and could ultimately have a deleterious effect on the status of marine resources. Other examples in Tanzania and elsewhere have shown that sound decision-making cannot take place without meaningful participation of women and that this participation is better achieved from the outset of the management plan.

4.2. Management Strategies

The following management strategies, which reflect the guiding principles listed in the previous section, are means to achieving the nine goals of the Marine Park (see Chapter 1). The strategies consist of concrete actions and approaches that can be taken to ensure the successful implementation of the GMP. However, these are draft strategies that will be evaluated and assessed and that may be modified, during the first two-years of the implementation stage of the GMP.

4.2.1. Strategy to conserve biodiversity and ecosystem processes

- a) Build on and complement existing knowledge and understanding of the following critical aspects of biodiversity and ecosystems:
 - ⇒ The distribution of marine and terrestrial biodiversity within the Park
 - ⇒ The status and distribution of species and habitats considered to be endangered, threatened and/or critical, including turtles, dugongs, marine mammals, wrasses (including Maori humphead wrasse) and groupers
 - ⇒ The status in the buffer zone of the same species and habitats
 - ⇒ Ecological processes responsible for maintaining the productivity and diversity of marine and terrestrial resources, including, but not limited to, spawning areas, other aggregation areas, current patterns, seed and larvae dispersal and recruitment, and reproductive cycles
- b) Collate all information on the species, habitats and ecosystem processes in GIS format, building on the database established by MBREMP
- c) Identify threats to critical and threatened habitats, species and ecosystems, as they evolve
- d) Phase out all resource-use practices damaging to threatened habitats and/or species
- e) Isolate all threatened and critical habitats from destructive activities through the designation of no-take core zones
- f) Focus compliance efforts in critical and threatened areas, through patrolling and self-enforcement
- g) Subsume all other development plans to the designation of core zones in the GMP

- h) Maintain a turtle conservation plan, including protection of nesting sites (with financial incentives if necessary), a ban on the slaughter of nesting turtles, and reduction of accidental catches through gear replacement, where necessary and appropriate
- i) Undertake regular monitoring and assessment of critical and threatened habitats and species.

4.2.2. Sustainable Use of Marine Living Resources and Rehabilitation of Damaged Resources

- a) Incorporate the recommendations suggested by the communities in Village Environmental Plans, where compatible with the objectives of the GMP
- b) Implement national legislation on banned gear (including but not limited to, dynamite fishing). Wherever possible, exchange rather than confiscate banned gear
- c) Implement national legislation prohibiting the takings of endangered species, including sea turtles and dugongs and the export of Maori humphead wrasse (*Cheilinus undulatus*)
- d) Ban coral mining within the boundaries of the Park, and facilitate the development of an alternative strategy in the buffer zone
- e) Designate core, no-take zones around critical habitats (e.g. breeding grounds, spawning aggregation sites)
- f) Restrict fishing activities during key periods (e.g. spawning season), where scientifically called for
- g) Restrict fishing activities to local Park stakeholders, through the designation of an artisanal fishing zone, where fishing activities by outsiders are prohibited
- h) Limit and manage artisanal fishing by fishers from outside the Park
- i) Establish a register of fishers in the Park, including type of vessel/gear(s) used
- j) Establish a comprehensive and community-based fisheries catch and effort data collection scheme
- k) Encourage sustainable harvesting of mangrove resources, including temporary closing of the most affected areas and a temporary ban on the harvesting of the most threatened species

4.2.3. Community Participation in Management and Access to Resources

- a) Give priority to the implementation of the VEMPs, once they have been reviewed and approved by the local authorities
- b) Ensure that gender considerations are taken into account in the VEMPs, through the participation of women in training activities and in liaison with Park authorities
- c) Ensure the integration of local residents' indigenous knowledge with scientific data in the planning of sustainable resource use strategies
- d) Give residents of the Park priority over access to resources, including banning fishing activities from outsiders

- e) Establish a community-based catch and effort data monitoring programme where the most diligent villages and villagers are given priority in livelihoods development efforts
- f) Facilitate mechanisms that assure a significant portion of revenue from gas exploitation and ecotourism development is dedicated to compensating Park residents whose activities have been curbed by the implementation of the GMP
- g) Facilitate mechanisms to include part ownership by Park residents from any ecotourism development plan in the Park
- h) Develop community-based collaborative enforcement mechanisms, including the attribution of radios, boats and petrol for community patrols in the most remote areas (including remote turtle nesting sites)

4.2.4. Environmental Education and Information Sharing

- a) As a first priority, ensure that Act 29 of 1994 on Marine Parks and Reserves is translated in Kiswahili, widely distributed through Village Liaison Committees and all other means necessary, and explained in workshops in each of the villages within the Park
- b) Translate in Kiswahili and widely distribute a copy of this GMP in all villages
- c) Prioritize outreach efforts to the local communities on the goals, objectives, guiding principles and management strategies of the GMP
- d) Ensure that Marine Park staff spend more time in each village
- e) Ensure that each village has a designated Marine Park staff to which its residents can go with questions, suggestions and complaints about implementation of the Plan.
- f) Promote a culture of information-sharing and transparency in decision-making through regular dialogue with all stakeholders, including residents of the buffer zone
- g) Design a turtle education programme, including regular workshops on the ecology and critical importance of marine turtles for marine biodiversity

4.2.5. Research and Monitoring of Resource Condition and Use

- a) Prioritize research and monitoring of resource condition around critical and threatened habitats and threatened/endangered species
- b) Ensure that the local community is fully involved in research and monitoring of resource condition and use, with a reward system where appropriate (e.g. the most diligent villages, or those whose data collection is most thorough can be given priority in any alternative livelihoods development programme)
- c) Develop a detailed monitoring and assessment programme, ensuring that all critical aspects of resources and resource use are monitored at regular intervals
- d) Ensure that research and monitoring of fisheries resources covers catch landed as well as level of fishing effort
- e) Integrate research and monitoring in day-to-day management of the Park
- f) Collaborate with scientific institutions in Tanzania, in East Africa and overseas to build on the existing database set up by MBREMP and to fill outstanding data requirements not covered by internal monitoring and research capacity
- g) Ensure that all data collected are integrated in the existing GIS database

4.2.6. Sustainable Use of Under-Utilised Resources

- a) Ensure that any effort to develop under-utilised resources in no way undermines the sustainability of existing activities
- b) Ensure that the precautionary principle is applied before any exploitation of under-utilised resources is allowed, including strict Environmental Impact Assessments (EIAs) for any infrastructure development and thorough stock assessment for new fishing activities
- c) Ensure that any proposed ecotourism activity is compatible with the Tourism Investment Framework Report prepared for MBREMP
- d) Ensure that any proposed ecotourism activity does not exceed the ecological and socio-economic carrying-capacity of the Park
- e) Ensure that any proposed ecotourism activity does not impact the natural and aesthetic value of the Park
- f) Facilitate mechanisms that assure a significant proportion of the revenues from ecotourism activities are redistributed to local stakeholders whose activities have been curtailed by implementation of the GMP
- g) Ensure that new fisheries are not subject to excessive pressure from international trade
- h) Ensure that any new fishery developed be established in partnership with local stakeholders, including through local part-ownership of any new gear utilised, including new boats, wherever possible
- i) Ensure that any gas extraction activities are subject to strict EIA requirements
- j) Ensure that any destruction of natural resources is compensated through contingency valuation, where other areas are designated and protected whenever project development impacts ecosystems in the Park
- k) Facilitate mechanisms that assure benefits from any gas extraction is shared with local stakeholders, especially those excluded from fishing in the vicinity of the gas well

4.2.7. Protection of Aesthetic and Natural Values of the Park

- a) Establish a special committee to advise the Park staff on aesthetic and natural values. The committee shall be comprised of community representatives, scientists and other government officials including those with experience in the preservation of historical or natural sites
- b) Ensure that any new development in the Park is subject to an aesthetic evaluation by the special committee before it is approved by the authorities

4.2.8. Protection of Cultural Heritage of Park Residents

- a) Identify and collate, in association with local communities, existing information on sites of cultural significance within the Marine Park
- b) Establish a special committee on cultural issues, comprised of community representatives, national historical authorities and appropriate government

representatives, to evaluate new developments and ensure that they do not threaten the cultural integrity of Park residents

- c) Collaborate with communities and mandated institutions to formulate appropriate management measures to preserve and restore historical and sacred sites
- d) Facilitate implementation of appropriate management measures in collaboration with communities, tourism operators and, where appropriate, institutions and donors
- e) Encourage new investigations on historical and cultural resources
- f) Train staff on the importance and management requirements of cultural sites and relics

4.2.9. Sustainable Ecotourism

- a) Ensure that any proposed ecotourism development project is compatible with the objectives and restrictions of the Tourism Investment Framework (including the restrictions on ecological and socio-economic carrying capacity)
- b) Give priority to the development of small-scale but high value, low-impact ecotourism developments, while encouraging the development of higher volume tourism in the buffer zone, including Mikindani
- c) Provide incentives to developments that use low impact construction material
- d) Provide incentives to developments that provide partial ownership to local communities
- e) Support tourism operators in the promotion and marketing of a diversity of tourism attractions, including recreational fishing, diving, wildlife observation and local culture
- f) Collaborate with tourism operators, where appropriate, to develop public tourism facilities, such as nature trails and mooring sites
- g) Train Park staff to interact with visitors in a professional, courteous and constructive manner
- h) Assist investors to ensure that they are fully aware of all restrictions on ecotourism developments
- i) Facilitate dialogue between ecotourism operators and communities to ensure that resident communities share in the economic benefits of the Park

Chapter 5. Zoning Scheme

5.1. Rationale

The zoning of a marine park is an integral part of any management plan. A variety of users cohabit in MBREMP, but sometimes their activities are not compatible. For instance, some type of fishing should not take place in a relatively pristine area with high aesthetic value that may have been set aside for the development of an ecotourism enterprise. Likewise, gillnets should not be used in an area known to be a breeding area for endangered marine turtles. Zoning is a way of setting aside some areas for certain uses while excluding others. Some uses are more destructive than others; some are extractive, while others are not. A given use can be the mere protection of a critical habitat, where no other uses are allowed at all. Zoning provides all users with a greater amount of clarity and predictability. Once the Park has been zoned, and this information has been made available, everyone knows *what* they can do and *where*. Conflicts among users then become much easier to avoid.

It should be noted, however, that within the boundaries of a marine park and according to Act 29 of 1994, no use is permitted unless it has specifically been authorised by the competent authorities. In addition, when a use is permitted, it may not be permitted to everyone, but may be restricted to some categories of stakeholders (e.g. artisanal fishers who reside in the Park and who hold a license to fish).

The following purposes have been incorporated in the MBREMP zoning scheme (Salm *et al.*, 2000):

- To permit selective control of activities at different sites, including both strict protection and various levels of use
- To establish core conservation areas as sanctuaries where no uses are allowed (this is particularly useful to protect critical habitats)
- To separate incompatible activities, including incompatible *recreational* activities
- To set aside damaged areas to recover
- To recognize the traditional fishing rights of local communities
- To protect breeding areas of fish to allow impacted stocks to recover

5.2. Designation of Zones, including pilot zones

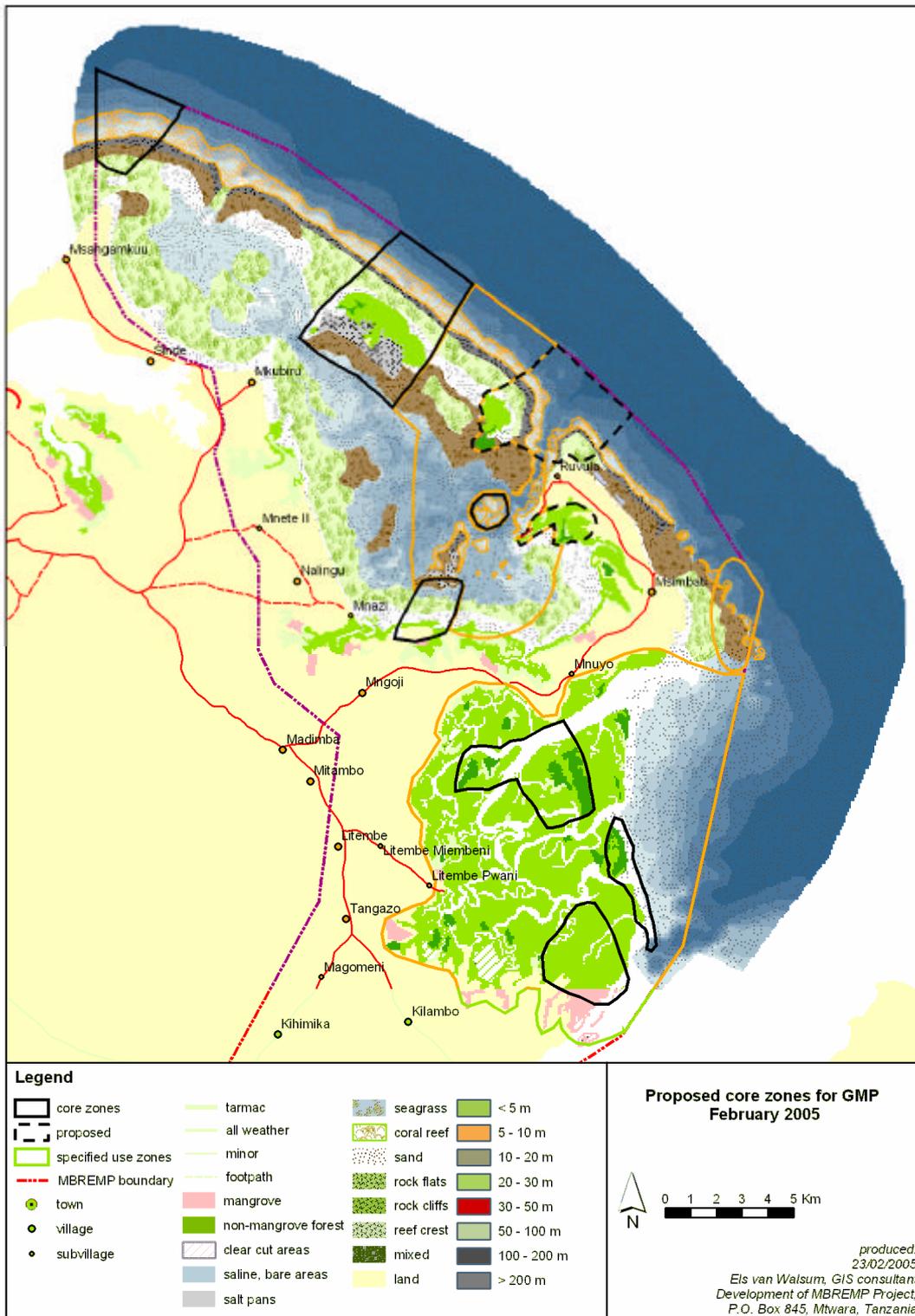
- ⇒ To the extent possible, the designation of zones, including core zones, is based on the recommendations contained in the VEMPs (see van Walsum *et al.* 2005) and the scientific assessments of the Park.
- ⇒ Zones have been designated and mapped through a participatory zoning workshop, with input from communities and the scientific assessments carried out for MBREMP.

- ⇒ The zones have been designated on an experimental basis and will be adjusted in the course of the two-year implementation phase, with participation from the local communities
- ⇒ Some core zones are designated, where the impact on the local communities is limited but where the most critical habitats exist. Close monitoring will assess and document the impacts of the closure, including impacts on adjacent areas through the spillover effect. Based on the results of this monitoring the boundaries and location of these zones will be modified, as appropriate.
- ⇒ Core zones have been designated to cover significant areas of coral reefs, seagrass beds and mangroves
- ⇒ Two proposed core zones require further study before they can be designated

5.3. Definition of Zone Types for MBREMP (see Map 3)

1. Core zones, where no extractive use is permitted and where other, non-extractive uses are either prohibited or strictly limited.
2. Specified-use zones, where a given activity is specifically permitted and only for the designated beneficiaries, or where cultural sites are afforded special protection. This covers Artisanal Fisheries zones, where fishing is limited to artisanal fishers who are resident of the Park and engage only in legal fishing practices.
3. General-use zones, where only legal activities are allowed under the law, and where outsiders are allowed but require a permit.

Map 3. Core and Specified Use Zones for Mnazi Bay Ruvuma Estuary Marine Park



5.4. Modification of the zoning scheme

The first attempt to delineate the various zones is based on the biological and socio-economic information available, and a participatory workshop with 10 of the 11 villages. This information, however, is incomplete and the situation may evolve over time. As a result, the zones may need to be evaluated and adjusted. This is particularly true for the designation of the core zones, which represent a compromise between the value of the habitats being protected and the opportunity costs of the stakeholders who will not be able to carry out their activities. In that case, the boundaries of the core zones may be fine-tuned to limit the displacement of traditional users. In addition, the designation of some core zones may not be permanent and the restrictions in these areas may be reduced or removed once the objectives of the core zone have been achieved (e.g. after the recovery of a damaged habitat).

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Chapter 6. Prohibited and Regulated Activities

6.1. Prohibited activities

Every use that is not specifically authorised under the Act and in the GMP is prohibited in the Marine Park. According to Act 29 of 1994, Part X, Other Regulations, Section 22:

“No person within a marine park or reserve shall, except in accordance with terms and conditions specified in the regulations or the provisions of this Act

- Fish, hunt, kill or capture any fish or animal or disturb any egg, nest, roe, or spawn within the marine park or reserve
- Gather, collect or remove any fish, animal, aquatic flora, or vegetation, whether live or dead, or any sand, minerals, or aquatic substrate
- Sell or transport any fish, animal, aquatic flora, vegetation, or the products thereof or any sand, minerals, or aquatic substrate;
- Be in possession of any weapon, explosive, trap or poison;
- Engage in aquaculture
- Make salt
- Conduct any sport fishing, tourism or other commercial activity
- Operate any vessel or vehicle within any marine park or reserve
- Clear or cultivate land for any agricultural use, or use or operate agricultural implements, or machinery
- Construct, or extend any buildings, road or any other work, or
- Destroy, deface or remove any object within a marine park or reserve”

Park residents are therefore required by law to obtain Marine Park authorisation to carry out their livelihoods. All activities prohibited under Tanzanian national law (Act 29 of 1994 and the Fisheries Act 2003) shall be prohibited in all zones within the Park boundaries. In addition, the following activities are prohibited:

6.1.1. Prohibited extraction of living resources

- Use of beach seine nets, including those known locally as “juya” or “kavogo”
- Any activity involving mechanical damage to, or breakage of, coral and other benthic habitats or organisms, whether by hand or by use of poles or other implements
- Killing of turtles, whether accidental or deliberate, including removal of turtle eggs
- Killing of dugongs, whether accidental or deliberate
- Trawling
- Use of propelled spear-guns and harpoons
- Use of dynamite
- Use of chemicals and poisons for fishing

- Use of SCUBA gear to collect any marine organism, other than for research purposes and subject to prior authorisation
- Mangrove cutting for commercial sale
- Mining of live coral from inter-tidal and sub-tidal areas

In addition, the use of pull nets with stretched-mesh size of less than 2.5 inches – including tandilo – will be phased out within the boundaries of the Park

6.1.2. Prohibited extraction of non-living resources

- Mining of dead coral from inter-tidal and sub-tidal areas
- Sand mining from beaches and sub-tidal areas
- Any form of seabed mining
- Hydrocarbon exploration and drilling (other than the existing gas well, where exploitation will be subject to review by the Warden and other relevant authorities)

6.1.3. Prohibited construction and development

- Port development and/or dredging (marina development and permanent docking facilities – including wood jetties - will require submission of an EIA and prior approval of the Warden)
- Industrial development
- Use of explosives for any purpose
- Dumping into marine waters of solid waste, untreated waste water and sewage or chemically polluted water or liquid

6.1.4. Prohibited tourism activities

- Jet skis
- Sea-planes

6.2. Regulated activities

6.2.1. Fishing activities

- All fishing will be prohibited in the core zones
- All fishing in the Special Use zones will be restricted to artisanal fishers who are resident in the Park
- All artisanal fishers in the Park will be issued a fishing license and will provide all required information on the type of vessel/gear they use
- Lobster and octopus fisheries may be subject to minimum catch weight limits
- Destructive and illegal gears will be phased out with due compensation
- Sport fishing will be restricted to designated areas within the Marine Park
- Sport fishing will be subject to prior issuance of a sports fishing license and payment of the appropriate fees

- Sport fishers may be bound by minimum and maximum size restrictions. Furthermore, the fishing of some species, to be determined by the Warden, may be restricted to catch and release only
- Sport fishers will show permits and provide catch information to any duly authorised Marine Park staff. Furthermore, and, as deemed necessary by the Warden and subject to scientific justification, a Marine Park observer may be posted on sport fishing vessels, at the sport fisher's expense.

6.2.2 Mangrove harvesting

Harvesting of mangrove products, especially tree-cutting, will be strictly regulated under a permit system. In addition, the following will apply:

- Mangrove harvesting will be strictly prohibited in all core zones
- Mangrove harvesting for firewood, charcoal and kilns will be forbidden
- Mangrove harvesting will be restricted to Park residents who have obtained a permit to do so.
- Harvesting mangroves for commercial purposes within the Park boundaries is prohibited.
- Non-residents caught harvesting mangroves within Park boundaries will be prosecuted to the full extent of the law.
- Even when a permit has been granted, clear felling of mangroves should be limited.
- Further regulation may establish limits on the species of mangroves that may be harvested.
- Permit issuance may be subject to a limited number of mangroves to be cut and may require the applicant to plant seedlings.
- Prior to harvesting, a cutting site may be specifically approved by the Warden-in-Charge or one of his/her representatives.

6.2.3 Non-mangrove harvesting (other forest products)

Harvesting of non-mangrove products will be subject to a permit system.

- Pole cutting will be strictly prohibited in all core zones
- Pole cutting will be restricted to Park residents who have obtained a permit to do so. The number of permits issued will be limited.
- Even where a permit has been issued, the cutting of poles may be subject to replanting alternatives as a condition of cutting natural trees

6.2.4. Scientific Research

- All scientific research within the Park boundaries will be subject to prior issuance of a scientific permit by the Warden-in-Charge, at his/her discretion but subject to scientific justification
- A scientific permit allows for the limited collection of specimens for scientific reasons, but not for bio-prospecting purposes
- A differential fees system will be applied to Tanzanians and non-nationals, though the fees may be waived if the Warden-in-Charge deems the planned research to be in the interest of the Marine Park
- All the results from scientific research carried out in the Park will be forwarded to MBREMP in the most useful format (and in GIS format wherever possible)
- Any publications based on scientific research carried out in the Park should be forwarded to MBREMP as soon as they become available
- Failure to abide by these requirements may result in a ban on further scientific research within the Park for the individuals/institutions involved

Chapter 7. Management Structure and Village Environment Management Plans

In accordance with Act 29 of 1994, the Board of Trustees, through the Marine Parks and Reserve Unit (MPRU), is responsible for the management of Mnazi Bay Ruvuma Estuary Marine Park (MBREMP). Day to day operations are the responsibility of the Warden-in-Charge, supported by a team of professional and support staff in the field. In the case of MBREMP, priority is given to Village Environment Management Plans (VEMPs), which form the cornerstone of management within the Park.

7.1. Key role of the VEMPs

Once they are finalised and approved by the Park authorities, the VEMPs will be collated to ensure that they are compatible with one another, and will then form the basis upon which the Park is managed.

Each VEMP contains the following:

- ⇒ A short description of each village
- ⇒ An assessment of natural resources, management issues, problems and opportunities
- ⇒ The rationale for each VEMP
- ⇒ A village-based zoning scheme
- ⇒ A management system, including committees with roles and responsibilities and relationships with Park authorities, relations with MBREMP, laws and penalties and financial management issues
- ⇒ An objective hierarchy of the VEMP
- ⇒ An action plan for natural resource management, and
- ⇒ A section on monitoring and evaluation

In many ways, the format of each VEMP follows that of the GMP, which will ensure that the villages become the on-the-ground implementers of the GMP. Such an approach is the only way to ensure that the local communities are truly and meaningfully involved in the management of the Marine Park, as required by Act 29 of 1994.

7.2. Supporting role of other strategic documents

Two very important documents have been commissioned by MBREMP, first, a Strategic Development Framework and, second, a Tourism Investment Framework, both of which provide a roadmap for the development of new activities in the Park. These documents emphasise the importance of taking into account the carrying capacity of the Park, both ecological and socio-economic, when developing new economic activities. Both documents provide clear recommendations on suitable developments for MBREMP and will be used as guidelines for any new developments in the Park.

7.3. Further legislation

The enforcement of the GMP requires the preparation and implementation of subsidiary regulations covering, *inter alia*, the following issues:

- The zoning scheme and resource-use restrictions, as outlined in Chapters four, five and six
- Qualifications for residency in MBREMP
- EIA requirements and procedures

All these implementing regulations will be referred to collectively as the General Regulations for the Mnazi Bay Ruvuma Estuary Marine Park. Their preparation will be guided by sections 13, 18, 19, 20, 21 and 23 of the Marine Parks and Reserves Act No. 29 of 1994. The Warden-in-Charge and MREMP field staff will initiate the process of preparing draft regulations under the guidance of MPRU and such drafts will be submitted to the Park Advisory Committee. Following modification and approval, the proposed drafts will then be submitted to MPRU for professional legal drafting and subsequent submission to the Board of Trustees for further modification and approval. The Board will then recommend proposed regulations to the Minister for approval and gazettment.

7.4. Organization structure, roles and responsibilities

7.4.1. The Board of Trustees and the Marine Parks and Reserve Unit

The Board of Trustees formulates policies on all marine parks in Tanzania and directs the MPRU on all matters regarding the designation and management of the marine park system. Part II of Act 29 of 1994 establishes MPRU, whose functions include:

- To seek funds for the establishment and development of marine parks and reserves, and
- To implement and enforce the provisions of Act 29 and any subsidiary legislation pursuant to sections 18 to 38 of the Act

7.4.2. The Advisory Committee

The purpose and composition of the MBREMP Advisory Committee is provided in the Second Schedule of Act 29 of 1994. As such, the Advisory Committee is established to advise the Board of Trustees; consult with the Marine Park Warden on technical, scientific and operational matters and to propose names to the Board of Trustees for the purpose of appointing a Warden. The Advisory Committee constitutes a representative forum of MBREMP stakeholders, including local communities, regional and district government, a non-governmental organisation, a research institution and representatives of the tourism and fish processing investors within the Park area. The Committee meets quarterly and submits its regulations directly to the Board of Trustees. The Warden-in-Charge serves as Secretary of the Committee.

7.4.3. The Warden-in-Charge

The Warden is responsible for all matters concerning the Park's administration and is subject to the control of the Board of Trustees and the Advisory Committee. The Warden

has a responsibility to local communities, district authorities and other stakeholders, including that of notifying them of planning efforts and ensuring that they have an adequate opportunity to participate in the management of the Park.

7.4.4. Village Liaison Committees

Act 29 of 1994 provides that each Village Council which “affects or is affected by the marine park, either directly or through a designated committee ... shall participate fully in all aspects of the development of regulations, zoning and the general management plan.” Accordingly, the committees shall continue to serve as the primary interface between the communities and the Marine Park.

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Chapter 8. Monitoring the management effectiveness of the Park

8.1. Why monitor management effectiveness

The long-term success of a marine park depends on effective management and community participation, combined with demonstration of its usefulness and appropriateness as a conservation and management tool (Mangubhai and Wells, 2005). In many ways, the effective management of MBREMP will depend on the extent to which this general management plan has assessed the situation and the threats, and how well it has anticipated the issues that will arise in the future. Foresight in this respect is limited, so procedures must be set up to monitor the extent to which the goals of the Park are being met, and if not, what new management measures can be adopted to meet all nine goals of the Park (see the introductory chapter for a list of the nine objectives). One of the guiding principles of this GMP is the reliance on an *adaptive management* approach, where assessments will be carried out to establish the success of the GMP in meeting the goals of the Park and where the management approaches will be *adapted* accordingly. In addition, the monitoring of management effectiveness will create a learning environment, which encourages the sharing of knowledge, skills and experience so that lessons are learned and mistakes are not repeated (Mangubhai and Wells, 2005).

8.2. How to assess management effectiveness

In order to assess the effectiveness of the Park, it is necessary to look at changes in biophysical and socioeconomic environment, which will provide *indicators* that can be monitored and measured. The assessment will cover issues that fall within the responsibilities of the Park managers as well as those that are beyond their control. If changes occur outside the boundaries of the Park but have an impact inside the Park, the managers need to be aware of these changes so that they can modify their management approach to address them.

The assessment of management effectiveness within MBREMP will be carried out using the methodologies and tools developed in two important initiatives: the workbook developed by the Group of Experts on Marine Protected Areas for Eastern Africa (GEMPA), and the Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness developed by IUCN's World Commission on Protected Areas (WCPA). Both initiatives provide guidelines and steps that can be followed to ensure that any management assessment is comprehensive and thorough. In addition, however, the following aspects of management assessment must be emphasised in the case of MBREMP:

- ⇒ the bulk of the assessment will be carried out *in close cooperation with* and, wherever possible, *by* the local community
- ⇒ the assessment will rely on a combination of biological, socio-economic and governance indicators²
- ⇒ the level of detail of the assessment will depend on the infrastructure and resources in place and may start at a basic level and increase as know-how is acquired, capacity built and resources assigned
- ⇒ as the level of assessment increases, Park authorities will work with the local community to ensure that their capacity to carry out the assessment increases accordingly
- ⇒ the results of the assessment(s) will be shared and widely disseminated, with the local community in MBREMP and in other communities affected by marine parks in Tanzania
- ⇒ The results of the assessment(s) will be incorporated in the further development of the GMP, particularly as it is modified after the initial implementation stage.

² All three sets of indicators are explained in greater detail in the WCPA methodology, available at <http://www.effectiveempa.noaa.gov/guidebook/guidebook.html>.

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APPENDIX I: BOUNDARY DESCRIPTION FOR MNAZI BAY RUVUMA ESTUARY MARINE PARK

The Marine Parks and Reserves (Declaration of Mnazi Bay Ruvuma Estuary Marine Park) Order, 2000

Government Notice No. 285, published on 4/8/2000

Made under Section 9 of the Marine Parks and Reserves Act, No. 29 of 1994

1. This Order may be cited as the Marine Parks and Reserves (Declaration of Mnazi bay Ruvuma Estuary Marine Park) Order, 2000.
2. This Order shall come into operation on the First day of July, 2000
3. The area covering the Mnazi Bay Ruvuma Estuary Marine Park specified in the Schedule to this Order is hereby declared a Marine Park for the purposes of section 9(1) of the Marine Parks and Reserves Act, 1994.

SCHEDULE

All that area of Land and Water in the Mtwara District the boundaries whereof are more particularly defined as follows –

Commencing at a point (10°34'46''S, 40°16'13''E) on the Ruvuma River and its International Boundary between Tanzania and Mozambique;
Thence following the Ruvuma River Easterly and Northerly direction to Ras Mwamba;
thence Easterly direction to Ras Ruvuma (10°34'40''S, 40°16'13''E);
Thence in Northerly direction bearing of 10°07'29'' for a distance of approximately 14 km to a point (10°20'31''S, 40°28'10''E);
Thence Northwesterly direction to a point (10°17'46''S, 40°26'29''E) for a distance of 6.75 km;
Thence Northwesterly direction bearing of 313°34'04'' for a distance of approximately 5.5 km to a point North of Ras Msangamkuu (10°09'28''S, 40°13'56''E);
Thence due South for a distance of 7.75 km to a point (10°13'40''S, 40°13'57''E);
Thence Southeasterly direction to a point (10°14'43''S, 40°14'34''E) for a distance of 2.25 km;
Thence Southeasterly direction to a point (10°15'35''S, 40°15'48''E);
Thence in a bearing of 110°33'21'' for a distance of 1.3 km to a point (10°15'50''S, 40°16'42''E);
Thence Southwesterly direction to a point (10°17'35''S, 40°16'24''E);
Thence Southerly direction for a distance of 3.25 km to a point (10°19'35''S, 40°16'59''E);
Thence Southerly direction to a point (10°17'35''S, 40°15'48''E);
Thence in a bearing of 110°33'21'' for a distance of 1.3 km to a point (10°15'50''S, 40°16'42''E);

Thence Southerly direction to a point (10°17'35''S, 40°16'24''E);
Thence Southerly direction for a distance of 3.25 km to a point (10°19'35''S, 40°16'59''E);
Thence Southerly direction to a point (10°19'57''S, 40°17'28''E);
Thence Southerly direction to a point (10 22'30''S. 40 17'46''E)
Thence Southerly direction to a point (10°23'39''S, 40°19'09''E);
Thence in a bearing of 191°07'45'' for a distance of 3 km to a point (10°23'39''S, 40°19'09''E);
Thence in a bearing of 185°37'50'' to a point (10° 27' 14''S, 40 °18'38''E) for a distance of 3.5 km;
Thence Southerly direction in bearing of 208° 43'52'' for a distance of 9.4 km to a point (10°31'45''S, 40°16'10''E);
Thence Southerly direction to a point South of Mahurunga Village (10°32'52''S, 40°15'55''E);
Thence Southerly direction for about a distance of 2.8 km approximately to a point (10°34 25''S, 40°16'02''E);
Thence in a bearing of 151° 41'57'' for a distance of 38M approximately to the point of commencement.