

# Assessing the effectiveness of management of marine protected areas in Kenya: Experiences from the Mombasa marine park and reserve

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**Abstract** Marine protected areas (MPAs) are reported to be effective means of managing coral reefs; consequently, many developing countries have established MPA programs. However, whether these MPAs are successful measured against their stated objectives has rarely been assessed. An assessment of the management effectiveness of Kenya's youngest MPA, the Mombasa Marine National park and reserve, was conducted using biophysical, socio-economic and governance indicators including coral reef health, socio-economic welfare and participation of stakeholders and the level of institutional support for the management of the MPA. Rates of recovery of coral cover and finfish biomass were higher in the marine park (no-take area) than in the marine reserve (restricted fishing zone) indicating that the marine park is making some progress towards meeting the stated objective of biodiversity conservation. The marine reserve however, is not as effective in meeting the objective of sustainable utilization, because both coral cover and finfish biomass have not shown any appreciable increase after protection. The MPA and local communities are highly dependent on tourism and their financial stability was negatively impacted by factors external to the management of the MPA including ethnic violence and international terrorism. In addition the 1998 bleaching event caused high mortality of corals in the MPA; while the park is showing signs of recovery the reserve is not. Finfish biomass did not show marked changes after the bleaching. The MPA is adequately supported with national legislation, financial support and a management plan. However administrative instability within the management authority (the Kenya Wildlife Service) and conflicts of mandate with other national institutions such as Fisheries department has constrained the ability of the MPA to implement management initiatives.

**Keywords** Management effectiveness, marine park and reserve, Mombasa, coral reefs

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## Introduction

The coral reefs, seagrass beds and mangrove ecosystems of the Kenyan coast support an important finfish and

invertebrate fishery, play a key role in shoreline protection and sediment catchment, and directly or indirectly support coastal tourism the major foreign exchange earner in Kenya (Muthiga et al. 2000). However the rapid increase in the coastal population coupled with poorly planned coastal tourism developments have led to increased pressure on coastal resources resulting in overexploited and degraded coastal ecosystems (Kairo 1995; McClanahan and Obura 1995). Over fishing for example has led to the loss of biodiversity and detrimental changes in community structure in coral reefs in Kenya (McClanahan and Muthiga 1988; McClanahan and Shafir 1990; McClanahan 1994, McClanahan et al. 1994). Mangrove ecosystems are also seriously threatened (Kairo 1995; Dahdouh-Guebas et al. 2000; Nzuki 2004) to the extent that a total ban on logging has been in place since 1978 (Forestry dept per com).

One of the strategies the Kenya government has used to address marine resource exploitation on the Kenyan coast has been the establishment of Marine Protected Areas. (MPAs). Kenya currently has 4 marine parks managed as fully protected no take areas and 6 marine reserves where fishing activities are regulated (Muthiga 1998). Management of marine resources however is only one of the purposes that MPAs were established in Kenya, biodiversity protection, managing tourism activities, reducing conflicts among users, and education and awareness are also important objectives for these MPAs (Muthiga et al. 2000; Weru et al. 2001).

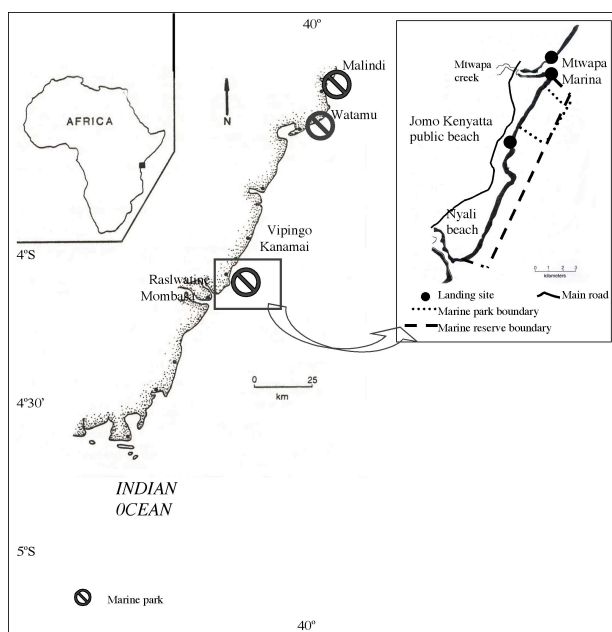
The use of protected areas has proven successful in the management of fisheries and preservation of biodiversity in many parts of the world (Roberts and Polunin 1991; Bohnsack 1993; McClanahan 1994). In Kenya for example, there is a higher diversity and abundance of key species in MPAs than outside MPAs, indicating the importance of these areas for biodiversity conservation and as refugia and supply of larvae to adjacent fished areas (McClanahan and Shafir 1990; McClanahan and Arthur 2001). The effectiveness of MPAs however, needs to be assessed against specific and measurable objectives (Pomeroy et al. 2004). Despite establishing MPAs since the 1960s

and a great deal of national and donor investment, assessments of effectiveness, measured against the stated objectives of MPAs have not been carried out on Kenyan MPAs.

This study summarizes a management effectiveness assessment that was carried out in Kenya within the framework of a regional assessment that was conducted in Kenya, Tanzania and Seychelles. The project was facilitated by IUCN Eastern African regional programme (EARP) as a contribution to the Nairobi Convention work programme and activities of the International Coral Reef Action Network (ICRAN) (Wells 2004). The study focuses on the Mombasa MPA looking at several elements of the first two objectives of the MPA by assessing three key indicators of these objectives 1) ecosystem health, 2) governance and 3) socio-economic, with a view of assessing the effectiveness of management of the MPA.

## Materials and methods

*Physical description of the study site:* The Mombasa marine national park and reserve (MMNPR) lies between Tudor Creek to the south and Mtwapa creek to the north, of Mombasa District, Coast Province, Kenya (latitudes  $40^{\circ} 43'$  and  $40^{\circ} 15'$  and longitudes  $30^{\circ} 55'$  and  $4^{\circ} 12' N.E$ ; Fig. 1). The MMNPR was gazetted in 1986 and is zoned into two main management areas, the marine park a no-take area that is  $10 \text{ km}^2$ , encompassed within the larger marine reserve with an area of  $200 \text{ km}^2$  (Chebures 1989; Weru et al. 2001).



**Fig. 1** Map of the Kenyan coast showing the Mombasa marine park and reserve. The inset shows the main fish landing sites (Mtwapa, Marina, Jomo Kenyatta and Nyali) in the MPA. From McClanahan et al. 2002.

*Methodology:* The information for this study was largely derived from a combination of a review of biophysical and socio-economic studies carried out in the MPA as well as a compilation of existing data to look for trends in key indicators. Information was compiled on elements of biophysical, governance and socio-economic indicators of the main objectives of the Mombasa MPA, 1) preservation and conservation of marine biodiversity and 2) provision of ecologically sustainable use of marine resources for cultural and economic benefits (Weru et al. 2001), for which adequate and detailed information were available.

Since the focus of activities in the Mombasa MPA are concentrated around coral reefs (the key marine ecosystem in the MPA), the main biophysical indicators used were drawn from coral reef monitoring and research studies from the long term monitoring program of the Coral Reef Conservation project (CRCP). Key parameters assessed included hard coral cover, finfish biomass of major families and sea urchin biomass at sites in the Mombasa marine park and reserve. In addition, since the objectives of the MPA have no specific targets for these or any biodiversity parameters, changes in these parameters were contrasted against measurements before establishment of the MPA and sites outside MPAs. Information on focal species such as sea turtles was assessed from the monitoring program of the Kenya Sea Turtle Conservation committee (KESCOM).

Socio-economic indicators though scarce were drawn from information from tourism, fishing and other socio-economic activities in and around the Mombasa MPA. Governance indicators included an assessment of the management authority, supporting policy and legislation and the presence and implementation of the management plan. Documents, minutes of meetings and the management plan were reviewed for this component of the assessment.

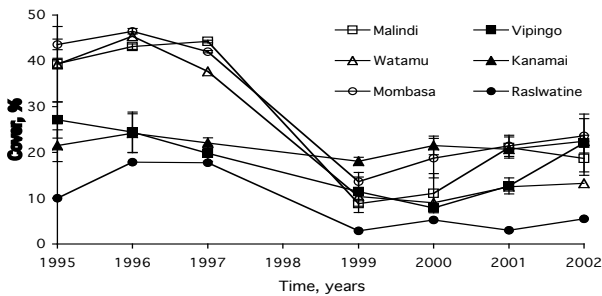
Additional information was drawn from the regional assessment. The process undertaken in the regional assessment involved completion of worksheets that were developed based on IUCN World Commission on Protected Areas/ Management Effectiveness Task Force (WCPA/METF) guidelines (Hockings et al 2000; Mangubai and Wells 2003). MPAs lead by Wardens completed seventeen worksheets that were based on the six assessment components of the management cycle: the context, planning, inputs, process, outputs and outcomes (Hockings et al 2000). The process that was undertaken in the regional review as well as the strengths and weaknesses of the methodology are discussed in Wells (2004). Although all the MPAs in Kenya were involved in the exercise, this study is based on the assessment carried out in the Mombasa MPA. This is the youngest MPA in Kenya and it has received more attention from researchers hence more information is available for this preliminary assessment. Information

from the worksheets is used to supplement the data gathered from studies in the MPA.

## Results

### 1. Biophysical indicators

Coral cover increased in the Mombasa marine park from 8% prior to establishment of the MPA in 1987 to 45% by 1994 (McClanahan et al. 1998). Comparison with the older marine parks, Malindi and Watamu, show similar levels of coral cover up to 1997 (Fig. 2).

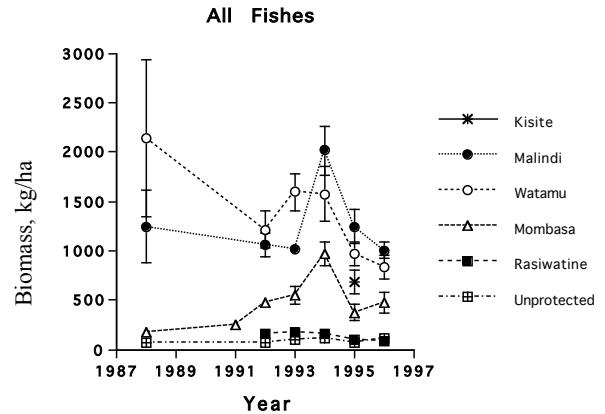


**Fig. 2** Coral cover in marine parks (Malindi, Mombasa, Watamu), marine reserve (Ras Iwatine) and unprotected areas (Kanamai, Vipingo), 1995 to 2002. From McClanahan et al. 2004.

Unfortunately, the Western Indian Ocean region experienced a drastic coral bleaching event during the El-Nino of 1997-98, in Kenya, this led to very high mortality of corals (Goreau et al. 2000; McClanahan et al. 2001), reducing coral cover from ~45% to ~10% in marine parks and 20% to 5% in unprotected reefs (Fig. 2). Comparison of coral cover at studied sites between the fully protected Mombasa marine park and the adjacent partially protected Mombasa marine reserve (Ras Iwatine; Fig. 1) indicate a slower recovery from 10% to 20% in the reserve after establishment of the MPA (Fig. 2). The bleaching event reduced coral cover at Ras Iwatine to less than 5% and there are no signs of recovery (Fig. 2).

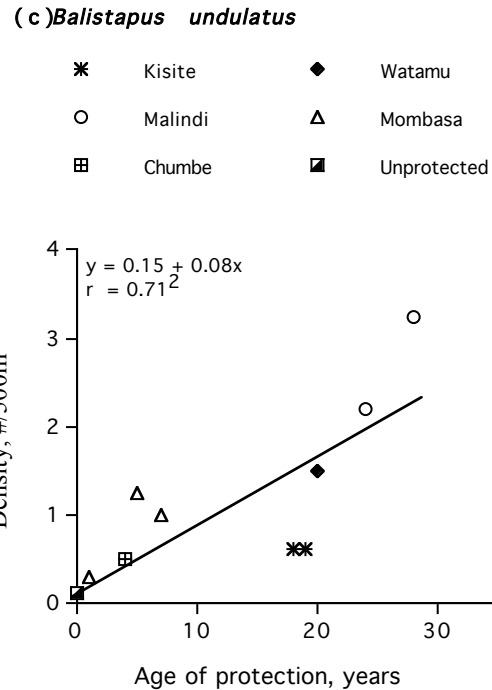
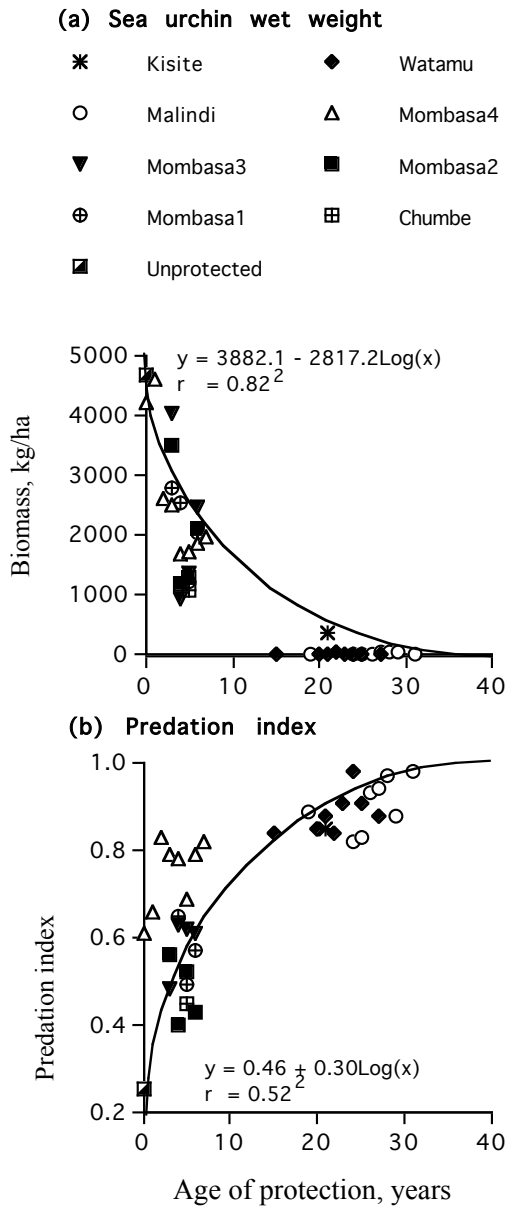
The biomass of finfish of key coral reef families in Mombasa marine park increased from ~100kg/ha in 1988 to 900 kg/ha in 1994 then decreased to 500kg/ha in 1996 (McClanahan et al. 1998). This decrease was attributed to the reduction in the size of the park (Fig. 3). The biomass of finfish has subsequently increased to ~1200kg/ha comparable to the older Marine parks (McClanahan unpublished data). The biomass of the Redline trigger fish (*Balistapus undulates*), an important predator of sea urchins that is typically much higher in protected areas than unprotected areas (Fig. 4) on Kenyan reefs has also shown a slow increase in Mombasa MPA (McClanahan 2000). In addition, a

study of the potential contribution of the marine park to the adjacent marine reserve (southern end of the park) and fished area (northern end of the park) showed 1) a decline in the catches as a function of the distance away from the park edge 2) a truncation of this function from the northern end of the park where fishing occurs indicating a spill-over effect (McClanahan and Mangi 2000).



**Fig. 3** The biomass of finfish in Kenyan marine parks (Kisite, Malindi, Watamu, Mombasa), marine reserve (Ras Iwatine) and unprotected areas from 1988 to 1997. From McClanahan et al 1998.

The sea urchin biomass decreased from more than 6000kg/ha in 1987 to between 1000- 2000 kg/ha at different sites in the Mombasa MPA by 1999 (McClanahan et al. 1998). Sites in the MPA where the sea urchin biomass primarily consisted of the large bodied sea urchin *Echinothrix diadema* however, showed slower reductions in biomass (McClanahan et al. 1998). In general, the biomass of sea urchins in the older marine parks including Malindi, Watamu and Kisite are significantly lower than in fished reefs in Kenya (Fig. 4; McClanahan 2000). The rates of predation on tethered sea urchins (*Echinometra mathaei*), an assay of predation rates (McClanahan and Muthiga 1989) is higher in protected reefs than unprotected reefs with Mombasa having levels only slightly lower than in the older marine parks (McClanahan 2000).



**Fig. 4** The biomass of sea urchins (a), the predation index on *Echinometra mathaei* (b) and the biomass of the trigger fish *Balistapus undulatus* (c) in protected and unprotected reefs in Kenya as well as in a protected reef (Chumbe) in Tanzania. From McClanahan 2000.

In a recent survey (Muthiga and Ndirangu 2000), of the 31 species of sea cucumber identified at 31 sites along the Kenyan coast, Mombasa MPA had the highest number of species (14 species) and the highest density of sea cucumbers (15 ind/250m<sup>2</sup>) composed of a new species of sea cucumber, *Holothuria (Mertensiothuria) arenacava* (Samyn et al. 2001). In addition, an average of 60 green turtles (*Chelonia mydas*) and a small number of hawksbill turtles (*Eretmochelys imbricata*) nest along this beach each year (Baobab 2000, Okemwa et al. 2004).

## 2. Socio-economic indicators

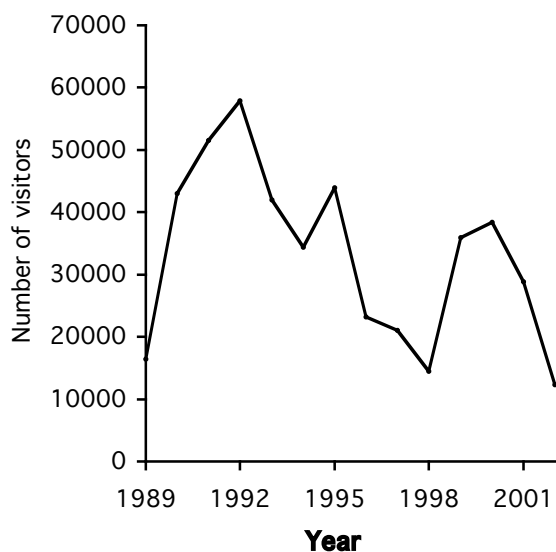
Although socio-economic information was scarce, some general data indicating the importance of the area to the socio-economic level of the local community are available (Table. 1). Tourism is the main economic activity in the area (CDA 1996) and there are 25 hotels (~ 7000 beds) along the prime beaches adjacent to the MPA. Although precise figures are not available, it is estimated that at least 13,000 people receive formal employment from these hotels (CDA 1996). In addition, there are numerous cottages, apartments and private houses that cater to the local market and low-cost visitors as well as numerous small enterprises including curio and tour dealers that provide an income for an estimated 153,000 persons in the area (CDA 1996).

**Table 1.** Socio-economic information on various aspects of the Mombasa marine park and reserve as well as communities utilizing the MPA

<i>Indicator</i>	<i>Factor</i>	<i>Comments</i>
Population	207,862 (Kisauni division)	Kisauni division is 32% of the population of Mombasa district and 8.3% of the population of Coast province (Central Bureau of Statistics 2003).
Population density	1650/km <sup>2</sup>	The MPA straddles Kisauni and Bamburi locations of Kisauni division with a density of 1087 and 3150 persons/km <sup>2</sup> respectively. Mombasa district has a density of 2896 persons/km <sup>2</sup>
No of hotels	25	The number of hotels increased from 5 with less than 1000 beds in 1971 to 25 with 7000 beds by 1993 (UNEP et al. 2000).
No of persons employed in tourism sector	153,000	This number includes persons employed in small-scale tourism sectors. An estimated 13,000 persons are employed in the hotels (CDA 1996)
No of fishermen and CPUE		Fishers that land their catch at the Jomo Kenyatta landing site use mainly traps, gillnets, and hook and line. Fishers at Nyali and Marina use beach seines recently banned in Kenya (CRCP unpublished data).
- Kenyatta	45 (2.5)	
- Nyali	40 (1.5)	
- Marina	50 (1.5)	
No of boats based at hotels	25 – 30	This number fluctuates increasing to 30 during the high season (KWS per com)
Number of community boats	15 - 20	This number fluctuates depending on the season peaking between Nov and Jan (KWS reports)
No of visitors to the MPA	~ 10,000 Residents ~ 30,000 Non-residents	The number of visitors was impacted by two main events; 1) BMP caused an increase by ~ 65% 2) Likoni clashes caused a reduction by ~ 25% (Muthiga 1998).
Revenue to MPA	~ \$50, 000 – 180,000 per year	The revenue was negatively impacted by the Likoni ethnic clashes in 1997 decreasing by more than 50%
Community projects	- Rehabilitation of Jomo Kenyatta beach - Infrastructure for fishers and boat operators - moorings and code of conduct	~ 3000 local residents utilize this beach every weekend  - this consists of a building housing the offices of the Mombasa boat operators and fisher associations as well facilities for processing fish (CDA 1996) - moorings and a code of conduct were installed for use by all boats in the MPA (Muthiga 1998)

The MPA is also an important recreational area, having one of the few public beaches (Jomo Kenyatta beach) along the northern coast of Kenya. It is estimated that ~3000 local residents utilize this beach each weekend (Kahaso per com).

Most of the water sports activities are concentrated around the coral reefs of the Mombasa marine park with an average of 30,000 visitors annually providing approximately US\$ 50 - 180,000 revenue to the MPA (Fig. 5). Glass bottom boats, sailing, goggling, swimming and SCUBA diving are the major recreational activities carried out in the MPA (Muthiga et al. 2000).



**Fig. 5** The number of received visitors to the Mombasa MPA from 1989 to 2002.

The marine reserve is an important fishing area for artisanal fishers who land their catch at three landing beaches (Nyali, Jomo Kenyatta and Marina) in the marine reserve. An estimated 90 - 135 fishers are involved (approximately 12 fishers/km<sup>2</sup>), dugout canoes are the main type of vessel and catches, estimated at 8 ton/km<sup>2</sup>/yr are dominated by rabbit fish, parrotfish and octopii (McClanahan and Kaunda-Arara 1996). The most detailed studies of fishing in the reserve have been carried out on the fishers at Jomo Kenyatta landing site (Table. 2). The total number of fishers at this site decreased from 100 to 33 after establishment of the park. Catches increased from 20kg/fisher/month to 67kg/fisher/month due to the reduction in number of fishers. The total catch however, decreased from 2063 kg to 1179kg in the area.

It is estimated that fishers at this landing site earn approximately US\$ 40 per month from fishing using basket traps (madema), hand-lines, pull and gill nets and spear guns (McClanahan and Kaunda-Arara 1996). Other forms of fishing including sports and aquarium fishing as well as gleaning for gastropods and sea cucumbers occur in the reserve but no reliable statistics are available (Fisheries dept per com).

**Table 2.** Summary statistics (mean  $\pm$  SD) of the fishers, fishing area, and catch statistics at Kenyatta Beach (modified from McClanahan TR and Kaunda-Arara B 1996)

<i>Summary Statistics</i>	<i>Before Park</i>	<i>After Park</i>
Total number of fishers	102.0 $\pm$ 0.7	33.0 $\pm$ 7.0
Fishing area (km <sup>2</sup> )	8.0	3.0
Fisher density (n/m <sup>2</sup> )	12.7 $\pm$ 0.1	11.0 $\pm$ 2.3
Total catch (kg)	2063.9 $\pm$ 686.4	1179.6 $\pm$ 635.3
Catch/person/month (kg)	20.3 $\pm$ 6.7	67.1 $\pm$ 69.7
Catch/boat/month (kg)	95.1 $\pm$ 31.9	285.6 $\pm$ 193.9
Total catch/area (kg/m <sup>2</sup> /month)	367.4 $\pm$ 346	674.5 $\pm$ 2493
Benthic catch/area (kg/km <sup>2</sup> /month)	258.0 $\pm$ 85.8	448.8 $\pm$ 298.9

Approximately 200 vessels of various kinds including deep sea fishing vessels, small boats (ngalawa), sailing boats and glass bottom boats utilize the Mombasa MPA (Mr. Amboga per com). The most important activity for the local communities is the glass bottom boat business conducted through the Mombasa boat operators association (MBOA) that include 20 boats earning an estimated US\$30 per boat per day (Mtuga per com). After the establishment of the MPA, some fishers converted their fishing vessels to tourism activities, the exact number and contribution to their total earnings is unknown.

The MPA has benefited from several activities implemented by the Integrated Coastal Area Management secretariat since it lies within an ICAM project pilot site area (Bamburi –Shanzu) coordinated by Coast Development Authority (UNEP et al. 2000). Projects aimed at the local community include rehabilitation of the Jomo Kenyatta public beach facilities and infrastructural developments for the fishers and boat operators at this landing site, (supported through UNEP and USAID) as well as awareness programs such as the annual marine environment day and International Coastal Clean-ups. In addition, the MPA management has been assisted through provision of moorings, park equipment and training through the KWS/Netherlands wetlands conservation and management project.

### 3. Governance indicators:

Marine protected areas are managed under the Wildlife Conservation and Management Act Cap 376 of 1977 (with an amendment in 1989) and the Wildlife policy

that governs the management of wildlife in Kenya. All protected areas including MPAs are currently managed by the Kenya Wildlife Service (KWS), a government organization established under this legislation in 1989. The Mombasa MPA was established in 1986 through legal notices 315 and 316 (boundary plan No. 204/5 for the park and 204/6 for the reserve). However, several other government institutions have administrative and management jurisdiction over coastal resources in general including the fisheries, tourism and forestry departments (Table. 3).

In addition, Kenya is a signatory to several international and regional conventions including the Conventions on Biodiversity (CBD), on Climate Change (CCC), on Migratory Species (CMS) and on Trade in Endangered Species (CITES) and the Nairobi Convention and its protocols. Through these protocols MPAs are receiving increasing recognition and support (Muthiga et al. 2000).

The Kenya government has committed substantial resources to MPAs through KWS. A warden administers the daily management of the Mombasa MPA with assistance from Park rangers with different skills and responsibilities such as, security, revenue collection, SCUBA diving, boat operation and maintenance. Daily activities include patrolling, liaison with users, conflict resolution, revenue collection, monitoring and awareness (Table. 4). Facilities include a park base, vehicles, boats for monitoring and surveillance, SCUBA equipment and boundary and user moorings, communications equipment, firearms and an annual budget of US\$ ~ 50,000. Over the years, various donors have also provided substantial funds for various activities in the MPA, and several local and international institutions support activities in the MPA (Table. 4).

The Mombasa MPA management plan (Weru et al. 2001) was developed through a participatory process between 1999 and 2000. The plan includes a general description of the biophysical and socio-economic profile of the area, details the goals and objectives of the MPA, the management strategy, the

administration, surveillance and enforcement as well as a daily management handbook. The plan also includes draft MPA regulations, key management actions, time frame and budget to 2004.

## Discussion

### *Biophysical indicators*

Estimating the rate of change of key habitats and species are commonly used biodiversity indicators when assessing MPA effectiveness (Pomeroy et al. 2004). In this study, coral cover, finfish biomass and sea urchin biomass were utilized since long-term information were available for these parameters. The results indicate that the full protection of the Mombasa marine park is meeting some of the objectives of biodiversity protection at least for coral reefs. Long-term monitoring of coral cover showed a greater increase at studied sites in the Mombasa marine park than at Ras Iwatine in the marine reserve (McClanahan et al. 2004). Unfortunately, the gains in coral cover were reduced by the bleaching event of 1997-98 since mortality was greater as a percentage of total coral cover in MPAs than outside MPAs (McClanahan et al. 2001). However, the recovery rate after bleaching in Mombasa MPA has been fairly rapid compared to older MPAs (McClanahan et al. 2004) indicating that the situation in the marine park is not completely irreversible.

The abundance of the major groups of coral reef fish also increased by an order of magnitude inside the MPA indicating that restriction from fishing has had a positive impact on the finfish community within this MPA (McClanahan and Arthur 2001). The fact that eliminating fishing provides a refuge allowing finfish to increase in biomass is widely reported in the literature (Russ and Alcala 1989, McClanahan and Shafir 1990,

**Table 3.** Government Departments with jurisdiction over coastal resources and development in Kenya.

<i>Department</i>	<i>Ministry</i>	<i>Role/Responsibility</i>
Coast Development Authority	Rural Development	Initiation and coordination of development projects at the coast
Fisheries Dept	Environment and natural resources	Management of fishing activities including licensing and regulation of fishing gear.
Forestry Dept	Environment and natural resources	Management of forests (coastal and mangrove) including licensing of logging and reforestation activities
Kenya Marine & Fisheries Research Institute	Ministry of Agriculture	Research into all aspects of aquatic systems freshwater and marine
Kenya Port Authority	Ministry of Transport	Management of ports including construction and regulation of cargo handling

**Table 3 (Contd)**

Kenya Wildlife Service	Ministry of Tourism and Wildlife	Management and conservation of wildlife focusing on protected areas and endangered species
Municipal councils	Local government	Regulation, licensing and management of all city and town activities
Provincial and District Administration	Office of the President	Liaison with Central government on all development activities at the grassroots
Tourism Dept	Ministry of Tourism and Wildlife	Management and regulation of all tourism activities including licensing

Watson et al. 1996). Studies in the MPAs in Kenya show that restriction from fishing is the single dominant factor in predicting abundance, diversity and rarity of fish (McClanahan and Arthur 2001).

Sea urchins are dominant grazers that have major biological and geological effects on coral reefs and other marine habitats (Lawrence 1975; Estes et al. 1978; Lessios 1988; McClanahan and Muthiga 1988; Watanabe and Harrold 1991). On Kenyan reefs, the biomass of urchins is much higher in fished reefs than in un-fished reefs attributed to removal of the key predator *B. undulates* through fishing (McClanahan 2000). Studies in the Mombasa MPA showed a reduction in the biomass of most species to levels similar to the older marine parks. This is a further indication that protection from fishing is having a positive effect on other components of the coral reef.

Measuring the effectiveness of the Mombasa marine reserve presents some difficulty since the definition of sustainable utilization is not well articulated in the objectives of the MPA. For purposes of this assessment it is assumed that maintenance of finfish biomass in the marine reserve at higher levels post establishment of the reserve in 1991 (when formal management of the Mombasa MPA started) is a reasonable measure of success. Studies indicate no increase in fish biomass in the reserve after many years of protection except for a short period in 1996 just after removal of beach seines however biomass reduced to pre-MPA levels when beach seines were re-introduced (McClanahan 1994; McClanahan & Kaunda-Arara 1996). Using finfish biomass as a measure of success, coupled with the poor recovery of coral after establishment and bleaching strongly indicates that the marine reserve may not be effectively meeting the objective of biodiversity conservation or fisheries sustainability.

This can be attributed to weak enforcement strategies in the marine reserve, since despite the banning of destructive gears such as beach seines (Fisheries Dept gazette notice No. 7565 of 2001), these gear continue to be utilized in the reserve (Wakaba per com). In addition, there are jurisdictional conflicts between the KWS, responsible for management in the

marine reserve and the fisheries department with authority to license fishing activities including in the marine reserve (Muthiga et al. 2000). Increased consultation between KWS and Fisheries department in the last few years, has led to some improvements in the area, for example the Fisheries department recently stopped the licensing of sea cucumber collection after a research study showed drastic reduction in sea cucumber numbers in fished areas including the Mombasa marine reserve (Muthiga and Ndirangu 2000).

#### *Socio-economic indicators*

The socio-economic welfare of key stakeholders of MPAs is often used as a measure of effectiveness of MPAs (Bunce et al. 2000; Pomeroy et al. 2004). The objectives of the Mombasa MPA however fail to indicate specific socio-economic targets to measure the broad objective of sustainability (Weru et al. 2001). The problem is made more complicated by the fact that no socio-economic assessment has been carried out in the area. During this assessment, the assumption was made that the intension of this objective in most MPAs is to ensure sustained economic benefits to the MPA, as well as to the main stakeholders of the MPA. Hence the available information on the key stakeholders of the MPA as well as the financial information of the MPA is assessed for indications of sustainability.

Tourism is the key sector contributing to local livelihoods, and the main businesses that the local communities are involved in are water sports and recreation activities (CDA 1996; Muthiga et al 2000). Shortly after establishment of the MPA, a local boat association MBOA was formed (Bess 1992). MBOA has received support through projects initiated by KWS and the ICAM secretariat including support for registration, training, boat rehabilitation all aimed at improving the ability of the association to increase their revenue base. This is critical support since MBOA depends directly on the existence of the MPA.

Unfortunately, the revenue accrued by MBOA and the contribution of this business to the local community is not known. However, given that MBOA commands ~50% of the glass bottom boat business, this income is a substantial contribution and is greater per individual than revenues from fishing (Malleret-King 2000). In addition, although there are



no detailed data available on the financial records of other water sports businesses, the fact that there are ~200 vessels utilizing this MPA and ~ 460,000 receipted visitors since 1989 (KWS per com), indicates that the MPA contributes substantially to the income of a large number of people in the area.

The benefits of the MPA to the fisher community are more difficult to measure since information on the economic status and wealth of the fisher communities dependent on the MPA is unknown. At the establishment of the MPA, the number of fishers reduced by ~50% hence fishers received more fish per person (McClanahan and Kaunda-Arara 1996). The total catch however, reduced by ~ 50%, the effects of this reduction of

protein on the food security and income of the local fisher population is unknown. There are indications that some of the fishers converted to tourism activities at the inception of the MPA (Glaesel 1997), however, the effects of this change to their livelihoods is unknown. It is reasonable to assume that the income for the few fishers that may have been absorbed into the tourism sector would show a dramatic increase since tourism pays substantially more than fishing (Malleret-King 2000), however given that this sector has been very volatile in Kenya in the last 10 years, livelihood security of community members depending to a large extent on tourism would be expected to be tenuous.

**Table 4.** Management strategies of the Mombasa marine protected area

<i>Strategy</i>	<i>Activity</i>	<i>Comments</i>
1. Enforcement of MPA regulations	Daily patrols to enforce regulations i.e. no fishing in park, restricted fishing in reserve, use of moorings	Within the park this is fairly effective mainly due to the willingness of users to comply, not as effective in the reserve as beach seining continues. Occasional poaching in park
2. Collection of MPA fees	Collection from several entry points sometimes based at a beach hotel	Time consuming and expensive.
3. Mooring buoys	Moorings were installed at snorkel and dive sites including a code of conduct for boats	- Fairly effective because user group understands benefits - Maintenance and repair a challenge
4. Beach Management program (BMP)	Patrol of beaches to ensure security, beach cleaning. Revenue collected by hotels based on number of tourists at \$0.5/bed-night	- The code of conduct is mostly effective - Very effective at the beginning, however after the ethnic clashes of 1997 number of visitors decreased and hotels were reluctant to pay dues. - No legal framework was developed and there was little government support
5. Research and Monitoring	- Annual monitoring by CRCP, KWS, research by CORDIO, CRCP and KMFRI - monitoring of visitor statistic, water quality assessment and - turtle nesting and mortality	- This has been a very successful partnership, many research publications on the area now exit - Effective although information not always readily available for management
6. Community initiatives	Community projects include training in mooring use, refurbishment of boats and provision of safety equipment	- Collaboration reduces management costs Effective in assisting communities gain benefits from tourism activities in the MPA
7. Integrated Coastal Zone Area Management	- Formation of ICAM secretariat and participation in ICAM activities - Fisheries, boat operators and mooring demo projects	- Shows the benefits of working in an integrated way  - reduced destruction of reefs
8. Management Plan development and implementation	Stakeholder consultation leading to drafting of management plans	- slowly being implemented - Key features include MPA regulations, formation of an Advisory committee and training
9. Awareness and Education	Annual Marine Environment Day, International Coastal Clean-up and School Groups	- these programs are especially effective in raising awareness in schools and tertiary education institutions

Creation of the MPA was beneficial to KWS since it legalised the collection of revenue from park fees and other charges. The MPA showed increased revenue from 1989 to 1992 when the MPA earned 180,000 US\$ collecting ~50% more revenue than recurrent costs (Weru et al. 2001). However, several factors have combined to decrease these revenues including; the collapse of the Beach Management program in 1998, the 1997 Likoni ethnic clashes in 1997 that led to a dramatic decrease in visitors to Kenya and the bombing of the twin trade towers in 2001 that had the same effect on foreign visitor numbers (Central bureau of statistics 2003). Events external to the MPA therefore had a dramatic effect on financial sustainability and the effects are still being registered on the financial health of KWS to date (KWS per com).

#### *Governance indicators*

The management of MPAs in Kenya is adequately supported by a national institution (KWS), national legislation as well as management plans (Weru et al. 2001) indicating a high level of commitment for MPA by the government of Kenya. Kenya is also a signatory to several international and regional conventions governing the management and conservation of marine resources. However, a major weakness in the Wildlife Conservation and Management Act is the strong bias towards protection and management of terrestrial fauna and flora. Hence the legislation lacks regulations specific to MPAs (Weru et al. 2001). One of the key management actions outlined in the plan is legalization of the draft regulations detailed in the plan. The draft regulations have been reviewed by all MPAs and are currently in the KWS legal department for implementation.

In the last few years, KWS has experienced dramatic changes in its administrative and management structure including, the move to three different ministries (Ministries of Environment and Natural Resources, Office of the President and, Tourism and Wildlife) and changes in strategic policies implemented by five different Directors in a period of 7 years. In addition, a draft Wildlife Policy that governs the activities in all protected areas in Kenya has been under review for several years with no indication of implementation in the near future. This has greatly reduced the ability of the MPAs to implement any new strategies or regulations, retain and train staff and plan for future developments.

For example, the management plan has not been formally adopted by the KWS nor has it been adopted at the District and Provincial levels where development decisions are made. However, legally, the plan is well supported by the Wildlife Conservation and Management Act (section 3A) as KWS is mandated to *'prepare and implement management*

*plans for national parks and national reserves'*. Currently, implementation of the plan is carried out mainly informally with MPA management referring to it on a regular basis for planning and reporting (Mombasa warden per com). In addition, the management plan does not adequately address ways to resolve areas of jurisdictional conflict including licensing of tourism activities in the MPA, management of fisheries in the marine reserves and control of land-based activities that impact the MPA. It is hoped that these weaknesses will be addressed in the upcoming revision of the management plan (Weru et al. 2001).

The administrative difficulties experienced by KWS have also had a negative impact on innovative initiatives such as the Beach Management Program (BMP). This program, initiated in 1995 had positive financial and management implications for the MPA and key stakeholders. The main objective of the program was to address the issue of beach operators that had become a major nuisance to tourists along this and other beaches on the Kenyan coast while improving revenue collection by KWS (Bess 1992). Unfortunately the BMP was not successful due to lack of strong government support and a legal framework to enforce the program (Muthiga 1998).

At the initiation of the BMP, only 12 hotels (out of a possible 25) signed up through a Memorandum of Agreement with KWS. Although obligations of each party were clearly laid out in the MOA, the hotels could not be forced to remit funds collected for the program to KWS. The initial reaction to the BMP were favourable, however, as soon as tourism revenues to hotels decreased due to the Likoni ethnic clashes of 1997 the program became ineffective (Muthiga 1998). Although attempts were made to requests the Minister for Tourism to gazette a legal notice to enforce the BMP, the program was not supported by some of the key stakeholders in the coast tourism industry and hence was shelved by KWS (Kavu per com).

In conclusion, although there are no precise definitions of successful management of MPAs, there are several measures that can be used to indicate a 'perception' of success. These include the condition of the habitat, trends in the key resources, and assessment of legislation and management regulations (Pomeroy et al 2004). An assessment of available information on these trends and additional factors indicate that overall the Mombasa MPA has been fairly successful based on 1) the fact that there is a permanent investment and commitment by the national management authority KWS in infrastructure, staff and funds to manage the MPA, 2) there is a management plan that guides management 3) there are discernable improvements in the coral reef habitat and increased biomass of fish in the MPA as a result of protection and, 4) there are

administrative strategies including enforcement, monitoring, community initiatives and awareness as well as partnerships that support and assist in the management of the MPA.

However there are still many areas that require improvement for the future sustainability of this MPA. There is an urgent need to improve the administrative stability of KWS to ensure that management actions are sustained. In addition, the management of the MPA continues to be hampered by overlapping mandates between different government agencies with conflicting objectives, specific regulations for MPAs will greatly minimise this conflict. Finally, an assessment of the socio-economic environment around the MPA will lead to a better understanding of the social benefits of the MPA.

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