MPA's and Poverty Alleviation

An Empirical Study of 24 Coastal Villages on Mainland Tanzania and Zanzibar

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ACRONYMS

CHICOP	Chumbe Island Coral Park Ltd.
JCBA	Jozani-Chwaka Bay Conservation Area
MIMP	Mafia Island Marine Park
MPA	Marine Protected Area
MPRU	Marine Parks and Reserves Unit, Government of Tanzania
MBCA	Menai Bay Conservation area
MICA	Misali Island Conservation Association
MICP	Misali Island Conservation Program
TCZCDP	Tanga Coastal Zone Conservation and Development Program
WWF	World Wide Fund for Nature
IUCN	The World Conservation Union

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INTRODUCTION

The purpose of this study is to provide baseline information on a wide variety of social and economic variables in coastal areas of mainland Tanzania and Zanzibar where there are existing or potential future Marine Protected Areas (MPAs). In particular, it explores the links between the coastal and marine environment and poverty with the goal of identifying long-term management options for poverty alleviation through community-driven coastal and marine management. Data sources for the study comprise an extensive review of literature, key informant interviews, household surveys and focus group meetings in 24 villages from six coastal sites.

Attention to the links between the environment and poverty has grown in recent years. The 2002 World Summit on Sustainable Development in Johannesburg, South Africa, resulted in an international consensus that for sustainable development to be successful it needs to be defined by the simultaneous objectives of poverty alleviation and conservation Since then, environmentally sustainable development and poverty alleviation have become focal points of international aid and development assistance. In Tanzania, the importance of sustainable environmental management and poverty reduction is articulated in the government's Poverty Reduction Strategy Paper and Development Vision 2025. These documents highlight the heavy dependence of the poor in Tanzania on the environment and natural resources for their livelihood and therefore emphasize the need to mainstream environmental sustainability into poverty reduction efforts.

MPA management as an approach to coastal and marine conservation has also grown rapidly in Tanzania and worldwide. Brown et al. (2002) report that there are approximately 1,300 MPAs worldwide. Francis et al. (2002) identify some 28 MPAs in East Africa. Support for protected area management in Africa was recently reconfirmed in July 2003 when heads of state amended the African Convention on the Conservation of Nature and Natural Resources to promote the establishment of community-based protected areas and address gaps in the conservation of biodiversity. Boersma and Parrish (1999) have reviewed the reasons for the establishment of MPAs and find that almost all aim for some form of protection of local marine resources. In addition, conservation of biodiversity, maintenance of fisheries and sustainable tourism development are frequent reasons for designation. MPAs have multiple objectives, but all are in effect related to a desire to maintain or increase ecosystem values.

The appropriate level of attention given to social and economic issues in conservation and protected area management is an active area of debate. To what extent should poverty reduction and livelihoods be a central theme, rather than a means towards an end? Some authors (Terborgh, 1999; Oates, 1999; Kramer et al., 1997; and, Brandon et al., 1998) argue that conservation programs have become diluted by strategies that promote community development, work on socioeconomic issues, and greater local participation in decision making. They find that these approaches to conservation channel away funding yet produce minimal results in terms of biodiversity protection. By contrast, Pollnac et al. (2001) show in a comparative study of MPAs in the Philippines that integrating conservation with promotion of livelihood opportunities is significant factor in explaining MPA success.

The links between poverty and MPA management have not previously been analyzed systematically across MPA sites in Tanzania. A better understanding of the status, issues, and threats to the coastal and marine environment and the direct and indirect links to human welfare is essential for policy decisions to manage natural resources in a sustainable and effective manner.

BACKGROUND

Poverty in Tanzania

Addressing the issues associated with poverty and sustainable use of the coastal and marine environment is critical in Tanzania. Despite significant economic growth in recent years, most rural coastal communities are still very poor and dependent on common property natural resources—the sea, intertidal marine systems, and forests—for livelihood.

We define poverty broadly to include income and non-monetary dimensions of poverty. This highlights the idea that development must be people-centered to be sustainable and include the human dimensions of development such as participation in decision making,health, education, vulnerability, food security, cooperation, trust, and equity. Poverty is a multidimensional phenomenon with different sets of indicators illustrating different factors that exclude people from a minimum acceptable way of life within their own society. By almost any poverty measure, Tanzania ranks low compared to other countries (Table 1).

Table 1. Selected country information: Tanzania

Population (2002 census)	34.5 million
Life expectancy at birth (2000)	44
Under-5 mortality rate (2000)	149 per 1000
Gross national income (2001)	US$270/capita
Rural population below the poverty line (1993)	49.7%
Ranking on the Human Development Index	151 (out of 173)

Source: 2003 World Development Report, World Bank, 2003.

The National Bureau of Statistics conducted a household budget survey in 2000-2001 (NBS 2002). The survey results confirm that income poverty is high and social indicators show high levels of non-income poverty. Nationwide only 12% of households have electricity (only 2% in rural areas), 6% have a bank account, 25% have modern walls, and for 45% of households, drinking water is more than 1 km away. One quarter of Tanzanian adults have no education and 29% can neither read nor write. Women are about twice as likely as men to have no education.

The survey also revealed that poverty remains overwhelmingly rural—87 percent of the poor live in rural areas. The percentage of rural population in food poverty and basic needs poverty dropped over the last decade, but remains high (20 percent below the food poverty line; 39 percent below the basic needs poverty line).The implication of this background is the compelling need to focus on reducing poverty in rural areas. Rural areas lack basic infrastructure and services such as electricity, communications, adequate health care and education, potable water and other social services. One of the rural regions that is consistently most disadvantaged is Lindi region, which includes Kilwa District on the coast. This study provides additional insights into problems of poverty in rural coastal communities.

Tanzania's Coastal Resources

The Tanzanian coastline runs approximately north-south and is dominated by three large offshore islands: those of Pemba, Zanzibar[1] and Mafia. Among the countries of Eastern Africa, Tanzania has the greatest reef area (3,580 km ^{2}; Spalding et al., 2001). There are fringing and patch reefs along much of the mainland coast and the offshore islands.

Misali Island, just west of Pemba, has been singled out for having some of the highest recorded coral cover, and high species diversity. Chumbe and Mnemba islands off Zanzibar have been similarly singled out as offshore islands with diverse and well-protected reefs. Mafia Island has extensive reefs, particularly in the south, many of which remain in good condition. Likewise there are many reefs around the Songo Songo Archipelago in good condition, especially those furthest from the mainland.

There are mangrove forests in most river mouths and seagrass ecosystems are widespread, particularly in the shallow waters around the Mafia and Songo Songo Archipelagos. The Rufiji delta supports the largest single mangrove forest in eastern Africa, covering 53,000 hectares. Mangroves and shallow coral reef resources represent accessible open access resources, which are highly diverse, productive, and provide an important resource for poor people living on the coast.

There are over 43,000 marine fishermen in Tanzania predominantly operating in shallow waters using traditional canoes, outrigger canoes, and dhows (Jiddawi and Ohman, 2002). Fish caught by small-scale fishers provide a high percent of the animal protein consumed in coastal communities. The fish from rural communities also take part in fulfilling a growing need for fish protein in the expanding urban centers. Fishing is practiced throughout the year but the peak season is during the Northeast monsoon (November to April) when the ocean is calmer and clearer (TCMP, 2003). When the sea is turbulent, fishermen spend their time repairing fishing gear and cultivating their farms.

The coastal population of Tanzania is about 23 percent of the national population and is mostly concentrated in the urban areas of Tanga, Zanzibar, Dar es Salaam and Mtwara. In the urban areas, rapid population growth combined with poor management of the coastal area has lead to the rapid and extreme degradation of coral reefs, shoreline change, and deforestation. In the vicinity of high population areas, shallow reefs are almost completely destroyed. The large urban demand for resources from the coast also exerts pressure on the natural environment along the entire coast. For example, the urban demand for timber, poles for construction and charcoal for fuel, ornamental shells, lobster, crabs, octopus and all types of fish products is a driving force of growing resource exploitation in rural areas.

Most of the coast is relatively isolated with very poor infrastructure in terms of roads, communications, electrical service, and ports. For communities directly on the coast or located on small islands, fishing is the primary activity. Overfishing and destructive fishing is a problem everywhere. Inshore fishing effort has roughly doubled in less than 20 years. A report published in August 2003 on the state of the coast of Tanzania proved a comprehensive overview of the human and environmental condition of the coast of Tanzania (TCMP, 2003). We know with considerable certainty that the inshore fishery of mainland Tanzania and Zanzibar is

[1] Officially this island is known as Unguja, while the term Zanzibar refers to the administrative state which includes both this island and Pemba. Despite this, the term Zanzibar is most commonly used in relation to the single island.

overexploited and that shallow reefs are degraded. Fish abundance in most locations has declined significantly in the last decade, while fishing effort has increased. With essentially no deep-sea fishery, the pressure exerted on fragile inshore coral reef ecosystems is persistent.

Marine Fisheries

The marine fisheries in Tanzania are mostly artisanal and are located along a relatively narrow strip along the coast. This limitation is due to the limited range of the traditional vessels and the narrow continental shelf. The continental shelf typically extends to about 4k offshore with the exception of the Zanzibar and Mafia channels, where the shelf extends form 60km. Nevertheless, this nearshore fishery is extremely important to coastal communities, both as a direct source of food for households and as a source of income. As with many other tropical countries, the fishing community in Tanzania is comprised mostly of individuals with very little alternative income-earning capacity.

Fishing activities also take place along the intertidal zones during low spring tides especially by fisherfolk who cannot afford vessels or gear. They usually collect sea cucumbers, shells, and octopus by hand or with the assistance of a stick. Historically, shells were exported in bulk from Zanzibar.

Marine fisheries are an important source of income for many groups besides fishers. These include all those involved in boat construction and repair, and marketing and sale of fish products. The middlemen and traders play an important role in the artisanal fishery in providing an opportunity for those fishermen who cannot afford to buy gear or vessels. A middleman usually owns the expensive gear and vissels, such as the seine or gill net and boats or dhows. He partners with the fishermen such that the money obtained from the catch is divided into three parts: one to the middlemen, one for boat and gear maintenance and one for all the fishers on the boat. And, besides local consumption, fisheries provide foreign currency through international export products like sea cucumber, shells, live lobsters, crabs, squid, octopus, sardines and shark fins.

According to Jiddawi and Ohman (2002), there has been an increase in the number of local fishermen as well as an increase in the number of migrating fishermen who travel from their homes to camp and fish in other areas. This movement locally known as *dago* is an important characteristic of many fisheries in Tanzania. It has resulted in a localized increase of fishing effort in some areas during certain periods of the year and has been the cause of fishery conflicts with local communities. It also poses particular problems for the management of fisheries, and for the adoption of community based approaches to management. Fishing activities are strongly influenced by the monsoon winds which are seasonally reversing winds, with most fishing ocurring during the northeast monsoon (*kaskazi*) which prevails from november to February and is characterized by higher air temperatures and weaker winds.

The artisanal fisheries of Tanzania are characterized by the use of simple, passive fishing gears which are mostly used in depths not exceeding 30m (Jiddawi and Ohman 2002). Gears and vessels used are mostly traditional and low cost, such as outrigger canoes, line and hooks, fish traps, nets and spears, although recently more modern technologies such as boats with engines and SCUBA have been introduced. The most common methods are trap fishing and hook and line fishing. Usually one fisher owns about 5 traps. The means of propulsion of fishing boats are usually paddles, long poles and sails, which are used in 90% of the vessels. A few are

fitted with outboard or inboard engines. Most of these vessels lack cooling and freezing facilities so fishing is limited by both time and distance, thus fisherfolk continue to fish the same grounds as were fished by earlier generations.

Fishery target species are very numerous, especially in terms of fish species. The number of marine fish species in Tanzania is estimated to be over 1000, out of which about half may be utilized as food or for commercial purposes (Jiddawi and Ohman 2002). The lobster fishery is especially important for tourist hotels and restaurants, although some lobsters are also exported to Portugal, UK and Hong Kong (Jiddawi and Ohman 2002). The seacucumber trade is a comparatively big industry in Tanzania. Twenty two species are traded, with *Holothuria scabra* and *H. nobilis* being the most important. The product is gutted, boiled and dried before being exported ot the Far East. Virtually no sea cucumbers are consumed locally. More than 150 species of sea shells are collected by fishermen in Tanzania for food and to be sold as curios.

Artisanal fishing for octopus is also a highly important economic and subsistence activity for local coastal communities in East Africa, and is extensively practiced along the coast of Tanzania (Guard and Mgaya 2002). Octopi (*pweza*) are collected from intertidal reef flats and subtidal inner reefs for both local and inland consumption and for export to European and Far Eastern markets (Darwal 2000). Traditionally, fishing for octopus has been dominated by women and children and is important for being one of the few sources of income for this gender group (Guard and Mgaya 2002). In recent years, however, men have become increasingly involved with octopi fisheries due to a rise in demand and greater income opportunities (Guard and Mgaya 2002). Outside buyers, who export octopus, now operate along the coast, and using specially comissioned boats to take fishers to fishing sites also pay premium prices for the catch. Mafia island and Tanga have octopus processing plants which involve considerable number of fisherfolk and have created an overexploitation of the resource (Jiddawi and Ohman 2002). The majority of octopus is sold fresh or iced with some going to the local restaurant industry. The remaining is salted and dried and later exported to Kenya, the Middle East, and Spain. Octopus is also an important component on tourist restaurant menus.

Coastal Management Issues

Much of the pressure on fisheries and degradation of reef ecosystems in Tanzania has been caused by destructive fishing methods. By far the most destructive type of fishing is the use of dynamite.
Dynamite fishing was once widespread, but its use has been reduced drastically throughout the country. Dynamite fishing has been practiced in Tanzania for over 40 years. Each blast of dynamite instantly kills all fish and most other living organisms within a 15-20 m radius and completely destroys the reef habitat itself with a radius of several meters. With numerous blasts occurring daily on reefs all over the country, over a period of many years, the cumulative effect has been devastating. Before 1995, Mafia Bay was reported to be like a “war zone” with blasts going off every hour. A survey in Tanga region has shown that dynamite fishing was responsible for the damage beyond recovery of 10 percent of coral reefs in the region and 70 percent showed significant damage but could recover if protected.

Such numbers are ominous, especially when viewed in the context of the country’s ability to produce food for its people. A health coral reef can produce 20 metric tons of fish per square kilometer per year, enough fish to provide 50 kilograms of fish per year to 400 people (CRMP,

1998). One square kilometer of reef in poor condition, on the other hand, produces no more than 5 metric tons of fish per year, barely enough to feed 100 people.

The use of small mesh seine nets to capture fish on the bottom and around reefs is almost as destructive as the use of dynamite. The nets are weighted and dragged through the reef flat or are pulled around coral reefs. Dragging them over the reef flat unavoidably damages coral and other marine life. Some techniques additionally involve beating and smashing coral colonies with poles to frighten fish into the net. The small-mesh size of seine nets results in the capture of many juveniles. Capture of juvenile fish, when conducted intensively in nursery areas, results in depletion of fish stocks, alteration of species composition, loss of species diversity, and disruption of food webs.

Destructive fishing methods are illegal, but continue to be used due to lack of enforcement and competition for marine harvests. Shells, sea cucumbers, and lobsters are all over exploited. Nesting populations of marine turtles have been declining rapidly due to incidental turtle catch, hunting, poaching of turtle eggs on the beach, and loss of nesting beaches. In some areas of mainland Tanzania (especially the Rufiji Delta area and Bagamoyo) the commercial shrimp trawling fishery degrades or destroys seagrass, destroys marine turtles, and depletes fish stocks and diversity through incidental bycatch.

Extraction of living coral for use in building and in conversion into lime for cement is another highly destructive activity that is also widespread along the entire coast. Live and dead corals are extracted from reefs using pick axes, crowbars and other implements. The corals are brought ashore where they are piled into kilns and burned to produce lime for local building and trade. It is prevalent in Lindi and Mtwara regions and in Dar es Salaam. In 2000 it was estimated that 1,500 tons of coral were being mined every year from the Mikidani Bay area in southern Tanzania alone. The damage to shallow inshore reefs in such a case is immense. On Mafia Island, coral mining was ranked third as an income-generating activity, in terms of the numbers of people involved in the early 1990's (Dulvy et al., 1995).

Other significant pressures on wood resources in the coast include mangrove and forest cutting for household cooking, charcoal production, building poles, and fuelwood to produce lime from coral. A recent GIS assessment of land cover change in the coastal districts of mainland Tanzania by the University of Rhode Island shows that mangrove forest and closed woodland have declined in area from 1990 to 2000, while grassland, urban area and residential area have increased (Wang et al, 2003).

Tanzanian Government Commitment

Livelihoods, environment, and poverty reduction are main objectives of Tanzanian Government policy. Plans for poverty reduction were outlined in the Tanzanian Development Vision: 2025, the National Poverty Eradication Strategy of June 1998, the Poverty Reduction Strategy Paper of October 2000, and the Zanzibar Poverty Reduction Plan adopted by the Government of Zanzibar. The Government of Tanzania's Poverty Reduction Strategy Paper (PRSP) and Development Vision 2025 clearly articulate the importance of sustainable environmental management for poverty reduction. It recognizes that the poor in Tanzania are heavily dependent on the environment and natural resources for their livelihood and income generation and therefore, emphasizes mainstreaming environmental sustainability into poverty reduction efforts.

Poverty alleviation and protection of coastal and marine resources are policy priorities in both Tanzania mainland and Zanzibar. Concern with growing and cumulative threats to coastal and

marine resources and degradation of the coastal environment led to the establishment of the Marine Parks and Reserves Unit (MPRU) in 1994 under the Ministry of Natural Resources and Tourism. MPRU has the mandate to establish and ensure sustainable conservation for areas of outstanding marine ecological importance and manage them in partnership with coastal communities on mainland Tanzania and other stakeholders. In addition, a government decree will soon be released that mandates all small islands be developed as multi-purpose protected areas.

Protected areas in Zanzibar are considered to be an essential element in the implementation of both the National Environmental Policy (1991) and the Forest Policy. The legal framework for protected area establishment is enabled through the Environmental Management for Sustainable Development Act (1996), the Forest Resources Management Act (1996) and the Fisheries Act (1988), which provides for the establishment of MPAs. A National Protected Areas Board was established in 2002 in Zanzibar under section 80 of the Environmental Management for Sustainable Development Act to coordinate the designation and management of the national protected area system.

The National Integrated Coastal Management Strategy (adopted by Cabinet in 2002) stresses the need "to preserve, protect and develop the resources of Tanzania's coast for use by the people of today and for succeeding generations to ensure food security and to support economic growth." One of the principles of the Strategy is that coastal development decisions shall be consistent with the government's priority of poverty alleviation and food security. The Strategy offers an opportunity for the coordination of marine parks, conservation areas and reserves with a broader policy framework focused on the conservation of natural resources, on ensuring food security, and on supporting poverty alleviation and economic growth.

MPAs as a Strategy of Marine and Coastal Management

There is occasional debate among marine researchers and conservation practitioners as to the precise definition of a "marine protected area." In this study, we use the generic term MPA to mean any designated coastal and marine area where specific natural resource and conservation actions are undertaken. This broad interpretation of an MPA is consistent with the definition used by the World Conservation Union:

"Any area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which as bee reserved by law or other effective means to protect part or all of the enclosed environment."

Brown et al. (2002) report that there are approximately 1300 MPAs worldwide today, but only four countries in Africa have designated MPAs. The degree of protection, responsible governmental authority, and reasons for establishing MPAs are varied. Boersma and Parrish (1999) have reviewed these reasons and find that almost all aim for some form of protection of local marine resources, and either conservation of biodiversity, maintenance of fisheries or sustainable tourism development are additional reasons for designation. The two principal uses of MPAs are therefore as fisheries management tools and as national parks protecting habitats and resident marine communities.

There is ample empirical evidence that MPAs can, if well managed, provide benefits for biodiversity conservation and fisheries management. However, many MPAs exist in name only as "paper parks". Kelleher (1999) claims that fewer than 50 percent are effectively managed. A

survey of MPA effectiveness in the Philippines concludes that only some 20-25 percent of the over 400 MPAs in the Philippines are successful (Crawford et. al., 2000). Likewise, Kenchington (2000) notes that the concept of a protected area that can be managed in effective isolation from activities in surrounding areas is not ecologically tenable.

Today we find much ongoing work on the design principles and best practices by which MPAs are made sustainable and effective in practice. Pollnac et al. (2001) measured success of MPAs in the Philippines in terms of the MPA's impact on the resource, degree of adherence to the rules associated with the MPA, and degree that community members are empowered to manage their own resources. Their results show that critical to MPA success is: community involvement in negotiating the objectives of the area and in subsequent management and monitoring, political commitment, and the integration of conservation with promotion of alternative livelihood options.

An extensive survey of the state of MPA management by Alder (1996) concludes that planning and management are constrained by factors including complicated legislation, absence of political support, lack of funding, and insufficient information and education for the decision-makers and resource users. The survey also finds that despite the widespread promotion of "integrated conservation and development" models, most MPAs are still implemented as more conventional exclusionary protected areas with little involvement by local communities and little local input to decisions on user or access rights to the resources in the MPA.

Alternative Livelihood Strategies

Promotion of alternative income-generating options has become a standard practice to reduce fishing pressure on overexploited inshore fisheries is often part of MPA strategies. The strategy is summarized by a quote from a specialist working with the national ICM program in the Philippines:

> *Seaweed farming helps protect our remaining coastal resources by building up other marine life and providing alternative livelihood for coastal fishermen, who might have otherwise resorted to cyanide and dynamite fishing.* (Sun Star Manila, February 25, 2000).

There is evidence from specific project experience that new sources of employment and income have been created as a result of efforts promoting alternative livelihood strategies. However, whether or not alternative livelihood strategies have reduced pressure on fisheries is not clear. A comparative empirical study of coastal resource management in the Pacific islands found that most alternative income generation programs have not been successful in reducing pressure on coastal resources (World Bank, 1999). We can identify several possible reasons.

One is that in most low-income countries there is a large surplus labor force. Another reason is the unique characteristics of fishing that make it a desirable occupation. For instance, coastal communities in Tanzania mainland and Zanzibar believe that the fresh sea air and salty moisture from seawater is healthier than working on land and builds strength and resistance to disease. In Tanzania mainland and Zanzibar, there are also positive social sentiments and relations between fishermen from one coastal village and other villages along the coast. Finally, traditional, small-scale fishing ensures a daily food supply and/or income.

Experience shows that care must be taken to ensure that coastal investments in alternative livelihoods benefit local people. Managerial jobs in the large scale businesses often go to

outsiders while people from the coastal village are employed in the lower paying jobs, as they lack skills. Where enterprises have partial foreign ownership, profits may "leak" abroad and the local benefits of income generation can be small. Thus, to alleviate poverty, the type and ownership of the enterprise must be considered in advance and job training may be necessary to increase local employment benefits.

Care must also be taken to ensure that alternative livelihoods do not generate new forms of environmental degradation or resource use conflicts. Depending on the specific situation, tourism, mariculture and other income-generating activities can entail environmental impacts and generate conflicts with other resource users.

The importance of income generation and poverty reduction in rural coastal communities makes alternative livelihood strategies an important component of MPAs and integrated coastal management despite their uncertainties and complexities. It has been found that promoting income-generating businesses as part of community-based coastal management improves community interest and participation, and therefore the likelihood of success. An empirical study of community-based coastal management efforts in Philippines showed that those coastal projects with a sustainable livelihood component were more successful in marine conservation (Pollnac et al., 2001).

MPAs in Tanzania

Coastal and marine protection takes a variety of forms in Tanzania. The Dar es Salaam Marine Reserves System, encompassing four small islands was designated in 1975. None of these was fully implemented and, in reality, their status as a marine reserve remains on paper alone. The Fisheries Division is authorized to manage the reserves, but no specific management and institutional mechanisms were put in place. Maziwi Island (off Pangani) and Chole Bay and Tutia Reef (Mafia Island) were designated as marine reserves in 1981. The Mafia Island sites were later incorporated in the Mafia Island Marine Park and Maziwi Island is now part of the Ushongo collaborative reef and reef fisheries management plan lead by the Tanga Coastal Zone Conservation and Development Program (TCZCDP). By law, the reserves are restricted no-take zones.

The Marine Parks and Reserves Act of 1994 provided the first guide on the establishment and the institutional mechanisms for the management of parks and reserves. **Mafia Island Marine Park** was legally established in 1996 and the **Mnazi Bay Marine Park**

Marine Park and Reserve Unit, Government of Tanzania

Goal: To ensure sustainable conservation of Marine Protected Area resources for the benefit of present and future generations

Vision: Establishment of a well managed, integrated network of marine and fresh water protected areas, which ensure the sustainability of Tanzania's aquatic biological diversity and ecological processes for the benefit of present and future generations

Objectives:

- To protect, conserve, and restore the species and genetic diversity of living and non-living marine resources and ecosystem processes of marine and coastal areas.
- To stimulate rational development of underutilized natural resources.
- To manage marine and coastal areas so as to promote sustainability of existing resource use, and the recovery of areas and resources that
- To ensure communities in the vicinity of marine parks and reserves are involved in the all process of management and share the benefit of protected areas.
- To promote community awareness on sustainable conservation of marine parks and reserves resources.
- To facilitate research and to monitor resource conditions and uses within the marine parks and reserves

was gazetted in 2000. These MPAs consist of relatively large, multiple use MPAs that are very much like small-scale models of integrated coastal management. The need to balance the protection of the natural resource base while maintaining the local communities' right to resources has necessitated the adoption of this management approach.

Protected areas are declared under separate legislation in Zanzibar and Pemba. The **Menai Bay Conservation Area** off the south coast of Unguja island was established in 1997 and is one of a number of new marine protected areas being operated at the local level. Menai Bay Conservation Area started as a local initiative based on local fishermen's interest in halting the trend of environmental degradation and overexploitation of marine resources. Local communities have developed regulations and procedures governing fishing and the establishment of fishing camps excluding outsiders from fishing in the bay. Another initiative in Unguja island is **Jozani-Chwaka Bay Conservation Area,** located 35 kilometers south east of Zanzibar town. Jozani Forest was declared a Reserve in 1960. In recent years its status was upgraded to a National Park expanding the area from 2,500 to 5,000 hectares and extending its area to the Chwaka Bay mangrove system. **Misali Island Marine Conservation Area** is located 10 km off the west coast of Pemba. Misali Island was leased to a private company for hotel development in 1993, but local community and international objections led to an annulment of their permit and establishment of the island as a conservation area.

Another approach to marine protection in Tanzania is community-based management, which is based on the idea of enabling communities to care for their own resources. Some examples are the Tanga, Muheza, and Pangani Districts under the direction of the **Tanga Coastal Zone Conservation and Development Program** (TCZCDP). Rather than establishing marine protected areas through formal MPA legislation, the program has relied on a reef closure system based on community-based, collaborative fisheries management plans. A marine reserve, the **Maziwi Island Marine Reserve**, has been incorporated into the Ushongo fisheries management plan.

Finally, there are small protected areas managed by private companies with the agreement of government in Zanzibar. These include **Chumbe Island Coral Sanctuary**, a nature reserve that is managed by Chumbe Island Coral Park, Ltd., and **Mnemba Island Marine Reserve**, managed by Conservation Corporation Africa.

METHODS

Study Sites

Six sites from the United Republic of Tanzania were selected for this study: five with existing MPAs (Tanga, Mafia Island, Kilwa, Menai Bay, Jozani-Chwaka Bay, and Misali Island)and one where a new MPA has been proposed (Kilwa; for key facts and characteristics see Tables 2 and 3). Of the selected sites, three were located in mainland Tanzania, and three were in the Zanzibar islands of Unguja (Menai and Jozani Chuaka Bay) and Pemba (Misali Island) (Figure 1). Data was collected in 4 villages within each of the study sites (Table 4). Three out of the four villages selected at each site were located within the MPA or in close proximity to it, and one (to be used as a control village) outside the MPA or far enough from it so that it lacked major interactions with it. With no MPA in Kilwa, all four villages from that site are controls. In Tanga, all coastal villages are to some extent involved in the collaborative fisheries management program and hence, there is no control village in Tanga.

Villages were selected in consultation with local and national level officials and MPA project staff. Key criteria in selection of villages included proximity to the protected area, community involvement in conservation, and livelihood dependence on coastal and marine resources such as mangrove, coral reefs, fishing and seaweed farming. We also purposefully selected island villages as part of the sample; villages representative of the entire geographical area; and, in some cases selected villages where there were known histories of conflict (e.g. the village of Jibondo in Mafia).

Table 2. Key facts about the study sites

	Tanga Coastal Zone	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island*
Year of establishment	1994	1995	1999	1997	1995	1998
Size of protected area (km²)	?	822	na	467	2,500	22
Villages in the management area(s)	42	11	na	17	7	36
Population	150,000	18,000	172,000	16,000	9,100	~11,000
Approved management plan	Yes	Yes	Na	No	Yes	Yes
Alternative income generating activities	Yes	Yes	Na	Yes	Yes	Yes
No-fishing protected area zone	Yes	Yes	No	No	No	Yes

na = not applicable

Table 3. Characteristics of protected areas in the selected study sites.

Name/Location	Type of Protected Area	Donors and Government Partners

Tanga Coastal Zone Conservation and Development Program	Community-based reef closure and collaborative fisheries management	Irish AID and IUCN in collaboration with local government
Mafia Island Marine Park	Marine Protected Area	WWF and NORAD in collaboration with Marine Parks and Reserves Unit
Kilwa District	Proposed Marine Protected Area	District government office
Menai Bay Conservation Area	Conservation Area	WWF in collaboration with Department of Fisheries and Marine Products
Jozani-Chwaka Bay Conservation Area	Forest Reserve	CARE International, Government of Austria, with the Zanzibar Department of Commercial Crops, Fruits and Forestry
Misali Island Marine Conservation Area, Pemba	Conservation Area	CARE Tanzania with the Zanzibar Department of Commercial Crops, Fruits and Forestry and the Misali Island Conservation Association

Table 4. Villages and number of households surveyed for this study.

Site Name and Location	*District*	*Village (C) = control*	*Population* [1]	*No. of Households*[1]	*No. of Household Surveys*
Tanga Coastal Zone Conservation and Development Program Tanga Region	Tanga	Sahare Kijijini	828	170	31
	Tanga	Tongoni	1566	356	30
	Pangani	Ushongo	760	219	30
	Pangani	Mkwaja	746	187	30
Mafia Island Marine Park Coast Region	Mafia	Baleni	2938	761	37
	Mafia	Jibondo	1580	301	31
	Mafia	Bwejuu	833	158	30
	Mafia	Chunguruma (C)	1881	493	34
Kilwa District Lindi Region	Kilwa	Somanga (C)	3529	722	30
	Kilwa	Kisiwani (C)	995	215	30
	Kilwa	Songosongo (C)	2577	601	32
	Kilwa	Rushungi (C)	1030	240	30
Menai Bay Conservation Area Unguja Island	Magharibi	Nyamanzi	868	186	32
	Chake	Ng'ambwa	4851	846	34
	Kusini	Mtende	1431	347	35
	Magharibi	Buyu Hamlet (C)	474	112	32
Jozani-Chwaka Bay Conservation Area Unguja Island	Kati	Ukongoroni	752	157	30
	Kati	Michamvi	1120	202	31
	Kati	Cheju	302	57	30
	Kati	Pongwe (C)	513	106	30
Misali Island Conservation Program Pemba Island	Mkoani	Wambaa	2603	431	30
	Mkoani	Mwambe	7444	1432	30
	Chake Chake	Wesha	3209	575	30
	Micheweni	Maziwa N'gombe(C)	3465	743	30

[1]Source: 2002 Population and Housing Census, Government of Tanzania

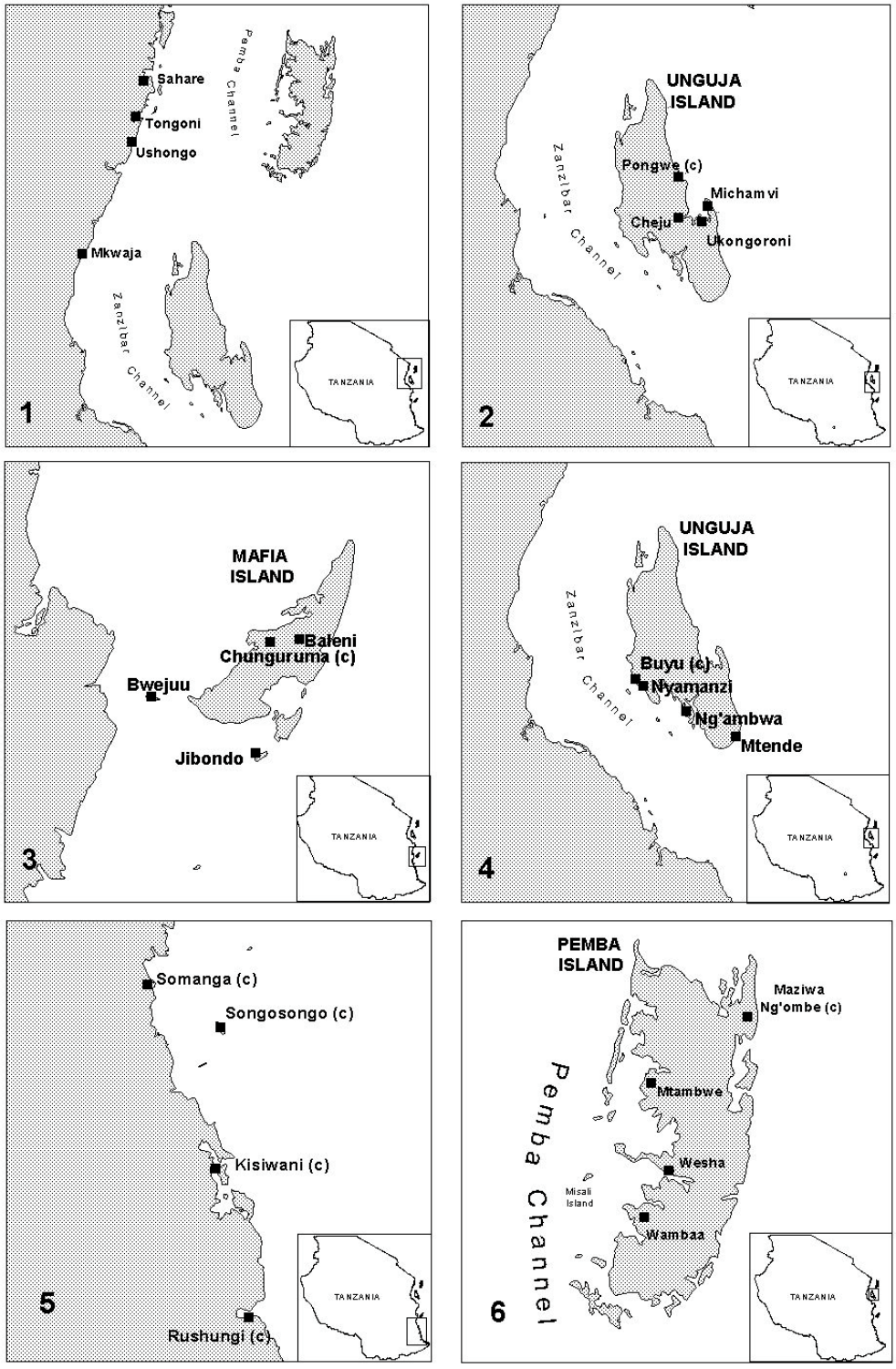


Figure 1. Location of study sites. 1= TCZCDP, Tanga Region, 2 = Mafia Island Marine Park, 3 = Kilwa District, Lindi Region, 4 = Menai Bay Conservation Area, 5 = Jozani-Chwaka Bay Conservation area, 6 = Misali Island Conservation Program. Control villages are denoted by (c).

Tanga Coastal Zone Conservation and Development Program

The Tanga Coastal Zone Conservation and Development Program was initiated in 1994 to halt the decline of the economic wellbeing of coastal fishing villages in Tanga Region resulting from a decline of fish resources. This decline was attributed to over fishing and the intensive and long-term use of destructive fishing gears and methods. The Tanga Program was designed to improve coastal wellbeing by empowering local communities to restore and protect the coastal environment. The three coastal districts of the Tanga Region have ecologically important and diverse marine habitats, including coral reefs, mangrove forests, estuaries and bays, and seagrass beds. In total there are 96 fringing and patch reefs along the 180-km shore of the Tanga Region.

Phase one (July 1994 - June 1997) had two objectives: to strengthen the capacity of local public institutions to undertake integrated coastal management, and to work with coastal communities to manage coral reefs and other natural resources. Phase two, which ended in December 2000, focused on the development and implementation of collaborative fisheries and reef management plans. Phase three has continued with a similar focus.

The Tanga Program is acknowledged worldwide as a practical example of the application of effective methods for community-based coastal management. The core strategy of the program has been action planning—the use of issue-based plans, outlining specific actions targeted at either the causes or effects of problems, and providing detailed guidance on how they will be implemented, monitored, and adapted over time.

When the Tanga Program began a strategic decision was made to work at the most decentralized level (village, ward and districts) rather than work with Regional governmental bodies to develop institutional capacity and plans for coastal management. This proved to be an important decision and was consistent with policy changes in Tanzania, such as the Local Government Reform Act of 1998 and the Land Act of 1999.

Nine villages were selected (three in each district of Muheza, Tanga, and Pangani) to take part in a participatory resource assessment of coral reefs and coastal forests and an overall socio-economic assessment. These studies described ecosystem condition, resource use patterns and priority resource management issues. The Program intentionally invested much time and effort into the assessment process to ensure that the participants, i.e. the resource users and managers, were the ones to identify and prioritize issues and recommend actions. A number of priority resource management issues were selected: 1) Over fishing and destructive fishing methods 2) Poor government 3) enforcement and management 4) Coastal erosion 5) Destruction of mangroves, 6) lack of firewood and building materials 7) Poor agricultural production due to vermin 8) Beach pollution 9) Lack of basic sanitation in villages.

In July 1995, the three participating Districts were invited to select one village each to begin a process of action planning directed at these issues. The three villages were selected to illustrate a range of different situations and challenges for coastal and marine management. The villages of Kigombe, Kipumbwi, and Mwambani were selected and with assistance from extension staff participants in the villages began to analyze the causes and consequences of problems, and develop actions that could improve the situation. In the villages, a management committee was formed for each of the two to four resource issues that were identified as priorities. The Program provided training on how to formulate action plans with clear, achievable objectives, work plans, monitoring and evaluation. The first action plans were one-year plans with evaluation and revision every six months. Later, they were structured with a three-month planning horizon. The

first plans were formally adopted by the Village Committees, District Advisory Committee and the Tanga Program in early 1996.

The second stage of action planning (1996-1999) was directed at marine ecosystem issues (such as reduced fish catch and dynamite fishing) shared across more than one village. Implementation of village specific action plans continued in the initial villages, and additional villages were added to two of the first three villages (Kigombe and Kipumbwi) to develop multi-village fisheries management plans.

As a response to the conflicts created by the attempt to do single-village management of coral reefs, the program decided that all villages that share a specific fishing area should be equal partners in developing, implementing, monitoring, and evaluating the fisheries management plan. A system was created in which each participating village elects a Village Environmental Committee responsible for developing a plan for fisheries management in their village. The village committees feed into a Central Coordinating Committee (CCC) comprised of representatives from all villages that take part in the collaborative management scheme. The CCC is responsible for formulating a management plan approved by all villages. The collaborative fisheries management plans include actions, common rules, and penalties. The CCC is also responsible for resolving inter-village disputes and proposing by-laws to complement the implementation of the management plan. After the plan is approved by all villages and adopted by the CCC, the Village Environmental Committees are responsible for implementing village-based actions while the CCC is responsible for overseeing overall plan implementation and monitoring. Currently, all 42 coastal villages in the Tanga Region are to some extent involved in planning and implementing collaborative fishery management plans.

The six collaborative management plans in operation currently encompass six reef closures (one permanent, some for five years, and others to be reviewed annually) and cover most of the coastline. Some villages have been equipped with radio equipment and patrol boats for enforcement and monitoring. Fishermen have established patrol units in several involved villages to monitor and report incidences of illegal fishing. The navy is also involved in enforcing the protected areas and the program has worked to increase follow-up at the government level for prosecuting dynamite fishermen. Villagers are also involved in data collection and monitoring or reef status and fish counting.

The program has implemented gear exchange programs for illegal nets and installed offshore fish aggregating devices to draw fishers away from the reefs. After initial success, these devices were stolen. Several attempts have been also made to initiate alternative livelihood programs in participating villages such as mariculture and expansion of seaweed farming.

Mafia Island Marine Park

Mafia Island Marine Park (MIMP) is the largest marine park in the Indian Ocean. It covers an area of 822 km² around the south end of Mafia Island and Chole Bay. Mafia Island and its chain of small islets lie approximately 20 km offshore from the Rufiji river delta. The huge Rufiji delta influences the Mafia Island ecosystem by supplying additional nutrients to the marine food chain . The main island of Mafia is about 48 km long and 17 km wide at its widest point.

The Mafia Island geographical region is one of the finest complexes of estuarine, mangrove, coral reef and marine ecosystems in the world. It has been recognized internationally as a critical site for biodiversity. The waters around Mafia include a great diversity of tropical marine habitats

including coral reefs, seagrass beds, mangroves, inter-tidal flats and contain important nesting grounds for sea turtles.

MIMP is managed by the Marine Parks and Reserves Unit in collaboration with the World Wide Fund for Nature (WWF). Norwegian Aid (NORAD) has also supported alternative livelihood activities in villages in the Park. A General Management Plan for the Park was adopted in June 2000. The Plan's zoning scheme divides all areas within the park boundary into 3 types of use-zones, each with different degrees of protection and permitted activities. The aim is to spatially separate extractive resource-use areas from sensitive habitats.

MIMP supports a wide array of connected activities: fishery monitoring and enforcement, improved fishing techniques and marketing, environmental education, mariculture development, livelihood development, micro loans, and coral and mangrove conservation. These actions are having a significant impact on the marine environment in the Park. In the 1980's fishing pressure was intense with a big influx of fishermen from the coast further south. Patrol boats and a water guns successfully stopped dynamite fishing, about 50 percent of illegal seine nets have been eliminated, and the permit system was successful in controlling outside fishers in the boundaries of the Park. Fish abundance and reef condition has improved and new ways to improve the condition of people's lives have been introduced.

MIMP has three boats on the water monitoring the Park's boundaries all day. Also, two tourist lodges have agreements with MIMP to monitor seine net fishing through their guests when they go on the water (when illegal seine net fishers see the MIMP boats they stop using them because they know it is illegal). MIMP collects fish catch data through fish traders. Fish traders with permits to trade in the Park are required to complete forms on catch provided by the Park. Most fish is sold to traders on the water and the fish is carried to boat to Dar es Salaam. Mafia does not have landing sites. Some fishers also volunteer to collect fish catch data themselves. MIMP provides weighing equipment and the forms to register data. The Park has conducted numerous surveys and baseline analyses: reef benthic survey, reef fish survey, mangrove inventory, community knowledge survey, and household economic survey.

A fishing gear exchange program aims to eliminate small mesh seine nets and to both promote fishing outside of Mafia Bay and alternative fishing techniques. The net to be exchanged is valued and a calculation of the value of the old net and cost of the new net is made. If the new net costs more an interest free loan equal to the difference is provided. If the old net belongs to a fish trader, the net is returned and the fisherman is given a new one with a loan (with favorable conditions, such as no interest and 3-6 month repayment grace period). About 40-50 percent of nets are owned by intermediaries. The limiting factor to increase the rate of gear exchange is funding.

Some of the options being promoted for alternative fishing techniques include: fishing offshore in 200-500 meter depths using large mesh gill nets and deep-sea line fishing with lights; purse seine fishing outside of the Park for pelagics like sardines; low technology cage fishing using fence and basket traps; and, fishing around fish aggregating devises to draw fishers away from the reefs.

Linked to changes in fishing gear, the MIMP project aims to improve fish marketing capacity. At present, the fish traders provide seine nets, even boats and engines on no-cost loan on agreement that fish is sold to them at a low price, a fraction of what the fish are worth at wholesale. Thus, they both promote damaging methods and exploit the fishermen. The Mafia project has started discussions concerning organizing fish marketing systems for local fishers in Kilindoni (center town of Mafia Island) and Dar es Salaam. The main obstacle to selling fish in Dar es Salaam is

not technical or financial, it is human. The cost would be only about $4,000 for a boat, 40 hp engine, and 2 ton ice box. They plan to form two Fishing Groups, one focused on fish catch the other on marketing.

Environmental education has always been part of the MIMP project. At first, adults were targeted, but school children are now the main target of education and awareness programs. MIMP has supported some community development projects. The MIMP project is building a community center that can be used to hold meetings, workshops, and conduct training. Also, the project contributed to construction of a dispensary.

In mariculture development, the project is working on rabbit fish cage farming, pearl farming, and plans to explore the feasibility of sponge farming. Rabbit fish culture as a subsistence activity is the most advanced of the mariculture efforts. Two villages are involved, one has already had a harvest. MIMP established fishing groups to guide the activity in the future.

MIMP has worked with villages to improve agricultural practices and to introduce alternative livelihoods. The project is providing improved crop seeds, like improved maize and introducing new oil seed cash crops (sunflower, palm oil, simsim). It has also provided chicken vaccinations against Newcastle disease, which is a big problem. The project is trying to make this sustainable by providing interest free loans and technical assistance to small shops to stock and sell drugs for livestock, seeds, and pesticides. Also helping Juani Island with problems of pests (monkeys and pigs) that are feeding off the shambas (household agricultural plots). These types of assistance are really appreciated by the communities. However, agriculture will always be only supplementary in the fishing villages because of the soil and hydrology. Ninety percent of the population is dependent on fishing for their livelihood.

In alternative livelihoods the project has helped introduce handicrafts, seaweed farming, and apiculture. MIMP has convinced traditional beekeepers to incorporate modern methods to increase profits and has provided technical assistance in the marketing of honey products. A Beekeepers Cooperative Society is being established to take over this role marketing later. Four villages in the Park have beekeeping. Marketing honey at hotels began in December 2002. A handicrafts projects with NORAD funding has assisted village women to produce and market doormats made from coconut fiber and rope. The products are marketed in Dar es Salaam. In seaweed farming, MIMP helped to get it started on the small island village of Jibondo in partnership with the ZASCOL seaweed farming company.

Coral mining and mangrove cutting was a serious environmental threat in Mafia Island prior to establishment of the Marine Park. The original Park plan banned all coral mining and mangrove cutting. Later there was a compromise in which coral mining and cutting was banned for commercial sale, but allowed for household use (with a permit). Commercial lime production (from live and dead coral) was successfully stopped after MIMP staff confiscated boatloads of lime being shipped to the capital. MIMP is providing technical assistance and demonstrations of home building without coral or poles. The technology involves stabilized mud bricks and coconut fiber tiles. Individuals in 3 villages have been trained and in each of those villages, demonstration houses are being built.

A micro credit and savings scheme has been established and is tied to several of the activities of the MIMP project. Saving and Credit Committees have been formed in 9 of 11 villages in the Park. Previously there was no credit and savings in Mafia. After 3 months of deposit, a member can borrow up to twice as much (up to $1000) as the deposited amount at an annual interest rate of 12½ percent. A condition of anyone who receives an interest free loan from the project for

beekeeping, fishing gear replacement, or small shop is that they become a Member of the Savings and Credit Society. Without the Saving and Credit Society, saving money in practice is very difficult here. Setting money aside is normally impossible.

Kilwa District

Kilwa is a coastal district in the Lindi Region with a coastline of about 150 km. There are no marine protected areas in Kilwa at present, although the District Council is pursuing establishing an MPA like MIMP in order to control overexploitation of marine resources and destructive fishing practices. The goals of the MPA would include legal empowerment, enforcement, improved fishing gear, and development of markets for fish projects.

Coastal management initiatives in Kilwa include the Community Based ICM Program under the Pew Fellowship Award of Magnus Ngoile, the Mangrove Management Project, the Village Based Forest and Wood Management Project (UTUMI), and the tourism management planning work of the Kilwa District Council and Tanzania Coastal Management Partnership.

The marine and coastal assets of Kilwa are similar to Mafia: abundant and diverse coral reefs, seagrass beds, extensive mangroves, inter-tidal flats and highly productive marine fisheries. Agriculture is generally poor along the coastal strip and the fishery is the primary source of livelihood. There is some traditional bee keeping, but there are no District officers with expertise that can provide extension assistance. The area is very isolated due to poor roads, lack of electricity and communications. The road from Kilwa to Dar es Salaam passes through one of Africa's largest mangrove and wetland system.

Seaweed farming and other mariculture is being promoted by District officials. They would like to see seaweed farming expand with floating rafts and try to introduce pearl oyster culture. There are now four villages farming seaweed, having started about 5 years ago.

Anecdotal information indicates that pressure on marine resources is increasing. Main sources of pressure include:

- Dynamite fishing has begun in the last 10 years
- Before fishing was seasonal, now people fish everywhere regardless of the season
- Before only women fished lobster, now male divers also capture lobster
- Before gill netting took place only at certain times, now its year-round.
- Harvest of juvenile lobsters
- There is a growing number of visiting fishing boats (including commercial trawlers) from Mtwara district, Dar es Salaam, Tanga, Zanzibar and even Pemba and Mozambique
- Lime making from live corals is widespread

.Archeological and historical attributes make Kilwa unique. The historical coastal ruins include mosques, forts and palaces of early traders. Kilwas was a most famous a prosperous city from the 14th Century all the way through the mid-19th Century. It was occupied as early as the 10th Century and by the time the Portuguese arrived in 1498, it was a large town that derived its wealth from gold trade with the African interior. Many of the ruins can be visited today. Kilwa was designated by UNESCO as a World Heritage Site in 1981.

Tourism is viewed as a key source of growth and revenue for the District. The attributes of Kilwa that tourism can build from include the tranquil, rural character of the area, diverse marine

resources for sport fishing, diving and boat excursions, terrestrial parks and caves, and historic archeological sites.

Menai Bay Conservation Area

Menai Bay Conservation Area (MBCA) is situated in the southwest of Zanzibar and covers an area of 467 km² inclusive of 6 islets, with a seaward boundary close to 61 km offshore. It is the biggest marine conservation area in Zanzibar. The government of Zanzibar officially designated Menai Bay a conservation area in August 1997. The area is extensively covered with coral reefs, sea grass beds and mangrove forest. It had remained relatively undisturbed until recently, when fishing pressures combined with destructive fishing techniques became a serious environmental concern. This is partly due to high demand for fish from the growing urban populations of Dar es Salaam and Zanzibar town.

The decline of fish resources in other fishing grounds has resulted in the influx of fishermen from outside the area. The traditional *dago* system, referring to seasonal visits by fishermen camping in the area, has been replaced by permanent settlement on some of the bay area islets. Studies done in 1992 confirmed extensive reef damage in the Menai Bay.

As a step toward regulating fishing pressure, local communities around Fumba Peninsula, with the assistance of the Commission of Natural Resources formed an informal management committee to monitor fishing activities of visiting fishermen. Members of the committee volunteered to undertake unpaid sea patrols, but ran into trouble due to lack of training in arresting procedures.

In 1994, at the invitation of the Commission of Natural Resources, WWF began to provide support to enhance management measures originally initiated by local communities of Fumba Peninsula. This was instrumental in having the area designated a conservation area. Designation of the bay as a conservation area was received with mixed feelings. Visiting fishermen, especially those from Dar es Salaam, condemned the move outright as an act intended to discriminate against them. Local communities, however, applauded the decision.

The MBCA is sponsored by the Department of Fisheries and Marine Products with WWF providing both technical and financial support. There are seventeen villages in the MBCA with a population of about 16,000. For most of the villagers living around Menai Bay, fishing is the main source of income. Most of the villages are situated within the coral rag area with poor soil.

The main goal of MBCA is to conserve the natural resources of the area for sustainable use with active community participation. The objectives of the project are to:

- Protect the marine ecosystem and improve resource yields through management systems that include active local community participation
- Involve local communities in planning, implementation and monitoring of the natural resources of Menai Bay
- Increase awareness of conservation through educational and public awareness programs
- Support biological and socio-economic research and monitoring to provide the basis for rational management

Menai Bay does not have any exclusion zones where fishing is not allowed, but has slightly stricter fishing regulations than other parts of Zanzibar. MBCA has increased patrolling against

illegal fishing methods in collaboration with the government anti-smuggling unit. Local fishermen help to patrol their areas using hand-held radios provided by WWF, and a 7-meter fiberglass patrol boat is based in one village to respond to emergencies and incidences of illegal fishing. This patrol system has significantly reduced dynamite fishing in the area and fishermen using illegal nets are increasingly being prosecuted in court (Ngaga et al., 1999). However, some villages do not see the Menai program as useful because it has not provided alternative sources of livelihood to villages in the area that have traditionally used illegal fishing gear.

Under the supervision of village headmen and Menai Bay project staff, an Environmental Committees has been setup in each of the 16 participating villages. Village representatives also participate in the overall management of the project. A number of alternative income generating projects have been supported, including bee keeping and tree farming. The program also encourages mangrove protection and replanting. Many of these activities were initiated by villagers before the program began. The program has provided infrastructure (such as hives and harvesting equipment) to several communities and helped to form bee keeping and mangrove protection projects in others.

Menai Bay, including the 17 surrounding coastal villages is a large area. A primary problem for the Menai program is lack of funding to effectively support all the work that is needed and fulfill program expectations. Levine (2002) notes that in the Fumba peninsula, which is far from the patrol boat headquarters, villagers feel particularly abandoned by the project. Villages in this area had previously established patrol systems and their own conservation committees, which they recently dismantled at the request of program officers to fit into the structure of the Menai project. However, the project has not followed through on promised support to build the new committees, and the patrol boat is rarely able to respond to their calls for assistance because of distance and the price of petrol. Because previously existing local conservation initiatives were dismantled, local fishermen in these villages believe that illegal fishing is on the increase in their area.

Local officials hope that user fees collected from tourists visiting MBCA will provide a sustainable source of revenue. Menai Bay, particularly Kizimkazi village is a popular destination for dolphin viewing and boating excursions, but the current fee of $2 per person is rarely collected successfully from tour operators using the area. Previously, hoteliers maintained a record of the number of boats and visitors on dolphin sighting tours with information on country of origin. This helped to monitor expected revenues, but the system is no longer in use. Research in currently being undertaken on how to improve the impacts of dolphin tourism on the welfare of village residents, including ways to promote cultural tourism in Kizimkazi. Because the Menai Bay area is so large, many villages may never directly receive benefits of tourism. Other alternative livelihoods need to be promoted in these villages.

Jozani-Chwaka Bay Conservation Area

Chwaka Bay is located 34 km east of Zanzibar town in the main island Unguja. The Bay is a shallow water body, which covers an area from 20-50 km^2 at low and high water. There is a limestone reef in the south covered by a dense mangrove forest with an area of about 3000 ha. On the seaward side, immediately adjacent to the forest, the bay opens up to large intertidal flats that are covered by a mixed assemblage of sea grasses and algae. Beyond that a coral reef, which is part of the extensive reef fringing the coast of East coast of Unguja. The Bay forms an important ecological linkage between the marine and terrestrial ecosystem of Jozani forest and is one of the most ecologically productive marine areas in Zanzibar in terms of nursery habitat for all forms of marine life and species diversity of mangroves, sea grasses, seaweed, and coral reefs.

Jozani forest was declared a reserve in 1960. Within the groundwater forest the soil is black and highly organic but outside the forest margin it changes abruptly into coral rag with red brown soil. The reserve is currently 2,500 ha, of which 76 percent is coral rag. The intention of the Government of Zanzibar is to upgrade the status of Jozani into a National Park and expand the protected area to 5,000 ha, which will connect with the Chwaka Bay mangrove. This will provide a legal base for protection, especially from woodcutting.

The Jozani-Chwaka Bay Conservation Area forms the last remnant of the vegetation types that once existed throughout the island. Twenty-six endemic tree and shrub species grow in this habitat. Jozani also holds a variety of endangered bird and animal species that have both national, as well as international significance. About one-third of the total 2,400 endemic red colobus monkeys of Zanzibar are found in Jozani. Jozani forest has also recorded 86 bird species, including many endemic and endangered.

The main resource threat in the area is forestry over harvesting. Masoud (2001) reports that annual extraction of wood is four times the allowable cut of 8,000 cubic meters. A driving force behind high extraction rates is demand of wood fuel in Zanzibar town. 85% of the households in the Zanzibar urban area use fuel wood and charcoal for cooking and heating. Wood cutting is one of the few sources of income in the area. Agriculture is limited by soil and hydrological conditions. Almost all the villages under JCBCA are located in the coral rag zone, in which soils are poor. Farming is mainly for household subsistence though some crops may be grown locally for sale.

The Jozani-Chwaka Bay Conservation Area partnership is a collaborative initiative between the government of Austria, the Zanzibar Commission for Natural Resources (now the Department of Commercial Crops, Fruits and Forestry), CARE Tanzania, and most recently the GEF/UNDP biodiversity conservation fund. The JCBA partnership was initiated in 1995 with the long-term goal of biodiversity conservation and enhancing the living conditions of people around the protected area. A special area of interest is to protect the biodiversity of the last remaining ground water forest and associated fauna. The project goals are:

- Assist the Government of Zanzibar in development and management of Jozani Forest and Chwaka Bay Conservation areas
- Improve the local economy and living conditions of surrounding communities through ecotourism and the wise use of resources
- Improve awareness of conservation through extension training and conservation activities

The groundwork for designating the park has been accomplished and includes negotiations with local communities about boundaries, surveying and mapping proposed boundaries, and zonation of the proposed park based on use categories. The National Park regulation is being drafted and will be submitted to the cabinet.

There are seven villages surrounding Chwaka Bay with a population of 9,100 (census 2002) and there are nine villages around the proposed National Park. Village Conservation Committees have been established in 9 villages, and an Advisory Committee was formed from representatives from each of the participating villages. The Advisory Committee was later (1999) registered as a NGO and became the Jozani Environmental Conservation Association (JECA).

Local land use management agreements are being developed in each of the villages for submission to the Department of Commercial Crops, Fruits and Forestry. By the end of 2001, one agreement had been approved and was ready for implementation (Masoud, 2001).

The JCBCA project will promote ecotourism development and management. Attractions include the ground water forest, mangrove boardwalk and red colobus monkey viewing site. Jozani currently collects $70,000 annually from tourism (Masoud, 2001). Twenty percent of total revenue is shared with the community as a means to compensate farmers whose crops suffer damage by the red colobus monkeys. A larger portion is spent on community development activities.

Community development projects of the JCBCA partnership include improvements to social services like schools, dispensaries, water supply and electrification. These project are largely being funded by tourism revenue from Jozani Reserve.

A Grameen model savings and credit scheme was established in 1999 for the purpose of issuing loans to village groups to be used for developing small enterprises. A total of 76 groups were formed. It proved difficult to identify income-generating activities so loans were used for purposes other than small investments. Other challenges included low repayment rate and loans too small to establish enterprises. The Grameen model was replaced with an Accumulated Savings and Credit Association (ASCA). Individuals can borrow up to three times the amount saved but must repay in three months with 5% interest. Training on how to manage the Association and on alternative income generation was also provided.

Income generating activities promoted by the JCBCA partnership include beekeeping, handicrafts, and weaving. A visitor shop was established at Jozani for local producers to sell their products. The project has also trained farmers to produce crops, such as vegetables, for the tourist market. Pumping water in the coral areas is the main difficulty due to the nature of the land.

Misali Island Marine Conservation Area

Misali is a small (0.9 km^2) forested island of coral rag surrounded by a ring of coral, located 10 km west of Pemba Island. No one lives on Misali permanently, but it provides a campground for fishermen who stay there for shorter periods of time. Over 1500 fishermen, living in some 30 villages around Pemba, are active in the Misali waters and it is estimated that about 11,000 people directly depend on Misali for food and income (based on an estimate of the number of fishermen times number of average number of household members).

Misali is renowned in diving circles for its coral and marine diversity. At least 300 species of fish and 42 genera of corals have been observed in a single day visual census. The island supports a number of endangered and endemic species. The Pemba Flying-fox, Pemban velvet monkey, the Pemba Sunbird, and the Pemba White-eye are endemic. The endangered coconut crab and sea turtles are common on the island.

A government approval to develop an exclusive hotel on Misali Island provided a catalyst to protect the Island. In 1993 the fishing community worked together with conservation groups and succeeded in reversing the government's decision to lease-out the island. The Misali Island Conservation Project (MICP) began in 1996, implemented by the British Environment and Development Group in coordination with Zanzibar government departments and funded by the Commission for European Communities. CARE Tanzania took over the Misali project 1998, when it became part of CARE's Integrated Conservation Development Programs (ICDP) in

Zanzibar. The government counterpart in the Misali Island Conservation Program is the Department of Forestry. The Fisheries Department is not directly involved. The reason for this is that it is part of the CARE ICDP program, which is forestry-focused.

The conservation area is relatively small, approximately 22 km^2, including a non-extractive use zone (core protected area) and an extractive use zone (the multiple use area). The non-extractive use zone on the western side of the island is 1.4 km^2 and includes important turtle nesting beaches and coral reefs. In the multiple-use zone fishing is allowed, but regulations on fishing gear and techniques are slightly stricter and more tightly enforced than in other waters around Pemba. Five rangers have been recruited from neighboring communities and take turns living and working on the island. Tourists and researchers are charged a small fee for visiting the island. Out of these fees, 60% are used for the conservation program and 40% are fed back into the communities. The funds have been used to support community projects such as building or improving dispensaries, wells, and schools.

Fishermen participate in the management of Misali Island through the Misali Island Conservation Association, MICA. The association, which has more than 700 member, works in 36 Pemba villages. It has established village conservation committees in over 20 villages where there are Misali Island fishers. In addition the association is leading a broad range of activities: management of Misali, revenue collection, environmental education in communities, establishing environmental clubs, building capacity of village leaders, and a savings and credit scheme.

By June 2003, a total of 389 persons (189 women and 200 men) from 8 villages had obtained loans through the credit and savings scheme. The scheme follows that same design as that established in the Jozani-Chwaka Bay Conservation Area project. It provides loans for supplemental livelihood projects such as bee keeping, seaweed farming, vegetable gardens, and mushroom growing. Everyone with loans is required to take part in a MICA organized training on how to formulate a CBO, how to save, and how to plan and manage small-scale income-generating projects.

Women and men from Pemba villages can participate in the Misali program through village-level Conservation Committees, District Environmental Committees, and the Misali Island Management Committee. The Management Committee has fifteen members, including representatives from villages (nine individuals), NGOs (i.e. MICA), and government. This is the main decision-making body of the Misali program. Through a memorandum of understanding, the Management Committee has charged MICA with the task of managing the protected area.

The Misali Island Conservation Program also has an environmental education program based on Islamic ethics. Since over 95% of the population are Muslim, the program decided to experiment with a religious environmental education program. The program operates in 12 villages divided into three groups. The first group of villages receives religious environmental messages, the second receive technical information on resource conservation and the third group receives no specific environmental education. The project found that some religious leaders did not have the capacity to link Islam and the environment. Training has helped and overall the feeling is that combining religion and environmental education has helped build awareness among communities. Before starting the experiment, the group did a baseline survey to be compared with an end survey, which will be conducted in 2003.

Misali Island is highly respected by the surrounding communities, many of whom believe that the island has religious significance and spiritual characteristics. There is a common belief that one of the Prophets *(Nabii Hadhir A.S.*) once came to Misali, where he asked for a prayer mat. When he

found out that there was no mat, he asserted that "the island is like a prayer mat (*kisiwa cha mithali ya msala*) because it points exactly towards the Alkaaba in Mecca". He prayed and then disappeared. According to this myth, this is how the island got its name, Misali, which in Kiswahili means *mithali*. There are also ancestor healing/divination sites on the island and there are taboos related to specific activities (e.g. women are not allowed to sleep on the island). All these traditions have made it easier to combine traditional, religious and scientific conservation ethics to protect the island.

Household and focus group surveys

The Household and Focus Group surveys were developed following a review of guidelines on socioeconomic assessment of MPAs and coral reef management (Bunce, et al., 2000; Pollnac, 1998; Pomeroy, et al., 2002). We also benefited from a review of the MIMP questionnaire on Material Life Style, Occupational Structure, Income Distribution and Food Security in Mafia Island (WWF, June 2003) and the Pemba survey on Rural Livelihood Security Assessment (CARE International-Tanzania, February 2002).

The household questionnaires covered information on: household composition and characteristics, economic activities, material assets, expenditures, food security, education and health, markets, credits and savings, social capital, knowledge and participation in MPAs, and perceptions of change due to MPAs. Focus group surveys were used to assess village characteristics and problem perceptions.

Prior to the fieldwork, the household survey form was tested on 12 households to assess the time required to conduct the surveys and to improve or eliminate questions that were confusing or too difficult for respondents. A survey team of four field assistants supervised by the members of the study team spent 3-4 days in each village collecting data. A quota sample of 30 households was conducted in each village. Households were randomly selected from the population registers of each village using a random number table.

In some villages there was no population register and one had to be assembled HOW??before the random sampling could be conducted. In Pemba, only the register for one village (Wambaa) was available. In the other villages, a list of heads of households was constructed by the field team with help of local people. names were randomly selected for the sample. When household heads selected were unavailable (e.g. out fishing) the spouse was asked to respond to the HH questionnaire. If they were absent as well, a new household from the list of 40 selected was approached. A total of 749 households were surveyed in 24 villages between May 31 and June 9, 2003. Of these, fourteen percent (103 households) were female-headed (see Table 5).

Additionally, three focus group meetings were held per village (village leader, women, and fishery focus groups). On average, 8-12 people participated in each focus group meeting, and discussions went on for 1½ to 2½ hours. Focus groups were formed in consultation with the village authorities to ensure their representativeness. Fishery focus groups included fishers representing the different types of fishing methods in the area, regardless of sex. Village leader focus groups involved village political leaders, the executive village officer, a school teacher, a religious leader, a leader in youth movements, female leaders, a witchdoctor (if there was one with commanding authority in the village), and care was taken to include political leaders from the opposition political parties where such parties were found to have a strong presence in the village.

In addition, we conducted key informant interviews to government authorities, project staff, private sector representatives, and community leaders. A list of all key informants is presented in Appendix 1.

Table 5. Total number of male and female headed households surveyed in each field site

	Tanga Coastal Zone	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*
Male-headed	101	112	109	112	100	112	646
Female-headed	21	20	13	21	21	7	103
TOTAL	122	132	122	133	121	119	749

RESULTS

Village and Household Characteristics

All the surveyed villages were directly on the coastline. Most of the surveys were located in rural areas; less than five percent of the household surveys were conducted in urban or mixed rural/urban areas.

The mean number of people living in a household was 5.6 (range: 1-11) from the household surveys. Twenty-one of 22 village-leader focus groups reported net population growth over the past 5 years.

Most of the villages had small shops, markets, primary school, madrassa, recreation facilities, health facility, and mosque or temple (Table 6). Roads are constructed of dirt in all but two of the villages (where there are tarmac roads). In 14 of 21 villages reporting, the road condition was considered by key informants as poor to very poor. Sixteen of 19 villages have open-air (under a tree) meeting places, and 3 have enclosed or semi-enclosed structures.

Table 6. Village infrastructure

Structure	*Number of Villages*	
	Yes	*No*
Shops	22	2
Food market	18	6
Restaurant	20	4
Post office	0	24
Hotel	3	21
Bank	0	24
Drugstore	1	23
Gas station	0	24
Mosque/temple	24	0
Church	4	20
Fishing dock	14	10
Madrassa	24	0
Nursery school	9	15
Primary school	19	5
Government office	12	12
Recreation facilities	21	3
Health facility	18	6
Telephone	8	16

Source: Village leader focus group

In 14 of 22 villages, it is the Village Executive Officer who is perceived as making the decisions that impact the village. Other important decision-makers are the village Chairperson/Sheha and the Village Assembly. These individuals get their authority from District Authority and the Village Assembly. However, there are many unofficial leaders in the villages, (e.g. rich people, religious leaders, and fortunetellers) that may influence decisions behind the scenes.

Focus group discussions with village leaders identified the number one priority problem in the village to be the lack of clean water (Table 7). Other problems frequently reported were transportation, poor farming and fishing gear and limited social services, such as health and education.

The perception of village leaders on the cause of poverty (in order of importance) is poor fishing gear, lack of employment, low level of education and weak economy due to a lack of capital (Table 8). Community leaders felt that poor fishing gear, such as lack of motorized boats, increases poverty because it limits fishers' operations to nearshore areas, where the competition is intense, and overfishing is common.

Table 7. Perceptions of priority problems in the village

	Percent
Lack of clean water	25

Poor means of transport	21
Poor farming/fishing gear	17
Limited access to social services	13
Lack of skills/low education	8
Lack of employment	8
Marketing constraints	4
Lack of electricity	4

Source: Village leader focus group

Table 8. Cause of poverty

	Percent
Poor fishing gear	22
Unemployment	18
Low level of education	13
Weak economic base (due to lack of capital)	13
Low prices	9
Poor farming implements	5
Limited economic generating opportunities	5
Limited market for local products	5
Vermin infestations	5
Lack of technical support, extension services	5

Source: Village leader focus group

Household demographics

Fourteen percent of surveyed households were headed by a woman. This is lower than the mean for rural Tanzania (about 22%; NBS 2002). It is possible that the greater prevalence of fishing as the main productive activity (a male-dominated occupation: 96% of fishers were male) and lack of adequate soils for agriculture in these coastal villages, difficults the establishment of female headed households.

In terms of size, surveyed households showed a greater average number of people than in NBS (2001) for Tanzania (5.6 v. 4.9).

Education

In general, the surveyed villages showed higher education levels than rural Tanzania for 2000/01 (as reported by NBS 2002). Like NBS (2001), we found that women are about twice as likely as men to have no education. On average, study villages showed a greater proportion of adults with some formal education than other rural areas in Tanzania according to NBS (2001) data (82.6 v. 74.8%).

For heads of household, the mean number of years of formal education (excluding adult school and Madrassa) was 5.6 (range: 0-18, Std. dev. = 3.9, n =612). This mean was significantly higher for male heads of household than for female heads (6.2 v 3.7 years; $t = 5.2$, $df = 610$; $p < 0.001$). There also were significantly different proportions in the type and level of education attained by the head of household according to gender ($\chi^2 = 43.6$, $df = 7$, $p < 0.001$). Male heads, in general, attained higher levels of education in greater proportions (see Table 9b). Female heads of household seemed to be twice as likely as male-headed ones to have lacked formal education alltogether, and of those having some education, none surpassed the lower secondary level.

Mean literacy rate (78.7%) was also higher in the survey villages than in rural Tanzania (66.9%) and Tanzania overall (71%; Table 10)). While 15.5% of adult men and 26.4 % of women surveyed can neither read nor write, in rural Tanzania 23.9% of men and 41.2% of can neither read nor write. In terms of site differences, the number of illiterate persons (men and women) was higher on Pemba than in all other places. Literacy in English was higher in Jozani-Chwaka Bay than in the other sites, a fact that might be attributed to the tourism sector on Zanzibar.

Primary school enrollment rates for children between the ages 7-13 was found to be higher in the coastal communities surveyed than in other rural communities of mainland Tanzania (Table 11). Most children between the ages 7-13 years have been enrolled in primary school. Again, Pemba is worse off, with around 80 percent of children enrolled, compared to over 90 percent in all other sites.

There were, however, important differences in education between study sites (Table 9a) . In the Pemba villages, adults had a higher iliteracy rate (34.5%) and were more likely to lack education than in all other sites. Conversely, the Unguja and Pemba Island sites had a greater proportion of adults with some education beyond primary school. The reason may be that, until recently, there was a policy on Zanzibar to provide basic education for all children until Form III, whereas elsewhere only primary education until Standard VII is provided. Even though this policy seems positive, it is possible that authorities may be allocating more resources towards advanced education than to increase the enrollment in basic levels, as seems to be the case in the Pemba villages surveyed.

Table 9a. Highest level of education achieved by adults[1] (percent)

Education Level	*Tanga Coastal Zone*	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*	*Tanz. Rural (1)*
No education	15.3	18.1	18.4	12.1	15.1	27.4	17.4	29.0
Adult education only	6.0	8.5	2.6	5.4	7.9	7.0	6.2	2.3
Primary 1-4	9.3	8.2	13.3	6.9	5.4	7.7	8.4	12.8
Primary 5-8	65.6	60.4	63.4	30.3	29.7	22.4	45.2	52.5
Form 1-4	2.1	3.0	1.6	35.0	28.4	25.4	16.4	2.2
Form 5-6	0.6	0.3	0.0	0.3	0.6	1.0	0.5	0.2
Diploma / degree	0.0	0.0	0.3	0.3	0.3	2.3	0.5	0.1
Course after primary	0.0	0.6	0.0	5.1	6.3	4.7	2.8	0.4
Course after secondary	0.0	0.9	0.3	4.4	5.4	2.0	2.2	0.2
Other certificate	1.2	0.0	0.0	0.3	0.9	0.0	0.4	0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100

(1) NBS (2001)

Table 9b. Highest level of education achieved by adults[1] (percent) according to sex

Men	*Tanga Coastal Zone*	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*	*Tanz. Rural [2]*
No education	14.1	12.4	10.4	9.4	10.8	22.0	13.0	19.8
Adult education only	3.7	7.7	2.6	4.2	8.3	9.3	5.9	2.7
Primary 1-4	12.9	9.5	20.1	5.8	8.3	8.0	10.6	15.4
Primary 5-8	65.0	65.7	63.0	31.4	29.9	24.7	46.5	57.6
Form 1-4	1.8	1.8	2.6	34.6	26.8	23.3	15.5	2.8

Form 5-6	0.0	0.6	0.0	0.5	0.6	2.0	0.6	0.3
Diploma / degree	0.0	0.0	0.6	0.5	0.6	4.0	0.9	0.3
Course after primary	0.0	1.2	0.0	5.2	5.7	3.3	2.6	0.6
Course after secondary	0.0	1.2	0.6	7.9	7.6	3.3	3.6	0.3
Other certificate	2.5	0.0	0.0	0.5	1.3	0.0	0.7	0.3
Total	100	100	100	100	100	100	100	100
Women								
No education	16.4	24.1	26.5	14.6	19.4	32.9	21.8	37.1
Adult education only	8.2	9.3	2.6	6.6	7.5	4.7	6.5	2.0
Primary 1-4	5.8	6.8	6.5	8.1	2.5	7.4	6.2	10.6
Primary 5-8	66.1	54.9	63.9	29.3	29.4	20.1	43.8	48.1
Form 1-4	2.3	4.3	0.6	35.4	30.0	27.5	17.2	1.7
Form 5-6	1.2	0.0	0.0	0.0	0.6	0.0	0.3	0.0
Diploma / degree	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.0
Course after primary	0.0	0.0	0.0	5.1	6.9	6.0	3.0	0.2
Course after secondary	0.0	0.6	0.0	1.0	3.1	0.7	0.9	0.1
Other certificate	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.2
Total	100	100	100	100	100	100	100	100

[1] Note: Adults are defined as individuals aged 15 years and above
[2] Source: NBS (2001)

Table 10. Percent literacy of adults[1] in surveyed households.

	Tanga Coastal Zone	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*	*Rural Tanzania[1]*
Swahili	77.0	71.9	76.0	57.8	55.4	49.0	64.4	60.0
English	3.0	0.9	0.3	1.0	10.5	3.5	3.2	1.9
Swahili and English	0.3	2.6	3.6	24.9	8.2	13.0	9.1	4.8
Other	0.3	2.9	1.8	0.0	7.4	0.0	2.0	0.2
Illiterate	19.4	21.8	18.3	16.3	18.5	34.5	21.3	33.1
Percent adult men literate	84.7	85.8	88.3	88.2	85.1	74.4	84.5	76.1
Percent adult women literate	70.9	75.8	79.7	78.0	58.7	58.7	73.6	58.8

[1] Adults are defined as individuals aged 15 years and above. For literacy calculations, literacy in any language was considered.
[2] NBS 2002

Table 11. Primary school enrollment ratios (children aged 7-13 years)[1]

	Tanga Coastal Zone	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Rural Tanzania[2]*
Total	96.0	97.6	91.3	93.2	98.5	81.1	84.2
Boys	98.7	96.7	94.8	92.5	98.6	83.9	83.5
Girls	93.2	98.5	87.7	93.9	98.4	77.6	85.0

[1] Note: These ratios might be slightly different from NBS (2002) table on net and gross enrollment ratios, because this table summarizes highest formal education level reported in the household survey for members between 7-13 years old and some of these children could have already dropped school by the time of the study.

[2] Household Budget Survey 2000/01

Health

During the household surveys, heads of household were asked about sickness or injury of household members during the past 12 months. The most common disease reported was malaria (53% of households, Table 12). Similarly, the NBS (2002) in 2000/01 found that for individuals who had been ill in the previous month, the most commonly reported complaint was fever/malaria (69% of children and 60% of adults). Within our study sites, this disease seems much more prevalent on the islands (Mafia, Unguja and particularly Pemba) compared to the mainland sites (Tanga and Kilwa). [2]

Table 12. Percent of households affected by sickness or injury within the past 12 months

	Tanga Coastal Zone	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*
Malaria	28.7	56.1	28.7	62.4	56.2	85.7	53.0
Eyes, ears, respiratory diseases	4.9	5.3	8.2	9.0	15.7	26.1	11.3
Typhoid fever	6.6	9.1	7.4	6.8	12.4	18.5	10.0
Tooth pain	1.6	0.8	0.8	6.0	16.5	27.7	8.7
Chronic diseases (Diabetes, Asthma, Epilepsy, Anemia, BP)	7.4	4.5	4.9	7.5	5.8	0.8	5.2
Accident	2.5	2.3	6.6	7.5	4.1	5.9	4.8
Legs, arms and backbone ache	4.1	7.6	4.1	6.0	0.8	0.8	4.0
Stomach ache and headache	7.4	3.8	5.7	3.0	2.5	1.7	4.0
Airborne diseases (Tuberculosis, Meningitis, coughing)	3.3	3.0	5.7	4.5	3.3	0.8	3.5
Foot diseases	0.8	8.3	4.1	0.0	2.5	0.0	2.7
Hernia	1.6	3.0	3.3	1.5	0.8	3.4	2.3
skin diseases	0.0	1.5	3.3	0.0	3.3	3.4	1.9
Mental complications	0.0	2.3	2.5	2.3	1.7	1.7	1.7
HIV	0.0	0.8	0.8	0.0	4.1	0.8	1.1
Hypersoster & other skin diseases	2.5	0.8	0.0	0.0	0.0	0.8	0.7
Possessed by evil spirits	0.0	1.5	0.8	1.5	0.0	0.0	0.7
Mental illness	0.0	0.0	1.6	1.5	0.0	0.0	0.5
Paralysis	0.0	0.0	1.6	0.8	0.0	0.8	0.5
Tumors and swellings	2.5	0.0	0.0	0.0	0.0	0.8	0.5
Pneumonia	0.0	0.0	0.0	1.5	0.0	0.8	0.4
Goiter	0.8	0.8	0.0	0.0	0.0	0.0	0.3
Old age	0.0	0.8	0.8	0.0	0.0	0.0	0.3
Bilharzia	0.0	0.0	0.0	0.0	0.0	0.8	0.1

[2] Direct comparisons with the HBS results was not possible, because in that survey sickness/injury occurrence was recorded at the individual level (as opposed to the household level in the present study) and for a considerably shorter period (four weeks v. 12 months in our study).

Jongo	0.0	0.0	0.0	0.8	0.0	0.0	0.1
Paralysis	0.0	0.0	0.0	0.8	0.0	0.0	0.1
Polio	0.0	0.0	0.8	0.0	0.0	0.0	0.1
Undiagnosed disease	0.8	0.0	0.0	0.0	0.0	0.0	0.1
Yabisi	0.0	0.8	0.0	0.0	0.0	0.0	0.1

[1] Note: these percentages indicate incidence of disease in the total number of interviewed households by site (n = 122, 132, 122, 133, 121 and 119, respectively). Since the incidence is for the entire household, there could be households with multiple diseases or members affected by the same sickness.

[2] The prevalence of HIV reported should be taken with caution. While preparing the survey, some team members maintained that people would not report HIV sickness in the household, in part because many do not know that they are infected and also due to the social stigma that if often associated with the disease. Judging by the survey responses, this suggestion seems to have been correct, given the few households reporting that they were affected by HIV in the past year. For Tanzania as a whole, the prevalence of HIV among people between 15-49 years old was estimated at 7.8% in 2002 (Population Reference Bureau, 2003). When households are the sampling unit, as in our survey, this prevalence should be even higher.

Drinking Water

Most households in our survey obtained water from protected sources, such as piped water or protected springs and wells, especially in Tanga and Unguja sites (Table 13 and Figure 2). Comparing with NBS (2002) results, piped water was less common than in rural Tanzania (22 v. 28%). However, this difference seems to be more than compensated by a greater availability of protected springs and wells (44% v.18%).

Also, the NBS (2002) reports that 53 % of rural Tanzanian households use an unprotected source of drinking water, including unprotected wells and springs and surface water such as rivers and lakes. All of our survey sites had lower percentages of unprotected water source use, except for Mafia Island. In Mafia Island, drinking water was mostly obtained from unprotected wells (49%) as well as other sources, such as rain harvest (12%) or has to be fetched from other places (6%). The scarcity of water on this island seems to be a major limitation for its residents.

During focus groups, nine villages reported that some or all of the villagers had to walk more than 1.5 kilometers to collect water (between 1.5 and 8 kilometers). During village leader focus groups, 12 villages reported having water problems shortages during the dry season, which forced them to buy water during this period. For example, in Songo-Songo, village leaders reported that they have to buy water for 150-200 Tsh/liter.

Another major water problem reported in four villages was water contamination (Table 14). Some villages reported that the water becomes contaminated with cholera during the rainy season whereas others stated that their well water becomes salty during the dry season or is salty year-round.

Table 13. Source of drinking water (*percent)*

	Tanga Coastal Zone	*Mafia Island*	*Kilwa District*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*	*Rural Tanz.* [1]
Piped water	**31.1**	**0.8**	**0.0**	**72.9**	**18.0**	**5.0**	**21.9**	**28.3**
Private piped to house	0.0	0.0	0.0	13.5	0.0	0.8	2.6	0.8
Private piped outside house	6.7	0.0	0.0	16.5	2.7	1.7	4.8	2.1

Piped to neighbor	4.2	0.0	0.0	2.3	0.9	0.8	1.4	3.5
Piped in community	20.2	0.8	0.0	40.6	14.4	1.7	13.2	21.9
Other protected sources	**59.7**	**17.6**	**61.5**	**18.0**	**66.7**	**47.5**	**44.0**	**17.6**
Public well (protected)	52.9	16.0	56.6	10.5	65.8	45.8	40.1	13.3
Private well (protected)	6.7	1.5	3.3	7.5	0.9	1.7	3.7	1.4
Spring (protected)	0.0	0.0	1.6	0.0	0.0	0.0	0.3	2.9
Unprotected sources	**9.2**	**48.9**	**38.5**	**8.3**	**11.7**	**46.7**	**27.4**	**53.2**
Public well (unprotected)	7.6	45.0	24.6	8.3	10.8	46.7	24.0	21.2
Private well (unprotected)	0.8	3.8	8.2	0.0	0.9	0.0	2.3	3.8
Spring (unprotected)	0.0	0.0	4.9	0.0	0.0	0.0	0.8	12.4
River, dam, lake	0.8	0.0	0.8	0.0	0.0	0.0	0.3	15.8
Other sources	**0.0**	**32.8**	**0.0**	**0.8**	**3.6**	**0.8**	**6.7**	**0.9**
Rain harvested	0.0	12.2	0.0	0.0	0.0	0.0	2.2	-
Fetched from nearby village/island	0.0	6.1	0.0	0.0	3.6	0.0	1.6	-
Water reserve tank	0.0	14.5	0.0	0.8	0.0	0.8	2.9	-
Total	100	100	100	100	100	100	100	100

[1] NBS 2002

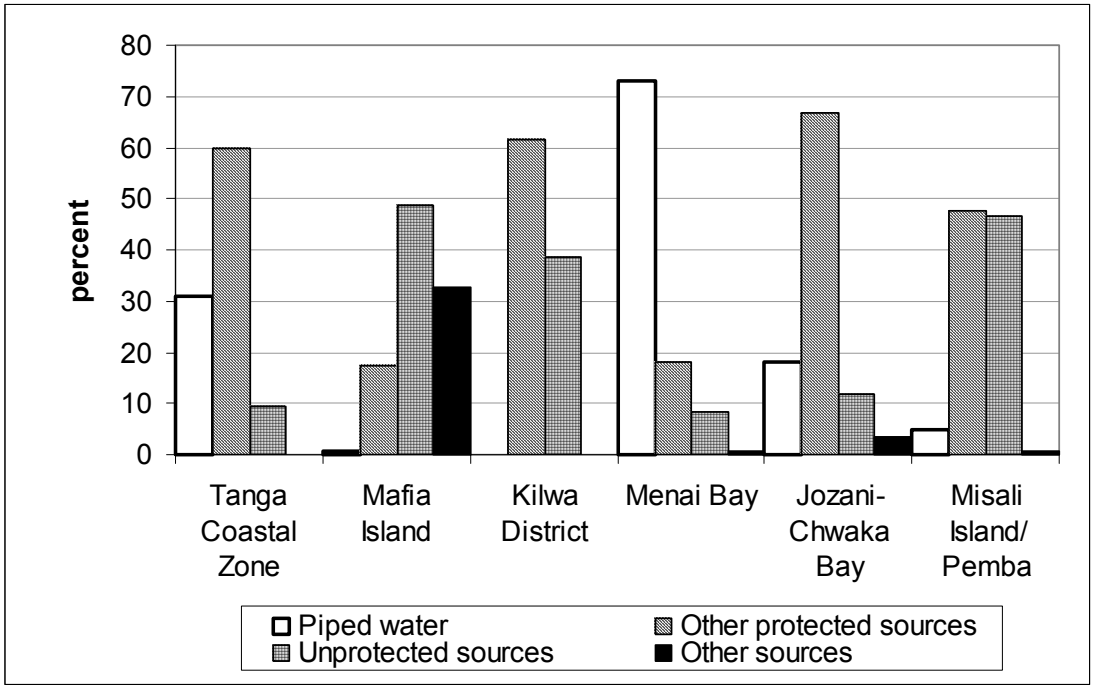


Figure 2. Household source of drinking water *(percent values by site).*

Table 14. Water problems in villages

Problem	*Villages*	*Percent*
Lack of water in dry season	12	50
No problem	5	21
Water contamination	4	17
Other	3	13

Source: Village focus groups

Sanitation and Public Services

According the household surveys, 74% of households reported using some kind of toilet , 59% of these being a pit latrine toilet (Table 15). This is considerably lower than toilet use reported in rural Tanzania (over 91%). Since 24% of households in our study sites use the shore as a toilet, it is likely that the proximity to shore is not an incentive for construction and use of toilets. The Tanga program identified this practice as a priority issue during its first phase, but finding a good solution that changes people's behavior has proven to be difficult. Health impacts on crowded coastal communities are probably occurring as a result of this practice.

Only four percent of the households surveyed reported a connection to electricity. This is higher than the coverage for rural areas (2%), but is much lower than the coverage for Dar es Salaam (59%) and other urban areas (30%).

Fifteen out of 22 villages surveyed have no indoor plumbing at all. According to key informants, out of the seven villages with indoor plumbing, only three had one to three houses with plumbing, while four villages had 11-50 houses with plumbing.

Table 15. Type of toilet used by household

Type	*Percent*
Pit latrine	59
At shore	24
Neighbor	12
Flush toilet	1
Modern toilet - VIP	1
Public toilet	1
Other	1

Cooking fuel

According to the household surveys, the principal energy source for cooking is firewood (Table 16). Nationwide, firewood and charcoal are the most important cooking fuels – used by 78 and 14% of households respectively.

Mangrove trees are known to be an important source of wood in coastal areas of Tanzania. Only 2 out of the 24 villages studied did not have mangrove forests nearby. However, only 27 respondents reported using or selling mangrove wood. This is probably because a permit is required to harvest them, and the level of compliance with the permit process for the typical household is low. As one person in Tongoni village commented: "The 3,000 Tsh permit to cut mangrove is prohibitive for the normal person. Therefore, when in need, we cut mangroves, and when we are caught, a case is filed".

Table 16. What is the principal energy source for cooking? (Percent)

Source	*Study sites*	*Rural Tanzania*[1]
Firewood	88	93.4
Charcoal	9	3.9
Other (solar, kerosene, coal, etc.)	3	2.7

1 NBS 2002

Productive Activities

When asked which was the most important economic activity during the past week, 38% of households responded farming/livestock keeping (from here on refered to as farming) and 34% responded fishing (Table 17). Other activities included petty trading (8 %) and government employment (7%). There were no significant differences in proportions of the main economic activity practiced by household heads between control and project villages ($\chi^2 = 4.64$, df = 5, p = 0.46).

However, we found significant differences in terms of main economic activities by gender of the head of household ($\chi^2 = 49.5$, df = 5, $p < 0.0001$). While fishing was slightly more common than farming as the main activity of male-headed households, most female-headed households practiced farming as their main economic activity. Agriculture was also important for female spouses (not heads of household) who worked outside the house, with 65% of them declaring farming as their main economic activity, followed by fishing (15%) and petty trading (10%). Only ten female heads of household practiced fishing as their main economic activity, and most of these (eight) harvested octopus on foot.[3] Petty trading was another activity conducted more commonly in households headed by a woman. Only one female head of household was an employee.

When asked more detailed questions about the range of resource-based productive activities that each household is engaged in, different types of fishing, seaweed farming and various types of agriculture dominated (Table 18). A greater proportion of female-headed households were engaged in algae farming ($\chi^2 = 8.31$, df = 1, p = 0.006), particularly of *E. spinosum* (26.2% of female-headed households v. 15.2% of male-headed ones). Seaweed farming was more frequent in Unguja Island and Mafia (Figure 3).

Table 17. Main economic activity declared by head of household *(percent)*

	Male-headed households	*Female-headed households*	*TOTAL*
Self-Employed			
Farming/livestock keeping	35.7	52.4	38.4
Fishing	38.1	9.7	34.5
Mining	-	0.1	0.1
Tourism	0.1	-	0.1
Petty trading	7	16.5	8
Other forms of self employment	5.7	7.8	6.4
Employee			
Government employee	8.5	1	7.3
Employee of a parastatal organization, NGO or private sector	2.5	-	1.4
Not employed			
Unemployed	1.1	-	1.2

[3] The types of fishing by female spouses could not be assessed because fishing variables were gathered on a household basis (most female fishers –65%- had a spouse that also fished for a living). According to focus groups, other fishing conducted by women include catching small shrimp (*uduvi / ushimba*) and bivalves (*chaza*) from shore; and retailing marine food products.

Housewife / domestic chores	-	4.9	0.7
Disabled - old age or sick	1.2	2.9	1.8

Table 18. Resource-based household subsistence and employment activities

Activity	*No. of households*	*Percent (out of 749 households)*
Marine fauna		
Fish	355	47.4
Crustaceans	117	15.6
Sea cucumbers	32	4.3
Mollusks	18	2.4
Other	3	0.4
Seaweed farming		
E. spinosum	125	16.7
E. cottoni	69	9.2
Mangrove extraction	25	3.3
Coral mining	7	0.9
Salt mining	3	0.4
Sand mining	6	0.8
Farming – Crops		
Cassava	375	50.1
Bananas	245	32.7
Rice	206	27.5
Maize	141	18.8
Millet	117	15.6
Sweet potatoes	107	14.3
Groundnuts	7	0.9
Tomatoes	32	4.3
Pineapples	11	1.5
Pulses	41	5.5
Simsim (oil seed)	10	1.3
Other	4	0.5
Farming – Agroforestry		
Coconuts	110	14.7
Cashewnuts	41	5.5
Mangoes	30	4.0
Cloves	15	2.0
Citrus	2	0.3
Other	33	4.4
Livestock keeping		
Cattle	38	5.1
Goats/sheep	15	2.0
Poultry	90	12.0
Donkey/horse	1	0.1
Other	3	0.4

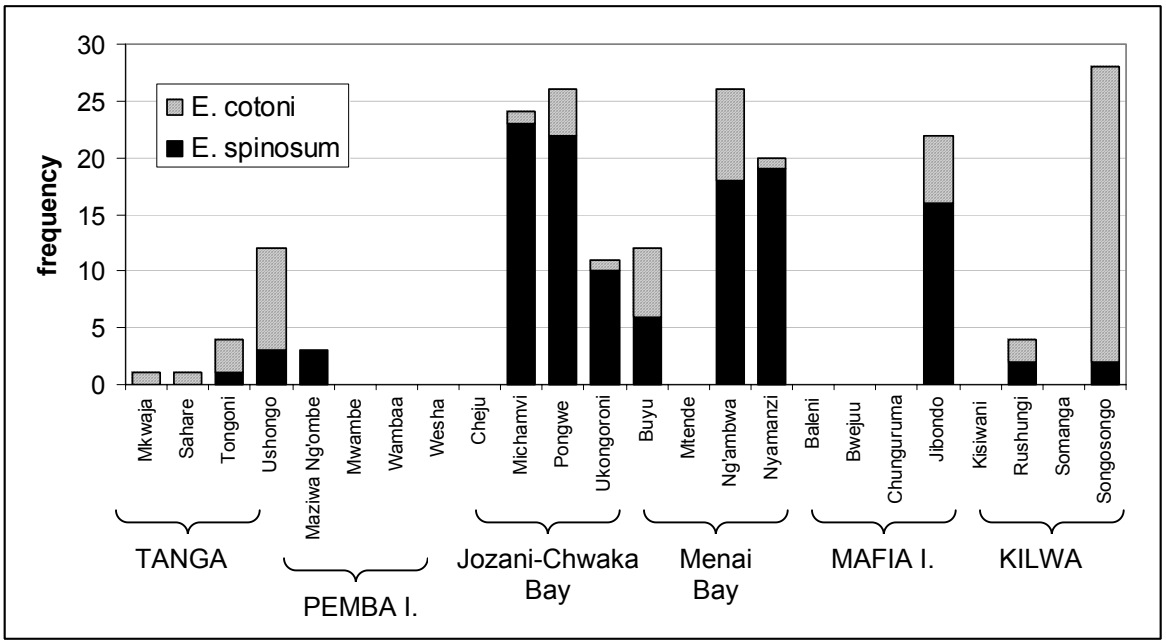


Figure 3. Frequency of seaweed farming

Occupational problems

The top four problems identified by fishers in their work are poor equipment, weather, lack of market, and lack of capital (Table 19). The top four problems identified by farmers in their work are vermin, poor equipment and inputs, unreliable rainfall, and low prices (Table 20). In Jozani-Chwaka Bay, conservation of terrestrial forest is perceived by farmers to be a problem because the reserve has become a refuge for wild pigs. The farmers stated that because the pigs tend to destroy the crops, the forest conservation program has increased their vulnerability.

Table 19. Major problems facing fishers as perceived by heads of household

Problem	*Percent*
Poor equipment	38
Bad working environment and weather hazards	19
Lack of market	17
Lack of capital	11
Marine regulations	6
Lack of education	1
Other	8

Table 20. Major problems facing farmers as perceived by heads of household

Problems	*Percent*
Vermin	34
Poor and inadequate tools and inputs	22
Unreliable rainfall	17
Low market prices	8

Lack of education	6
Unfertile and insufficient land	6
Poor infrastructure	1
Other	5

Markets and marketing

Most people sell their fish, agricultural, and other products directly to someone right in the village (Table 21). Sales are almost entirely on a cash basis (Table 22).

In Tanga, many of the fishermen who fish for octopus, lobster, or other seafood, sell their products to the SEAPROD Inc. When the company started, they bought their products directly from fishermen. Now they buy fish from company representatives who are present in the villages. These representatives sell seafood to the company on a commission basis.

The greatest proportion of fish catch is not stored at all. Fifty-eight percent of fishers reported that they have no storage facilities for their fish (Table 23).

Table 21. Where do you sell your products?

Place	*Frequency*	*Percent*
Local business person - within the village	376	54
Business persons - outside the village	188	27
Sell to village consumers	58	8.3
Do not sell	27	3.8
Others	53	7.5
Total	702	100

Table 22. How do you purchase and sell your products?

Method	*Percent*
On cash basis	92
On credit	6
Exchange goods for goods	2
Other	0.3

Table 23. How is fish stored before it is sold?

Method	*Percent*
No storage	58
Smoked	15
Fried	15
Sun dried	13
Salted	8
Ice	3
Refrigeration	3
Other means	10

Food Security

Most respondents (69 %) indicated their households took three meals a day, followed by 29% households reporting only two. This can be compared with NBS (2001), which reported that 42.8 % of Tanzanians living in rural areas take three meals per day, and 55.8 % with two meals per day. The reason that the coastal villages surveyed are better off than the national average is probably because of easy access to marine resources as a complement to subsistence agriculture.

Regarding site differences, households on Pemba, are worse off, with only 51% taking three meals per day, whereas Mafia Island reports 90% (Table 24). We did not find important differences between male-headed and female-headed households in the number of meals taken per day. The percentage of households that take 3 meals a day on average is 70 percent and 68 percent for male and female-headed households respectively.

When asked how their food situation is today compared to five years ago,49 % considered that it was worse, 21% considered that it had improved, and 30% did not consider that it had changed (Table 25). Looking over a longer time horizon, 16% of the households reported being unable to secure a normal diet most the time over the past 12 months (Figure 4). Low income and poor harvest are the main causes for not obtaining three meals per day during the past 12 months (Table 26). Respondents identified many factors that could affect their household income and lead to famine (Table 27). Bad weather and human diseases were the most frequently mentioned. During periods of insufficient food, most households cope by obtaining a loan, seek help from relatives, reduce the number of meals per day, or draw down household food reserves (Table 28).

Table 24. Percentage of households with three meals a day

Site	*Percent*
Misali Island/Pemba	51
Tanga	62
Jozani-Chwaka Bay	65
Menai Bay	68
Kilwa	78
Mafia Island	90
Average, all sites	69

Table 25. Household perceptions on food situation compared to five years ago (percent)

	Male-headed households	*Female-headed households*	*Total*
Improved	22	18	21
Worse	48	55	49
Unchanged	30	27	30

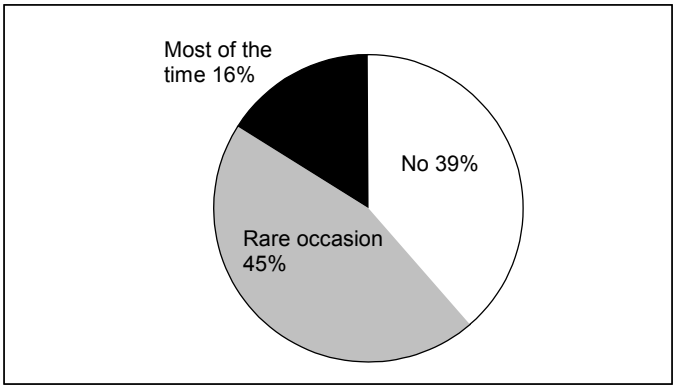


Figure 4. How often did your household fail to get its daily normal diet during the past 12 months?

Table 26. Over the last 12 months, what was the reason the household failed to get daily normal diet?

Reason	*Frequency*	*%*
Lack of money/poverty	287	57.4
Poor harvest/catch	78	15.6
Bad weather /draught /strong wind /too much rain	61	12.2
Human diseases	19	3.8
Lack of market	13	2.6
Unemployment	13	2.6
Destructive animals	7	1.4
Insufficient labor force	4	0.8
Lack of capital	3	0.6
Large family	3	0.6
Old age	3	0.6
Poor supply of food items/high prices	3	0.6
Insufficient capital	1	0.2
Low prices	1	0.2
Marine parks authority/harsh restrictions	1	0.2
Poor/insufficient inputs and tools	1	0.2
Proximity to basic social services	1	0.2
Salary delays	1	0.2
Total	500	100

Table 27. Most important factors affecting household income that could lead to famine

Factor	*1st problem (frequency)*	*2nd problem (frequency)*	*3rd problem (frequency)*	*Total (frequency)*	*Total %*
Bad weather	203	75	24	302	21.90
Human diseases	134	69	19	222	16.10
Destructive animals	47	52	17	116	8.41
Lack of money	65	35	14	114	8.27
Lack of markets	40	39	22	101	7.32
Insufficient/poor inputs/tools	43	42	16	101	7.32
Poor harvest/poor catch	36	20	10	66	4.79

Low prices	12	17	19	48	3.48
Unemployment	24	14	6	44	3.19
Crop/livestock diseases	15	14	10	39	2.83
Insufficient/lack of capital	17	9	9	35	2.54
Poor supply of food items/high prices	14	14	5	33	2.39
Poor transportation/infrastructure	5	13	4	22	1.60
Large family	8	10	3	21	1.52
Insufficient/lack of arable land	7	6	2	15	1.09
Insufficient labor force/old age	9	2	4	15	1.09
Social/culture constraints (funeral, wedding)	3	7	2	12	0.87
Do not know	10			10	0.73
Salary delays	3	6		9	0.65
Marine park authority/harsh restrictions	2	5	1	8	0.58
Illegal fishing methods	4	3	1	8	0.58
Theft	1	4	1	6	0.44
Lack of education/skills	2	1	2	5	0.36
Laziness	2	2	1	5	0.36
Lack of storage facilities	2	2	1	5	0.36
High education expenses	2	2		4	0.29
Supernatural powers/God	4			4	0.29
Proximity to the basic social services		3	1	4	0.29
Lack of extension services	2		1	3	0.22
Ad hoc official trips		1	1	2	0.15

Table 28. During the period of insufficient food, how did the household cope with the situation?

Coping Strategy	*Percent*
Seek a loan	41
Grant from relatives	18
Reduce number of dishes taken in a day	16
Use the household food reserves	13
Seek employment to get additional funds	8
Other	4

Savings and Credit

Most households store their surplus earnings inside the house our use it to buy food (Table 29). Of the surveyed households, only 13% reported having a savings account in a bank, and 17% said they participated in an informal credit and savings group. This is a much higher rate than in rural Tanzania, where the corresponding figures are around 4 and 3 %.

The majority of households have never borrowed and when they do, they go most often to relatives (Table 30). Only 3% of households have borrowed from a credit and savings scheme, and of those, over half said it was it was somewhat or very difficult to repay the loans.

Women engaged in seaweed culture may also wait with selling some of the crop until they need money. Some women buy *khangas/lesos*, which they can give (in case they do not have money) during weddings, funerals or to someone who delivered a new baby. In some cases women keep their money in micro credit revolving funds (*upatus*) where they are able to earn a lump sum, which they tend to spend on social activities. Upatu credit and savings systems were identified in all villages interviewed as one of women's most strategic means of coping with income insecurity.

Table 29. How does the household store its surplus (i.e. money or produce)?

	Tanga Coastal Zone	*Mafia Island*	*Kilwa*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*
Inside the house	52.3	39.1	36.5	9.8	10.8	31.9	28.6
Food	4.6	11.8	7.7	40.2	23.4	12.1	17.3
No saving at all	9.2	11.8	23.1	16.7	8.1	10.3	13.3
Bank	10.8	12.7	10.6	8.8	16.2	3.4	10.4
Purchase cattle	0.0	0.9	1.9	5.9	3.6	13.8	4.8
Credit and savings association	0.0	1.8	0.0	0.0	12.6	0.9	2.8
Invest in business	0.0	4.5	1.0	3.9	4.5	4.3	3.3
Keep at relative's/neigbor's	0.0	10.9	4.8	0.0	0.0	0.0	2.8
Buy gold and other valuables	6.2	0.0	0.0	0.0	0.0	0.0	0.7
Other	16.9	6.4	14.4	14.7	20.7	23.3	16.1
Total	100	100	100	100	100	100	100

Table 30. Where have you borrowed money from?

Source	*Percent*
Never borrowed	61
Relatives	28
Credit and saving association	3
NGO	2
Bank	1
Co-operative	1
Other	4

Material lifestyle

In terms of home ownership, the household surveys indicated that most homes (93%) are owned by their occupants (the national estimate is 84%). About 4 % are owned by relatives; 1% by government and another 1% are rented.

Most homes had cement floors, earth or coral walls and had palm thatch roofs (Table 31). Many households owned a household agricultural plot (*shamba*), boat, bicycle, and simple farming implements. Radio ownership in our sample (77%) was higher than the rural estimate for Tanzania (46%). As expected in coastal areas, ownership of boats and fishing equipment is relatively high. Very few own a motor vehicle, telephone, or have refrigeration.

Table 31. House construction materials and ownership of assets

House Construction	*Percent*	*Ownership of Assets*	*Percent*
Floor		Telephone	11 (0.2)
Cement	42 (12.5)	Radio or radio cassette	77 (45.7)
Earth	37 (86.6)	Electric/gas cooker	2 (1.2)
Wood	20	Refrigerator	2 (0.4)
Other	1	Bicycle	48 (38.4)
Roofing Material		Motorcycle	2 (0.7)
Palm leaf thatch (makuti)	65	Agricultural plot (shamba)	59
Iron sheet	34 (31.1)	Hand-hoe	66 (91.8)
Tile and other	0.2 (0.1)	Fishing nets	18 (2.6)
Walls		Dugout canoe	14
Earth	33	Outrigger canoe	16
Coral stone/lime	32	Dhow	12
Fito	14	Larger boat (mashua)	13
Cement bricks	9		
Soil bricks	2		
Coconut leaf thatch	1		
Wood planks	1		
Other	9		

Note: Numbers in parentheses represent percentage of rural households reporting ownership of the item in the 2000/01 NBS (2002).

Material lifestyle indices

To develop a standardized material lifestyle scale for all households, a factor analysis was carried out using the 31 household assets and construction material variables from the household survey. Variables related to ownership of electric appliances (e.g. TV, refrigerator) were not included in the analysis because their ownership was conditional to the village having electricity. Since 11 variables had very low component loadings in the first analysis of the data, some were recoded so they would fall into similar ones (e.g. mbao, fito and makuti walls were recoded together as "fiber walls"), and some were eliminated. The results of this analysis, using varimax rotation of components, is shown in Table 32. The scree test (Cattell 1966) was used to determine the number of components, resulting in four components which accounted for a total of 42.1% of the variance. However, after inspecting the results of this factor analysis, we decided to repeat it excluding roofing materials (e.g. palm thatch or makuti, iron sheet, ect.) because some members of the study team pointed out that some residents prefer palm thatch roofs even if they could

afford iron sheet roofing for reasons associated with social cohesiveness in the village and witchcraft. Therefore, roofing materials may not necessarily indicate the welfare level of a household. The results of this second analysis also produced four similar components (Table 33).

Items loading highest on the first component indicate a relatively well-constructed house (e.g. iron/tinroof, cement floor, latrine), while those loading negatively are associated with a less permanent dwelling (makuti roof, soil and wooden floors, and fiber walls). Thus, we denominated this component "solid house". A second component, which we called "basic furnishings" showed high loadings on variables such as owning a table and chairs. An "accesory goods" component manifested high loadings in variables such as having a bycicle, a hand-watch, and a radio/cassette player). Finally, a "luxury goods" component had high loadings in variables such as having a motorcyle, a wardrobe/book shelf, and a cupboard).

Next, component scores representing the position of households on each component were created separately for the analysis with roofing materials and without.[4] Then, we computed material lifestyle indices (one with and one without roofing materials) for each household by adding the four component scores. As a reality check for these indices, we looked at their mean values for different types of households (see Figures 5-8). The indices seem to agree with the relative material wealth one would accord to different groups in society. For example, employees and literate heads of household have higher material lifestyle indices, and male-headed households seemed better off too in all four component scores.

Regarding site differences in material lifestyle, villages on Unguja Island (Menai and Jozani-Chwaka Bay) seem better off than Tanga, Kilwa and Misali (Figure 9). The discrepancy between the two indices (with and without roofing materials) in the case of Mafia (and to a lesser degree to Jozani-Chwaka Bay) could be attributed to differences in local socio-cultural beliefs associated to *makuti* roofs.

Another trend related to material lifestyle (both indices -with or without roofing materials-) and location was that we found significant differences between island sites and mainland villages (Student's $t = 7.01$ –no roofing- and 5.85 , $df= 747$, $p <0.001$). Most of the villages located on islands seem to be better off, in general than those on the mainland, with the exception of Pemba Island.

To explore further the relationships between village and household variables and material lifestyle indices, we conducted a stepwise linear regression analysis. Village variables included were: MPA near village, and whether village is on an island. Household variables included were: gender of head of household, number of persons in the household, main occupation of head of household, fisher type scores, whether household farmed algae, years of formal education of head of household. Even though only a modest amount of variance was explained (see Tables 34 and 35), this analysis revealed that education was the most important factor explaining material lifestyle. Other variables such as being on an island, algae farming and being a male headed

[4] Component scores are the sum of the component coefficients times the sample standardized variables (scores with a mean of zero and a standard deviation of one). These coefficients are proportional to the component loadings. Hence, items with high positive loadings contribute more strongly to a positive component score than those with low or negative loadings. Nevertheless, all items contribute (or subtract) from the score; hence, items with moderately high loadings on more than one component (e.g., radio or sofa set in the analysis presented here) will contribute at a moderate level, although differently, to the component scores associated with each of the components.

household were also included in the models (we ran one for material index including and excluding roofing materials). Also, Pemba villages and beach fishers seemed to be worse off than others in terms of material lifestyle.

Table 32. Factor analysis results for material lifestyle variables of households, including roofing materials. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.57. Bartlett's Test of Sphericity = 7254.8, df = 210, p < 0.001).

Construction materials/ ownership of assets	solid house	Basic furnishings	accesory goods	luxury goods
iron/ tin roof	0.87	-0.18	0.21	0.01
makuti roof	-0.87	0.19	-0.20	-0.01
cement floor	0.71	0.37	-0.05	0.30
latrine	0.40	0.30	0.12	0.15
table	-0.02	0.75	0.10	0.05
chairs	-0.15	0.70	0.12	-0.11
oil lamp	0.11	0.39	0.32	0.01
bicycle	0.15	-0.14	0.67	0.14
hand-watch	0.06	0.30	0.62	-0.11
radio/cassette player	0.04	0.20	0.61	0.10
Books	0.05	0.26	0.32	0.12
motorcycle	0.00	-0.09	-0.09	0.71
wardrobe/book shelf	0.25	0.02	0.25	0.63
cupboard	0.01	0.18	0.31	0.50
soil floor	-0.42	-0.19	-0.01	-0.16
wooden floor	-0.37	-0.23	0.08	-0.17
soil walls	-0.27	-0.12	-0.01	-0.18
fiber walls (makuti, mbao, fito)	-0.35	-0.01	0.05	-0.03
bed	0.05	0.19	0.03	0.21
sofa set	0.04	0.23	0.10	0.14
brick walls	0.38	-0.05	-0.07	-0.01
% cumulative variance explained	**17.00**	**28.35**	**36.07**	**41.97**

Table 33. Factor analysis results for material lifestyle variables of households, not including roofing materials. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.51. Bartlett's Test of Sphericity = 3937, df = 171, p < 0.001).

Household characteristics/ commodities	solid house	Basic furnishings	accesory goods	luxury goods
cement floor	0.84	0.12	0.04	0.20
Letrine	0.54	0.09	0.22	0.03
Chairs	-0.05	0.77	0.11	-0.09
table	0.16	0.75	0.09	0.05
oil lamp	0.21	0.37	0.28	0.07
Bicycle	0.03	-0.17	0.68	0.17
radio/cassette player	0.10	0.14	0.64	0.06
hand-watch	0.04	0.30	0.63	-0.09
Books	0.13	0.20	0.37	0.07
Motorcycle	0.04	-0.11	-0.08	0.64
wardrobe/book shelf	0.30	-0.06	0.25	0.61
Cupboard	-0.02	0.24	0.26	0.57

wood floor	-0.38	-0.07	0.02	-0.12
soil floor	-0.54	-0.05	-0.06	-0.11
fiber walls (makuti, mbao, fito)	-0.32	0.12	-0.07	0.01
soil walls	-0.35	0.00	-0.03	-0.09
Bed	0.06	0.28	-0.05	0.37
brick walls	0.23	-0.15	0.04	-0.06
sofa set	-0.12	0.33	0.09	0.24
% cumulative variance explained	**16.66**	**26.05**	**34.13**	**40.65**

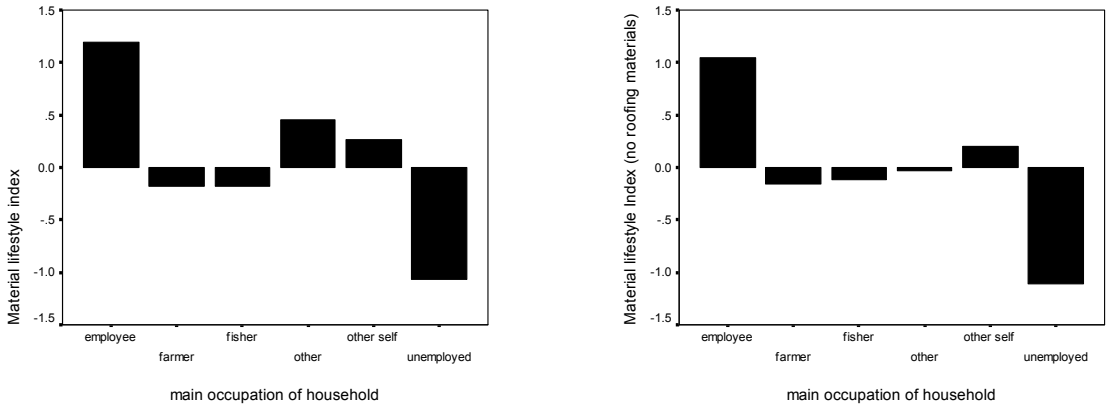


Figure 5. Material lifestyle indices by main economic activity of the head of household.

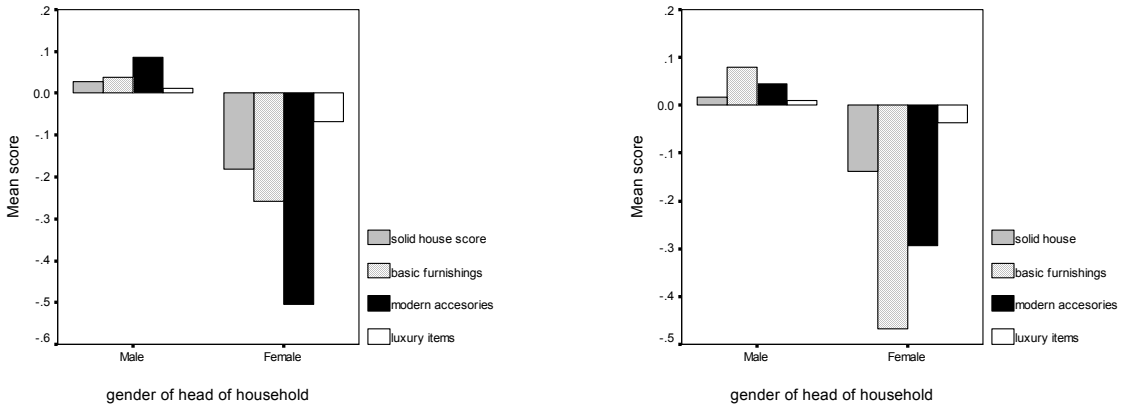


Figure 6. Mean scores of material lifestyle components by gender of the head of household (the left graph scores do not include roofing materials).

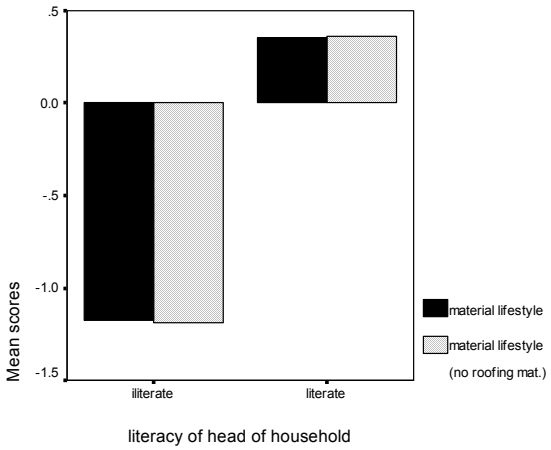


Figure 7. Material lifestyle index by literacy condition of the head of household.

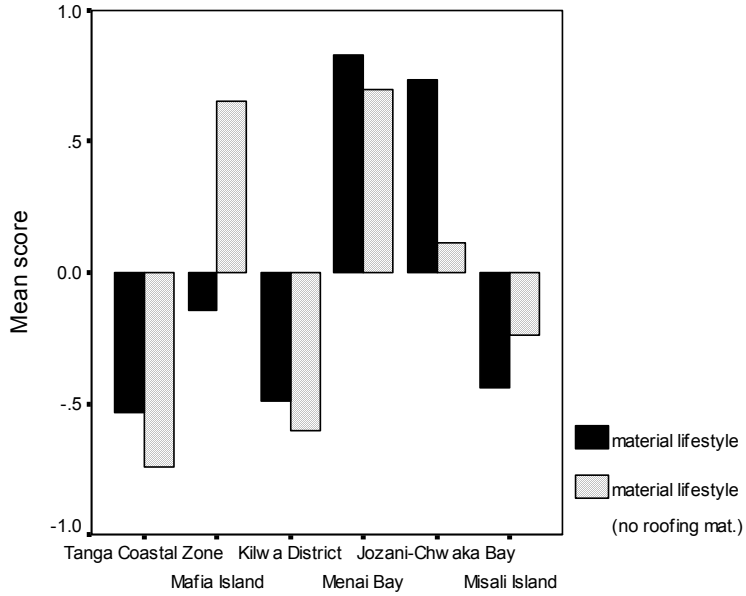


Figure 8. Material lifestyle score by MPA/region.

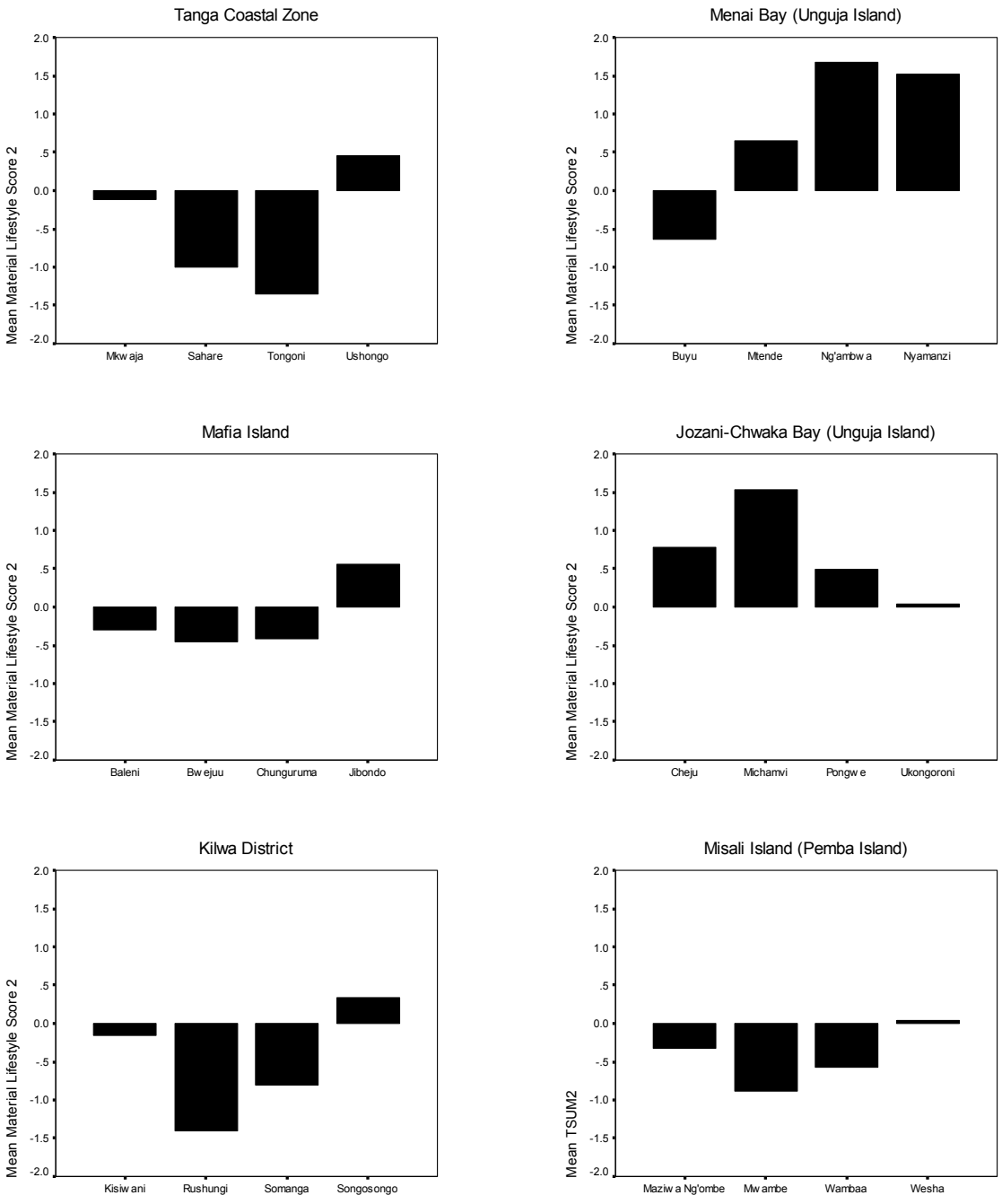


Figure 9. Mean material lifestyle score 2 by MPA / Region and village.

Table 34. Linear regression of relationship between selected village and household variables and material lifestyle index. B = regression coefficient, SE = standard error, p = significance. R^2 = 0.34, n = 600.

Variable	B	SE	Beta	p
years of formal education of head of household	0.18	0.02	0.35	0.000
algae farming household	0.68	0.17	0.15	0.000
village is on an island	1.06	0.26	0.23	0.000
Female head of household	-1.07	0.22	-0.17	0.000
Village is near Jozani/Chwaka Bay	0.84	0.23	0.14	0.000
Village is near Menai Bay	0.53	0.21	0.10	0.011
self employed (not including petty trade) is main occupation	0.76	0.26	0.10	0.004
dagaa fisher score	0.21	0.07	0.10	0.003
number of persons in household	0.08	0.03	0.10	0.005
Village is near Misali Island (Pemba)	-0.54	0.23	-0.10	0.017
Village is in Tanga region	0.68	0.28	0.13	0.016
fishing is main occupation	-0.35	0.15	-0.09	0.022

Table 35. Linear regression of relationship between selected village and household variables and material lifestyle index (no roofing). B = regression coefficient, SE = standard error, p = significance. R^2 = 0.28, n = 600.

Variable	B	SE	Beta	Sig.
years of formal education of head of household	0.18	0.02	0.35	0.00
village is on an island or not	1.28	0.17	0.28	0.00
beach factor score	-0.24	0.07	-0.12	0.00
Village is near Misali Island (Pemba)	-0.81	0.20	-0.15	0.00
Female head of household	-0.70	0.23	-0.11	0.00
dagaa fisher score	0.22	0.07	0.10	0.00
number of persons in household	0.07	0.03	0.09	0.02

Social Capital

The household survey contained questions about membership in groups and associations, perceptions of trust and trustworthiness in the village, and participation in local decision making. Households are members of varied formal and informal groups and associations (Table 36). Muslim, burial, political, and fisher groups are viewed as among the most important. People join groups for emotional and spiritual support, encouragement, for consolation during misfortunes, and to promote social development in general (Table 37).

Table 36. Group membership and importance *(percentages)*

Group	*Household Membership in Groups*	*Most Important Group*
Political organization	52	9
Muslim group	41	37
Burial society	33	13
Sports association	22	4
Women's group	18	4
Village committee	18	3
Environmental organization	14	7
Fishers group	13	9
Savings and credit organization	12	6
Farmer's group	11	4
Church	3	2
Other	3	2

Table 37. Benefits of joining groups.

Benefit	*Percent*
Help with unforeseen contingencies	18
Faith and spiritual development	18
Promote social development and availability of social services	17
Improve social outlook	17
Assist in society in general	15
Bring happiness and entertainment	9
Other	6

Source: household surveys.

The general level of political participation is very high in the study sites. Ninety-one percent of heads of household indicated that they voted in local elections and most (67 %) feel that they can influence decisions in the village (Table #).

Levels of trust are related to the level of positive reciprocity and cooperation. Table 39 shows that 93 percent of heads of household interviewed said that their village neighbors are somewhat to very trustworthy. When levels of trust are low among a group, associational activity and collective action are inhibited. Trust and trustworthiness increase the chances of exchange among people without written contractual obligations. Instead people rely on expectations of mutual

obligation, honesty, reciprocity, mutual respect, and helpfulness. In this environment, if there is a perceived need, cooperative action is more likely to occur than when trust is low among people living in the same village.

Table 38. Do you think you or any member of the household can influence decisions in the village?

	Percent
No	32
To some extent	45
Yes	22
Don't know	0.5

Table 39. In general, how do you view trust among villagers?

	Percent
Very trustworthy	44
Quite trustworthy	37
Somewhat trustworthy	12
Not trustworthy	3
Not trustworthy at all	0.5
Don't know	5

Fishery Characteristics

Fishers comprised the second major occupational group (after farmers) of the surveyed households (34%) and the major one for male-headed households (38%) after farming. Given their important relationship with MPAs we conducted further analyses of the characteristics of fisheries in order to understand the nature and patterns of resource dependence of fishing households on marine resources.

Target species

As is typical in tropical coastal areas, fishing households harvest a great diversity of species. Fishery catches include reef, sandy-bottom, estuarine, and pelagic fishes, as well as crustaceans (such as lobster and crabs), mollusks (oysters and other shellfish) and sea cucumbers (see Table 40 and Figure 10). Figure 40 shows some of the most common marine species harvested.

Table 40. Marine species harvested (Each household was invited to name up to 5 species ranked from largest quantity =5 to fifth largest quantity harvested=1)

Common name (english)	*Common name (local)*	*Representative Species*	*Habitat*	*Frequency*[1]	*Relative Abundance*[2]
Anchovy	Uono	*Stolephorus commersonii, Encrasicholina punctifer, E. devisi*	Pelagic	12	46
Sea Catfish	Hongwe	*Arius* spp.	estuaries; mangroves	14	41
Cobia	Songoro	*Rachycentron canadum*	Pelagic	12	31
Crabs	Kaa	*Scylla serrata*	estuaries; mangroves	15	51
Emperor fish	Changu	*Lethrinus* spp., *Lutjanus spp.*	Reef	189	765
Goatfish	Mkundaji	*Parupeneus indicus*	Reef	37	105
Grouper	Chewa	*Epinephelus spp.*	Reef	35	106
Lobster	Kambakoche	*Panulirus ornatus, P. versicolor, P. longipes*	reef	39	149
Mackerel	Nguru	*Scomberomorus commerson*	Pelagic	31	99
Mackerel	Vibua	*Rastrelinger kanagurta*	Pelagic	15	53
Mojarra	Chaa	*Gerres* spp.	sandy-bottom	25	81
Mullet	Mkizi	*Mugil cephalus*	Pelagic	10	42
Octopus	Pweza	Various	Reef	122	491
Other	Other [3]		Various	441	1175

Parrotfish	Pono	*Leptoscarus* spp.	reef	48	149
Pompano	Kolekole	*Trachynotus* sp.	pelagic	109	353
Rabbit fish	Tasi	*Siganus spp.*	reef	105	384
Ray	Taa	*Rhinoptera javanica*	reef	40	140
Sardine	Dagaa	*Sardinella gibbosa*	pelagic	33	137
Sea Cucumber	Jongoo	*Holothuria scabra*	reef	32	117
Shark	Papa	*Hypogaleus hyugaensis, Hemipristis elongata, Triaenodon obesus, Negaprion acutidens, Loxodon macrorhinus, Carcharhinus falciformis*	various	36	120
Shell, Oyster	Chaza	*Ostrea amasa, Pinctada* sp., *Saccostrea cucullata*	estuaries; mangroves	7	32
Shells	Komee	*Cypraea tigris, Cypraeacassis rufa*	beach?	8	26
Snapper	Fimbo	*Aprion virescens*	reef	3	15
Snapper	Kelea + Maginge	*Lutjanus spp.*	reef	37	111
Squid	Ngisi		reef	41	111
Sweetlips	Komba	*Diagramma pictum, Plectorhinchus chubbi*	reef	7	20
Tuna	Jodari	*Euthynnus* sp.*, Thunnus* sp.	pelagic	14	49
Unicorn fish	Puju	*Naso unicornis, N. hexacanthus*	reef	18	51

[1] The frequency column indicates the number of households that reported normally harvesting that species, in any rank

[2] Relative abundance column is the sum of the ranks obtained by each species

[3] Common local names under *Other* category include: bangala, bojo, bumbwi, chafi, chadi, chana, chandara, change, chapechape, chome, choo, chuchunge, chuwale, dimbwala, domopande, dondo, dula, duni, faitundu, fulusi, gam, ginge, golori, gongoya, gonyogonyo, janja, kafukile, kaka, kande, kalambisi, kambisi, kanadi, kande, kangaja, kangaya, kangu, kapungu, kasa, katundu, kauri, kena, kibua, kikande, koana, koroma, kouna, kui, kukungi, kulungu, kumbamaji, kumugwi, kungu, kure, kurubuni, laga, loba, mabole, madomo panda, madondo, mafiro, mafulusi, mafumi, magamu, magome, makoe, makorobwe, makovu, mapuju, mashedi, matubwe, mbalawala, mbase, mbawi, mbondaji, mbono, mbulumbulu, mbuzimto, mchone, mendele, mikungu, mikitu, mikizi, milimba, mishe, mjana, mjombo, mkitu, mkoma, mkule, mkungu, mlapinga, mlea, mlimba, mokee, msolopa, mnyimbi, mpweke, msumari, msusa, mumba, mwanapinga, mwani, mwatiko, mwewe, mwidu, mzia, nakeni, ndolo, ndumi, ndwaro, ngarengare, ngogo, ngurangura, nguru, njana, nkadagi, nsulisuli, numba, nungu, nyamvi, nyazi, nyenga, nyuma, nyuna, paragunda, paalamamba, pandu, parapanda, parawe, pelee, pitiwi, poas, pondo, pooza, powe, rukutwi, sahara, samamwezi, samsuri, saladin, sehewa, shairi, tandaza, tawa, tembo, tuju, tuku, ubua, una, viali, vibanzi, vidau, vikande, vikobe, vinengwe, vitatange,and wihono.

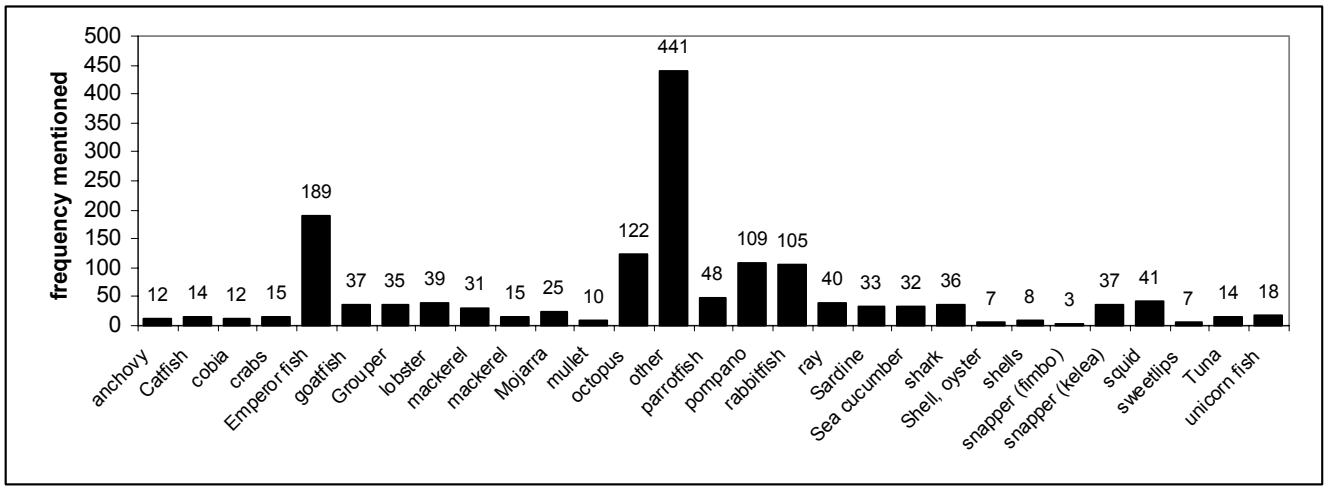


Figure 10. Frequency of marine species commonly harvested by households

Fishing technology

According to the household surveys, the most common fishing platforms were outrigger canoes, followed by dugout canoes (Figure 11). About 12% of the respondents fish on foot from shore. Most of the fishing platforms in operation seem to be owned by the users, with the exception of large or engine boats (there might be some overlap in these two categories; Figure 12). In terms of fishing gear, gill nets and lines (probably handlines fitted with hooks) were the most commonly used (Figure 13).

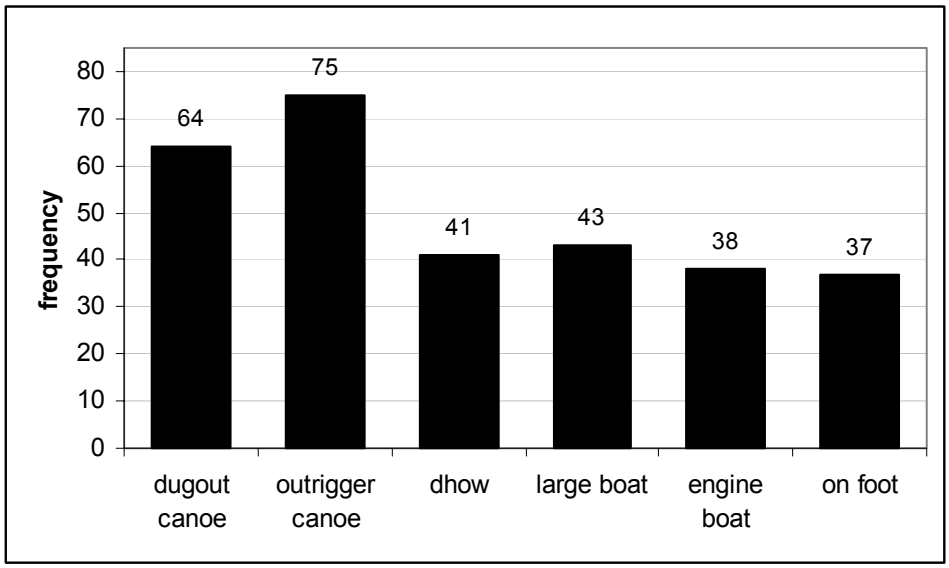


Figure 11. Fishing platforms used an their frequency

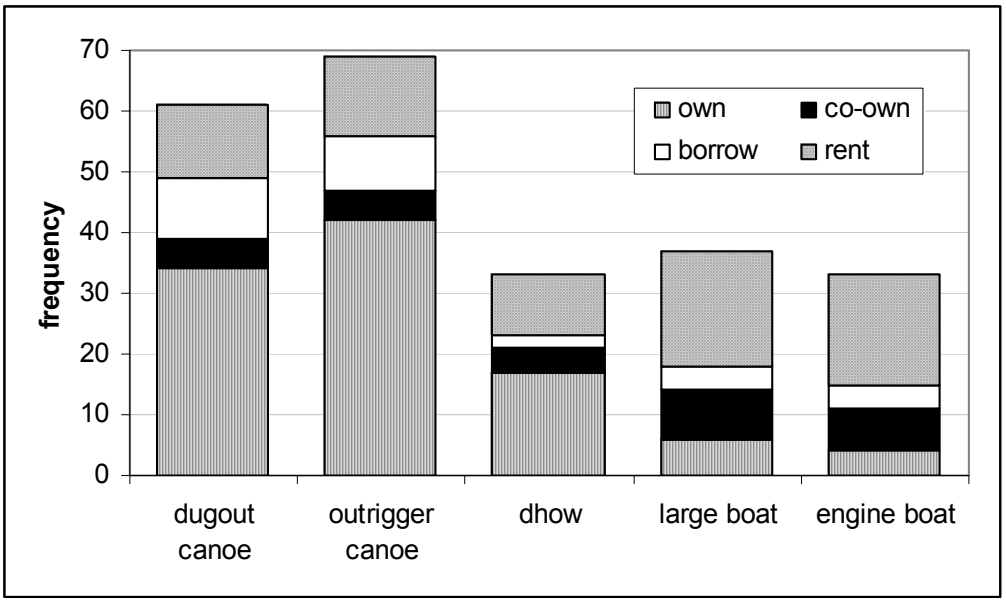


Figure 12. Ownership of fishing platforms and their frequencies

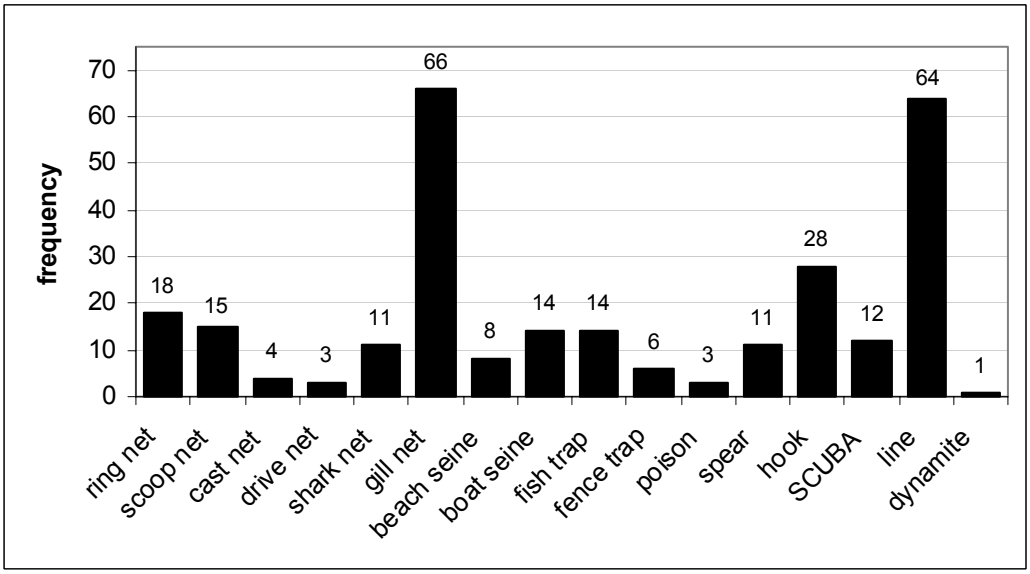


Figure 13a. Fishing gears used and their frequency

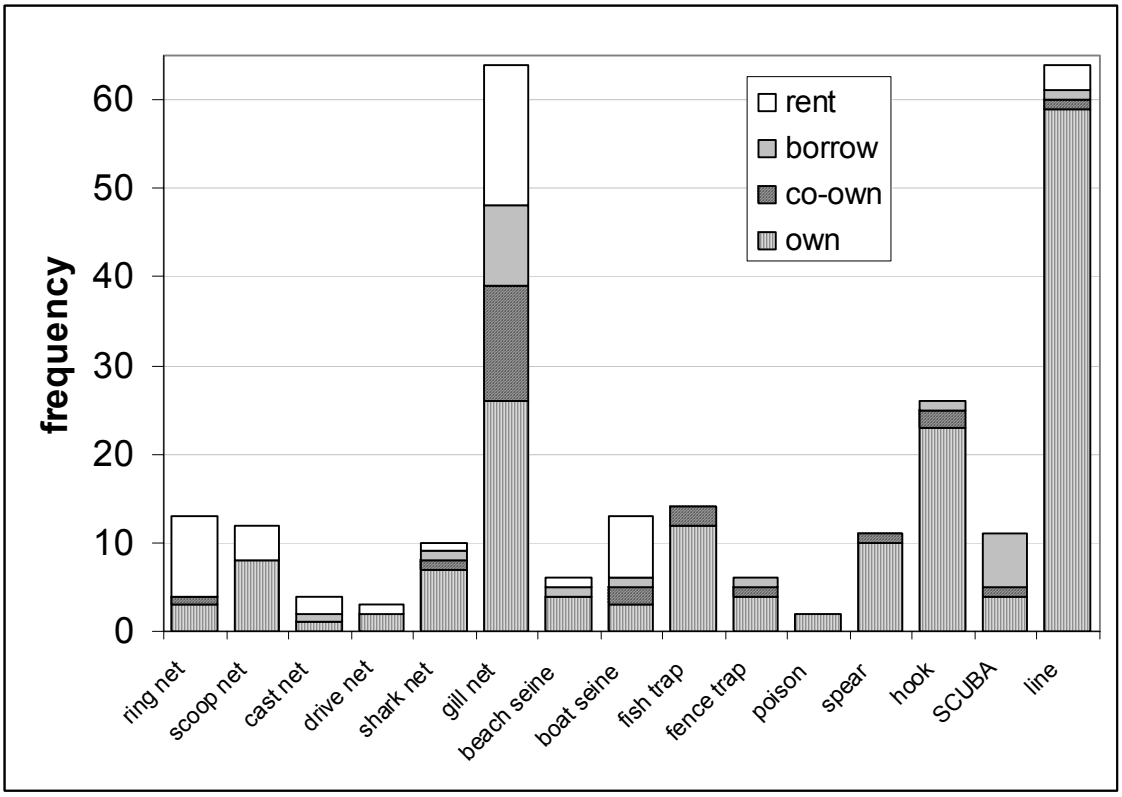


Figure 13b. Ownership of fishing gears and their frequencies

Fisher groups

To classify fishers into similar groupings, we factor-analyzed fishing household responses for variables related to fishing platform, gear, and target species for all households involved in some form of fishing. Initially, 47 variables were included in our analysis, but some had to be dropped due to low loadings on all components (Table 41). A relatively high proportion of the total variance (44%) was explained by eight components. The number of components was determined using the Scree plot.

Table 41. Factor analysis results for fishers. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.63. Bartlett's Test of Sphericity = 4594.66, df = 666, p < 0.001)

Fishery characteristics	*Dagaa*	*reef*	*pelagic shallow*	*foot*	*shark*	*pelagic deep*	*scuba*	*beach*
Fishes sardines (dagaa)	0.77	-0.05	-0.14	-0.07	-0.14	0.08	-0.01	0.12
Use ring net	0.70	-0.04	0.20	-0.04	-0.03	-0.05	-0.10	0.00
Fishes anchovies (uono)	0.69	0.00	-0.21	-0.09	-0.08	-0.03	-0.03	0.05
Use large boat	0.62	-0.01	0.14	0.05	0.25	-0.03	0.11	-0.02
Use engine boat	0.58	0.09	0.16	0.04	0.07	0.12	0.09	-0.16
Fishes parrotfish (pono)	0.01	0.77	0.08	-0.01	-0.03	-0.02	-0.03	-0.07
Fishes goatfish (mkundaji)	-0.04	0.73	0.03	0.04	-0.08	-0.04	-0.05	0.01

Fishes rabbitfish (tasi)	0.02	0.60	0.43	0.15	-0.06	-0.02	-0.07	0.10
Fishes unicorn fish (puju)	0.01	0.49	-0.07	-0.14	0.23	-0.04	0.05	-0.02
Fishes emperor fish (changu)	0.05	0.32	0.67	0.05	0.02	0.12	-0.02	-0.07
Fishes jacks (kolekole)	0.08	0.01	0.60	-0.08	0.16	0.21	-0.04	0.07
Use dugout canoe	0.03	0.04	0.58	-0.06	-0.11	-0.11	0.22	0.30
Fishes snapper (kelea)	-0.01	-0.03	0.45	-0.11	-0.05	0.05	0.07	-0.10
On foot	-0.03	0.00	-0.04	0.73	0.02	0.01	-0.06	0.00
Use spear or spear gun	-0.04	-0.02	-0.05	0.68	-0.11	0.08	0.00	0.05
Fishes octopus (pweza)	-0.02	0.03	0.04	0.65	0.01	-0.05	0.30	-0.06
Fishes snapper (maginge)	0.00	0.20	-0.03	0.46	-0.01	0.03	-0.07	0.16
Fishes rays (taa)	0.00	-0.03	0.02	-0.05	0.80	-0.02	0.00	0.00
Fishes shark (papa)	0.00	-0.01	-0.02	-0.01	0.77	0.18	0.00	-0.02
Fishes sea catfish (hongwe)	-0.05	-0.07	0.05	-0.04	0.48	-0.01	-0.09	0.34
Fishes tuna (jodari)	0.07	-0.07	0.03	-0.04	-0.02	0.74	0.02	-0.03
Fishes mackerel (nguru)	0.03	-0.08	0.14	0.04	0.13	0.64	-0.09	-0.05
Use outrigger canoe	-0.12	0.35	-0.08	0.10	0.14	0.56	0.02	0.05
Fishes lobster (kamba koche)	0.01	-0.02	-0.02	0.05	0.08	-0.03	0.73	-0.05
Use SCUBA	-0.01	-0.01	0.12	0.03	-0.06	0.05	0.70	-0.02
Fishes seacucumber (jongoo)	0.01	-0.05	0.00	0.01	-0.03	-0.05	0.63	0.09
Fishes mullet (mkizi) yes/no	0.01	-0.01	0.15	0.09	0.12	-0.09	-0.08	0.72
Use beach seine (small mesh)	0.00	-0.01	-0.05	-0.03	-0.10	0.08	0.14	0.68
Fishes mojarra (chaa)	-0.04	0.00	0.23	-0.05	-0.02	0.00	-0.02	0.13
Fishes crabs (kaa)	0.03	-0.08	-0.13	0.29	0.10	-0.11	0.06	-0.07
Fishes squid (ngisi)	0.00	-0.01	0.13	0.33	-0.04	-0.13	0.08	-0.11
Use line fishing	0.06	0.02	0.21	0.06	0.12	0.42	0.02	0.06
Use dhow	0.01	0.04	0.12	-0.02	0.14	-0.03	-0.02	-0.03
Use fishing net (Gillnet)	0.13	0.21	0.30	0.11	0.32	0.14	0.22	0.03
Use fish traps	0.00	0.29	-0.07	0.04	0.18	0.01	0.05	0.00
Fishes chewa (grouper)	-0.07	-0.05	0.12	-0.03	0.01	0.30	-0.07	0.10
use boat seine (large mesh)	0.05	0.00	0.02	0.04	0.10	-0.03	-0.05	0.17
% Cumulative variance explained	**8.50**	**15.24**	**21.07**	**26.69**	**31.53**	**35.96**	**40.17**	**43.57**

The resulting eight components make sense in terms of natural groupings of target species and fishing technology. They help understand the fishery in terms of reliance on near shore resources, technology. Items loading highest on the first component indicate fishers specialized in harvesting sardine-like fish (*dagaa*) and anchovies (*uono*), operating from large, engine-driven vessels that use ring nets. *Dagaa* is the collective name for various small sardine-like fresh- and saltwater fish, consumed in a whole dried form. *Dagaa* has been a significant part of popular diet over a wide area of (at least) eastern and southern Africa since written records began. According to Gibbons (1997) the increasing demand of freshwater *dagaa* from lakes Tanganyika and Victoria over the last three decades, spurred in Tanzania the search for new sources of supply of *dagaa*. A fishery for marine *dagaa pwani* developed around Dar es Salaam, Tanga and Bagamoyo using ring (or purse seine) nets and large wooden vessels with inboard and outboard engines. By the 1990s there were several different types of *dagaa*, each named after its place of origin, being traded on a long-distance basis from mainland Tanzania both in-country and internationally (Gibbons 1997).

With regards to location of this fishery, according to the TCMP (2001) that the "Zanzibar channel is an important area for sardines (*dagaa*) and Indian mackerel that are caught on moonless nights using purse-seine nets, scoop nets, and lights to attract the fish". This supports our analysis, which revealed the highest mean scores for *dagaa* to be located in Sahare, in the Tanga Region (Figure 14). Indeed, during field visits, it was confirmed that people in Sahare are almost entirely dependent on this type of fishery locally known as (*dagaa, bangala, gololi*). In Sahare, two local people own 5 boat engines between them, which they lend out for hire. Its vicinity to the Municipal has made its landing site a famous fish marketing spot for residents and fishmongers alike.

The second component in our analysis seems to encompass fishers that work on coral reefs, since their catch represents assemblages of typical reef fish (thus, we refer to this component as *reef*). Coral reefs serve as breeding, nursery and feeding grounds for many marine animals, including over 500 species of commercially important fish. Common species harvested in our study include parrotfish, goatfish, rabbit fish, unicorn fish and emperor fish. Other animals that are dependent on coral reefs include lobsters, octopi, bivalves, gastropods, and sea cucumbers, all of which are important in artisanal fisheries, with some contributing to the export earnings of the country. According to Ngoile and Horrill (1993), Coral reefs support some 70 percent of artisanal fish catch in Tanzania.

For coral reef fishing, there is probably a combination of fishing methods and platforms used, however, in our study sites, the main methods seem to be fish traps and gillnets. This is commonplace for shallow-water reef fisheries around the world. The villages studied in Menai Bay (especially Mtende, Ng'ambwa, and Nyamanzi) and Pongwe in Jozani-Chwaka Bay show high mean scores for *reef* (Figure 15).

The third component, *pelagic shallow* is composed of fishers using dugout canoes and fishing for reef species such as emperor, jack and snapper fish. All villages in the Kilwa and Mafia study areas show positive scores for *pelagic shallow* (Figure 16).

A fourth component (*foot*) showed high factor loadings for items such as the use of spears and spear guns, crab collection, snapper and octopus fishing. It is possible that this group represents fishers that have no boats and simply work alone with spears, sticks and hooks collecting crabs, octopus, lobster, sea cucumber and seashells in the intertidal area or with hook and line from the shoreline. Two villages in the Jozani-Chwaka Bay study area show high mean scores for *foot* – Michamvi and Ukongoroni villages (Figure 17).

Fishers specialized in catching sharks and rays are represented by the fifth component. The co-occurrence of shark and rays in a group of respondents could indicate a specialization in terms of preparation of this kind of flesh; both sharks and rays are elasmobranchs, known for the ammonia-like taste of their flesh unless they are processed in specific ways. It is possible these fishers are involved in the international shark fin trade for oriental markets as well. Ushongo village in Tanga Region, Buyu in Menai Bay, Zanzibar, and Jibondo village in Mafia District all show high mean scores for *shark* (Figure 18).

The sixth component, which we termed *SCUBA*, is comprised of fishers that use SCUBA equipment to catch mostly lobster and sea cucumbers. These species are high value items, often found in coral reefs. Sea cucumbers are boiled and dried for export to Asia where they are a

traditional food item (known as beche-de-mer or trepang). Lobsters are sold in Tanzania to the tourism sector and are also exported live.

Divers in Tanzania are often hired by patrons (possibly foreign) who provide the SCUBA gear and air compressors for tank refills. The value of exports of these and other high value items such as crabs, shark fins, octopus and squid from the mainland and Zanzibar exceeds several million US dollars annually. The highest mean score for *SCUBA* is located in Somanga village in Kilwa (Figure 19). There are several lobster marketing and export companies in Kilwa town, including Oceanic Lobster and Bahari Star Lobster Company.

The seventh component we refer to as *pelagic deep*. It includes tuna and mackerel fishers, two pelagic species. The use of outrigger canoe is associated with this group, but the tuna fishery is one that involves the use of nets and engines. Ushongo village in Tanga region is one of the study areas with a high mean score for *pelagic deep* (Figure 20). They probably fish in the Pemba channel. The deep Pemba channel is important for over one hundred dhows *(mashua*) that fish for large species, such as yellowfin tuna and sailfish using gill-nets.

The final component (*beach*) has high factor component loadings for fishers using a beach seine and catching mojarras, a typical fish species of sandy bottoms. These fishers usually work in groups close to shore (pulling the net requires collaborative work), on foot or with the help of a small boat to help set the seine net. They probably catch many more species than mojarras, especially if there are nearby seagrass beds, but they tend to be juveniles of reef species with low commercial value. The highest mean scores for *beach* is located in Somanga village in Kilwa (Figure 21).

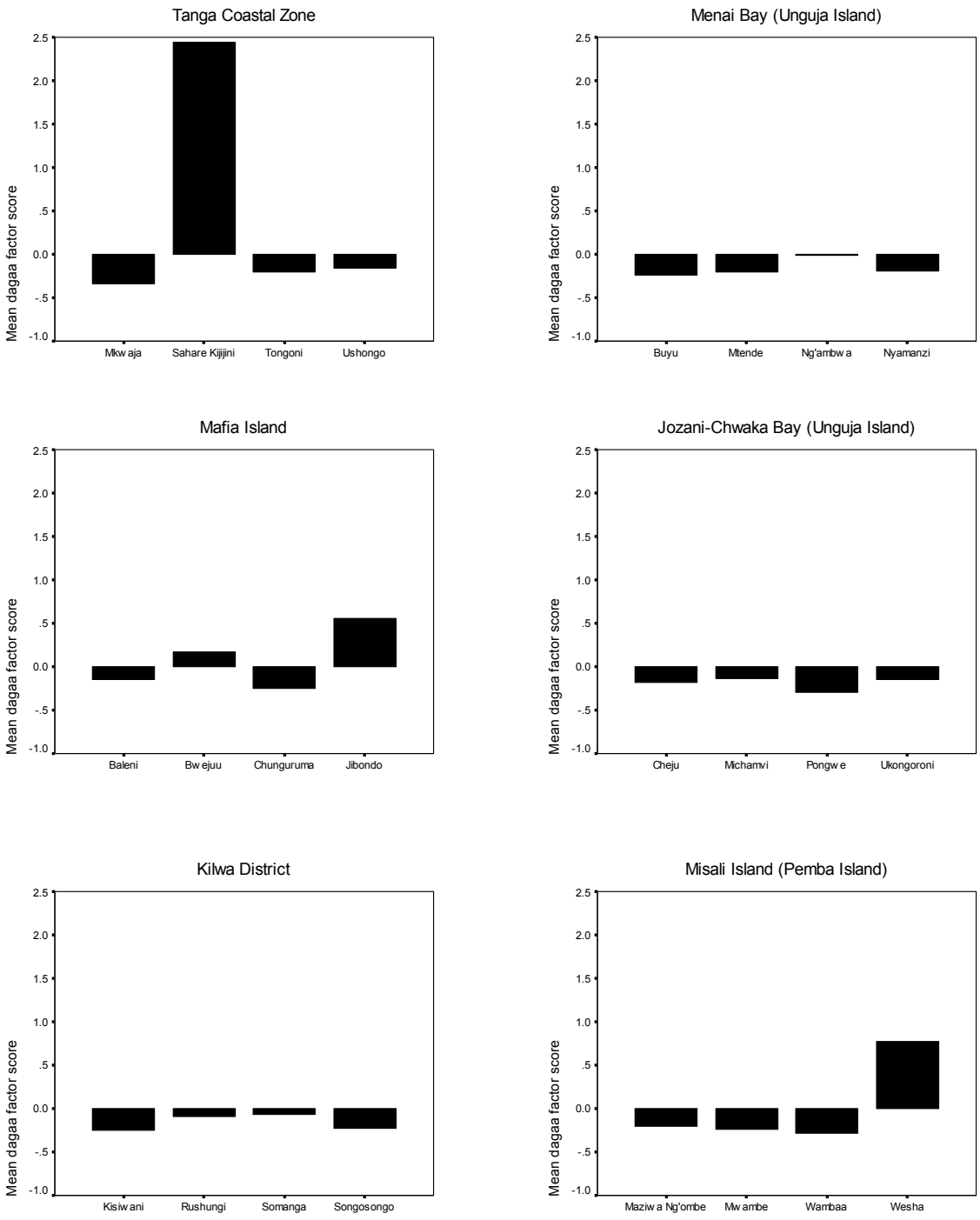


Figure 14. Mean factor *dagaa* scores by villages in study areas

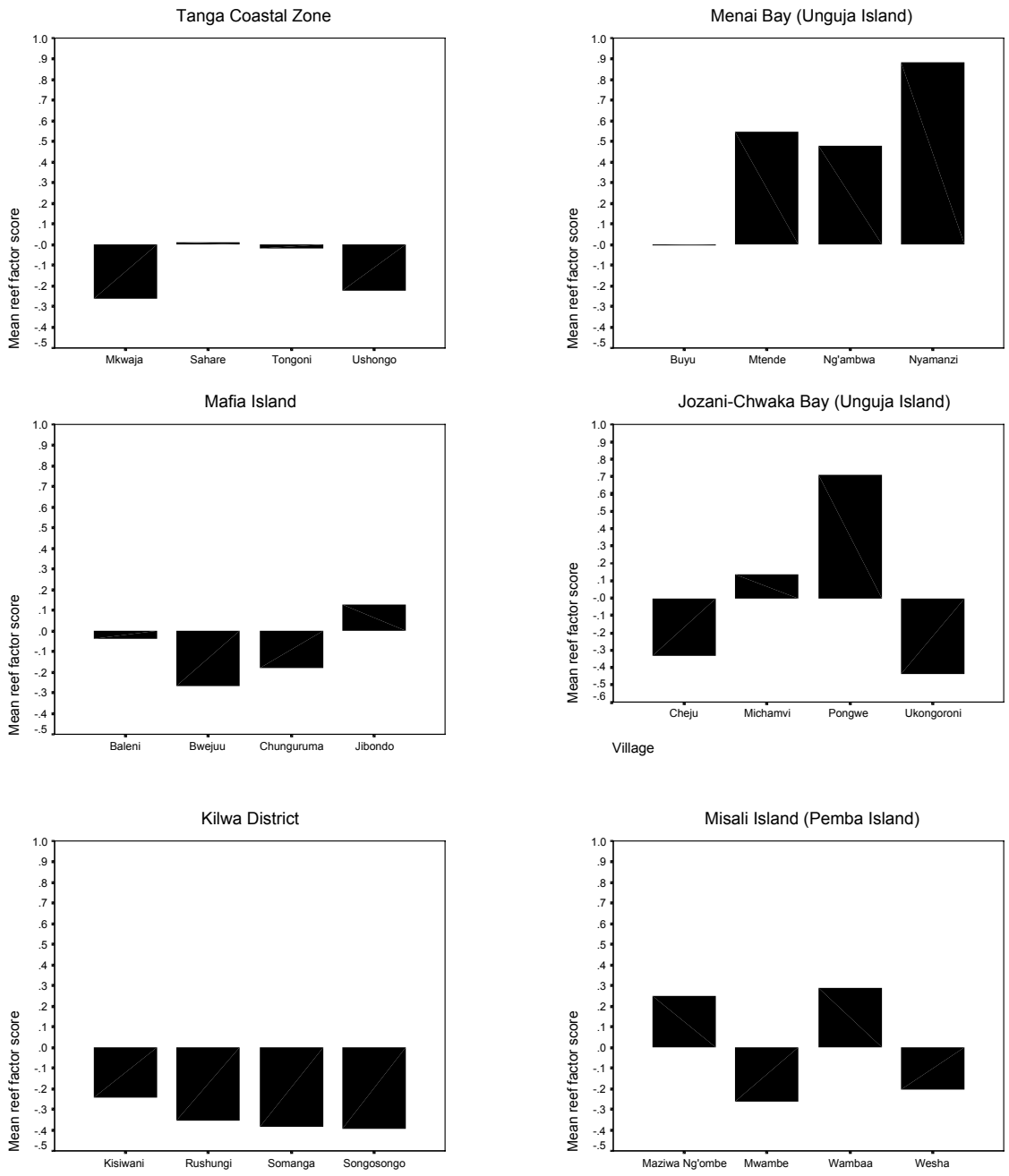


Figure 15. Mean factor *reef* scores by villages in study areas.

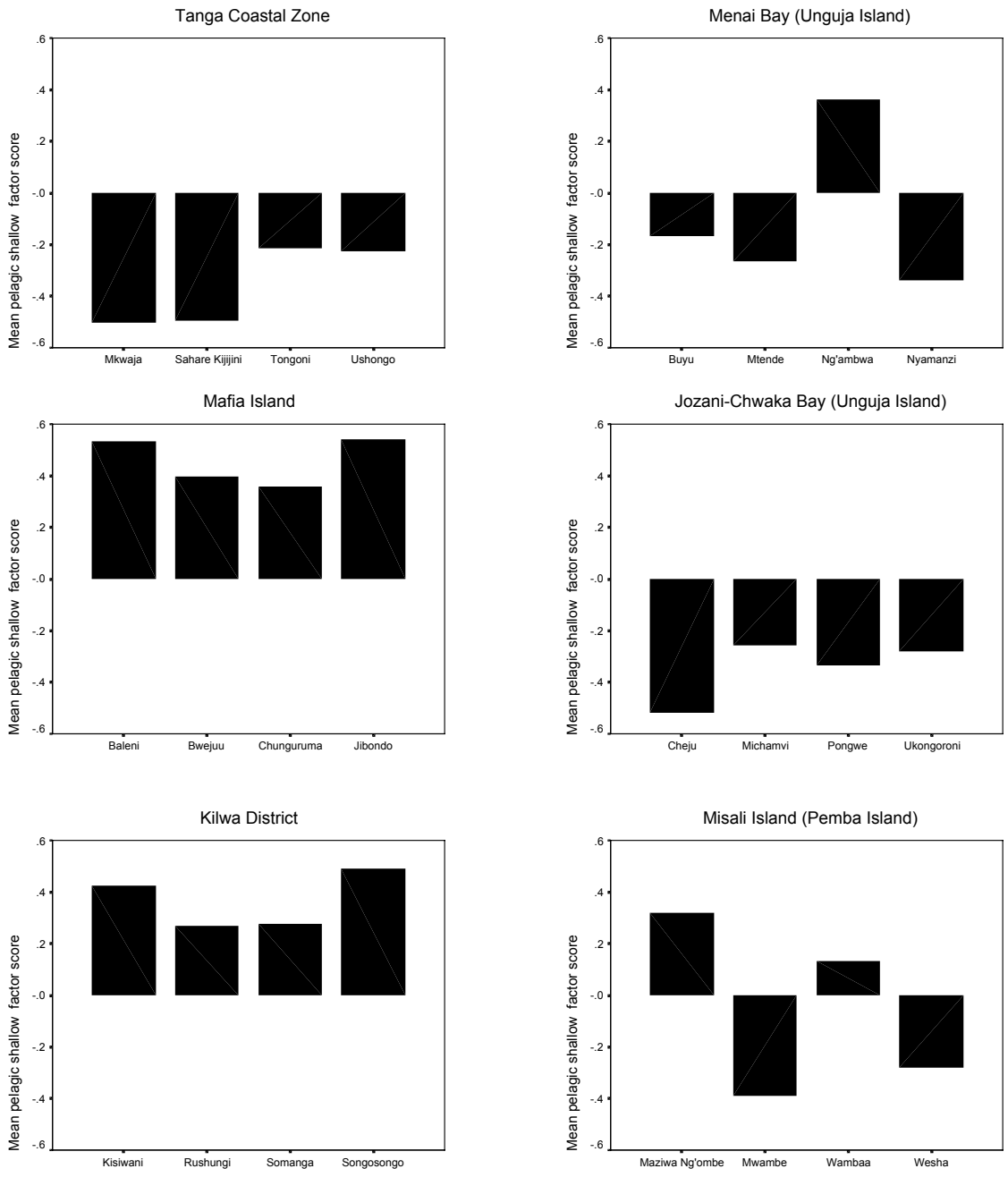


Figure 16. Mean factor *pelagic shallow* scores by villages in study areas

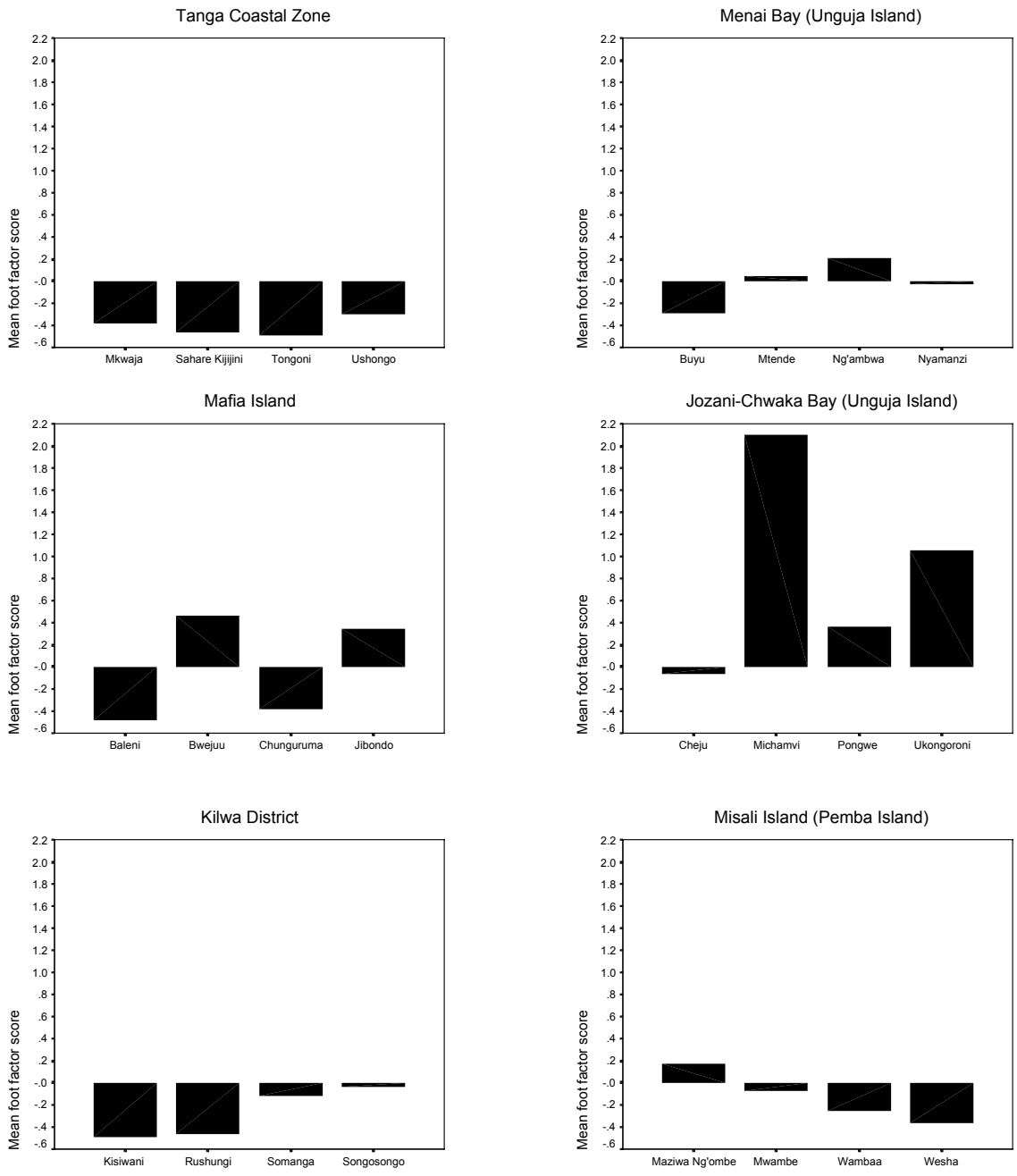


Figure 17. Mean *foot* component by villages in study areas.

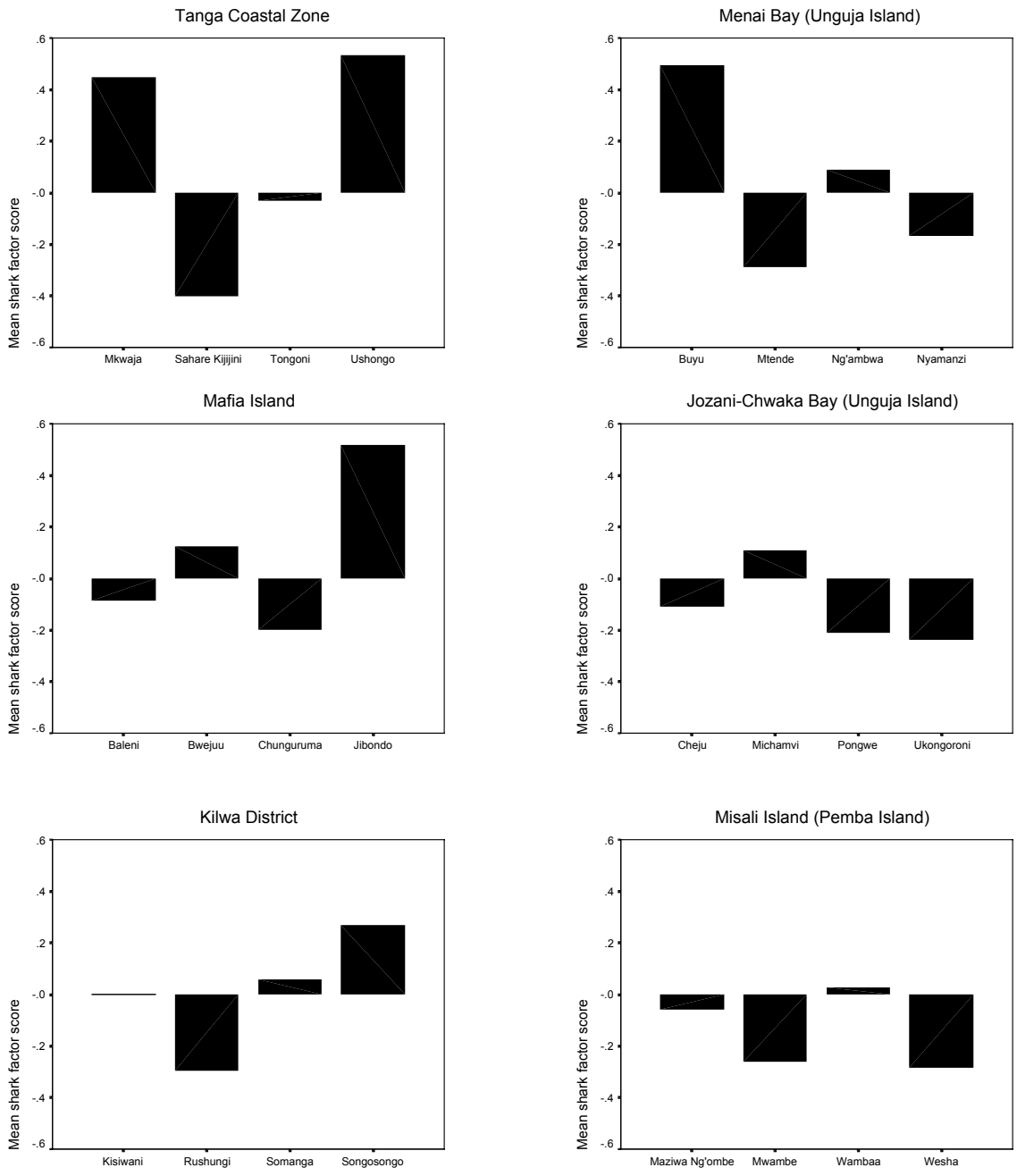


Figure 18. Mean *shark* component score by villages in study areas

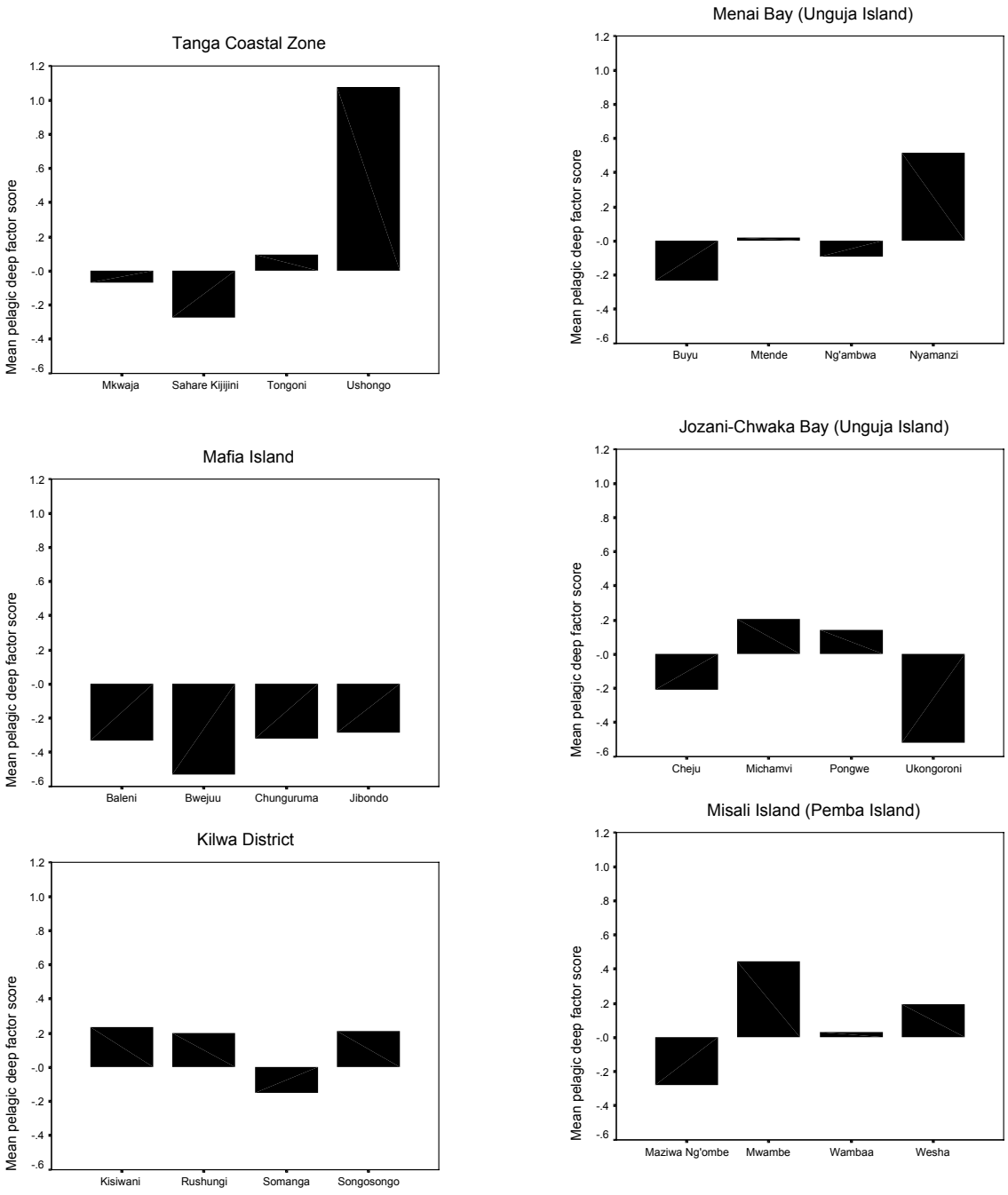


Figure 19. Mean scores for *pelagic deep* by villages in study areas.

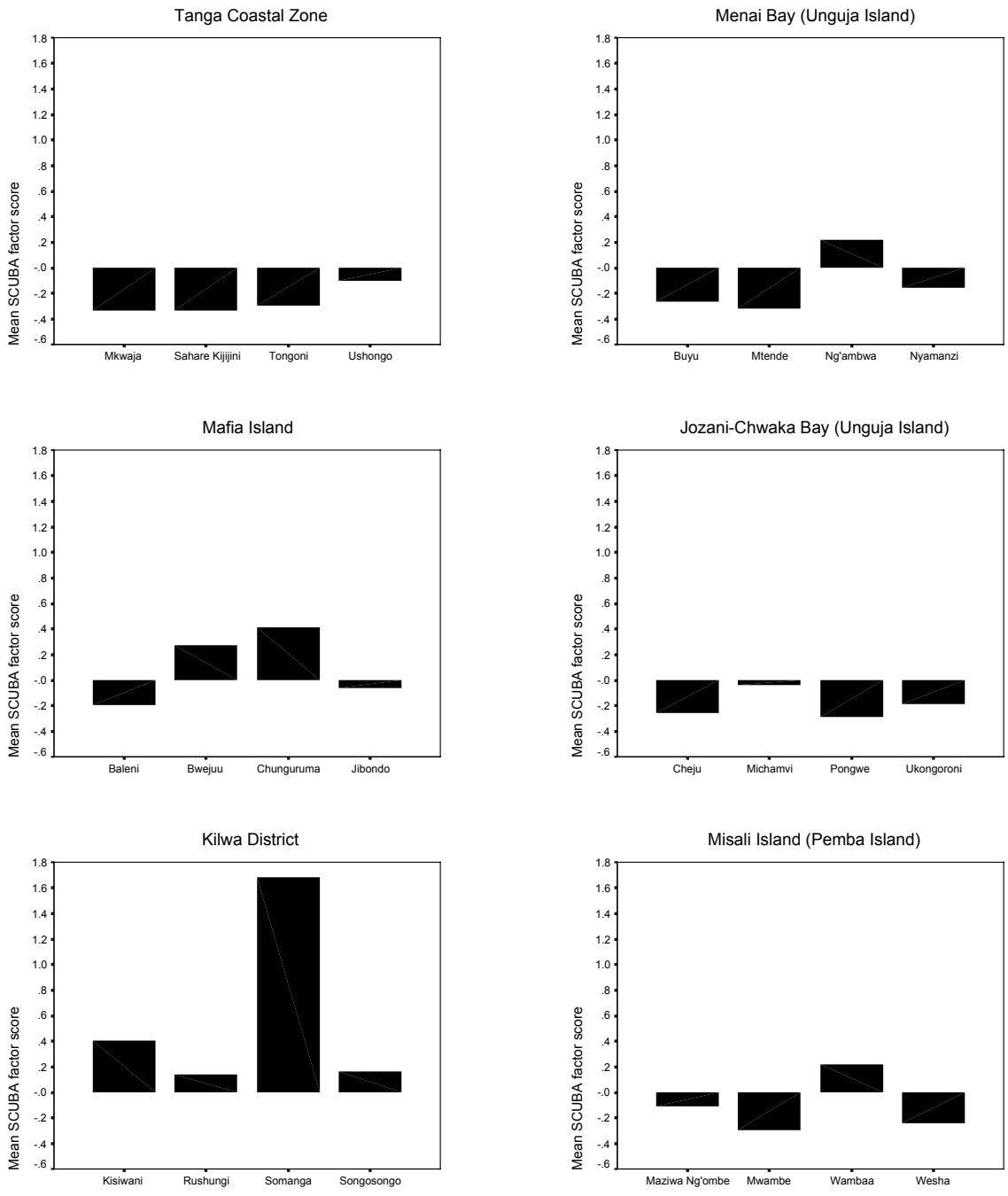


Figure 20. Mean scores for *SCUBA* by villages in study areas

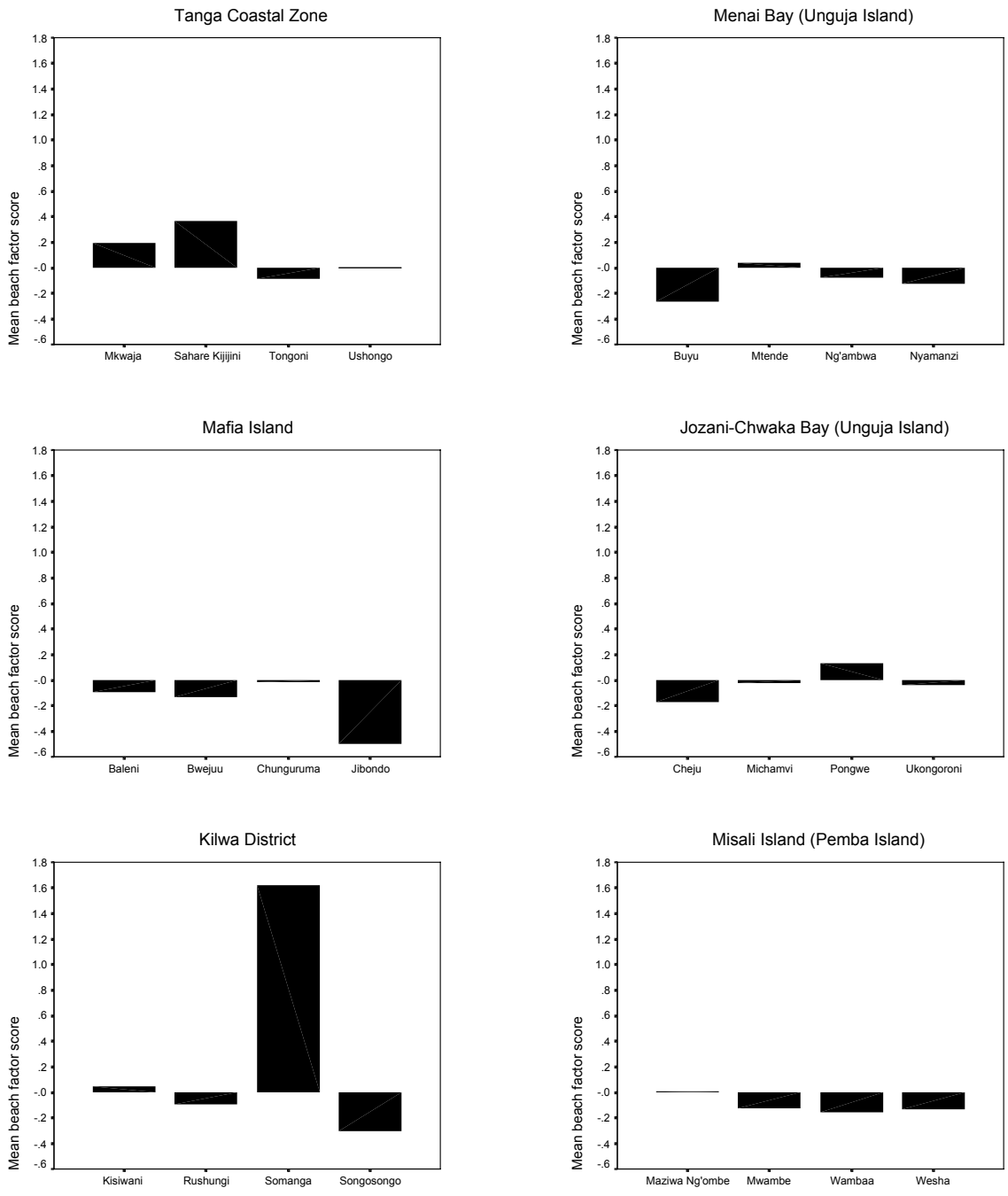


Figure 21. Mean scores for *beach* component by villages in study areas.

MPA Awareness

Awareness of MPA's is high, especially in Tanga, Mafia Island and Pemba (Table 42) . It is likely that the relatively greater awareness at these sites is due to the size and duration of the MPA projects and investments in environmental education and awareness. Also, there seem to be important differences in terms of awareness between male and female households.

Table 43. Have you ever heard anything about marine parks? *(percentage)*

	Tanga	Mafia Island	Kilwa District	Menai Bay	Jozani-Chwaka Bay	Misali Island/ Pemba	Male-headed household	Female-headed household
Yes	87	89	33	72	59	90	75	52
No	13	11	67	28	41	10	25	48

Only 32% percent of the respondents felt that they had sufficient information about the activities of marine parks. In several villages, focus group discussions revealed that villagers feel that the marine park staff and environmental committees withhold some information from the rest of the village (e.g. how much money is collected in revenues or how financial resources are used).

The three primary sources of information on marine parks accounting for 78 percent of responses comes from village meetings, neighbors, and District authorities (Table 44).

Table 44. Where did you get information on the MPA?

Source	*Percent*
Village meetings	38
Other villagers	21
District authorities	19
Leaflets, radio and other media	12
Fishers who have entered the reserve areas	2
Other	8

In 19 out of 20 villages reporting from focus groups, it is perceived that village government officials support MPA's. The main modes of support are establishment of village environmental conservation committees (10 villages), raising environmental awareness in the community (6 villages), and overseeing and enforcing marine rules (3 villages).

Across all sites, villagers perceived the principal goal of MPAs to be natural resource conservation (Table 45). However, in some sites the percentage of respondents that do not know the purpose of the marine park is high (46 % in Kilwa and 41% in Jozani-Chwaka Bay). This result makes sense since Kilwa does not have an MPA, and the Jozani-Chwaka Bay initiative is more a terrestrial conservation area than a marine protected area.

Knowledge of MPA rules is quite high, especially among fishermen. Knowledge of regulations that were mentioned in the sites included marine area closings to fishing, licensing, permits for mangrove exploitation, taxes on fish catch, and prohibitions of destructive fishing methods. Some regulations, such as closing periods of octopus harvesting, were not mentioned as part of current MPA rules. Instead they were regarded as part of the dying traditional resource management regimes in the communities. Some community members subtly expressed regret over the disrespect, shown by using inappropriate tools in octopus harvesting, maintaining that it is affecting local communities.

Table 45. What are the objectives of marine parks?

	Tanga	Mafia Island	Kilwa District	Menai Bay	Jozani-Chwaka Bay	Misali Island/ Pemba	Total
Natural resource conservation	76	65	54	58	57	71	65
Don't know	18	26	46	38	41	25	30
Community social service	4	2	0	1	2	0	2
Fishing education	1	4	0	3	0	0	2
Loans and employment	0	2	0	1	0	0	3
Other	1	1	0	0	0	4	1

MPA Involvement

The main form of community member involvement in MPA's is through public meetings and conversations with MPA officers (Table 46). Planning also plays an important role in Tanga, which may explain why the Tanga respondents also felt that the MPA has had a positive impact on individuals' ability to influence decisions on marine and coastal issues and a positive attitude overall toward the MPA.

Most respondents that have been involved in income generating components of MPAs come from Tanga, Menai Bay and Jozani-Chwaka Bay (Table 47). In a workshop held with Tanga villagers in 2000 (Torell *et al.* 2000) villagers conveyed that the alternative livelihood programs supported by the Tanga program had positive impacts on poverty reduction and food security. However, following the mid-term evaluation of the Tanga program's second phase, activities not directly related to coastal and marine resources management were eliminated and the program began to concentrate on collaborative fisheries management. This decision was quite unpopular with the communities and the district staff, who thought that the income generating activities were essential parts of the program.

Table 46. How have you been involved in the MPA? (percentages)

	Tanga	Mafia Island	Menai Bay	Jozani-Chwaka Bay	Misali Island/ Pemba	Male-headed household	Female-headed household
Public meeting	23	17	33	64	54	38	34
Normal conversation with MPA officers	41	38	24	22	31	32	23
Planning	23	12	10	4	4	11	7
Other	13	29	3	10	0	10	18
Never involved	0	5	30	0	11	9	18

Table 47. How have you been involved in MPA income generating components? (percentage)

	Tanga	*Mafia Island*	*Menai Bay*	*Jozani-Chwaka Bay*	*Misali Island/ Pemba*	*Total*
Saving and borrowing	0.0	15.8	2.0	13.0	11.1	7.0
Fishing techniques	4.2	21.1	2.0	0.0	14.8	7.0
Bee keeping	4.2	5.3	40.0	17.4	14.8	21.0
Tree planting	50.0	10.5	4.0	39.1	3.7	18.2
Loan provision	0.0	10.5	0.0	0.0	0.0	1.4
Employment by Marine Park	8.3	10.5	4.0	8.7	0.0	5.6
Turtle/fish keeping	4.2	0.0	0.0	4.3	0.0	1.4
Indirect income through increase in fish business	0.0	26.3	2.0	0.0	0.0	4.2
Agriculture	29.2	0.0	42.0	17.4	40.7	30.1
other	0.0	0.0	4.0	0.0	14.8	4.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 48. Has the MPA placed restrictions over marine resource use?

Mean values are shown followed by standard deviation (in parentheses)

Tanga	Mafia Island	Menai Bay	Jozani-Chwaka Bay	Misali Island/ Pemba
1.3 (0.7)	1.5 (0.6)	0.6 (0.7)	0.4 (0.6)	1.1 (0.6)

Note: responses were coded as follows (0=no restrictions; 1=some restrictions; 2=many restrictions)

Impact of MPAs

To evaluate the impacts of MPAs in each of the sites, we used two approaches. The first was based on a comparison of improvements of selected variables in control v. project villages for each study site. The variables were selected from the household survey questions by taking into consideration some of the commonly stated goals of the MPA projects. Our second approach, also using household survey data, centered on respondents' perceived effects of MPAs. For this, we created an "MPA impact score" to reflect their overall attitudes toward the MPA. This score was calculated for each respondent by adding the values (ranging from -2 = strongly negative to 2 = strongly positive) for the impact of the MPA on five variables: 1)Economic well being, 2)Ability of households to influence decisions on marine resources, 3) Local culture, customs and taboos. 4)Employment, and 5) Fish catch. Mean values for each of these variables, by village, is shown in Figures23-27)

When comparing project and control villages, the only significant, positive changes were detected in the Unguja (Menai and Chwaka Bay), and Mafia Island sites (Table 49). These improvements consisted in increased availability of protected water sources (in the Unguja sites); membership in environmental groups, perceived fish catches and perceived state of local economy (for Menai Bay); increased membership in credit and savings associations and decrease in use of shore as toilet (in Jozani-Chwaka Bay); and increased membership to fishers associations (Mafia Island).

In terms of attitudes toward the MPA, we also we found significant differences in proportions of positive attitudes between sites (Chi-square = 10.27, df = 4,1, $p < 0.001$). However, these did not match exactly with the positive achievements over control villages mentioned above. A greater proportion of respondents with positive attitudes was found in Mafia Island and Tanga (which had no controls) however, greater proportions of negative attitudes were found in Misali Island and, unexpectedly, in Unguja sites.

When we analyzed mean MPA impact scores at the village level, a more complex picture of MPA attitudes emerged (see Figure 22). Most villages in Misali Island had negative views; in Tanga, positive; lending general support to our previous observations on MPA attitudes by project. However, villages in the Unguja sites showed a mixed response, and in Mafia Island were very polarized. In Mafia, Jibondo village was particularly antagonistic against the park. This suggests that attitudes toward MPAs are influenced by other variables than just project achievements. For example, one of the main complaints about MPA's from the household surveys were limited access to natural resources and harassment from marine authorities (Table 51).

Therefore, we examined further the relationship between positive MPA attitude and other household and village-level variables. Household level variables included: gender of head of household, occupation, material lifestyle score, whether household farmed algae, education of head of household, literacy of head of household, whether the household had been involved in MPA activities (and types of activities), and whether household felt it had sufficient information on MPA projects. Village level variables included: whether village was on an island, MPA project, whether village was a control or project village, and whether village was rural a small town, or urban-mixed. Of these, only four variables were significant in explaining a positive MPA attitude (Table 50): involvement in MPA activities, feeling sufficiently informed about MPA project, and not being a village in the Unguja projects (Jozani-Chwaka Bay and Menai Bay).

Table 49. Comparison of selected variables in project (p) and control (c) sites, in percentages, using Chi-square tests. One asterisk indicates a significantl improvement at alpha = 0.05 and two asterisks at alpha = 0.01.

	Tanga[1] Coastal Zone		Mafia Island		Kilwa District		Menai Bay		Jozani-Chwaka Bay		Misali Island/ Pemba	
	(c)	(p)	(c)	(p)	(c)	(p)	(c)	(p)	(c)	(p)	(c)	(p)
Food security and basic services												
Improved food security from 5 y. ago	-	18.3	21.4	14	24.0	-	15.6	27.7	33.3	25.3	30.0*	16.1
Availability of protected water source (yes/no)	-	90.8	9.1	21.4	61.5	-	71.9	97.0**	63.3	82.4*	46.7	54.4
Use of shore as toilet (yes/no)	-	36.4	14.7	21.4	9.0	-	12.5	8.9	46.7*	25.3	30.0	45.6
Mean material lifestyle score		-0.4	-1.2	-0.7	-0.4	-	-1.9	1.3	1.7	0.9	1.0	-0.6
Social Capital												
Membership to women's group	-	11.0	0.0	6.7	12.1	-	19.2	33.3	50.0	41.1	20.0	8.9
Membership to	-	8.5	0.0	5.6	7.8	-	7.7	15.5	16.7	32.2	3.3	7.8

agricultural organization												
Membership to fishers organization	-	4.2	0.0	20.2*	14.7	-	15.4	21.6	6.7	12.2	20.0	12.2
Membership to savings and credit organization	-	8.5	3.4	10.1	3.4	-	7.7	9.3	13.3	41.1**	16.7	8.9
Membership to village committee	-	5.9	3.4	11.2	9.5	-	38.5	35.1	33.3	32.2	23.3	18.9
Membership to environmental group	-	9.4	3.4	5.6	3.4	-	3.8	29.9**	20.0	36.7	6.7	13.3
Membership to other (non-religious) organization	-	5.8	0.0	0.0	1.7	-	0.0	5.2	3.3	1.1	3.3	7.8
Empowerment												
Ability to influence village decisions on marine resources	-	56.8	53.1*	29.8	38.3	-	62.5	19.2*	76.7	78.0	71.4	70.0
Perceived effects												
Increase in fish catches due to MPA	-	52.6	50.0	66.3	-	-	15.8	38.8*	25.0	18.5	46.4	28.9
Effect of MPA on preservation of culture and traditions	-	4.4	0.0	2.27	-	-	0.0	5.6	5.3	11.1	14.3*	2.6
MPA's Positive effect on employment	-	35.1	8.3	29.3	-	-	10.5	18.4	15.8	13.2	3.4	9.0
MPA's Positive effect on local economy	-	38.5	30.8	34.1	-	-	5.3	23.6*	4.8	14.5	7.1	6.3

[1] Unfortunately, no control sites were avaiblable for the Tanga Project, and in Kilwa, all sites were considered as control since there is no MPA there currently.

Table 50. Stepwise logistic regression of retionship between having a positive MPA attitude and household/village variables (n= 335). *B* = regression coefficient, *SE* = standard error, *Wald* = Wald statistic, *p* = significance. Overall fit of predicted results = 67.8%.

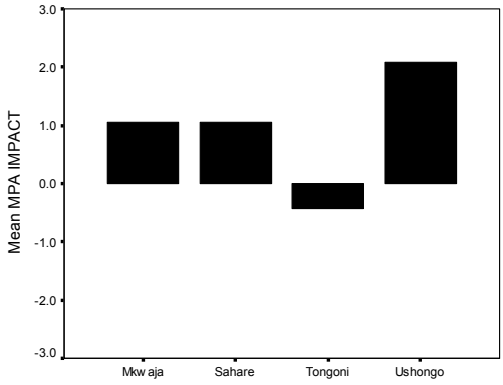
	B	*S.E.*	*Wald*	*p*	*R*
Involved in MPA income generating activity	1.65	0.34	23.95	0.000	0.28
Sufficient information on MPA	0.77	0.25	9.37	0.002	0.27
Project (Jozani-Chwaka Bay)	-1.23	0.41	9.17	0.002	-0.13
Project (Menai Bay)	-1.05	0.31	11.62	0.001	-0.09

Table 51. What do you dislike about MPA's?

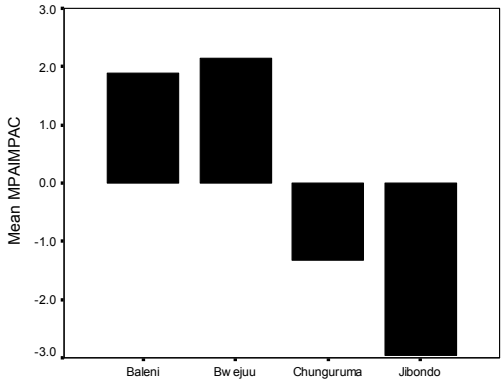
	Percent
No dislikes	23
Limit the access to natural resources	22
Don't know	20
Harassment from marine authority	10
Lack community participation for the initial stages	7
No transparency	6
Reduce the catchment area	5

Other	8

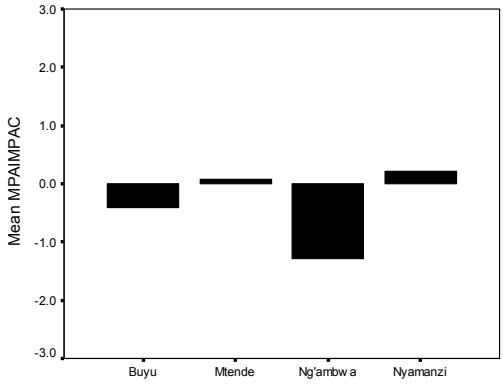
Tanga Coastal Zone

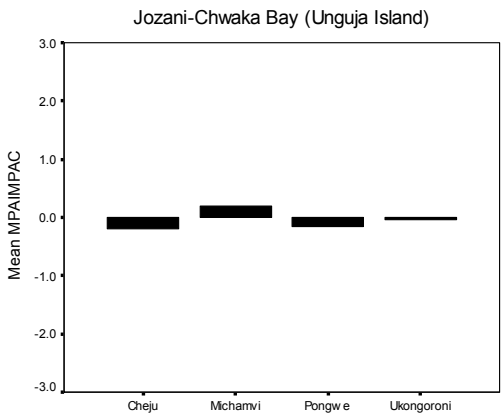


Mafia Island



Menai Bay (Unguja Island)




Jozani-Chwaka Bay (Unguja Island)
Mean MPAIMPAC
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
Cheju
Michamvi
Pongwe
Ukongoroni

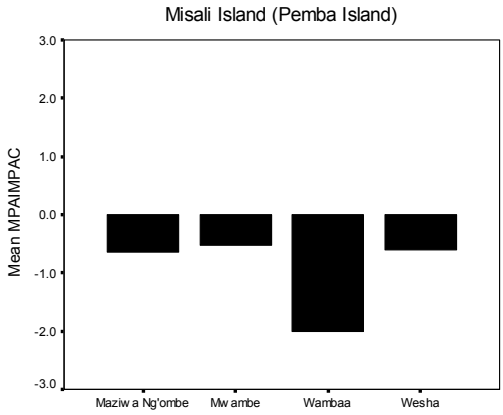

Misali Island (Pemba Island)
Mean MPAIMPAC
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
Maziwa Ng'ombe
Mwambe
Wambaa
Wesha

Figure 22. Mean MPA impact scores by MPA and village

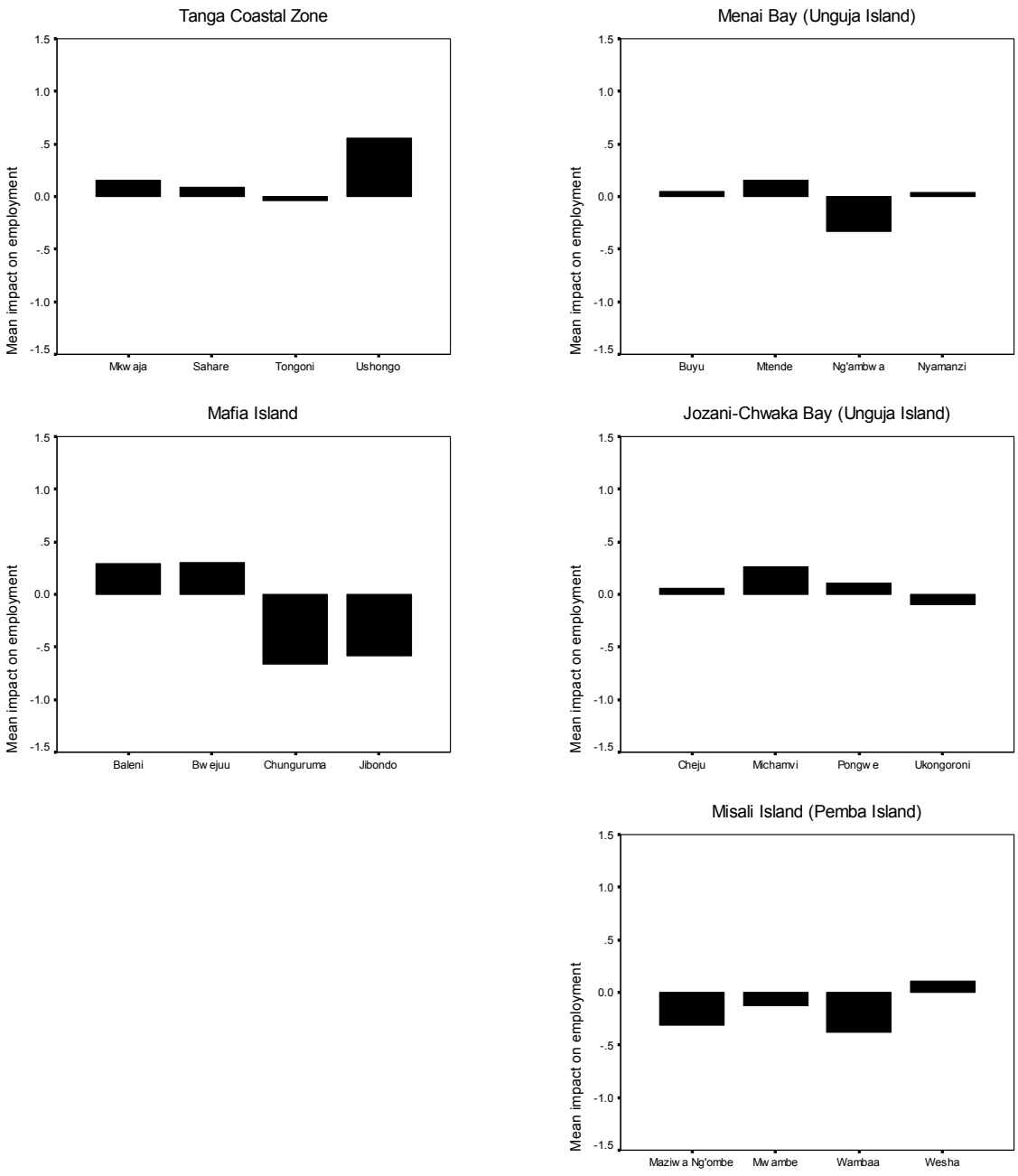


Figure 23. Mean impact of MPA on employment

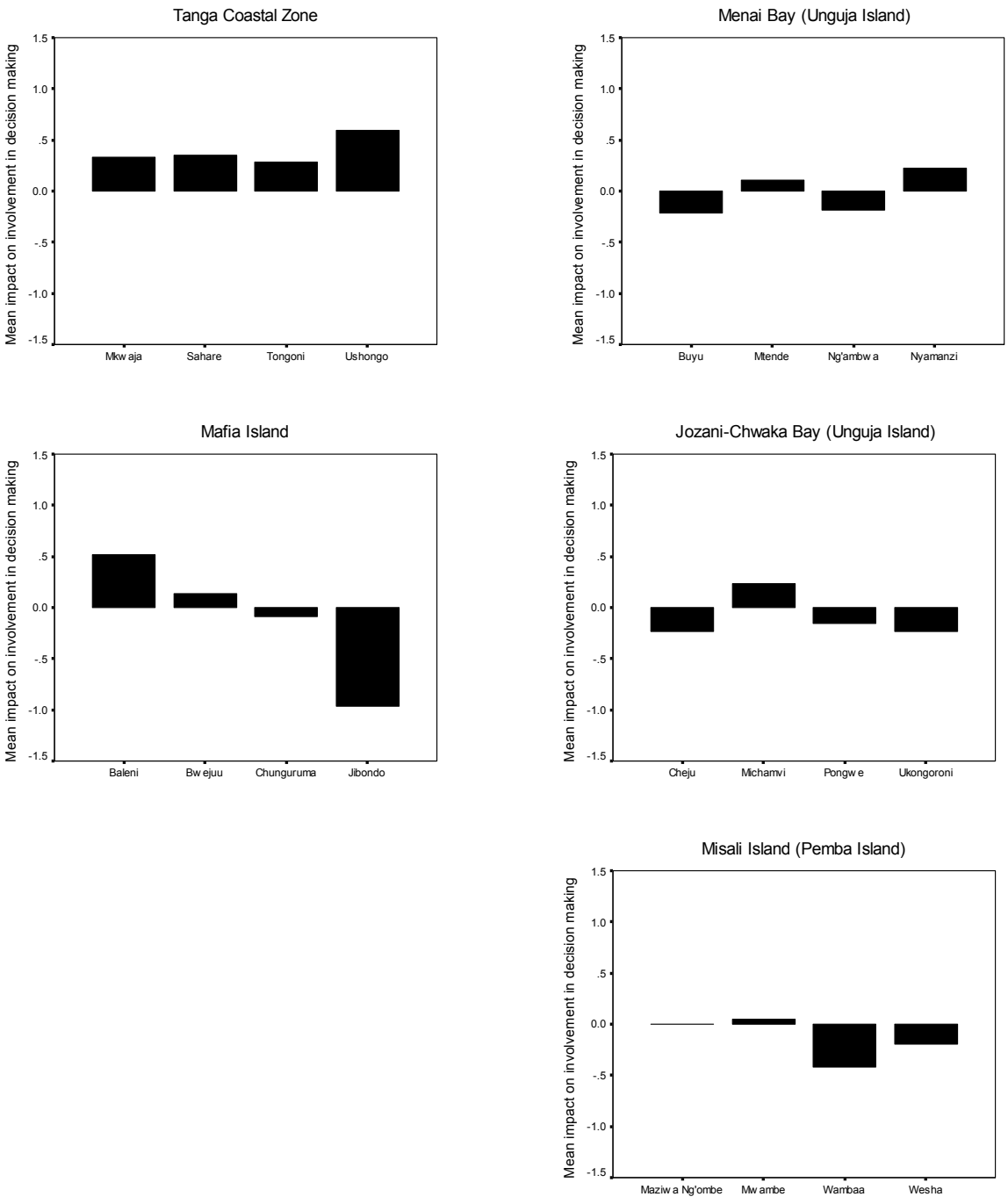


Figure 24. Mean impact of MPA on household involvement in decisions on marine and coastal resources by MPA and village.

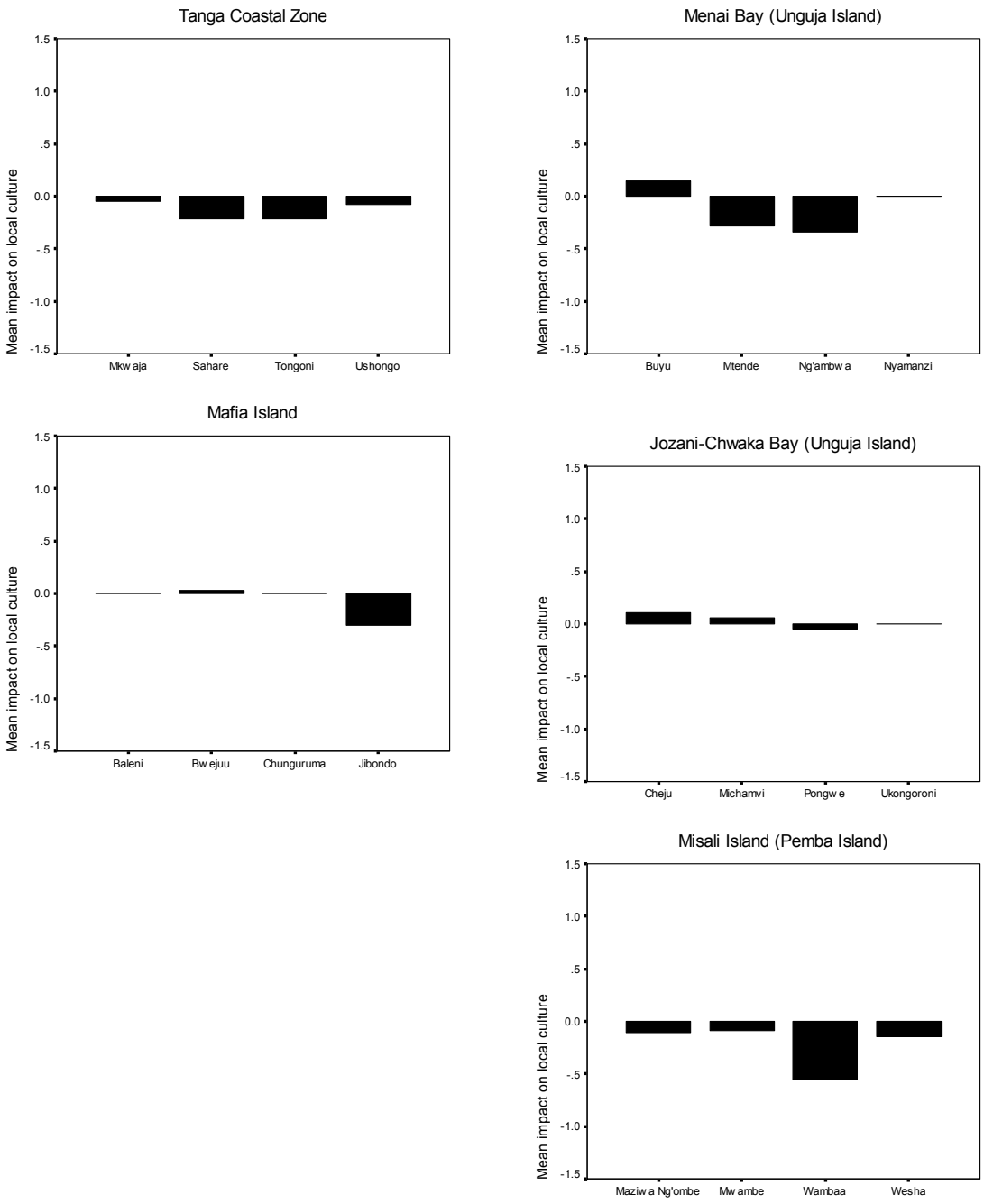


Figure 25. Impact of MPA on local culture and traditions.

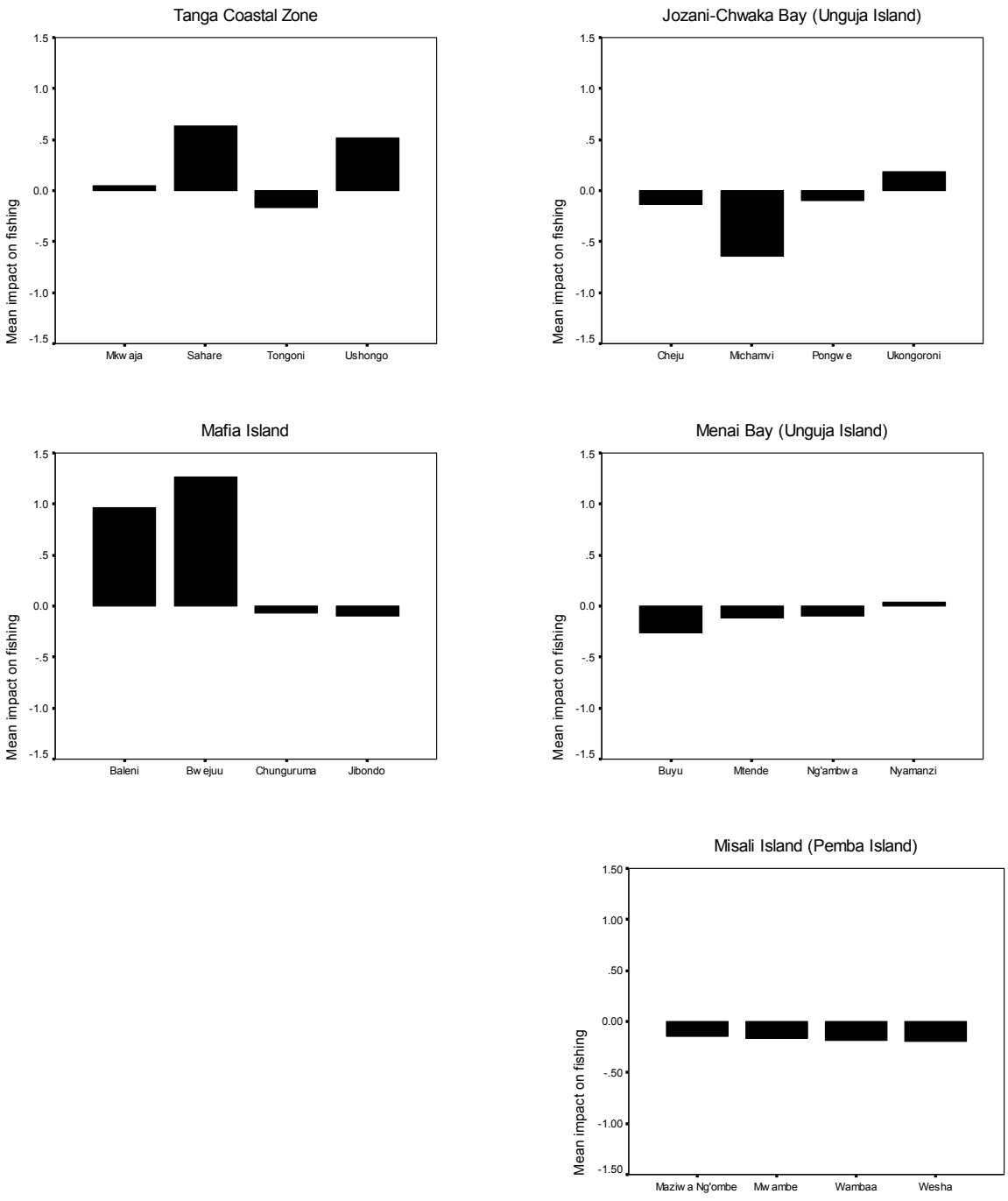


Figure 26. Mean impact of MPA on abundance of harvested fish

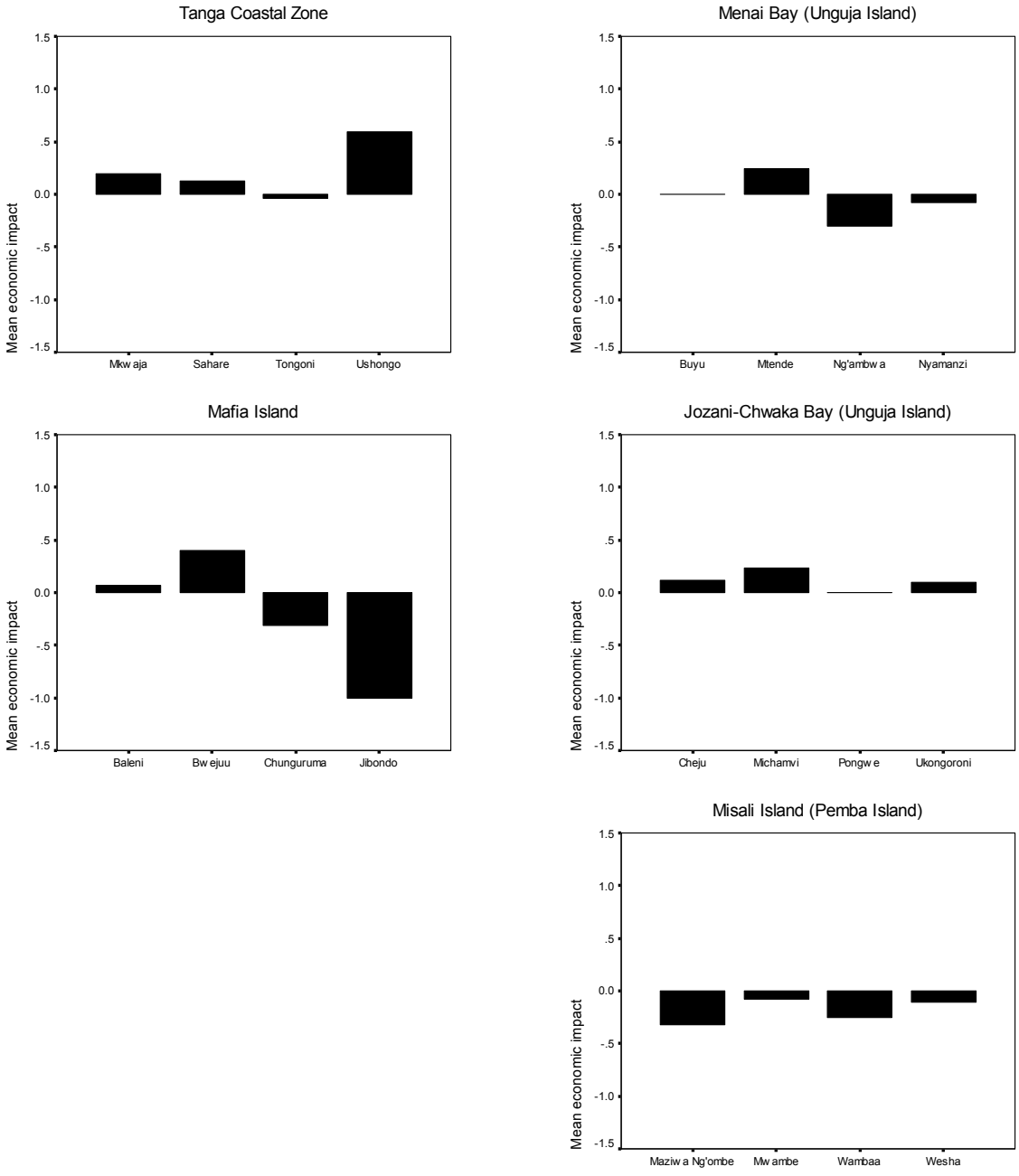


Figure 27. Mean economic impact of MPA

DISCUSSION

Productive activities

Most households surveyed (73%) depended on farming or fishing activities. This proportion, however, is lower than that reported for rural Tanzania (83%; NBS 2002).[5] The percentage of households that owned agricultural land was also lower for our study sites (59%) than in rural Tanzania (89%). This could be caused by the lack of suitable soils for farming that is characteristic of certain coastal areas (where coral rag may dominate the terrain), but at the same time could be reflecting the national declining trend in agricultural activity during the 1990s (NBS 2002). In any case, this lower dependence on agriculture emphasizes the critical importance of fishing activities for the livelihoods of many rural coastal residents.

Our study also found important gender differences in terms of productive activities. Female-headed households relied mostly on farming (52%), followed by petty trade (17%). In contrast, households headed by men were more evenly split between fishing (38%) and farming (36%) as their main economic activity. This is consistent with other observations on fishing and gender worldwide. Most women cannot fully participate in many fishing activities because they need to stay close to the house to care for children and perform household duties. However, in many parts of the world, women play a crucial role in trading and or processing the fish catch, which along with fishing and collection of sea products from shore (also known as gleaning) can supply them with important income or food sources. In our study, all women fishers harvested octopus.

Also, more female-headed households in our study were engaged in seaweed or algae farming. In 1989 people in Zanzibar began to farm seaweed of the genus *Eucheuma* (Richmond 1997). This genus is is particularly rich in algal carrageenan, a thickening agent used in various food and medicines, as well as beer, toothpaste and paints. In Zanzibar, seaweeds are farmed on the east coast, where the shallow lagoons with clear water provide suitable conditions, and the fringing reef prevents destructive wave action. The farming technique currently used in Zanzibar involves attaching small fragments of the algal stem to lines tied to wooden stakes hammered into the sand, with lines suspended about 20-40 cm above the sea bed. After harvesting, the algae is dried in the sun for a few days, then it is bagged and sold for its export to Europe where it is processed. Thus, seaweed farming not only important for bringing in foreign currency for the country and extra income to coastal households, but also because its one of the limited income-generating activities available to women, given its low investment requirements, and compatibility with women's household duties. Therefore, the regulation of this activity will have a disproportionate impact on the wellfare of coastal women. Also, one of our analyses found seaweed culture to be an important factor in determining household material lifestyle, an indirect measure of wellfare.

Nevertheless, excessive reliance on seaweed culture could be a source of vulnerability for coastal communities in the future, mainly because world prices for algae are outside the control of these coastal communities. The continued success of seaweed farming depends on continued foreign demand for the product and on the avoidance of disease. In Philippines, disease reduces the growth period to only half the year (Richmond 1997). Also, conflicts between algae farming and the tourism industry have also arised. Our recommendation is that coastal livelihoods dependent on algae farming should be carefully considered before committing and area to tourism developments.

[5] Comparing agriculture and fishing separately with the HBS 2000/01 results was not possible because in that survey farming/livestock activities were collapsed into one category with fishing.

MPAs and Social capital

Community groups and associations were common in the study villages: members of over 50% of households belonged to some group or association. The most common groups cited in surveyed households were such as Muslim groups, burial societies, and fisher's associations, are common in Tanzania.

Endowments of social capital exist in all the sites studied and the MPA initiatives have strengthened them to different degrees. Some of the groups promoted by MPAs involve both women and men. This is a notable difference from the traditional single-sex groups. Examples can be found in Ushongo village, where some of the seaweed production groups have both female and male members. Similarly the village of Cheju has a group called *hatuchoki* (literally meaning we never get tired) consisting of eleven male and female members, engaged in tree nursery activities.

Menai Bay, Jozani-Chwaka Bay and Mafia Island, the three MPAs that generated better local attitudes, also promoted group membership in environmental, savings and credit and fishers associations, respectively. This suggests that promoting social capital development, MPA initiatives can not only help cooperation between residents, but also improve their attitudes towards conservation.

Survey respondents in our study reported benefiting from groups by getting an income, savings and support. Among the most significant benefit that women mentioned was material assistance in forms of equipment, premises and credit as well as the ability to earn a reliable income and provide for household sustenance. One woman in Michamvi (Chwaka Bay) said they are now able "to assist their husbands in providing for their households". A women's octopus fishing group in Jibondo village (Mafia) has also been able to construct office premises with space for storing fishing gear.

Working together has also enabled some groups to save and invest in more efficient gear. For example, the Semeni (fishermen's) group of Baleni Village, Mafia District that has 6 (male) members has been able to purchase 30 fishing nets. The *Chama cha Wavuvi* group in Somanga village that has 26 members has been able to open a savings account. The group also has a system of helping each other during sickness or when a member loses gear while fishing, by assisting him to search for the gear or work with him until he is able to purchase new gear.

However, the degree of empowerment and trust achieved in the MPA-established groups is not clear. Many of the villages reported problems of nepotism. Even though the groups leaders are supposed to be democratically elected, it was felt that most members belong to the village elite and that the village chief (*sheha*) has a large say in who is involved in the committees. Also, many of the villagers who are not directly involved in the environmental groups suspect (correctly or incorrectly) that group members embezzle money from the project and that they participate because of self-interest.

Another issue that came up during interviews with the private sector was that the capacity among villagers to form marketing or other forms of business groups is low. They maintained that in order for such groups to function, one does not only need dedicated people, but also accounting, marketing, and other basic business skills.

MPAs and Vulnerability

An advantage of near shore fisheries compared to other resource dependent activities, is the diversity of exploitation options (species or reef habitats) available. This helps to buffer the effects of local depletions, seasonal unavailability or seasonal lows in market demand of a single species (Whittingham et al., 2003).

However, according to Jiddawi and Ohman (2001), most fisheries in Tanzania are showing signs of overexploitation. Indeed, most target species of the eight fisher groups identified in this study have significantly declined in recent years due to overexploitation (TCMP, 2001). The catch of *dagaa* by the boats of the Zanzibar Fisheries Corporation declined from 600 tons in 1986 to 91 tons in 1997 (TCMP, 2001). Trade in shark fins has also declined and some shark species are now rarely seen in Tanzanian waters. Sharks and rays require many years to reach breeding maturity and only produce a small number offspring each year. They are therefore very susceptible to over-fishing and local populations may never recover.

Sea shells are overexploited along the whole coast and the export of sea cucumbers has declined. The stocks of the highly valued sea cucumber species have been overexploited and the most abundant species are lower valued species (Jiddawi and Ohman 2002). In addition, the average size of lobster harvested in Tanzania has decreased compared to about to about two to three decades, the supply of lobster has fallen by 33% since 1988, and the export of lobsters from Zanzibar has declined form 23 t in 1993 to 0.7 t in 1997. A recent study by Guard and Mgaya (2002) suggests that octopi are overfished in Tanga and Mtwara. In Pemba, octopus collecting was traditionally conducted on foot. Now fishers use masks to catch octopus from deeper waters indicating that shallow, intertidal fishing grounds have been over-exploited (TCMP 2003).

The collection of lobsters is restricted to coral reef areas. Those who harvest these crustaceans are continuously searching for new fishing grounds indicating that fished areas are being depleted (TCMP 2001). Similarly, reef fishes live in close association with structural features of the bottom. Thus, habitat degradation (most notably through dynamite fishing) can have important long term effects on the standing stock of fish and lobster.

In general, poverty, and lack of fishing gear are viewed by surveyed villagers as limiting factors to marine conservation efforts. They force people into using destructive practices. During focus groups, each of the 24 study villages mentioned continued practice of destructive fishing – either by local people or visiting fishers. Even though they understand this is a threat to their resource base, they stated their inability to stop this practice. In addition, most communities complained of increasing resource competition, either due to the increased population of fishers, or caused by visiting fishers.

Thus, poverty constitutes a major challenge for MPAs to achieve their nature conservation goals. The fisher groups that we have characterized as *foot*, *beach*, and *shallow pelagics* appear to be the poorest of fishers, since they scored significantly lower than other fishers in simple correlations with material lifestyle indices. Many of these fishers do not have access to a boat, however, they can operate given the accesibility of reef areas from shore. In this way, reefs offer a haven for many poor residents with no economic alternatives. These fisher households would be disproportionately affected by coastal developments (including tourism) or MPA policies that restrict their access to them. Also, the fact that many fishers are very dependent on reefs also means that no take zones (often imposed as part of MPA policies) puts them at immediate risk. Because they are so restricted in their work to the areal extent of the reef, they are more

vulnerable by these types of policies than, for example, fishers of pelagic species (because those fish move about).

MPAs are in a unique position to stop the downward spiral of coastal resource degradation currently underway in Tanzania and other developing countries. However, they must learn from and adapt to the context where they operate in order to be effective. In developing countries, a major challenge of these efforts is to gain acceptance by villagers. This study highlights the importance of including income generating activities into this type of conservations programs, as well as provide adequate project information to the communities they affect.

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Appendix 1. Key Informants Interviewed

Tanga

Andrew Mhina, TCCIA
Salim Ali Choba PPDC
Christoper Kontonasy SEAPROD ltd.
Eric Allard, SEAPROD Ltd.
John Craig, SEEGAAD Seaweed company
Lugazo Zuberi SEEGAAD Seaweed company
Frida Urio, SEEGAAD Seaweed company
Mussa Dengo, District Natural Resources Officer, Tanga, Municipality

Mafia Island

Jason Reuben, WWF Technical Adviser, Mafia Island Marine Park
Catharine Muir, Mafia Island Turtle and Dugong Conservation Program and Wildlife Conservation Society project leader on Tanzania sea turtle and dugong survey
Mr. Kipanga, Fisheries Officer, Mafia Island Marine Park
Mr. George Msumi, Warden, Mafia Island Marine Park
Mr. G.S.A. Melele, Head of Community Conservation Unit, Mafia Island Marine Park
Thomas Chale, Community Conservation Unit, Mafia Island Marine Park

Kilwa

Mr. Mhando Harord Senyagwa, District Executive Secretary (DED)
Mr. A. N. L. Chipa, District Natural Resources Officer
Mr. Gabriel J. Sanga, District Planning Officer
Mr. D. M. Masasi, District Fisheries Officer
Mr. Ahmed Ally, Fisher's representative
Mr. Simon Kipeyah, Hotel Manager, Kilwa Ruins Hotel
Mr. Shewesi Mjaka, Owner, Mjaka hotels & Guest Houses
Mr. Mohamed S. Saidi, Fishery Businessman
Mr. Ido Ben, Bahari Star Lobster Company
Ms. Mwanahamisi, Bahari Star Lobster Company
Mr. Juma Abdallah, Pemba Oceanic Lobster Company

Zanzibar

Mrs Asha Khalfan, Zanzibar Fund for Self Reliance
Mr Gerunimo Apas, C-WEED Cooperation- Zanzibar

Chumbe

Ms. Sibylle Reidmiller, Chumbe Island Coral Park Ltd.
Ms. Eleanor, Chumbe Island Coral Park Ltd.

Mnemba

Mr. Geoff, Mnemba Island Conservation Area

Menai Bay

Mr. Anas Masoud Othman, Project Manager, Menai Bay Conservation Area
Mr. Khamis Shaaban, Adventure Afloat, Zanzibar

Jozani-Chwaka Bay

Mr. Thabit Thinan Massoud, CARE-Zanzibar Area Coordinator

Misali

Mr. Amour Bakar: Assistant CARE-Area Coordinator, Pemba
Mr. Mbarouk Salim: Head of Conservation Section, Department of Cash Crops, Fruits and Forestry (DCCFF), Pemba
Mr. Said Juma, Chief officer (DCCFF), Pemba
Mr. Ali Khamis Thani, Coordinator of Islamic Ethics within Misali Conservation Project
Mr. Salum Khamis, Ecotourism officer, MICA
Mr. Mussa Hamad. Director, Department of Fisheries, Pemba
Mr. Omar Makame, Planning officer, Department of Fisheries, Pemba
Mr. Stu Catling