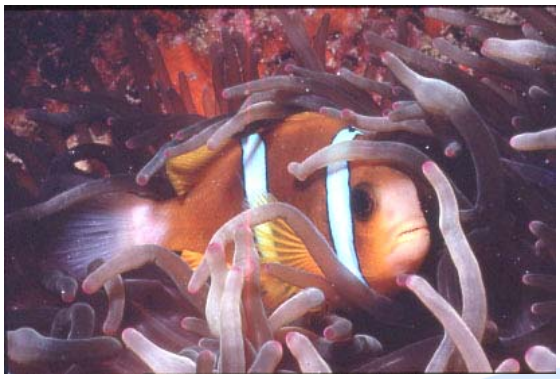
WCPA-Marine & WWF
Marine Protected Area Management Effectiveness Initiative

Application of the WCPA-Marine/WWF Guidebook on Evaluating Effective Management in MPAs

MAFIA ISLAND

A Demonstration Case



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September 2003

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Introduction

Why perform MPA management effectiveness evaluations?

Marine protected areas (MPAs) are recognized as management instruments to protect marine biodiversity, to maintain/restore ecosystem health, and to provide coastal communities with a sustainable source for economic growth. However, most MPAs around the world face multiple issues, such as insufficient financial and technical resources, lack of trained staff, and lack of natural and social sciences research support. These issues severely impact MPA managers and practitioners in reaching the goals and objectives of their MPAs.

Measuring the performance of MPAs and their impact on natural environments and society is becoming a priority for many national governments, international organizations, and donors. Evaluating the effectiveness of an MPA provides results on the successes or failures in reaching the goals and objectives of the MPA and gives critical information to:

- Adapt management strategies to improve the MPA performance
- Set priorities for new projects and strategies
- Improve accountability, and
- Implement measures to maximize the benefit to the society

The WCPA-Marine & WWF MPA Management Effectiveness Initiative

In 2000 the World Commission on Protected Areas-Marine (WCPA-Marine) and the World Wide Fund for Nature (WWF), initiated the MPA Management Effectiveness Initiative (MEI) to provide MPA managers and practitioners with a simple instrument to conduct an evaluation. This 4-year program aimed to increase international awareness of performing monitoring and evaluation in MPAs in collaboration with MPA managers and experts worldwide. A major product of this initiative is the guidebook *How is your MPA Doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness*. It gives a step-by-step description on how to perform an MPA effectiveness evaluation, how to select and measure the most appropriate indicators, and how to use the results of the evaluation. The guidebook contains a set of biophysical, socioeconomic, and governance indicators, which are designed to measure management effectiveness in a wide range of MPAs.

Demonstration case report

Eighteen pilot MPAs, with diverse management objectives and environments, were selected to field test a draft of the guidebook to develop a flexible tool that could be used in many types of MPAs. Over a 6-month period, representatives from these MPAs participated in two activities: (1) a training workshop to learn how to use and apply the guidebook, provide feedback and select the most appropriate indicators for each site; and (2) measure the selected indicators in their MPAs and submitted their results and recommendations to improve the guidebook. Four of these pilot sites, with different environments and management systems, did a more in-depth report of their experiences to illustrate how the guidebook can be implemented.

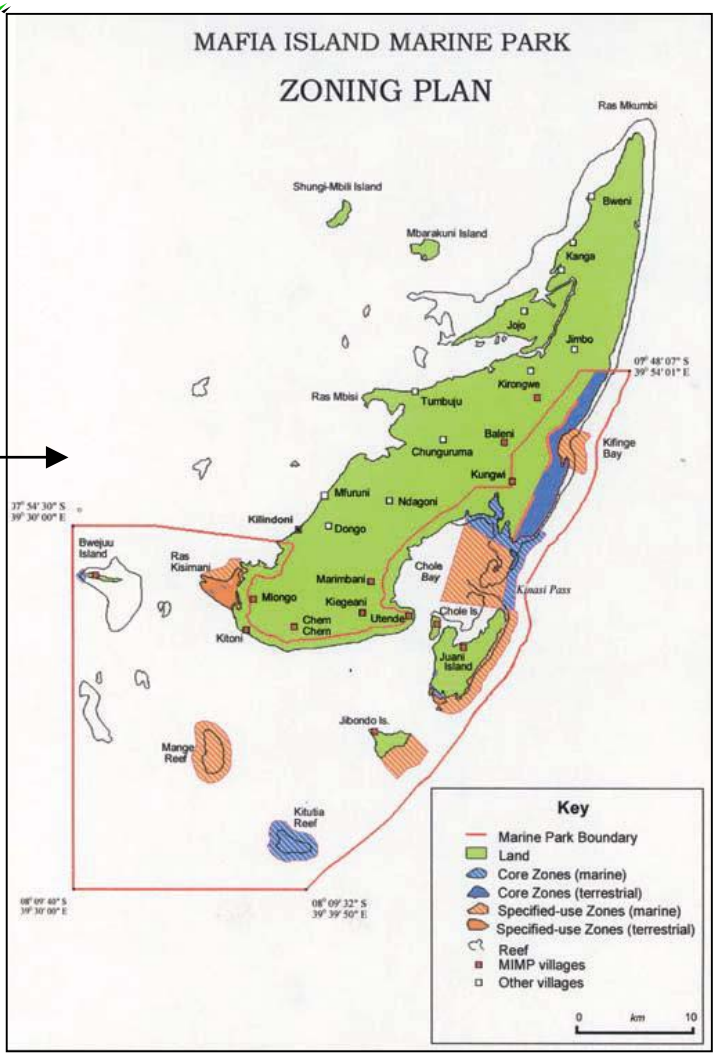
This report is the case of the **Mafia Island Marine Park**, Tanzania, and how this particular MPA followed the field-testing process of the Guidebook. This case study will provide MPA managers and practitioners working in similar MPAs an example of how the guidebook can be applied and adapted to conduct management effectiveness evaluations.

Descriptive Information

Name:	**Mafia Island Marine Park**
Country:	**Tanzania**
Location:	**7°37′ - 8°10′ S; 39°30′ – 39°55′ E**
Area:	**822 Km^2**
Objective:	**Multiple Use**
Near City:	**Dar es Salaam**

Mafia Island lies off the coast of Tanzania in mainland East Africa, approximately 120 km south of the capital Dar es Salaam, 20 km offshore from the Rufiji Delta and 850km south of the equator. To the east of Mafia Island is the open Indian Ocean, the only eastward land masses being the oceanic atoll Aldabra (750 km) and the scattered small islands of the Seychelles (1500 km). The main island of Mafia is approximately 500 km^2 in area, 48 km long and 17 km wide at its widest point. Several smaller islands and islets are scattered to the west and south, some inhabited.

The park area covers the southern coast of Mafia Island and includes 4 small inhabited islands; Chole, Juani, Jibondo and Bwejuu as well as numerous uninhabited rocky islets, reefs & sandbars.



Ecological Features

Mafia Island lies at the edge of the narrow eastern African continental shelf and the bathymetry on its eastern side shelves relatively steeply into the open ocean, reaching 500m depth, less than 10km offshore. The entire island consists of coral rag overlain by sandy loam soil, with a maximum altitude of 40 m.

Mafia Island's eastern seaboard is exposed to the low-nutrient, high-energy waters of the open Indian Ocean. The sheltered western side of Mafia Island is influenced by nutrient-rich sedimentary discharge from the Rufiji Delta (which drains 20% of Tanzania) and other river outlets to the south. These contrasting influences of a mainland river delta and the open ocean, together with the bathymetric complexity of the sub-tidal 'landscape' surrounding the various islands, islets and reefs endow the marine park area with unusually high habitat diversity sub-tidally. Species richness is correspondingly high for the region; to date over 400 species of fish, 5 species of marine turtle, 48 genera of scleratinian corals, 7 species of mangrove, 12 species of seagrass and 134 species of marine algae have been recorded.

Coral reef habitats dominate the marine park. The extensive 100 km eastern outer fringing reef is seasonally protected from artisanal fishing by rough sea conditions and is rich in reef benthos and associated fish and marine turtles. Chole Bay is a large body of water (100km^2) but is virtually enclosed so the huge volume of tidal water flooding in and out through the relatively narrow Kinasi Pass creates fine conditions for coral development along the pass walls as well as excellent feeding grounds for medium-sized pelagic fish such as jacks, barracuda, large groupers, Napoleon wrasse, pelagic rays and some sharks. The more sheltered back reefs within the bay also support a high diversity of corals, reef fish and other reef fauna. Other reefs to the south and west of the park, notably *Kitutia* and *Mange* are similarly rich.

There are 17.35 km^2 of mangrove habitat within the marine park. Much of this is composed of relatively narrow fringing stands but there are 3 medium-sized blocks at Mchangani and Juani in Chole Bay and at Ras Kisimani facing towards the Rufiji Delta. There are extensive seagrass beds scattered throughout the marine park. Those in Chole Bay formerly provided feeding grounds for a herd of 60-70 of the dugong (*Dugong dugon*) but they were hunted out by the early 1970s. Dugong are now critically endangered in the western Indian Ocean region, nonetheless one of the small remnant populations survives to the south of the Rufiji Delta some 30-40 km from the edge of the marine park. Individual animals very occasionally stray into the park's waters.

Mafia is an important area for marine turtles. Green and hawksbill turtles lay upwards of 200 nests per year on 14 different beaches both inside and outside of the marine park, and leatherback, loggerhead and olive Ridley turtles all feed in surrounding waters.
Approximately 10% of the marine park area is terrestrial including Mlola Forest on the eastern side of Mafia, as well as a 1km coastal strip along the southern coast and several small islands. Mlola Forest is a representative remnant patch of dry East African coastal forest, a highly threatened forest type recognised as having high plant and invertebrate biodiversity and a high level of endemism. In Mafia as a whole 656 species of higher plant are recorded of which 4 are endemic and 12 are near-endemic or rare. Of these, 10 are within the marine park, 6 in Mlola Forest. There are also 2 endemic reptile species in Mlola Forest, 130 bird species of bird (all Mafia) and several roosts of the Comoros lesser fruit bat which occurs only on the Comoros and Mafia.

Regional Significance

From a regional perspective, the marine habitats within Mafia Island Marine Park are broadly representative of the Eastern African 'coral coast' which could be said to stretch from Malindi/Watamu in central Kenya, south to the Primeiras and Segundos in northern/ central Mozambique, a distance of some 2000 km.

The marine habitats and species in Mafia Island Marine Park are particularly connected ecologically to the Songosongo Islands, an extensive archipelago of islets and coral reefs that stretches some 70-80km to the south of Mafia, as well as the vast mangrove forests of the Rufiji Delta (>1000km^2) just 15-20 km to the west. The Rufiji-Mafia-Songosongo complex is coming to be recognised by environmental managers as an inter-dependent ecological 'seascape' that in terms of size and condition encompasses the best overall assemblage of tropical marine habitats representative of the Eastern African coastline. The area is under consideration for both Ramsar and World Heritage status. It has also been identified by regional experts as one of two areas of global significance within the Eastern African 'coral coast', the other being the Mtwara-Querimbas reef complex stretching either side of the Tanzania-Mozambique border.

Human Dimension

The official human population of Mafia Island is 41,000. The direct 'user' population of the marine park is generally regarded to be around 18,000 people which is the population of the 11 villages that lie either wholly within, or else straddle, the park boundary. Of these, at least 8,000 or so reside within the boundaries of the marine park and a further 10,000 or so reside within 1-2km of the park boundary and are routine users of natural resources within the park.

Historically, the indigenous Bantu African tribes that settled Eastern Africa were strongly influenced at the coast by Persian and Arab traders/ colonists since the 11th century. Islam is central to the culture of the coast and Kiswahili and (to a lesser extent) Arabic are the important languages.

Communities in Mafia are entirely rural and relatively very poor even by national standards with an annual per capita income of 100 - 150 USD. On Mafia there is only one hospital and one secondary school and both are in a very poor, though slowly improving, state. The lack of health services over the past 20-30 years combined with a current high HIV infection rate (thought to be around 15%) has resulted in an age-structure that is heavily skewed towards youth. 71% of Mafians are 15 yrs or less. The lack of education services both at village and District level mean that literacy levels are low and general standards of education are very poor. Energy, communications and transport infrastructure are equally impoverished. Electricity is available in only 2 out of 24 villages, in one only a handful of houses are connected. Only the main town, Kilindoni, has telephone services to the mainland and even this is an antiquated system unable to carry Internet or e-mail and often doesn't work at all. There are no more than 20-25 functioning vehicles on Mafia and almost all of them belong either to tourism enterprises, District authorities or the marine park. Mechanised public transport (or private for that matter) is virtually non-existent and ordinary people depend entirely on bicycles, hitching lifts or their legs.

In general Mafia's communities, especially outside of the main town, are conservative and tend to have a *laissez-faire* attitude towards development and wealth creation. For many households, survival is genuinely a day-to-day, hand-to-mouth affair. Monetary savings are minimal and assets tend to be in the form of coconut trees, land, boats and livestock. There is little in the way of entrepreneurship, a combined result perhaps of Islamic tradition, traditional poverty and a genuine lack of enterprise opportunities.

Since Tanzania gained independence in 1961 the economy of Mafia has not changed greatly, however fishing and other marine resources have gradually acquired increasing prominence with the decline in the global market for coconut products. The availability of outboard motors and ice-machines in the 1990s have made possible the marketing of fresh fish directly to Dar es Salaam and there is also now a sizeable, export-oriented prawn, octopus and lobster processing plant on Mafia. Fish and related resources are certainly now the most important wealth generator in Mafia as a whole, however much of the market value goes to traders from Dar es Salaam and elsewhere rather than to Mafia fishers.

This said, probably no more than half of all households in Mafia depend primarily on fishing for their livelihood. Coconuts and small-scale subsistence farming remain an important contributor. Cashew nuts are the only other widely grown commercial crop but production is not well managed and marketing is inconsistent. Cassava is the predominant subsistence staple crop. Relatively few individuals manage to obtain employment in mainland Tanzania and remittances from salaries do not contribute very significantly to household incomes.

Commercial enterprises and opportunities for salaried employment are relatively few. There are 2 large coconut plantations on Mafia under single ownership which together with the fisheries processing company in Kilindoni and the District authority are the largest employers. The only other service or product that generates significant net wealth and employment to the Mafia economy is tourism. This is still at a relatively small scale with less than 1500 international visitors per year frequenting 4 small beach lodges located in Utende & Chole. The total number of employees in the sector is probably less than 200 and the benefits in terms of employment and ancillary business are confined to those 2 villages and the main town. They are nonetheless locally significant and are likely to grow over the next decade provided that the threat of international terrorism recedes.

Another commercial product is seaweed (*Eucheuma cottonii*) which is farmed on simple racks in shallow water around the spring low-tide mark. Seaweed farming has been well established on the Tanzanian coast since the early 1990s, especially Zanzibar, but in Mafia only since 1999. The bulk of production is currently confined to one small island village within the marine park, Jibondo, where about 125 women participate. Small farms are kept elsewhere but conditions are less good. The buying price doubled in 2002 as a result of competition amongst buyers and farming now yields a monthly *per capita* income of up to 40 USD. This is substantial and in recent months Jibondo women have all but abandoned octopus fishing, formerly their main cash-earner.

The over-riding social issue is probably HIV-AIDS although it is only very recently that it has become an openly discussed subject. Several small NGOs have been established since 2002 to disseminate AIDS-awareness, funded by UNICEF and Save the Children. Another widespread issue is youth unemployment; in all villages there are large numbers of youths aged 15-25 who have no land, fishing gears or salaried employment. There is widespread concern about the limited opportunities for primary school students to graduate to secondary school; 56% of successful primary graduates failed to secure a place in 2002. Lack of fresh water is a very pressing issue for the minority of people living on the small islands of Jibondo, Juani and Bwejuu (3000 people in total). For 6-9 months of the year there is no water at all on the 3 islands and all fresh water is fetched daily from Mafia Island. From an outsider's perspective, there are some major issues of gender inequality, not uncommon in Islamic societies. Women generally have little or no authority in the home and only token representation on village councils etc. Generally however there is little unrest or overt complaint from women in Mafia, it is less clear how women themselves perceive their gender status in private.

Legal Framework

Mafia Island Marine Park (MIMP) was established on 1st July 1995 by a resolution of the Tanzanian National Assembly. The boundaries were gazetted in Sept 1996. The resolution was passed under the then new *Marine Parks & Reserves Act, No. 29 of 1994* and MIMP became Tanzania's first marine park. Prior to that there had been a number of small marine reserves gazetted under the Fisheries Act in the early 1970s. Two of these were in fact within the current MIMP boundaries, but at no point prior to 1995 was there was any management effort of any kind due to lack of funding and political will. Since 1995 one other marine park has been established in Tanzania, Mnazi Bay & Ruvuma Estuary Marine Park, gazetted in 2000.

The Act endows the marine park authorities (ultimately the Minister for Natural Resources & Tourism) with substantial powers to regulate virtually any activity within the boundary of a park including all forms of natural resource-use; entry into the park of any human non-resident including inward migration and settlement; any non-domestic construction; any commercial operation; freshwater use and so on. A marine park may encompass land areas as well as sea. Aspects over which the marine park authorities specifically do *not* have control include the right of existing residents (at the time of gazettement) to live in within the park boundaries and to build domestic houses, and right of acquiring or exchanging land title (though the authority has substantial powers over how land is developed). Moreover the Act specifically requires that village councils of villages within and adjacent to the park boundary "*participate fully in all aspects of the development of, or any amendment to,the regulations, zoning and general management plan for the marine park* …". In short the marine park authorities are powerful in principle, but it is intended that their authority is harnessed to the interests and well-being of local communities and to a lesser extent other stakeholders.

MPA Goals and Objectives

The goal of the Mafia Island Marine Park as stated in the General Management Plan (2000) is *to conserve the diversity, abundance and function of all physical and biological resources, in order that they may continue to be enjoyed and productively utilised by present and future generations.*

The objectives of Mafia Island Marine Park are:

1. To protect, conserve and restore the species and genetic diversity and ecosystem processes of the marine and coastal area;
2. To promote sustainability of existing resource use;
3. To ensure that local residents are involved in all phases of planning, development and management; share in the benefits of the operation; and have priority in resource use and the economic opportunity afforded by the establishment of the park;
4. To stimulate the rational development of under-utilised natural resources;
5. To promote community-orientated education and dissemination of information concerning conservation and sustainable use of resources in the marine park;
6. To facilitate research and to monitor resource conditions and uses within the marine park.
7. To conserve and protect the historic monuments, ruins and other cultural resources that have been identified as of significance to the history of Mafia island.
8. To facilitate the development of appropriate eco-tourism.

Institutional Arrangements

The body charged with overseeing the development and management of marine parks & reserves in Tanzania is the Board of Trustees, Marine Parks & Reserves. The Board is a non-executive body answerable to the Minister of Natural Resources & Tourism, it has up to 11 members (senior Govt officers, academic, private sector, NGO representatives and one member of parliament from a marine park area) and meets quarterly. In the interim periods, the Board's directives are implemented by an executive body, the Marine Parks & Reserves Unit, which has a permanent office in Dar es Salaam.

Within Mafia Island Marine Park, the Board employs a Warden-in-Charge who, together with a team of 19 technical and support staff, is responsible for implementing management activities within the park. The efforts of the Warden and his team are overseen and advised by an Advisory Committee, which also has 11 members. Seven are resident on Mafia and include 3 representatives from local communities, 1 each from the District Council and District authority, and 2 from the tourism and fisheries private sectors. The other 4 representatives are from relevant institutions in DSM (academic, NGO, regional authority and the Forest Division).

The link between the marine park and the 11 villages formally recognised as being 'within' the park is provided by a village liaison committee (VLCs) in each village. These committees are answerable to the village council (of which they are a sub-committee) and their members are elected by a village assembly in which all villagers are able to vote. The VLCs have a Chairman, a Secretary and 4 other members. Villages are encouraged to elect 2 women to the committee though it is not a strict requirement. The Secretary should be a secondary school leaver. Each village committee also appoints a Village Liaison Officer who is effectively a village ranger.

Management Plan

The current MIMP General Management Plan (GMP) was approved by the Minister for Natural Resources & Tourism in September 2000. Aside from the standard sections describing the background, issues, objectives and structure of the marine park, there are three other substantive sections.

The first outlines a management strategy for tackling each of the 8 objectives (see above), detailing the major outputs that need to be delivered. The second is a zoning plan which divides the marine park area into the following 3 types of zone:

Core zones	Areas in which no extractive resource-use is permitted, but tourism is allowed. There are 4 marine and 2 terrestrial core zones. The marine core-zones comprise no more than 5% of the marine area of the park.
Specified-use zones	Areas in which certain techniques of extractive resource-use (such as seine nets) are not permitted. All resource-use by non-residents is also not permitted. There are 6 marine areas that comprise around 15-20% of the marine area of the park.
General use zone	The remaining area of the park where national resource-use regulations apply, but within which non-residents are required to buy a permit to fish or extract any marine resource.

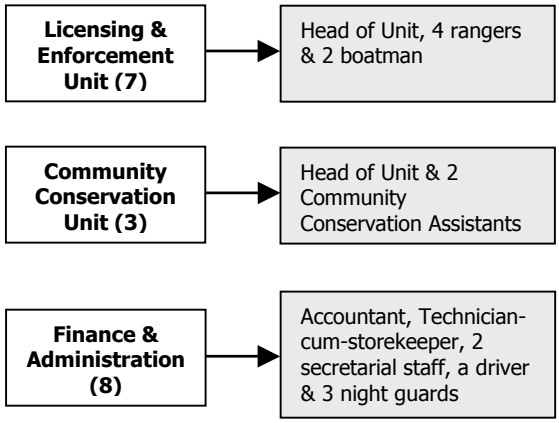
The third section of the GMP outlines in detail exactly which activities are prohibited in each type of zone, and which activities require permits to be issued either for non-residents or residents. The GMP is a policy document rather than a legal one; all the restrictions outlined in it are also in the process of being drafted into formal regulations that will be gazetted in law under the Marine Parks & Reserves Act, 1994, a process which the Minister can authorise directly without reverting to parliament.

The General Management Plan (2000) is due to be reviewed in 2005 but will remain valid if the review is delayed for any reason. Any amendments to the GMP must be agreed by the marine park villages and the Board of Trustees, who would then recommend the amendments for approval by the Minister.

MPA Staff

MIMP has 19 permanent government staff comprising 3 personnel units headed by the Warden-in-Charge.

During the period 1999-2004 the marine park has received project support from the Worldwide Fund for Nature (WWF) which has supported 7 additional staff including a Technical Adviser, 2 community fisheries officers, a micro-enterprise officer, a fisheries monitoring officer, an accounts assistant and a driver.



Outreach and Training

On 3 occasions in 1992, 1996 and 2000 there have been major initiatives to consult local communities about natural resources management issues on a systematic, village-by-village basis. From time to time training workshops and consultative seminars are conducted with village leaders and village liaison personnel to share information and get feedback about marine park procedures and regulations. Study tours for village leaders and fisher representatives have been arranged to other parts of the Tanzanian coast including Mtwara, Tanga and Pemba Island to share experiences on how other communities are tackling marine resources management issues. Various other specialised technical training is provided from time to time in areas such as micro-enterprise, mariculture, fishing gear construction, bee-keeping, handicraft production, alternative building techniques (ie. without using mangroves or coral lime) and so on.

MIMP operates an environmental education programme that focuses on disseminating awareness about the marine environment to primary school children in the 11 marine park villages. Environment clubs have been established in each school, approaches include painting, singing & drama competitions, field trips in a glass-bottom boat and distribution of educational materials such as calendars and t-shirts.

Stakeholder Participation

The primary vehicle for stakeholder participation in the management of the marine park is through the MIMP Advisory Committee, which has 3 representatives from the local community and one each from the tourism and fisheries commercial sectors. The committee should meet quarterly, in fact it meets 3 times per year on average, and has reasonably strong powers both to direct the Warden-in-Charge and to make recommendations to the Board of Trustees. Amongst commercial stakeholders the representation works reasonably well since there are relatively few of them and they can communicate relatively easily when they want to. Amongst community stakeholders such representation is a much greater challenge and works much less efficiently. There are thousands of stakeholders who have very little opportunity to communicate with their representatives.

A new initiative designed to strengthen community involvement in natural resources management is getting under way in 2003, namely a programme of village land-use planning. This is part of a national initiative to decentralise land-use decision-making to village level. The marine park is collaborating with communities and District authorities. Such a programme obviously has special implications within a protected area and all land-use plans will need to be compatible with the MIMP General Management Plan, nevertheless it will hopefully give communities an opportunity to examine more openly how they can accommodate livelihood concerns with principles of sustainable resource-use and environmental protection.

There is a provision in the MIMP GMP whereby a portion of revenues raised from tourism entry fees may be shared with both communities and District authorities. However the amount to be shared is stipulated as a percentage of *net* revenue (ie. After the park's running costs have been deducted).

In principle this leaves any revenue sharing at the discretion of the Board of Trustees. This is an anomaly, which probably needs to be corrected for the sake of relations between MIMP, the tourism sector and local communities.

Major Issues

Dynamite Fishing

At its establishment in 1995 the biggest issue facing the marine park was rampant dynamite fishing. As part of a national campaign in 1996-97, the marine park successfully stamped it out; the last incidence of dynamite fishing within MIMP was recorded in April 1998. Sporadic dynamite fishing still occurs outside the park and on other parts of the Tanzanian coast.

Small-mesh seine nets

Arguably the biggest issue facing the marine park currently is the use of small-mesh seine nets for fishing. These are thought to cause physical damage to sensitive benthic habitats such as corals and seagrasses, as well as undermining fisheries productivity by removing immature fish. In 1999 there were around 16 seine nets in use by fishers resident within the marine park and other nets are brought in from time to time by outside fishers. The marine park has had some success in encouraging several of these groups to switch to more sustainable fishing gears through providing interest free loans, supported by WWF. This initiative is ongoing.

Tourism-fisher conflict

There is a conflict between tourism interests and local fishers in Chole Bay. Tourists pay 10 USD per day to stay in the marine park and tend to expect that reefs where they dive and snorkel will be totally protected from fishing. The reefs in question are the traditional fishing grounds for 2 small island villages with a combined population of 2000 people. Local fishers tend to believe that their fishing rights are under threat of being sacrificed to the interests of foreign tourists and the marine park which currently retains over 90% of the entry fees for its operational costs. The conflict does not manifest itself openly between the respective parties, but rather through constant complaints from both sides to the marine park and through dogged reluctance by some fishers to comply with the seine net ban on the reefs in question.

Outside fishers

There is a degree of conflict between resident MIMP fishers and outside fishers, especially in Bwejuu, Mlongo and Miburani on the western side of the marine park closest to the mainland. The outside fishers are often from other parts of Tanzania, camping either around the main town Kilindoni, or in the aforementioned villages. Some of these groups are beachseine fishers, regarded as destructive by local fishers using more traditional gears. They also often refuse to pay permit fees, compete for space on fishing grounds with local fishers and are seen as a threat by fathers with young unmarried daughters. When instances of conflict occur, the MIMP communities in question generally seek assistance from the marine park and occasionally arrests are made.

Coral mining & mangrove cutting

Before 1995, coral mining within the marine park for lime production was a significant commercial activity, supplying lime for construction within Mafia and to Dar es Salaam. Since the park was established commercial trading of lime has been greatly reduced but lime production for domestic construction within park villages continues. Coral mining is permitted under the general management plan but only if a permit is granted by the Warden-in-Charge. Mangroves have been quite heavily cut in certain areas in the past, though it is not a very serious problem. Mangrove harvesting is also allowed under a permit from the Warden-in-Charge. In practice the management of the permit systems for both coral mining and mangroves needs improvement.

El Niño related bleaching

Some coral communities within the marine park were severely affected in 1998 by thermal stress resulting from sea temperature rises throughout the Indian Ocean, following the 1997 El Niño. As in other areas, mortality of branching corals (esp. Acropora spp.) was particularly high. Slow recovery is evident on the most severely affected reefs, and some reefs were relatively unaffected, however there are also areas formerly dominated by hard corals that have now been colonised by soft corals and macro-algae in what may well be a permanent ecological shift. It remains to be seen whether the surviving coral communities will now have increased tolerance to temperature stress, as a result of genetic selection, or whether 1998 was the first in a series of catastrophic mortalities connected with long-term global climate change.

Water quality

During the past 1-2 years an apparent deterioration in water clarity has been observed in Chole Bay. This is a problem both for tourists who dive in the bay for much of the year, and also for corals which can become stressed both by sedimentation and low light levels. There are no obvious local anthropogenic causes of this and it is not yet clear whether the turbidity is caused by organic or inorganic material. There is land clearance on the main island of Mafia, but Mafia's topography is very flat and the low levels of run-off do not seem to account adequately for the turbidity. It seems more plausible that this is part of a larger scale phenomenon acting on the wider coast, possibly related to discharge from the Rufiji Delta. There is certainly long-term accretion of sediment and recent mangrove development in parts of southern Mafia. Further research is a priority.

Need for Management Effectiveness Evaluation

Mafia Island Marine Park (MIMP) is established under an Act of parliament of the Republic of Tanzania. The Marine Parks & Reserves Act of 1994 requires that marine parks fulfil certain objectives that are deemed to serve the national interests of Tanzania in general (ie. biodiversity protection, tourism development etc), as well as the livelihood interests of local communities. Beyond this MIMP collects user fees from Tanzanian and foreign visitors entering the park for leisure purposes, as well as from non-resident fishers and fish traders involved in harvesting and trading marine resources from the park.

MIMP also receives financial support from the Tanzanian Government, the Worldwide Fund for Nature (WWF) and the Norwegian Government.

To all of the above stakeholders, MIMP has a statutory obligation not only to pursue the objectives set out in the Marine Parks & Reserves Act of 1994 and the MIMP General Management Plan (2000), but also to evaluate its progress and improve its performance where possible. The GMP itself contains an evaluation & review schedule which calls for an internal evaluation & review after 3 years (this year 2003) and a major evaluation & review after 5 years (ie. 2005). It is expected that these reviews should be based on an analysis of progress in implementing the strategies outlined in the GMP, as well as reviewing the appropriateness of the strategies themselves. To this extent, all aspects of the marine park's performance require evaluation to the extent that they are all components of the overall effort to achieve the gazetted objectives.

The direct target audience of any assessment of management effectiveness in MIMP includes the Board of Trustees (BoT); the Marine Parks & Reserves Unit (MPRU); the MIMP Advisory Committee; MIMP staff; Mafia District leaders; local community leaders; commercial tourism and fisheries investors; and international donors supporting the marine park.

The benefits of the evaluation, both actual and anticipated, include:

- Generating valuable information and data that will lead to improved awareness by all stakeholders of the progress and effectiveness of the marine park;
- Stimulating improved performance of the marine park, provided that the lessons from the evaluation are well derived, well learned and well applied,
- Providing a basis on which to formulate a long-term monitoring programme for the park; including identification of indicators for ongoing self-evaluation and future project planning.

Applying the Guidebook

Selected Indicators

Table 1 summarizes the 22 indicators selected for the management effectiveness evaluation at Mafia Island Marine Park.

Two of the above indicators were not included in the draft WCPA guidelines. One (Governance #18) was added during the orientation workshop for the 17 pilot sites and one (Gov new) was added for the Mafia evaluation.

The process used to select the indicators was to assign 2 qualitative scores (i.e. high, high-medium, medium, medium-low, low etc) to each indicator in terms of 2 criteria:

1. **Relevance** to MPA objectives and characteristics
2. **Feasibility** in terms of cost, time and technical expertise required.

This process was done during a one-day seminar involving all the marine park technical staff. From the resulting scores indicators that had *high-medium* relevance and *high-medium* feasibility or better were selected (examples: BP9, SE5, SE15, G10 etc). In addition 1-2 indicators with *high* relevance but *medium* to *low* feasibility were selected on the basis that the evaluation should not be restricted solely to indicators that are easy to measure (examples: BP3, SE11, SE14, G2). Finally 1-2 indicators were added with *low-ish* relevance but *high* feasibility, not because they would be particularly useful for assessing management effectiveness but because they would be easy to include and would yield useful background data (example: SE 3). Aspects of several indicators were already included in pre-existing monitoring activities (examples include aspects of BP1, BP3, BP8 etc.)

In making the indicator selections, care was taken to ensure that each of the 8 gazetted objectives of the marine park were covered by at least one, preferably several, indicators. Table 2 below matches the selected indicators against the marine park objectives. In practice some indicators relate to more than one objective. Despite this, two of the lower priority marine park objectives; *to protect historical ruins* and *to facilitate tourism development* were not covered by the indicators at all. This led the team to propose the additional indicator mentioned above, namely *trend in number of paying visitors*.

Modifications were also made to indicator G12, which in the draft guidelines was conceived as only *number of patrols per time period*. It was considered important to include *no. of infringements per patrol effort* and *percentage of all recorded infringements that were reported by the community*.

Aside from the seminar with MIMP staff to select the indicators, a further meeting was held to present the draft workplan and determine the role that staff would play in measuring each indicator. There were no other collective workshops or staff training as such, thereafter the involvement of MIMP technical staff was on the basis of individual involvement in the collection of data.

Table 1. Selected Indicators from the Draft Guidebook by Mafia Island Marine Park
(See Annex 1 for a detailed list of the indicators contained in the Draft Guidebook)

Biophysical	Socioeconomic	Governance
1, 3, 8, 10	3, 5, 11, 12, 14, 15, 16, 17	2, 6, 8, 10, 12, 14, 15, 16, 18 New: Trend in numbers of paying visitors (Actual & relative to regional trends)

Table 2. Indicators Selected Matched Against Mafia Island Marine Park Objectives
(See Annex 1 for a detailed list of the indicators contained in the Draft Guidebook)

Goal	Objective(s)	Biophysical	Socio-economic	Governance
To conserve the diversity, abundance and function of all physical and biological resources, in order that they may continue to be enjoyed and productively utilised by present and future generations	Protect, conserve and restore the species and genetic diversity and ecosystem processes of the marine and coastal area;	**1, 3**		**18**
	Promote sustainability of existing resource use	**8, 10**	**5, 11**	**10, 12, 15 16, 18**
	Ensure that local residents are involved in all planning, development and management; share in the benefits of the operation; and have priority in resource use and the economic opportunity afforded by the establishment of the park		**3, 5, 11, 17**	**2, 6, 8, 14 15, 16, 18**
	Stimulate the rational development of under utilised natural resources		**5, 11, 17**	**15, 18**
	Promote community orientated education and dissemination of information concerning conservation and sustainable use of resources in the marine park		**12, 14, 15, 16**	**2, 18**
	Facilitate research and monitor resource conditions and uses within the marine park	**All**	**All**	**All**
	Conserve & protect historic monuments, ruins and other cultural resources of significance to the history of Mafia			
	Facilitate the development of appropriate eco-tourism			**1 New**

Implementation of the Work Plan to Measure the Selected Indicators

A workplan to measure the 22 selected indicators was developed, comprising 18 activities. These included 7 surveys by professional researchers from outside the MPA; 5 desk studies based on existing internal reporting carried out by MPA staff; 2 surveys involving new internal sampling of MPA operations; and 4 surveys implemented by MIMP staff with communities. The activities together with corresponding indicators and methodologies are outlined in Tables 4.1, 4.2, and 4.3.

Two MPA technical staff, the authors of this case study, co-ordinated the design of the workplan and oversight of all the activities. Three other MPA staff played a central role in co-ordinating one activity each. The professional researchers involved were from Mafia (1), Dar es Salaam (3) and Zanzibar (2). Various other MPA & District staff and technicians assisted with data collection (see acknowledgements). A summary of the time inputs made by respective participants is given below in Table 3. The input by MPA managers includes time liaising with, and reporting to, the WCPA/WWF secretariat that co-ordinated the development of the MPA-MEI guidelines, and so is slightly higher than the task would otherwise have required. That said, co-ordination of the process was very time-consuming and became a primary (though by no means only) focus of attention for 2 staff over a 6-9 month period. The 5 surveys with researchers from outside Mafia were the most time-consuming involving identification of suitable researchers; preparation of terms of reference; determining methodologies; preparing survey instruments; supervising logistics during implementation; and reviewing draft reports, all with limited communication facilities between Mafia and the mainland.

For the activities that are not ongoing throughout the year, planning, implementation and draft reporting was largely completed within a 6-month period from October 2002 to March 2003, however 1-2 survey activities such as the mangrove inventory ran on until June 2003 and several reports are still being reviewed and finalised at the time of preparing this case study. On reflection this was a minimum duration. Given circumstances on Mafia and the importance of not disrupting other core activities within the MPA, implementing a workplan of the scale outlined here could not easily have been accomplished to a reasonable standard in less than the 6-9 months taken. Realistically, up to 12 months will be needed fully to complete all reporting.

Strengths and Limitation of Indicators

It was not considered useful to detail actual costs of the assessment activities here. Costs vary considerably in different places and details could be misleading. Substantially the largest proportion of costs however was for the surveys conducted by external professional researchers.

Aside from this, some of the activities are by nature ongoing throughout the year as routine monitoring activities, including fish catch monitoring, turtle monitoring and enforcement & surveillance monitoring. Two other long-term recording programmes, fisheries activity monitoring and stakeholder interaction monitoring, were introduced as part of the exercise but will hopefully be periodically maintained hereafter.

Please refer to Tables 5.1, 5.2, and 5.3 for a list of the identified strengths and limitations of the indicators selected by the Mafia Island Marine Park.

Table 3. Personnel effort during implementation of management effectiveness in MIMP

Personnel	Number	Estimated effort (man/days)
MPA managers	2	150
Professional researchers	6	150
Technicians (both MPA & non-MPA staff)	17	832
Volunteers	0	-
Village officers (paid)	15	637
MPA support staff (boatmen etc)	5	225
Local dive Instructors	2	15 mins /day ongoing

Table 4.1. Implementation of Bio-physical Indicators at Mafia Island Marine Park

ACTIVITY	INDICATORS	METHODS AND IMPLEMENTATION
Turtle survey	B1: Focal species abundance	Measured under a pre-existing programme of turtle monitoring, funded externally & co-ordinated by an independent researcher in collaboration with MIMP. Duration: work is ongoing since 2001. Parameters include nesting incidence, fate of nests, no. of hatchlings, incidence of captures in gillnets (all collected by villagers) & incidence of in-water sightings by SCUBA instructors.
Dugong survey	B1: Focal species abundance	Pre-planned survey implemented by 2 independent researchers, funded externally. Duration: 30 days. Method: systematic interviews with fishers. Parameters: No. & location of dugong sightings per year.
Benthic coral reef survey	B1: Focal species abundance B3: Composition & structure of community	Annual repeat survey conducted by a 4-person team of graduate researchers from Institute of Marine Science (IMS), Zanzibar. Duration: 8 field days. Method: line-intercept transects & belt transects, random sampling at 2 depths at each of 3 sites. Parameters: % benthic cover, frequency of coral general, abundance of selected macro-invertebrates (holothurians, lobsters etc.) & density of coral recruits.
Fish survey	B1: Focal species abundance B3: Composition & structure of community	Implemented by 2-man team of independent graduate researchers from Zanzibar. Duration 14 days. Method 1: underwater visual census on randomly located belt transects. Parameters: reef fish abundance identified to family. Method 2: Timed search within a defined area. Parameter: Seahorses' abundance.
Mangrove inventory	B3: Composition & structure of community	Implemented by 6-man team of Forest Division & District Forest officers. Duration: 48 days. Method: circular survey plots randomly located, covering 1% of total known mangrove area. Parameters: species composition; volume of standing stock by species; no. stems per ha; no. of seedlings per ha, incidence of disturbance (cutting & disease) per ha.
Finfish catch data collection	B8 Type & level of fishing effort & fish catch	Ongoing routine monitoring co-ordinated by MIMP fisheries monitoring officer. Method: data recorded daily by selected, unpaid fishers & fish traders. Parameters: catch per unit effort by gear & fishing ground; catch composition by gear & fishing ground; total estimated catch by gear & fishing ground.
Octopus catch data collection	B8: Type & level of fishing effort & fish catch	Ongoing routine monitoring co-ordinated by MIMP fisheries monitoring officer. Method: data recorded from a sample of fishers by trained, paid village recorders. Parameters: catch per unit effort by fishing ground & fishing method; total estimated catch by gear & fishing ground.
Fishing Activity Survey	B10: Area under reduced human impact	2 separate observation surveys, 1 by MIMP staff & village field assistants & 1 by tourist dive boats. Method 1: recording all fishing activity during 10hr sample periods within a 25 km^2 specified-use zone (Chole Bay), by recorders on 3 observation boats. Parameters: no. of fishing trips per day by gear & location on grid map. Method 2: daily recording by tourist boats of sightings of seine net use in Chole Bay. Parameters: frequency & location on grid map of seine net fishing within specified use zone.

Table 4.2. Implementation of Socioeconomic Indicators at Mafia Island Marine Park

ACTIVITY	INDICATORS	METHODS AND IMPLEMENTATION
Individual understanding & awareness survey	S12: Local attitudes & beliefs regarding marine resources S14: Community knowledge of natural history S15: Understanding of human impacts on marine resources S16: Distribution of scientific knowledge to the community G2: Understanding of MPA objectives & rules (& structure) G6: Level of satisfaction with participation in management	Field survey supervised by PhD sociologist + post-graduate assistant from University of Dar es Salaam, implemented with participation of 5 District officers & 1 MIMP staff. Duration: 9 days for field work + 2-3 days preparing survey questionnaire + 10 days for data input & analysis. Method: Standardised kiswahili questionnaire applied through 1-on-1 interviews lasting approx. 1 hour each. 404 respondents interviewed in 4 villages (about 12% of the population), villagers selected randomly within 7 social strata: elders, fishers, farmers, women, small businessmen & salaried employees; youths & students. Parameters: Questionnaire contained 47 questions corresponding to the 6 indicators, as well as 5 questions on personal circumstances (age, gender, level of education, social stratum/ occupation etc). Analysis of results was cross-tabulated with personal variables.
Household economics survey	S17: Income distribution by household S5: Household occupational structure S3: Material style of life (+ Additional questions on food security)	Field survey supervised by PhD economist + post-graduate assistant from University of Dar es Salaam, implemented with participation of 4 District officers & 1 MIMP staff. Duration: 12 days field work, 2-3 days preparing questionnaire and 14 days data input and analysis Method: Standardised kiswahili questionnaire applied through 1-on-1 interviews with head of household lasting approx. 1 hour each. 496 households interviewed in 5 villages within MIMP + 1 control village outside. Households selected randomly within selected sub-villages representative of different livelihood circumstances. Approx 35% of all households in selected sub-villages were interviewed. Parameters: Questionnaire contained 30 substantive questions + additional tables on sources of income etc, related to the 3 indicators + 5 personal questions on head of household (age, gender, where born, length of time in village, social group etc). Analysis of results was cross-tabulated with personal variables.
Fishing gear survey	SE11: Local use patterns	Standard fishing gear survey co-ordinated by MIMP community fisheries officer, implemented with assistance from 2 x District fisheries Officers & 11 x village liaison officers. Duration: 1 month on and off. Method: standard forms completed for all fishers in 11 villages recording details of all fishers, fishing vessels and vessel & gear owners. Parameters: fishing capacity by village in terms of fishers, gears & vessels; level of activity of each fisher & vessel; patterns of ownership; birthplace of fishers etc.

Table 4.3. Implementation of Governance Indicators at Mafia Island Marine Park

ACTIVITY	INDICATORS	METHODS AND IMPLEMENTATION
Stakeholder participation survey	G6: Level of satisfaction with participation in management	Activity conceived as a questionnaire-based survey of non-community MIMP stakeholders (District officers, tourism managers, commercial fisheries processors etc.). Complementary to data gathered under Activity 9 on level of satisfaction with participation in management amongst local communities. The survey to be undertaken by an independent researcher. At the time of preparing this case study the survey not yet implemented.
Review of patrol reports	G12: Number of patrols/ time period G12b: Incidence of non-compliance/ patrol G12c: % violations reported by community G16: No. stakeholders involved in surveillance	Analysis of routine reports undertaken by MIMP Licensing & Enforcement officer. Method: Desk survey of existing routinely-kept patrol records. Duration: 10 minutes /day to complete daily reports. -5 days part-time for analysis. Parameters: as per indicators opposite.
Sampling patrol resources	G10: Available human resources & equipment for surveillance	Undertaken by staff of the MIMP Licensing & Enforcement Unit. Duration: record keeping daily ongoing, analysis 2 days. Method: every morning and afternoon at pre-set times, a record of available patrol resources was logged. Parameters: no. vehicles, boats & engines available & in working condition; no. rangers available to go on patrol at short notice, availability of fuel on-site; etc.
Daily logging of MIMP interactions with stakeholders	G14: Regular meeting of MPA staff with stakeholders	Recorded by all MIMP technical/ managerial staff. Duration: 10 minutes per day for each officer to record the day's interactions, 4 days for 1 person for analysis. Method: log-book maintained within each of the 3 MIMP personnel units, all technical staff log meaningful interactions with local communities, district staff, tourism managers and tourists. Parameters: no. & duration of interactions per month, location of interactions; type of interaction (ie. subject matter of activity/ discussion etc).
Review of activity reports	G5: Degree of stakeholder participation in management G15: No. people trained in resource use G8: Amount of training for community in management	Desk survey undertaken by MIMP technical officer. Duration: 5 days. Method: review of existing training reports, village meeting reports and records kept by village secretaries. Parameters: no. villagers trained in resource-use/ management/ leadership etc.; frequency of in-village meetings in which MIMP management issues were main topic of discussion; level of attendance at such meetings; etc.
Review of financial records	G18: Availability of funding & resources (inc. personnel)	Desk survey undertaken by MIMP technical officer. Duration: 1 day. Method: review of financial & technical reports for past 5 years. Parameters: total funds available for recurrent operational costs, development activities, equipment & construction; no. personnel available on staff; & no. vehicles/boats.
Review of gate records	**New**: Trend in numbers of paying visitors	Desk survey undertaken by MIMP technical officer. Duration: 1 day. Method: review of entry gate records/ annual reports for past 3 years. Parameters: actual visitor nos per yr; no. of visitors as proportion of visitors to comparable coastal destinations in the region (Zanzibar & Kenyan marine parks).

Table 5.1. Strengths and Limitations of Biophysical Indicators for Mafia Island Marine Park

INDICATOR	STRENGTHS	LIMITATIONS
Biophysical 1 Focal species abundance	Trends in this indicator are central to MPA objectives	Abundances of some 'focal' species are not necessarily a good indicator of MPA management effectiveness because some species (1) are vulnerable to impacts beyond the scope of management (e.g. corals & climate change) or (2) migrate beyond the boundaries of the MPA (e.g. mobile species such as - turtles, reef sharks, large pelagic fish etc.). In certain cases interpretation difficulties can be mitigated by data from control sites outside MPA. If a given species has a downward trend in abundance within the MPA but an even steeper downward trend in control sites outside, it could even be regarded a (modest) MPA management success.
Biophysical 3 Composition & structure of the community	Trends in this indicator are central to MPA objectives, even more so than focal species abundance.	There are some very significant challenges related to spatial & temporal variability of tropical marine biological communities & species, and the implications for sampling design & effort. Neither MPA managers nor researchers from national institutions in Tanzania (and many other countries) are particularly comfortable with this issue. Coral reef benthos & fish for example have high variability & therefore a high sampling effort is needed, for random sampling at least. Analysis of benthic cover data indicated >100 transects needed per site to detect a 10% change in some categories – a prospect researchers understandably find horrifying even if adequate funding were available. Yet under-sampled data from random transects can be meaningless. Even inventory of much less variable mangrove habitats required 47 days of fieldwork to perform what is considered minimum representative sampling. One implication: it is essential to develop local capacity within the MPA to perform benthic & fish surveys, making it more feasible to perform intensive sampling at an affordable cost.
Biophysical 8 Type & level of fishing effort & fish catch	Fundamentally high relevance. Not a bad proxy for all bio-physical and socio-economic indicators combined so arguably the singe most important indicator & well worth doing properly.	There are numerous difficulties in collecting reliable, valid fish catch data, most of them well-documented elsewhere. Ideally analysis should not stop at trends in catch/ unit effort, but should also include (1) changes in catch composition by fish family (2) trends in estimated total catch & (3) population structure of 2-3 key commercial species. These require accurate data on catch composition, total fishing effort & length frequency data for selected species. It is easy to under-estimate the difficulty of maintaining a comprehensive catch data programme.
Biophysical 10 Area under reduced human use/ impacts	A useful indicator if the MPA has well-defined user zones that aim to regulate fishing without banning entirely. As a side-benefit, the observational survey doubles up as additional surveillance/ patrolling effort but with the drawback that the observations may then not be representative.	1) The method used was labour intensive & time-consuming - resource-use goes on for 12+hrs per day and even during the night so a lot of observation effort needed. We restricted the interpretation of the indicator to fishing in one limited zone only. Other resources use (e.g. mangrove cutting) is much less visible to observers). To capture seasonal variations, this activity will be continued throughout the year as part of routine monitoring 2) There is a problem of observer effect. If the observers are visible to resource-users then illegal activities will be under-reported since resource-users will obviously stay away. Better if observers can be hidden but it was not possible in our circumstances. 3) Night fishing not sampled at all because of logistical difficulties of night-time observations.

Table 5.2. Strengths and Limitations of Socioeconomic Indicators for Mafia Island Marine Park

INDICATOR	STRENGTHS	LIMITATIONS
Socioeconomic 3 Material style of life of households	Useful for an understanding the general socio-economic context of local community livelihoods	Not really an indicator of MPA management effectiveness as there are many variables affecting material style-of-life that are well beyond the scope of the MPA. This indicator was only covered because it was easy to include in the household survey for SE5 & SE17 and yielded interesting background info. Not a priority for management evaluation.
Socioeconomic 5 Household occupational structure	Important with respect to efforts to encourage changes in livelihood patterns / introduce new livelihoods	Can be difficult to assess the reliability of information gathered from household interviews. Inevitably there are biases on the part of the member of the household that is interviewed & it is not practical to interview all members separately.
Socioeconomic 11 Local use patterns	Important with respect to efforts within MIMP to control destructive fishing gears & promote sustainable gears	It was considered unfeasible to cover all types of resource-use, so this indicator was interpreted in terms of fishing patterns only and took the form of a standard survey of fishing gears & vessels. In a rapid survey one difficulty is to assess level of activity of a given vessel or gear but important if there are a lot of part-time/ seasonal fishers.
Socioeconomic 12 Local attitudes & beliefs regarding marine resources	Potentially useful to monitor traditional beliefs that tend either to reinforce or oppose management measures.	Arguable whether this is really an indicator of management effectiveness. In MIMP it was more considered as interesting background information similar to SE3. Moreover in the context of a rapid questionnaire interview combined with other indicators, it was impossible to explore beliefs and values in depth. Really it requires a dedicated anthropological study.
Socioeconomic 14 Community knowledge of natural history	Useful for planning environmental education initiatives but not really an indicator of management effectiveness as such.	As above it is arguable whether this is really an indicator of management effectiveness or just important background information. The aspects of information dissemination that are within the scope of the MPA management (i.e. environmental awareness campaign) are captured in a more focused way by indicator SE16.
Socioeconomic 15 Level of understanding of human impacts on marine population	Potentially important indicator with respect to the effectiveness of environmental education efforts, but to that extent inseparable from SE16.	Above comment applies
Socioeconomic 16 Distribution of scientific knowledge to the community	Fundamental indicator with respect to monitoring the effectiveness of environmental education efforts	Responses can be biased according to respondents' attitude towards the MPA, for example a fisher who for personal interests is reluctant to abandon an unsustainable or illegal activity such as seine-net fishing or coral mining, is more likely to claim not to be aware of negative impacts, regardless of having received relevant information.
Socioeconomic 17 Income distribution by source by household	As with SE 5, a potentially important indicator if the MPA is attempting to change resource-use behaviour or introduce new income sources.	Can be very difficult to assess the reliability of information gathered from household interviews on incomes. Villagers do not keep records, may not be very numerate and may be understandably reluctant to disclose income information for fear of being taxed etc. Fishers may also tend to over-emphasise the importance of fishing to their livelihoods if they fear that the MPA might ban fishing if they admit to other major income sources. All of these issues were evident during the survey.

Table 5.3. Strengths and Limitations of Governance Indicators for Mafia Island Marine Park

INDICATOR	STRENGTHS	LIMITATIONS
Governance 2 Understanding of MPA rules & regulations by the community	Fundamentally important indicator & relatively easy to measure	Good to include a measure of level of acceptability of regulations to community & also perceived level of participation in composing the regulations. But beware that some communities tend to deny earlier participation if regulations not favoured.
Governance 6 Level of satisfaction of stakeholders with participation	Fundamentally important indicator	Deals with a critical aspect of good MPA management BUT both community & tourism stakeholders can have unrealistically high expectations & therefore low levels of satisfaction even where there is a reasonable level of participation etc.
Governance 8 Amount & quality of training for community to participate in management	Important indicator for capacity-building efforts by the MPA.	Simple to measure as indicator of process (i.e. how much training was done) but much more difficult to measure how meaningful was the output (i.e. was the training effective, is it being applied). Important to include evaluation at time of training.
Governance 10 Available human resources & equipment for surveillance	Potentially useful to have quantitative measure of patrol capacity if lobbying higher authorities for more resources.	In general G12 more useful (i.e. actual patrolling). G10 only really useful in exploring reasons if patrol frequency is low, but reasons are normally obvious & well-known whether a lack of personnel, fuel, commitment etc.
Governance 12 No. patrols per time period /no. infringements per patrol/ % reported by community	Fundamentally important measure of enforcement, compliance & community support for compliance.	Simple to record day-to-day. Draft MEI guidelines focused on recording no. patrols per time period only. This not necessarily meaningful without also measuring incidence of non-compliance per patrol effort & % infringements reported by community.
Governance 14 Regular meeting of MPA staff with stakeholders	Fundamentally important measure of community liaison activity.	Method used required staff to log interactions on daily basis. This is not impossible but requires discipline & margin of inaccuracy may be significant. Also worth remembering this only measures a process not an output. Can have interactions without progress.
Governance 15 Number of people trained in sustainable resources use	Important indicator for capacity-building efforts especially if MPA aims to encourage changes in behaviour.	Same as Gov 8 above
Governance 16 No. stakeholders involved in surveillance, monitoring & enforcement	Important for MIMP, which has low enforcement capacity & relies on self-enforcement by communities.	Relatively straightforward to maintain records of community involvement in activities supervised by MPA staff. For activities conducted separately by village authorities (village patrolling) reporting is rather unreliable.
Governance 18 Availability of funding & resources (inc. personnel)	Important to have a basic measure of available resources as all other progress depend on this.	Not in itself a measure of effectiveness. Resources & funding by definition are not an end in themselves. Resources can be plentiful but misused or misapplied. However indicator is nonetheless useful in explaining trends in other indicators.
NEW Trend in paying visitors (actual & relative to regional trends)	Tourism volume at least partly reflects success of MPA in maintaining environmental values	Many other variables, national & international, affect tourism aside from MPA management success (not least global insecurity). This is not a very direct measure of MPA management effectiveness; tourism is not an end in itself except that it generates revenue, which itself is only a means to other ends.

Results

The following results are an illustrative summary only. Individual reports for survey activities have been compiled separately, some are indicated in the references at the end of this document.

Biophysical Indicators

Where trends were discernible from biophysical indicator results, they were broadly positive. Both coral and reef fish communities appear to be on a slow but steady trajectory of recovery from past impacts, and turtle reproductive success has improved markedly. Other results will serve mainly as a baseline for future monitoring

Focal species abundance (B1)

Turtle reproductive success showed a very positive trend since protection began in Jan 2001. Numbers of reported turtle nests increased from 6/month in 2001 to 19/month in 2003. Percentage of nests poached by humans fell from 49% in 2001 to just 4% in 2003. Confirmed hatchings increased from 2,259 in 2001 to a projected 12,404 for 2003 [REFS 6-8]. The increase in reported nests may be mainly attributable to a reporting incentive scheme introduced in Jan '02 but the decrease in poaching & increase in hatchings is actual.

The dugong survey confirmed there are no animals permanently resident within park boundaries. However the remaining population in Tanzanian waters in the Rufiji-Kilwa area is only 30-40 km from the park boundary & individuals occasionally stray into the western area of the park. Anecdotal sightings reported by fishers within the broader Rufiji-Mafia-Kilwa area were fairly constant between 2000-2003, with annual reported sightings of 10, 7, 9 & 7 in successive years (some sightings could be repeat sightings of the same animal).

Butterflyfish (Chaetodontidae), proposed in relevant literature as a general indicator for coral reef health, increased significantly (roughly threefold) on one reef (Utumbi) but did not change on a second reef (Kitutia). These results are consistent with trends in percentage hard coral cover (see community composition below).

Banching corals of the genus Acropora are a general indicator of reef damage owing to their higher susceptibility to both temperature stress and physical damage. Data on abundance of Acropora spp. as a proportion of all hard corals in 2003 was 24% at all sites combined providing a baseline for future trends. Baseline data on seahorse abundance in a limited, known habitat was also collected. It proved not possible to collect sufficient/ meaningful data for selected macro-invertebrates (commercial holothurians, crown-of-thorns & lobsters) and large reef fish (large groupers & Napoleon wrasse) as hoped but efforts will continue in future.

Community composition & structure (B3)

There are signs of recovery of hard coral communities following severe depletion during the 1998 mass coral bleaching. Mean percentage cover of hard coral showed a statistically significant increase at one site (Utumbi, 29% to 44%) but no significant change at a 2nd site (Kitutia) where there was a significant increase in fleshy algae cover [REFS 5 & 10]. Kitutia was more severely affected in 1998 having been dominated by Acroporid corals, and previously by dynamite fishing. Kitutia did however show a statistically significant (threefold) increase in density of coral recruits suggesting that a recovery process is in fact under way.

Total abundance of reef fish at Utumbi reef also showed a statistically significant increase (more than double) from 1999 to 2003, the increase reflected in 6 out of 15 fish families [REF 3]. The increase in total fish abundance was not reflected at Kitutia reef, however several individual fish families did increase significantly, balanced overall by a decrease in Acanthuridae (surgeonfishes). This suggests a rebalancing of reef fish biodiversity at Kitutia following the coral mortality in 1998 when an increase in turf algae favoured algal-grazing Acanthurids.

The increases in % hard coral cover and coral recruits are part of a natural recovery process after the severe coral bleaching in 1998. The increase in reef fish abundance at Utumbi probably stems more from the cessation of dynamite fishing in 1998 & possibly the gradual reduction in seine netting since 2001. Both are at least partly attributable to MPA management success, especially in sustaining the elimination of dynamite fishing without which even recovery from the 1998 coral bleaching event would have been retarded.

The value of the mangrove inventory is mainly as a baseline. Comparisons with a 1988 baseline based on aerial photography are largely meaningless. The 2003 inventory did show that cut stems in one sector were

17% of all cut & uncut stems, as well as high numbers of seedlings. This indicates a significant degree of disturbance, but not necessarily unsustainable. Future trends in standing volume from permanent plots will reveal more.

Type & level of fishing effort & fish catches (B8)

Catch-per-unit-effort of seine nets showed an upward trend in 2001-2 compared to baseline data from the early 1990s, probably a result of the elimination of dynamite fishing in 1998. The main value of the other data collected since August 2001 however is as a baseline, the period being too short to identify significant trends.

Area under reduced human impacts (B11)

No incidents of illegal seine-net use were witnessed within the Chole Bay specified-use zone from Nov 02-March 03, either by MIMP observer teams or tourist dive boats. However this is not the season when such illegal fishing is mainly practised in that zone, moreover seine-net fishers may be fishing at odd hours.

Socioeconomic Indicators

Community understanding of the environment was fairly robust, with one or two exceptions. However the impact of some MPA information-distribution mechanisms was low. The lack of historical quantitative socio-economic data means that the value of livelihood-related results is mainly as a baseline

Community knowledge of natural history (S14); Local attitudes & beliefs regarding marine resources (S12); Understanding of human impacts on marine resources (SE15)

Awareness on the nature of corals appears to be limited. 61% of respondents described corals as '*dead stones'* or '*sea stones'*, 19% as '*living stones'* and 7% as '*living creatures'*. Amongst fishers only 3% opted for '*living creatures'* but 28% for '*living stones'*. The highest awareness of corals as '*living creatures'* was amongst primary school students (25%), most of the correct responses coming from one village. This probably reflects the impact of the MIMP environmental education programme in that school combined with a proactive teacher, and highlights that further similar efforts are needed in other schools, and also with fishers in particular.

Awareness about fish reproduction was higher. 56% of all respondents thought that fish '*lay eggs'* and a further 14% that they '*give birth',* which is true at least for sharks & rays. Only 17% gave scientifically incorrect answers including '*they fall with the rain'* (4%) or that fish reproduction is '*God given'* (4%).

A majority of the community seem to have a good appreciation of the major causes of declines in fish catches. An important issue in Islamic coastal Tanzania is the extent to which people believe that the will of Allah rather than human activities determines availability of natural resources. In fact (only) 25% regarded the will of Allah as either '*great'* or '*very great'* in determining fish abundance, consistent across all social strata including youths & students surprisingly. Interestingly the group attributing most importance to Allah's will was fishers themselves (33%). The percentage of people rating other factors as being of '*great'* or '*very great'* importance were dynamite fishing (90%), small-mesh seine nets (63%) & too many fishers (31%).

Distribution of scientific knowledge to the community (S16)

A fairly large majority of villagers feel that they have had relatively little useful educational information on the marine environment from the marine park. Information sources disseminated by MIMP include (i) discussions with MIMP staff (ii) a kiswahili primary schools booklet on the marine environment and (iii) EE materials such as calendars and leaflets. Around 30% of villagers said that they have received information from at least one of these sources, mainly discussions and meetings, but 70% of people say they have had little or no information from any of the sources. Only 15% of primary school children were aware of the booklet circulated to primary school teachers. Given the size of the communities these results are not as negative as they otherwise seem, nonetheless they illustrate the wide scope for improving awareness-raising efforts.

Income distribution by household (S17); Household occupational structure (S5)
Results showed that most households are dependent on diverse but traditional income sources. The contribution of non-traditional income such as salaried employment in tourism or alternative livelihoods promoted recently by the marine park is (not surprisingly) not yet significant. Effectively all heads of households listed fishing (63%) or farming (36%) as their primary livelihood activity. Secondary livelihood activities for heads of households were farming (46%), fishing (30%) and small business (23%). Amongst 2nd senior members of households (mostly wives of household heads) 70% listed farming as their primary livelihood activity with fishing and small business each 14%. Data for other household members is still being analysed. Estimates of actual income from different sources similarly showed that the only livelihood activities providing more than 50% of cash and non-cash household income included fin-fishing (in 29% of all households), farming (in 13% of all households), small business (4%) and salaried employment (1%). No household reported coconut farming, mariculture, beekeeping or remittances from the mainland as a major income source. Amongst household heads interviewed, 83% were men and 32% were under 20yrs. 65% of household heads completed primary school, not one attended secondary school and 19% did not attend school at all [REF 2].

Local Use-patterns (S11)
Between 1995 and 2003 the total number of fin-fishers within the park rose by 23% from 746 to 920. Seine-net fishers have increased by 65% now comprising 23% of fishers compared with 17% in 1995. Use of other small-mesh nets as set-nets & hand-nets has increased even more substantially now used 22% of fishers whereas in 1995 other nets did not register. The main gears in decline are shark nets (by 37%) and basket traps (by 44%).

Material style of life (S3)
Some examples of the baseline collected: 17% of households have a cement floor against 83% mud/ sand. 25% have a corrugated iron roof against 75% coconut palms. 88% of households have walls of mud and sticks only, with no form of plastering or cement reinforcement. Other data on household possessions is still being analysed.

Food security (not amongst the MEI indicators)
26% of households have 2 meals per day, all others 3 meals per day. Only 16% of households eat fish less than 4 times per week on average. Nonetheless, 41% of heads of households felt that there was generally an insufficient amount of food in the household. Less than 5% eat meat or chicken on a regular weekly basis. 46% of respondents felt there is more fish available now than 10 years ago, 27% thought less is available [REF 2].

Governance Indicators

Encouraging results under the governance indicators included marked improvements in enforcement effort in recent years and relatively good community understanding of the MPA. However levels of satisfaction with participation in management and 1-2 aspects of MPA-community interaction were relatively low. Resource availability has been high in recent years but with heavy donor dependence, but revenue collection is also improving

Understanding of MPA objectives & rules (G2)
Understanding of MIMP objectives and rules was fair considering the size of the MPA's communities, nevertheless clearly there is still an important awareness-raising task to be done across all social strata.. 57% of villagers felt that MIMP regulations are either 'very easily' or 'easily' understood, but 30% of respondents that the regulations are 'very difficult' to understand or they 'didn't know'. 2% felt that the regulations are 'not available'. 54% of respondents felt that the benefit to the community as a whole of the marine park objectives are 'great' or 'very great' with only 12% indicating that they are either of 'little' or 'no benefit' [REF 4].

On the critical issue as to whether no-fishing zones are perceived to have any advantage to fishers (i.e. through replenishment effects) surprisingly 40% of respondents answered that there is either a 'great' or 'moderate' advantage whilst 29% felt there was 'little' or 'no advantage'. 31% didn't know. These proportions were consistent amongst both fishers and all social strata combined [REF 4].

Level of satisfaction with participation in management (G6)

Results on community participation in management were mixed. More than 60% of respondents said they have not been involved in policy discussions about the marine park either with MIMP representatives or even with their own village leaders. Despite this 47% of respondents were 'very satisfied' or 'moderately satisfied' with the level of participation whereas 42 % were 'not very satisfied' or 'not satisfied at all' [REF 4]. Considering the large size of communities, level of both participation and satisfaction are in some ways higher than one might expect, nonetheless participation mechanisms both **within** villages as well as **between** the villages and MIMP need to improve. Given that 60% have not participated in discussions but only 42% are dissatisfied, seemingly 20% or more of the community doesn't actually want to participate in management.

No. patrols per time period /No. infringements per patrol/ % reported by community (G12); No. stakeholders involved in surveillance, monitoring & enforcement (G16); Available human resources & equipment for surveillance (G10)

Frequency of sea patrols increased over the past 4 years from 1.25 to 6.3 per month. Incidences of non-compliance increased in absolute terms, but as a ratio of patrol effort did not show any particular trend. Rate of all infringements encountered varied between one per 3 and one per 6 patrols. Actual numbers of illegal fishing nets confiscated fluctuated between 1 and 4 per year. The number of arrests per patrol fluctuated but increased over time, possibly reflecting a greater preparedness by the patrol teams to make arrests, not necessarily a higher rate of non-compliance. Percentage of infringements reported by the community was 67% in 2002/03, the first year in which the parameter was recorded. Resources available for patrolling were generally adequate in terms of boats, fuel and other equipment. The main deficit was in terms of personnel; on most days there was only one ranger available in the event of a hypothetical emergency patrol.

Amount & quality of training for community to participate in management (G8); Number of people trained in sustainable resources use (G15)

The number of man-days of training provided to villagers per year between 2000-2003 showed a positive upward trend for training in alternative livelihood technologies (such as beekeeping, mariculture, handicrafts & building technologies) and micro-finance & micro-enterprise.

This reflects several specialised project activities in those areas over the past 2-3 years. Training in sustainable fishing techniques fluctuated and was generally lower. Training in natural resources planning and management, including legal rights and leadership and organisation etc. was relatively high in 2000 but showed a severe downward trend since then. The only activities since 2000 have been 2 study tours for village leaders to coastal resources management projects in other parts of Tanzania. This is an area where there is most obviously a need to increase training effort.

Regular meeting of MPA staff with stakeholders (G14)

Analysis of the frequency & type of interactions between MIMP staff and villagers over a 5 month period revealed signs of weakness in 2 areas. Interactions relating to environmental education and awareness-raising were limited almost entirely to formal training with teachers and environment club leaders; there were very few interactions involving direct, grass-roots contact with school children. Secondly the only village assemblies on general information-sharing, village planning or policy & management were with respect to resolution of a conflict in a particular village and issuing of ID certificates for resident resource-users in 3 villages. There has also been a general downward trend in all types of in-village meetings since 2000.

Availability of funding & resources (G18); Trend in paying visitors (actual & relative to regional trends) (New indicator)

Annual expenditure in yr 02/03 was 50% higher than in yr 99/00. Reliance on donor-funding was heavy but fell slightly from 90% in yr 99/00 to 83% in yr 02/03. Annual revenue from visitors' entry fees increased from <1000 USD to over 50,000 USD in the same period but remains a minor proportion of operational costs. The no. of technical staff increased from 6 to 15 over the same period but again 40% of posts were donor-funded. Foreign visitors rose by around 10% per year from 00/01 to 02/03 despite global & regional insecurity.

Lessons Learned

Process of Identifying and Measuring Indicators

- There is a strong justification for having one staff within the MPA *dedicated entirely to the oversight of monitoring* (& research) activities. The intensive process undertaken for the management effectiveness assessment outlined herein was in itself very demanding of management time, albeit for a discrete period. Added to this several important monitoring processed are necessarily ongoing throughout the year and require constant oversight, some need to be built into routine procedures of marine park staff. Involvement of external researchers requires a member of MPA staff who can analytically assess methodologies, sampling plans and draft reports to ensure that the data and results are valid. All of this is time-consuming and adds up to a full time job for a graduate or preferably M.S.-qualified officer. Without such a person it is inevitable that monitoring efforts will be sub-standard and inadequate, which in the medium-longer term effectively renders the MPA's managers blind as to whether the MPA is meeting objectives or making progress.
- It is equally important that all *MPA technical staff maintain disciplined, accurate recording* of relevant aspects of their routine work, in as quantitative a manner as possible. Examples are routine patrol reporting, routine recording of community meetings and reporting on training activities. A good number of the WCPA-MEI governance indicators for example can be measured on the basis of routine reporting, however if such information is not recorded contemporaneously it is impossible to measure it retrospectively. It is highly worthwhile to conduct short training for all technical staff on this subject.
- It is critically important *not to under-estimate the sampling effort* (and therefore funding) required to monitor certain indicators properly, most notably focal species abundance (especially species with low abundance), composition of biological communities with high variability (especially reef benthos & fish communities) and fish catch-per-unit-effort. Collecting inadequate quantities of data from an inadequate number of replicates such that analysis does not yield statistically valid results can literally be meaningless, not to mention also being a tremendous waste of time and money.
- It is essential for the MPA to *develop internal or local capacity for semi-specialised data collection*. MPA technicians, rangers and community members are more than capable of learning to survey mangrove plots, measure benthic transects or weigh fish catches. The high sampling effort often required for valid results (see point above) means that depending on external researchers is not routinely affordable. Moreover in many countries like Tanzania there is a shortage of competent researchers who are often not available when the MPA needs them. Higher levels of expertise are needed for oversight of sampling designs and data analysis, but with adequate training the (more costly) data collection activities can be accommodated internally

Implications for Management of Mafia Island Marine Park

- Communities (and other stakeholders) *do not feel adequately involvement in management* of the marine park. The identities of community representatives on village liaison committees and the MIMP Advisory Committee are not well known and communications with them are weak. Moreover community training in related areas of natural resources planning & management, legal rights and community organisation & leadership has been lacking. One proposal currently under consideration by the MPA management is to facilitate a major process of village-level, land-use & natural resources planning by communities, within the parameters of the MIMP general management plan. This could include enacting village bye-laws. This assessment confirms that such a process is needed, provided communities can be motivated to participate.

- Several aspects of the assessment highlighted the need for more emphasis on general community liaison, particularly with regard to general information-sharing. This reflects the transfer of the MIMP Community Extension Warden to another MPA in Sept 2002 and highlights the need for the post to be restored on Mafia.

- There is a need to increase emphasis on grass-roots environment education and awareness-raising, facilitating activities directly with school children, rather than relying primarily on teacher training.

- There is a need to increase awareness on regulations and the rationale underlying them.

- There are too few rangers to support regular enforcement activities. Other resources available for patrolling are OK. There is a need to continue to increase sea patrol frequency in particular to control seine-net use.

- It may be worthwhile to consider experimental removal of fleshy algae at Kitutia reef to test whether it will enhance recovery of hard corals.

- It is important that several continuous monitoring activities initiated as part of this assessment are maintained including community-MIMP interactions, fishing activity in Chole Bay and various patrol/ enforcement data.

- Revenue generation has improved but the park is not yet close to being self-supporting and is unlikely to be within 5 years. Funding requirements need to be actively planned and solicited from donors for that period.

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References

1. Haule EJ (draft in prep.) *Inventory of mangroves in Mafia Island Marine Park, April-June 2003*. Unpublished report to Mafia Island Marine Park. Survey & Inventory Section, Forest & Beekeeping Division, Tanzania.

2. Kilindo A, J Bamanyisa & JP Rubens (in prep.) *Survey of household economics in 6 villages in Mafia Island, July 2003*. Unpublished draft report to Mafia Island Marine Park, Tanzania.

3. Machano H (2003) *Coral reef fish populations survey at Kitutia & Utumbi reefs in Mafia Island Marine Park*. 2nd draft unpublished report to Mafia Island Marine Park, Tanzania, 29pp.

4. Mesaki S, J Bamanyisa & JP Rubens (draft in prep.) *Community knowledge & understanding survey, February 2003*. Unpublished draft report to Mafia Island Marine Park, Tanzania.

5. Muhando C (2003) *Underwater benthic survey in Mafia Island Marine Park, 2003*. Unpublished draft report to Mafia Island Marine Park, Tanzania.35pp.

6. Muir CE (2003) *Community-based marine turtle & dugong research and habitat protection progress report; April-June 2003*. Unpublished report to Commission for Science & Technology, Tanzania.

7. Muir CE & Abdullah O (2003) *Community-based marine turtle & dugong research and habitat protection; annual progress report 2002*. Unpublished report to Commission for Science & Technology, Tanzania.

8. Muir CE, Sallema A, Abdullah O, De Luca D, Davenport T (2003) *The dugong (Dugong dugon) in Tanzania; a national assessment of status, distribution & threats*. Wildlife Conservation Society, 30pp.

9. Pomeroy, R.; J. Parks; and L. Watson. 2003. *How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness*. IUCN, Gland, Switzerland and Cambridge, UK. In Press.

10. MNRT (2000) General Management Plan - Mafia Island Marine Park, Tanzania. Ministry of Natural Resources & Tourism, Tanzania

Annex 1

List of Indicators (A) contained in the Draft Guidebook and used by pilot sites to field-test the indicators, and (B) contained in the final version of the Guidebook

	A. Indicators used by the Pilot Sites Draft Version of the Guidebook (September 2002)	B. Revised list of Indicators Final Version of the Guidebook (September 2003) (*)
BIOPHYSICAL	B1. Focal Species Abundance B2. Focal Species Population Structure B3. Composition and Structure of the Community B4. Recruitment Success within the Community B5. Habitat Distribution and Complexity B6. Food Web Integrity B7. Water Quality B8. Type, Level, and Return on Fishing Effort B9. Area Restored B10. Area Under Reduced Human Use/Impacts B11. Area Free from Extraction	B1. Focal Species Abundance B2. Focal Species population Structure B3. Habitat Distribution Complexity B4. Composition and Structure of the Community B5. Recruitment Success within the Community B6. Food Web Integrity B7. Type, level and Return on Fishing Effort B8. Water Quality B9. Area Showing Signs of Recovery B10. Area Under No or Reduced Human Impact
SOCIOECONOMIC	S1. Household Perceptions of Availability of Seafood S2. Local Fisher Perceptions of Harvest S3. Material Style of Life of Households S4. Community Infrastructure S5. Household Occupational Structure S6. Number and Nature of Markets S7. Infant Mortality Rate S8/9. Perceptions of Non-Market and Non-Use Value of the MPA S10. Percentage of a Particular Group in Leadership Positions S11. Local Marine Resource Use Patterns S12. Local Values and Beliefs Regarding the Marine Resources S13. Changes in Conditions of Ancestral and Historical Sites, Features, and/or Monuments S14. Stakeholder Knowledge of Natural History S15. Level of Understanding of Human Impacts (Including Population) on Resource S16. Distribution of Formal Knowledge to Community S17. Income Distribution by Source by Household	S1. Local Marine Resource Use Patterns S2. Local Values and Beliefs Regarding the Marine resources S3. Level of Understanding of Human Impacts on Resources S4. Perception of Seafood Availability S5. Perception of Local Resource Harvest S6. Perception of Non-Market and Non-Use Value S7. Material Style of Life S8. Quality of Human Health S9. Household Income Distribution by Source S10. Occupational Structure S11. Community Infrastructure and Business S12. Number and Nature of Markets S13. Stakeholder Knowledge of Natural History S14. Distribution of Formal Knowledge to community S15. Percentage of Stakeholder Group in Leadership S16. Changes in Conditions of Ancestral and Historical Sites, Features, and/or Monuments
GOVERNANCE	G1. Existence of a management plan and adoption of plan G2. Understanding of MPA rules and regulations by the community G3. Existence of a decision-making and management body G4. Existence and adequacy of legislation to enable the MPA to accomplish its goals and objectives G5. Degree of stakeholder participation in management of the MPA G6. Level of satisfaction of stakeholders with participation G7. The amount and quality of training provided to resource users to participate in MPA management G8. The amount and quality of training provided to community organization to participate in MPA management G9. Community organization formed and active G10. Available human resources and equipment for surveillance and monitoring G11. Clearly defined enforcement procedures G12. Number and variety of patrols per time period per unit area G13. Effective information dissemination to enhance and support compliance of stakeholders G14. Regular meeting of MPA staff with stakeholders G15. Proportion of stakeholder trained in sustainable resource use G16. Number of stakeholders involved in surveillance, monitoring and enforcement	G1. Level of Resource Conflict G2. Existence of a Decision-Making and Management Body G3. Existence and Adoption of a Management Plan G4. Local Understanding of MPA Rules and Regulations G5. Existence and Adequacy of Enabling Legislation G6. Availability and Allocation of Resources G7. Existence and Application of Scientific Research and Input G8. Existence and Activity Level of Community Organization(s) G9. Degree of interaction between managers and Stakeholders G10. Proportion of Stakeholder Trained in Sustainable Use G11. Level of Training Provided to Stakeholders in Participation G12. Level of Stakeholder Participation and Satisfaction in Management Process and Activities G13. Level of Stakeholder Involvement in Surveillance, Monitoring and Enforcement G14. Clearly Defined Enforcement Procedures G15. Number and Variety of Patrols Per Time Period per Unit Area G16. Degree of Information Dissemination to Encourage Stakeholder Compliance

(*) Note: Some of the indicators contained in the Draft Guidebook (September 2002) and used by the pilot MPAs during the field-testing phase were altered for the final version of the Guidebook (September 2003). The indicators of the final version were revised, regrouped, merged, and/or renamed based on the comments and recommendations from the pilot sites and external peer reviewers.

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