Tanzania Coastal Management Partnership

TANZANIA

State of the Coast 2001

People and the Environment

A joint initiative between the National Environment Management Council, The University of Rhode Island's Coastal Resources Center, and the United States Agency for International Development

Tanzania State of the Coast 2001: People and the Environment

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TANZANIA STATE OF THE COAST 2001: PEOPLE AND THE ENVIRONMENT

Tanzania Coastal Management Partnership
Science and Technical Working Group

Working Document 5059 TCMP

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FOREWORD

It is with great pleasure that I introduce this first ever Tanzania State of the Coast Environment report which reflects on the condition of our coastal and marine endowment as well as the achievements of the past in conservation and sustainable use of coastal and marine areas and resources.

This report highlights the importance of coast for Tanzania society and the natural systems they support. Our coast contains some of the most biologically productive habitat that is home to a quarter of our population, houses three-quarters of our industrial segment of the economy, contributes about one third of the national gross domestic product not forgetting Dar es Salaam our largest urban centre. The coast attracts human populations because it is a focal point for economic growth and human development.

The socio-economic and ecological importance of the coastal zone is virtually unparalleled. This strip of land and water supports a diversity of natural systems, including coral reefs, beaches, estuaries, seagrass beds and mangrove forests. Coastal villages and urban areas rely on these coastal resources for their livelihood and quality of life. The value of coastal resources is much greater than that represented by fish catch, maritime commerce, tourism, industry and other economic activities. There are myriad ecological services and activities whose values are not easily quantifiable such as storm surge protection, water filtration, fisheries nursery, scenic and cultural amenities, waste discharge and dispersal, industrial and power plant cooling, to name but a few.

Being important economically, socially and biophysically, the coastal area is indeed a national asset that requires special attention. Our coastal resources are under increasing pressure from the populace that depend on them for food and income. The state of the coast environment is consequently of paramount interest to the Government of Tanzania. It is of utmost importance that we apply the best information and scientific knowledge available onto recommendations on how can we best utilize and manage our coastal resources in an equitable and sustainable manner. This report is a major contribution to this body of information and is an invaluable addition to the issue of sustainable use of our coastal resources, public awareness, informed decisions, and meaningful policies and strategies.

I take this opportunity to thank all those who made this document possible, including the United States Agency for International Development, the Tanzania Coastal Management Partnership, and the Coastal Resources Center of the University of Rhode Island. I congratulate the National Environment Management Council for its leadership in supporting this effort.

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The Tanzania Coastal Management Partnership (TCMP) appreciates the expertise and tireless efforts of the members of the Science and Technical Working Group for producing this important report. At the time of preparation, the Chairperson of the Working Group was the late Professor Adelaida Semesi. Members of the Working Group include:

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The contribution of many individuals who assisted in the preparation of this report, including the graduate students involved in the collection of field survey information and data analysis is greatly appreciated. They include Flora Akwilapo, Justin Bamanyisa, Eddy Epoda, Sanga Ignantio, Mohammed Kombo, Baraka Lamek, Mbije Nsajigwa, Mohamed Nur, and Saleh Yahya. The assistance of Matt Richmond in the production of this report is very much appreciated. TCMP would also like to express sincere gratitude to those coastal communities in Tanzania that participated in the state of the coast field survey.

We are also very grateful for partner agencies that provided assistance, advice and support, including the World Wide Fund for Nature (WWF-Tanzania), District Council offices, and the United Nations Environment Programme.

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Executive Summary

This document provides an overview of the human and environmental condition of the coast of Tanzania that is so critical to future social and economic development. On the environmental side, information is presented on coral reefs, mangrove ecosystems, marine fisheries, other marine living resources, water quality, and coastal erosion. The human resource aspect is organised by the topics of demographics, economics, infrastructure, health, education, gender equality, and community organisation. The many ways that the human and environmental dimensions of the coast are interwoven are highlighted. This State of the Coast report is the first for Tanzania and is intended to build awareness of the importance and key characteristics of the coast, provide a baseline of coastal condition and change, and lay the groundwork for future assessments of coastal condition.

The results show achievements of the past and challenges for the future. Mangrove forests have been fully inventoried, zoned and a management plan is operational. Many marine reserves, protected areas and coastal management efforts have been established in the last decade. National guidance for sustainable development of coastal aquaculture has been adopted. A national Coastal Strategy has been prepared. National awareness regarding all aspects of the coastal and marine environment has significantly improved in the past decade. These are some examples of significant achievements and are reasons why Tanzania is a leader in East Africa in coastal management.

Priorities that need urgent attention are identified in order to maintain and upgrade the critical marine habitats and the resource potential of the coastal zone. Much of the degradation of the inshore marine environment has been caused by destructive fishing methods and overfishing. The inshore fishery of Tanzania shows signs of over-exploitation and in the vicinity of high population areas shallow reefs are highly degraded.

The demand for fishery resources has been gradually increasing with the increase in population and tourism growth. This has caused an increase in fishing pressure and the use of gear and techniques that are destructive and cause damage to reefs. Degraded coral reef evidence is particularly prevalent in the shallower depths of 1-10 m, especially in the vicinity of urban centres like Tanga, Dar es Salaam and Mtwara, where shallow reefs are almost completely destroyed. Most of the destructive methods are illegal, and continue to be used due to lack of surveillance, enforcement and public awareness. The common destructive methods are the use of dynamite fishing, drag nets (*juya la kigumi*), fine-meshed fishing nets, spearguns, beach seine and poison.

Actions to address the declining trend in fisheries and coral reef condition proposed and envisaged include vigorous education and extension, the elimination of extraction of live coral for construction, monitoring and law enforcement, fisheries stock assessment, and promotion of alternative income generating opportunities to take pressure off the fragile near shore environment.

Management efforts, awareness and management of Tanzania mangrove ecosystems have improved significantly. However, the human pressures on mangrove forests require continued attention. Major pressures include demand for timber, fuelwood, production of charcoal, building poles, conversion of forest areas for urban development, salt production, and other land uses. Over-exploitation threatens some forests near urban centres where these pressures are high—such as Maruhubi in Zanzibar and Kunduchi in Dar es Salaam.

In addition to mangroves, coral reefs and fisheries, there are several other important marine resources in Tanzania coastal waters. These include plankton, seaweeds, seagrasses, marine turtles, marine mammals and coastal birds. These living resources play a major role in the health and functioning of coastal and marine ecosystems, artisanal fisheries, and the economies of coastal people. The most frequent cause of pressure on other marine resources that are currently exploited—such as shells, sea cucumbers, marine turtles, and dugongs, is over harvesting. The nesting populations of turtles have been declining rapidly due to incidental fish catch, hunting, and loss of nesting beaches. The alarming decline in sea turtle population may continue to extinction unless measures are taken to stop the trend and protect them.

Management options to ensure the diversity and condition of marine living resources in Tanzania include prohibition of commercial trade on marine turtle shells; public education for awareness and outreach on the importance of lessening threats to marine living resources; protection of critical habitats such as turtle breeding grounds; and enforcement of harvest limitations and prohibitions. In some cases, actions such as these can provide positive results in a short period of time. For example, the capture, slaughter and sale of marine turtle products decreased noticeably in Zanzibar following a successful outreach campaign during the 1990's. Marine turtles are now regularly seen around coral reefs off Zanzibar.

In urban areas, untreated municipal and industrial waste threaten the quality of coastal waters. Outside urban areas, sedimentation is the greatest concern in terms of water quality and marine life. Sediment is carried by rivers as a result of natural events such as heavy rains in upland areas, poor agricultural practices upstream are considered to be the leading cause of growing levels of sedimentation. National waste management policy that holistically addresses the waste problem is an essential prerequisite for effective coastal water quality management in the country.

Shoreline changes—erosion or accretion are known to be widespread, and in specific locations are severe, but a full assessment of the problem and priorities for control measures have not been undertaken. In some specific locations, erosion is known to be severe. For example, significant erosion over the last few decades has resulted in the loss of several buildings at Africana Beach Hotel and homes at Kunduchi beach area in Dar es Salaam where the beach is retreating at the rate of 4 meters per year. In locations such as these, the loss of land and coastal properties is a major threat to coastal communities, investment, and economic sectors such as tourism and industry.

This State of the Coast report highlights the linkages between socioeconomic wellbeing and the environment. Most rural coastal communities depend on nearby water and land to generate income and provide food. A decline in coastal ecosystem productivity has a direct negative impact on coastal communities. Hence, protecting environmental resources that people depend on for income generation and their very livelihood is critical to the survival of coastal families, poverty reduction and slowing down rural-urban migration.

Efforts to improve stewardship of coastal ecosystem productivity are undermined by deep-rooted human pressures on the environment—pressures that are related to the quality of life and welfare of people in coastal communities. The assessment of the condition of the human environment in coastal Tanzania shows that a large percentage of the population lives at very low levels of welfare. The level of

per capita income, health, nutrition, access to safe water, education, and basic infrastructure is very low, especially in rural areas. Some coastal regions are ranked among the most deprived in the nation in income, food security, health and education. Lack of communication and transportation infrastructure in coastal communities and lack of livelihood opportunities are reasons for a significant pattern of rural-urban migration, particularly to the city of Dar es Salaam.

The ability to alter unsustainable resource use patterns that damage the coastal and marine environment ultimately requires creating alternative livelihood opportunities, increasing income and food security and raising education levels. Achieving this, in turn, requires fundamental enabling conditions for human development—workable systems of credit, reliable roads and other transport, electrical power, and telecommunications.

These underlying challenges to human development in poor coastal villages and urban centres will surely not be resolved tomorrow. But most of the villages surveyed in this study perceived that at least some of the trends in key indicators of social welfare are improving. It is encouraging that there are a growing number of community organisations, village committees, and NGO's that can provide the foundation for resource management at a local level scale. Another positive trend is the increasing role of women in income generation, contributing to household expenditure, and community decisions. All of these trends should be closely monitored in the future to track progress and provide the information needed for effective coastal management and sustainable coastal development.

INTRODUCTION

This report provides an up-to-date overview of the status and trends in the condition and use of Tanzania's coastal resources and quality of life in coastal communities. It is based on best available scientific information and local knowledge that has the goal of helping government agencies, donors and practitioners involved in coastal planning and management to develop and promote sustainable coastal development strategies and programmes of action.

The preparation of this report builds on workshops, consultations, literature review, and field surveys carried out by the Science and Technical Working Group. It also builds on the findings of other TCMP working groups and special teams. It's creation began in 1999 when the Science and Technical Working Group initiated a systematic and comprehensive survey of the literature on priority coastal topics.

Following this in-depth literature survey, rapid rural appraisal methods for collecting first-hand information from the field were developed. Worksheets for collecting information on key characteristics of coastal ecosystems and the wellbeing of coastal people were formulated, field tested, and then completed in one village in every coastal District of mainland Tanzania and administrative unit of Pemba and Unguja, Zanzibar—for a total of 18 coastal villages. The survey was surely a small sampling of villages out of hundreds in Tanzania coastal areas, and therefore the findings may not necessarily be representative of the rest of the coast. However, by touching down on specific coastal villages in every district, important insight into the condition and problems facing coastal communities was obtained.

The worksheets are structured around the themes of condition, trends, and threats for both natural and human components of the coast. The specific indicators contained in the field worksheets represent core and essential information for participatory baseline surveys and monitoring of the status, trends and threats to human and environmental condition of Tanzania coast. To complete the worksheets, village meetings were organised with District officers, village leaders and focus groups—a fishermen focus group and a mixed focus group of men and women.

The worksheets can be used in future surveys of the state of the coast and will be used by the Tanzania Coastal Management Partnership in facilitation of District action plan for planning integrated coastal management.

This report is complete in support of national coastal management in Tanzania. The need for better information for decision-making is identified as a priority issue in the draft Tanzania Coastal Strategy. Reliable information is needed to identify geographic areas of concern and prepare special area management plans, set District conservation and restoration priorities, and promote sustainable approaches to siting and development of the coast to minimise negative impacts.

The Strategy recommends the Science and Technical Working Group be formally established as an advisory body of the National Environment Management Council and its proposed Integrated Coastal Management Office. The mandate of this group as indicated in the draft Strategy is to:

- Use best scientific information available to relate status and trends to human causes and consequences
- Promote information access and data sharing by employing a range of communication and dissemination strategies
- Strengthen and improve coordination of coastal monitoring and assessment efforts
- Increase the base of knowledge for coastal management through studies and investigation, sampling, resource inventories, and monitoring

Field Survey Sites

Field Survey, February-March 2001

Region	District	Village
Tanga	1. Muheza	Kicharikani
	2. Tanga	Tongoni
	3. Pangani	Kipumbwi
Coast	4. Bagamoyo	Kondo
	5. Mkuranga	Kisiju
	6. Rufiji	Myamisati
	7. Mafia	Chunguruma
D'Salaam	8. Kinondoni	Kunduchi Beach
	9. Ilala	Ferry fish landing site
	10. Temeke	Mjimwema
Lindi	11. Kilwa	Somanga Mbuyuni
	12. Lindi	Mchinga Mbili
Mtwara	13. Mtwara	Msangamkuu
Zanzibar	14. West	Fumba
	15. North	Nungwi
	16. South	Kizimkazi Dimbani
Pemba	17. Mkoani	Mbuyuni
	18. Wete	Kojani

Focus group discussion with villagers, Zanzibar

COASTAL ENVIRONMENT

CORAL REEFS

Coral reefs off Stone Town, Zanzibar

Coral reefs are one of the most diverse and productive marine ecosystems on earth. They develop only in tropical, shallow areas with clear waters and support a very high diversity of plant and animal species. Locally, '*matumbawe*' refers to corals and '*miamba ya baharini*' refers to coral reefs. Hundreds of species of hard corals form colonies that make up the main structures of coral reefs and numerous coralline algae contribute as a cementing element. In addition, there are thousands of species of other organisms associated with coral reefs including sponges, soft corals, crustaceans, molluscs, echinoderms, fish and several other groups of animals as well as algae and seagrasses. The productivity of coral reefs is particularly prominent because of the high retention of nutrients due to efficient biological recycling. This is partly achieved through the great diversity of species and the microhabitats they occupy. Some animals, which typically live in other coastal habitats such as the open sea, mangrove forests and seagrass beds are associated with coral reefs only during certain life phases or activities (e.g. reproduction, nursery or feeding). Thus the importance and influence of coral reefs extends over a much broader geographical area.

Indicators-Coral Reefs

- Area of damaged reef
- Proportion of hard coral cover that is alive
- Diversity of coral form and coral invertebrates
- Abundance of sea urchins and fish

DISTRIBUTION AND AREA

Coral reefs are found on about one third of the coastline of Tanzania. Most of these are comprised of fringing and patch reefs, restricted to a narrow strip (usually 1 to 3 km wide) along the coast. The islands of Unguja, Pemba and Mafia, as well as numerous small islands along the coast, are for the most part surrounded by fringing reefs. In areas around river mouths, an absence of a firm seabed and excessive freshwater and sediment discharge prevent the development of coral reefs. The areas of greatest concentration of coral reefs are Tanga, Pemba, Unguja, Mafia, the Songo Songo archipelago and Mtwara.

IMPORTANCE OF CORAL REEFS

Coral reefs have a number of ecological and economic values. The most obvious ones are associated with extractive activities such as fishing, shell and other invertebrate collection as well as tourism. These natural resources provide coastal people with both a source of income and a source of protein. The provision of a barrier against wave action, and the potential as a source of medical compounds to fight diseases are important, but more difficult to quantify. Another use of corals, which brings serious negative impacts on

the reefs, is the mining of live corals to produce lime for building.

Fisheries Coral reefs serve as breeding, nursery and feeding grounds for many marine animals, including over 500 species of commercially important fish. Other animals that are dependent on coral reefs include lobsters, octopuses, bivalves, gastropods, and sea cucumbers, all of which are important in artisanal fisheries, with some contributing to the export earnings of the country. Coral reefs support 70% of artisanal fish production in Tanzania (Ngoile and Horrill, 1993). Some of the more common species caught are the parrotfish (pono), emperors (changu), groupers (chewa) and goatfish (mkundaji).

Tourism Coastal tourism is becoming increasingly important to Tanzania. Currently development of this sector is most prominent on the islands of Unguja, Pemba and Mafia, though there is also expansion in Dar es Salaam, Tanga, Bagamoyo and at a few other sites along the coast. The beaches, seafood and aquatic features such as coral reefs, attract visitors to the coast. For example, about 20% of the tourists who visit Zanzibar annually are specifically attracted by its SCUBA diving and snorkelling suitability. Since almost all diving and snorkelling is done around coral reefs, this makes reefs a very important for other tourist attraction activities that bring foreign currency into the country and provide a livelihood for coastal people.

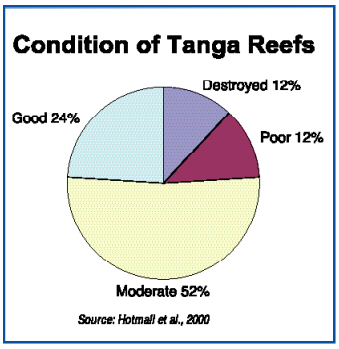
Coastal protection Coral reefs are mostly situated along the exposed areas of the coastline. In these areas the reefs serve as important barriers to wave action, thereby helping reduce the severity of coastal erosion.

Reefs identified in the village surveys that are preferred fishing areas and important fish nursery sites

- Wamba reef (Muheza)
- Yazinga, Dambwe and Maziwe reefs (Pangani)
- All the reefs of Tanga municipality
- All 15 reefs, including important nursery reefs of Tua, Tugawe, Kikuyuvi, Kitintali, Kitibue and Kinduki (Mafia)
- Fungu Yasini and Karage reef (Kinondoni)
- Dege reef (Temeke)
- Keme, Bwejuu, Alubamani, Tua, Tugawe, Kikuyuvi, Kitintali, Kitibue and Kinduki reefs (Rufiji)
- Banda, Chokaa, Zuweji, Banyani, Mwembe Usi, Semaya, Mchanemuovu, Silima, Totoma and Selemani reefs (Kilwa)
- Jome, Lipadeni, Maloo, Nachunjwe, Tomungu, Mongolo and Kele reefs (Lindi)
- Chumbie, Kigongo, Mvenuro, Mchopa, Songa, Viuru, Demo, Nusura, Namwend, Nzara, Nanundu, Naulumba, Nwale, Suweti and Ngandi reefs (Mtwara)
- Kwale and Pungume reefs (Unguja West)
- Kipisani, Musemba and Nungwi reefs (Unguja North)
- Pungume and Mtende reefs (Unguja South)
- Wamba and Misali reefs (Pemba)
- Malilini, Kiongweni, Mchanga and Mkuu reefs (Pemba)

STATUS AND TRENDS

The coral reefs in Tanzania are generally in reasonable condition. There are large, nearly pristine areas with high coral species diversity



(about 127 species from 13 families), areas with coral reefs in good or moderate condition and a number of smaller heavily degraded areas. Pristine areas are predominantly in the least accessible stretches of coast and the deeper zones of reefs. Conversely, degraded coral reef environments are particularly prevalent in the shallower depths of 1-10 m, especially in the vicinity of urban centres like Tanga, Dar es Salaam and Mtwara, where shallow reefs are almost completely destroyed.

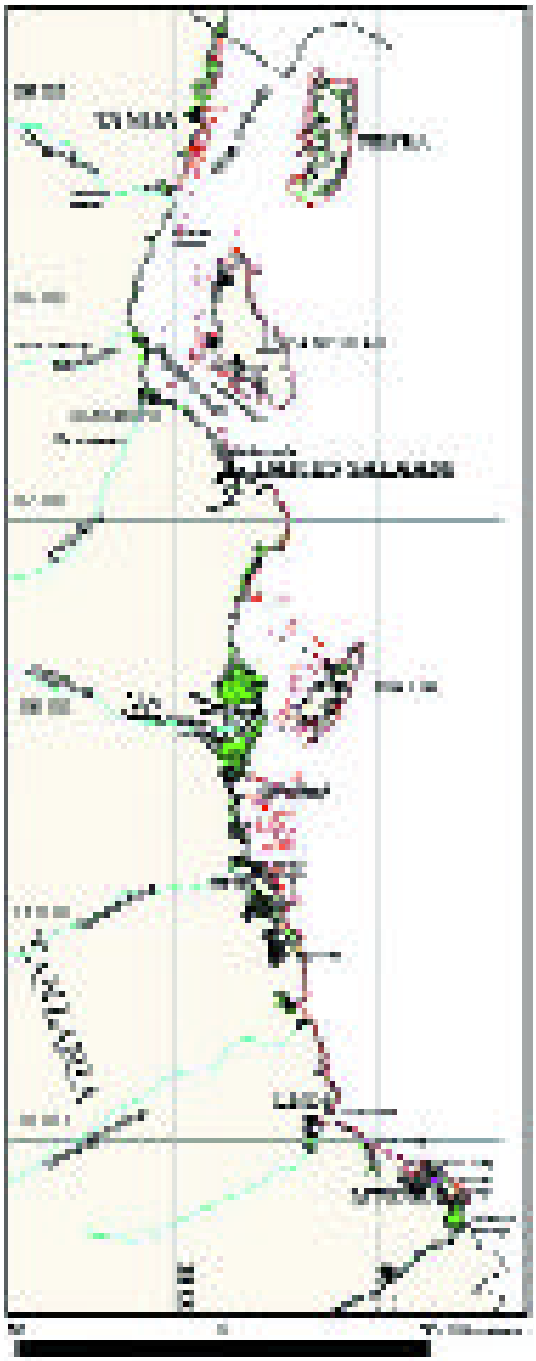
CONDITION OF CORAL REEFS OF TANZANIA

DISTRICT	REEF CONDITION
Tanga	The reefs have been extensively damaged by human impacts with 12% completely destroyed, 12% in poor condition, 52% in moderate condition and 24% in good condition (Horrill et al., 2000). Most of the damaged reefs are adjacent to areas of high population density. Damage to reefs north of the Pangani River is attributed to dynamite fishing (Horrill, 1997).
Dar es Salaam	Hard coral cover ranges from 35-81% on fringing reefs at two sites each at Mbudya and Bongoyo Islands and at one site at Pangavini Island (Kamukuru, 1997). On Mbudya Island 40-60% of hard coral cover was reported dead in 1999, largely due to coral bleaching, with a substantial area (15-40%) without coral at all, attributed to dynamite fishing and wave action (Ngowo, 1999).
Unguja Island Hard coral cover	Zanzibar: ranged from 11-14% at Mnemba Island on the northeast coast to 53% at Bawe Island off Zanzibar Town (Muhando, 1999). The highest live coral cover around Unguja Island is found on the reefs near Zanzibar Town. Reefs on the southwest side of Unguja, near Menai Bay, generally have lower live coral cover (12-29%), which can be attributed to the rampant use of destructive fishing methods, except for Pungume Island where it reaches 88% (Horrill et al., 2000).
Along the western	Pemba Island coast coral reef, there is 21-60% coral cover. The eastern fringing reef has about 15% coral cover due to its exposure to strong wave action. The highest live coral cover is found in Misali Island on the western side of Pemba, attaining 75% on the northern side and 53% on the eastern side of the island (Horrill et al., 2000). Misali has high taxonomic diversity (40 coral genera). There has been some damage to the reefs from dynamite fishing and dragging seine nets.
On the eastern fringing reef hard	Mafia Archipelago coral cover is diverse with good coral cover to 25-30 m. Two large, sheltered, shallow (less than 10 m) bays of Mafia Island, Chole and Jujima, have extensive growth of corals (Darwall et al., 2000).
Songo Songo Archipelago, Lindi, Kilwa and Mtwara	All coral reefs throughout the Songo Songo Archipelago and most reefs in Lindi and Mtwara are extensively damaged above a depth of 10 m, primarily by dynamite fishing, though below that level, the reefs are prolific with coral growth and abundant with fish (Guard and Masaiganah, 1997). Mpovi and Amani reefs near Kilwa Kivinje, previously very productive (Hasset, 1983) now have large areas of rubble, poor coral cover and low abundance and diversity of fish (Hanaphy and Muller, 1997). The reefs with the least degradation are those which are adjacent to deeper waters such as Poiasi and Pwajuu patch reefs and the outer fringing reef which has dense coral growth to 30 m. The northwestern reefs in the Songo Songo Archipelago have low coral diversity due to high sedimentation from the Mohoro River. In a survey of 13 patch reefs average hard coral cover ranged from 25-55% and the average proportion of hard coral that was alive generally ranged from 70% to 95% (Darwall et al., 1996a, b, c, d).

Lime making, Mikindani - Mtwara

Mangrove replanting, Tanga

Coral Reef (red) and Mangrove (green) areas



THREATS TO CORAL REEFS

The greatest source of stress on coral reefs is related to **destructive fishing practices**. By far the most destructive type of fishing is the use of **dynamite**. This has been practised 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 within a radius of several meters. There are also indirect impacts due to turbidity and sedimentation generated by dynamite blasts, which adversely affect marine life in a much wider area. Some of the fishermen who use dynamite originate from Dar es Salaam and travel to coral reef areas further away (e.g. Kilwa/Songo Songo reefs), while in other areas, such as Lindi and Mtwara, dynamite fishing is done by local fishermen, usually the youth.

With numerous blasts occurring daily on reefs all over the country, over a period of many years, the overall effect of dynamite fishing on coral reefs in Tanzania has been devastating. Damaged reefs can take many decades to recover and some, in fact, may never recover.

It is uncertain whether the practice will be completely eliminated without having a permanent armed patrol of the coast. A recent survey in Tanga region has shown that dynamite fishing was responsible for the damage beyond recovery of 10% of coral reefs in the region and 70% showed significant damage but could recover if protected. Only the remaining 20% of coral reefs were in good condition (Makoloweka et al., 1997). The impacts of dynamite fishing on coral reefs in Dar es Salaam, Songo Songo and Mtwara regions are probably similar to that in Tanga.

In 1997, the number of persons prosecuted for dynamite fishing along the entire coast was 601. This was expected to fall in 1998 as the Fisheries Division, with the cooperation of the Navy, launched a nation wide campaign in March and April 1998 to stem the practice. In June 1998 it was reported that in Tanga, Lindi and Mtwara regions dynamite fishing had stopped. Now there are reports that the practice is on the rise again

The use of **seine nets** to capture fish on the bottom and around reefs is almost as destructive as the use of dynamite. These nets, locally called *kigumi* or *kavogo* are used as beach seines on the reef flat or are pulled around coral reefs. Their use is destructive for three main reasons. Firstly, when used around coral reefs, fishermen often smash coral colonies in order to scare the fish out of hiding. Secondly, dragging them over the reef flat as beach seines unavoidably damages coral and other marine life. Thirdly, 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, disruption of food webs, and disturbance of the natural equilibrium of reef ecosystems.

Village perceptions
Villagers reported that over the last ten years the coral reef ecosystem condition was decreasing.

"We are grateful to the government action - dynamite fishing has stopped here and we now can get sardines" Fishers at Msimbati village , Mtwara

"The village communities are taking full responsibility for monitoring dynamite fishing. We have given them power and they are making sure dynamite fishing does not resurface again" Mrs. Fatuma Mikidadi, DC Mtwara.

Destructive practices also include **extraction of living coral** for use in building and in conversion into lime for cement. 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. This highly destructive activity is, in some areas, actively encouraged and considered to be a legitimate alternative income generating

activity. It is prevalent in Lindi and Mtwara regions and in Dar es Salaam. At one site in the south of the country, it was estimated that some 2,000 tonnes of coral are mined per year. The damage to shallow inshore reefs in such a case is immense. Other less harmful activities related to fishing include damage from anchors, the use of poisons and boat grounding.

There are other human-caused impacts on coral reefs. Humans cause many types of pollution due to industrial and domestic discharge. Other pollution sources include agro-chemical pollutants and sedimentation brought about by deforestation, poor agricultural practices and construction activities. All these pollutants can be detrimental to the health of corals when carried by seawater to the reefs.

Uncontrolled tourism activities too may adversely affect the reef, directly through damage to corals by careless SCUBA divers, snorkelling and anchoring damage, and indirectly through increased pressure on the reefs for food, curios and construction materials.
The consequences of human-caused degradation of reefs are a marked decrease in the diversity and abundance of fish, habitat loss, reduction in breeding and feeding grounds for fish and other organisms, and decline in the aesthetic value of reefs which reduces their attractiveness to tourists. The end result is a decline in income to coastal communities and to the country as a whole.

Badly damaged reefs identified in the village surveys

- Nyuli, Mwambanyama and Wamba reefs (Muheza)
- Karange and Jahazi reefs (Tanga municipality)
- Mjimile ndogo reef (Pangani)
- Mbudya to Fungu Yasini and Mkadya (Kinondoni)
- Kuhuri, Sinda reef (Temeke)
- Lukumbi, Nondo, Jiwe la Selemani, Nahumbu (Lindi)
- Kwale Pungume (Unguja West)
- All reefs of Unguja North
- Karage, Misamba Uzi reefs (Unguja South)
- Kojani Island reefs (Pemba Wete)

Natural impacts on coral reefs include storms, **crown-of-thorns starfish** and coral bleaching. Small outbreaks of the coral-feeding crown-of-thorns starfish have occurred in Tanzania over the last 30 years, resulting in severe localised damage to reefs. Infestations of crown-of-thorns starfish are partly attributed to the reduction in major predators (mostly fish and some large molluscs). Between March-September 1998 a significant **coral bleaching** event was documented in Tanzania. This was caused by higher than normal seawater temperatures and increased rainfall (lower salinity). The event was reported in all parts of the coast with 15 to 100% of hard corals showing damage (Wilkinson, 1998). Bleaching was worse in shallow waters than in deeper waters. In Zanzibar, more than 60% of hard corals showed signs of bleaching, while some species were seemingly unaffected. Some dive operators reported a decline in tourist potential due to the bleaching event.

Village perceptions
The major Threates to ***coral reefs*** *were identified as:*

- *Overfishing*
- *Use of seine nets*
- *Crown-of-thorn*
- *Starfish infesta-*

MANAGEMENT OPTIONS

Control and Surveillance. Control of various types of pollution, the elimination of destructive and excessive fishing practices, proper management of tourism, and the elimination of extraction of live coral for construction are some of the measures that must be seriously taken for the protection of coral reefs in Tanzania. Strategies to confront the problem of dynamite fishing should encompass a wide range of actions, such as patrolling, police enforcement, improved

legislation, increased fines, confiscation of vessels, jail sentences and education and outreach of local communities.

For severely degraded reefs, **restoration** is required in order to accelerate and ensure recovery of degraded coral reefs. The removal of sediments and rubble is one simple method of intervention. Another method is the transplantation of coral fragments, whereby fragments are broken from healthy colonies and attached to a suitable substrate using cement or glue. Artificial substrates or reef structures can serve as fish sheltering devices and can also enhance coral larval settlement. Coral reef restoration work ideally involves local fishermen and may be combined with ecotourism, whereby members of the communities receive payment from tourists for guided tours to coral reef and mangrove ecosystems while they carry on the restoration activities.

MANGROVE ECOSYSTEMS

Mangroves are salt tolerant forest or swamp ecosystems that occur along tropical and subtropical coastlines, usually in sheltered bays, often around river mouths. These forests are comprised of several species of trees, some of which reach over 25 m in height, usually rooted in mud. Through the action of the roots these forests trap land-based debris, sediments and suspended particulate matter carried to the coast by rivers. They are thus important for the health of near-shore ecosystems like seagrass beds and coral reefs that develop best in clear waters. Mangrove forests are extremely productive ecosystems that also function as feeding and nursery grounds for many species of fish, shellfish, prawns, and crabs. The mangrove forest at the Rufiji delta provides nursery grounds for 80 percent of Tanzania's shrimps. Mangrove forests along the shoreline also provide important protection against wave and current forces and therefore coastal erosion.

Indicators - Mangroves

- Density and height of the forest
- Area that is degraded
- Mangrove diversity
- Occurrence of seedlings
- Diversity of benthic fauna and animals in trees

Reef herons in mangrove trees, Mafia Island

For thousands of years, mangrove ecosystems have played an important role in the social and economic development of coastal communities. Today, this unique but fragile ecosystem is still the main provider of various useful products such as firewood, charcoal, poles, tannin and traditional medicines. The fisheries within mangrove areas are also a valuable resource to local communities. Overall, it is estimated that over 150,000 people make their living directly from mangrove resources.

Mangroves are an **important renewable resourse** for coastal populations and are noted for their ecological role and high productivity. Mangroves are also important for the protection of shorelines against erosion

One of the important features of many mangrove species is that they can be *"coppiced"*, whereby careful cutting induces the generation of more shoots and branches,

thus providing sustainable harvests. Furthermore, the reproduction of mangroves by live seedlings *(vivipary)* makes reforestation of cleared areas through re-planting a viable and simple restoration technique.

Distribution and Area

In Tanzania, nine species of mangrove trees form the forests that cover an estimated 133,480 hectares. The forests are found along many parts of the coastline from Tanga to Mtwara, occurring on gently sloping shores, and around river estuaries, creeks and bays. The Rufiji delta supports the largest single mangrove forest in eastern Africa, covering 53,000 hectares. Other major mangrove stands occur at the estuaries of the Pangani, Wami, Ruvu, Matandu, Mbwemkuru and Ruvuma rivers. The islands of Mafia, Unguja and Pemba also support well-developed mangrove forests.

Status and Trends

Over-exploitation is threatening many Tanzania forests where the demand for mangrove products (mainly poles for building and export, firewood, and charcoal making) has been high. Examples of forests particularly affected are those near urban centres such as Maruhubi in Zanzibar, Kunduchi, Mbweni and Mtoni in Dar es Salaam. Fortunately, mangrove ecosystems are quite resilient, given sufficient time they can recover, especially in areas where cutting has not been intense.

Mangrove Areas of Mainland Tanzania

District / Region	Forest Area (km^2)
Tanga and Muheza D	94.0
Pangani D	17.6
Bagamoyo D	56.4
Dar es Salaam R	21.7
Kisarawe and Mkuranga D	38.6
Mafia D	34.7
Rufiji D	532.6
Kilwa D	224.3
Lindi D	45.5
Mtwara D	89.4
Pemba Is.a	120.0
Unguja Is. a	60.0
Total	**1334.8**

Sources: Semesi, 1991 except a = Ngoile and Shunula, 1992. D =District; R =Region

Today, greater awareness of the value of mangrove resources among resource managers and local communities exists and extensive clearance of mangrove vegetation has been reduced.The Mangrove Management Programme (MMP) has shown that careful use and sensible harvest can result in increased area of mangrove growth.

High value mangrove ecosystems identified in the villages surveyed

- *All mangrove areas of Rufiji and Bagamoyo*
- *Jangusari and Turiari mangroves (Temeke)*
- *Fumbwini mangroves (Unguja South)*
- *Matumbini and Kisiwa Kikuu mangroves (Pemba)*

Threats to Mangroves in Tanzania

There are a number of threats to the continued existence of mangroves that have been clearly identified.

Demand for timber products: The use of mangrove trees for firewood, production of charcoal and for building poles remains an important economic activity in Tanzania, especially near urban centres. This demand has in some areas resulted in the clearance of mangrove forests. The production of charcoal is viewed as one of the main threats to the remaining mangrove forests, especially since all parts of the trees can be utilised and there is less incen-

Mangrove areas before and four years after the establishment of MMP

Region	District	Area 1989 (ha)	Area 1998 (ha)
Tanga	Muheza, Tanga, Pangani	11,200	12,000
Lindi	Kilwa	22,430	26,737
Lindi	Lindi	4,550	7,301
Mtwara	Mtwara	8,940	13,350

Source: Semesi, 1991.

tive for selective cutting and sustainable harvesting.

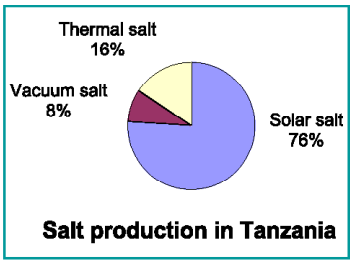
> ***Village perceptions***
> *The major threats to* ***mangroves*** *were identified as:*
> - *Cutting for building poles or boat making*
> - *Cutting for fuel for the coral mining (lime production) industry*
> - *Coastal erosion*

Urban growth: The rapid growth of coastal populations over the past few decades has resulted in the conversion of large areas of mangrove forests to ports, towns, settlements, industrial, hotel sites and agricultural lands. The development of municipal garbage dumps and landfill programmes within or adjacent to mangrove forests, for example in Zanzibar Town, have also adversely affected mangrove forests. Frequently, little consideration is given to the possible adverse effects of urban growth on mangroves.

Demand for salt has resulted in the clearance of areas behind and within mangrove forests for the construction of evaporation ponds for solar salt production. This has been identified as one of the greatest negative impacts on the resources. Solar salt currently contributes over 75% of the total salt produced in Tanzania.

Damage of mangrove forests from ***oil pollution and oil spills*** could in the future become a serious threat as marine shipping, industrial production and oil processing expand.

Though ***mariculture***, if well planned, would not threaten mangroves, there is a potential threat for adverse impacts if siting, construction and operation are mismanaged. The numerous deltas and river estuaries along the coast of Tanzania are ideally suited for the excavation of ponds for mariculture, notably the culture of prawn. To date limited efforts have been directed towards this potential—seaweed farming being the only exception. Recent proposals to convert a large part of Rufiji delta mangroves into prawn ponds were cancelled due to concerns over the potential impact to the mangrove ecosystem.



Salt production in Tanzania

MANAGEMENT OPTIONS

Actions to ensure sustainable use of the valuable and extensive mangrove forests in Tanzania include harvest restrictions, community based resource management, public education and outreach on the ecological importance of mangroves, and enhanced coordination and communication between research institutions.

> The **main sources of pressure** on mangroves in Tanzania include:
> clearance of coastal areas for development activities, exacerbated by increased coastal population growth, and, the demand of mangrove products for firewood, charcoal production and building poles

Restoration, involving replanting, should be carried out in order to regenerate areas that have been seriously affected. Mangrove restoration has been conducted in various parts of the country by the Mangrove Management Programme, as well as in Tanga and in Mbweni by local coastal management efforts. There is also a need to promote alternative sources of firewood and building poles, such as Casuarina forests, to reduce pressure on mangroves. In Zanzibar, Casuarina forests have been successfully established to offer an alternative source of timber for building poles.

MARINE FISHERIES

About 95% of fishing in Tanzania is conducted by artisanal fishers mainly along inshore areas of

the coast, around coral reefs, mangrove creeks and over seagrass beds. Gears and vessels used are mostly traditional and low cost, such as outrigger canoes (*ngalawa*), basic fishing line and hooks (*mshipi*), basket traps (*madema*), small nets (*bunduki*) and spears (*mikuki*). Several hundred species of fish comprise regular catches, though invertebrates such as octopus (*pweza*), squid (*ngisi*) and sea-cucumbers (*majongoo bahari*) are also highly important seafood items collected by artisanal fishers.

Mangrove areas identified in the village survey as needing conservation and restoration

- *Kichevi (Mafia)*
- *Chakomve (Kinondoni)*
- *Jangusari and Turiari (Temeke)*
- *Fumbwini (Unguja South)*
- *Kisiwa Kikuu (Pemba Wete)*

The slightly deeper Zanzibar channel is an important area for sardines (*dagaa*) and Indian mackerel that are caught on moonless nights

Wakojani fishermen netting around coral reefs, Zanzibar

using purse-seine nets, scoop nets, and lights to attract the fish. The deep Pemba channel is also important for over one hundred dhows *(mashua)* that fish for large species, such as yellowfin tuna (*jodari*) and the sailfish (*mbasi*) using gill-nets. Both these **semi-industrial** fisheries rely on out-board engines. In some cases the boats, nets and engines are not owned by the fishers, but by individuals who do not fish themselves.

Indicators - Marine Fisheries

- Distance to fishing grounds
- Fish landings
- Diversity and size of fish
- Abundance, diversity and size of seacucumbers, shells, octopus, squid, and crustacea

Inshore shallow areas around the mangrove fringed Bagamoyo/Sadani and Rufiji Delta are important for the **industrial prawn fishery**. A fleet of about 18 prawn trawlers based in Dar es Salaam represents the only industrial-scale marine fishery in the country. Fishing trials using long-lines in 1997-98 demonstrated that there is a potentially **valuable offshore fishery** of high value migratory fish species such as tuna, sailfish, sardines, marlin and swordfish. Foreign industrial vessels are known to illegally fish these waters.

Distribution and Area

The marine fisheries in Tanzania are located along a relatively narrow strip along the coast. The high seas, or the "Exclusive Economic Zone" that extend 364 km (200 miles) out to sea, are so far unexploited by Tanzanian fishermen because of lack of suitable vessels.

Importance of Marine Fisheries in Tanzania

Local livelihoods: The inshore marine fishery is extremely important to coastal communities in Tanzania. The number of full-time fishers in the country is estimated at 58,000, with about 23,000 on the islands of Zanzibar and about 25,000 along the mainland coast of Tanzania. The importance and impact of the fishery extends much beyond these full-time fishers, and includes all those involved in boat construction

and repair, and marketing and sale of fish products. For example, many women and children are engaged in the collection of shells and octopus from reef and beach areas during low tides and in the sale and processing of fish products. Almost all people in coastal communities are involved in fishing activities in one form or another. As with many other tropical countries, the fishing community in Tanzania is comprised mostly of individuals with very little alternative income-earning capacity. Fishing is often the fishers' primary occupation.

For the coastal dwellers of Tanzania, fisheries are important both as a source of food, contributing over 60% of protein consumption, and as a source of income. The average individual consumption of seafood in Tanzania is greater than the combined consumption of poultry and meat.

Marine fisheries are very important to Tanzania coastal communities for income, imployment, and food security

Export earnings: The majority of export revenue comes from the industrial fishery of shrimp or prawns (kamba). Other international export products include sea cucumber, shells, live lobsters, crabs, squid, octopus and shark fins. Asia is the primary export destination. The value of exports from the mainland and Zanzibar exceeds several million US dollars annually.

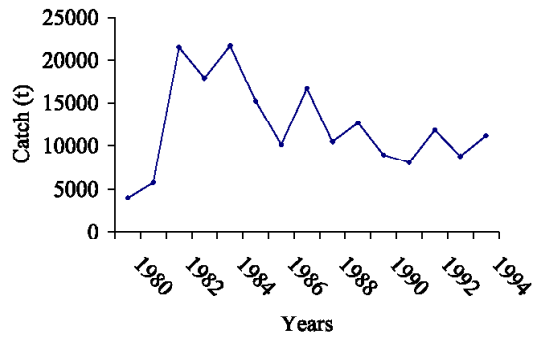
Status and Trends

Obtaining reliable **fisheries statistics** on the **artisanal and semi-industrial fisheries** of Tanzania continues to be a serious problem. It is recognised that obtaining these data, from the hundreds of fish landing sites scattered along the 1,400 km of shoreline (including that of the three main islands: Pemba, Unguja and Mafia) is extremely difficult. The departments responsible for collecting fisheries statistics recognise this shortcoming. This problem is not unique to Tanzania. In tropical coastal countries worldwide, fisheries are usually comprised of numerous species and gear types with catches landed at small isolated sites by thousands of fishers, thus the challenges of obtaining reliable statistics often seem un-surmountable and continue to confront fisheries managers. In Tanzania a further complicating factor is that part of the fishing community migrate up and down the coast depending on the season, thus fishing effort in each region changes throughout the year. Reliable trend data on fish catches and effort are restricted to just a few studies. These have confirmed that official statistics are unreliable and must be interpreted with caution.

Fisheries scientists agree that the inshore fishery of Tanzania shows **signs of overexploitation**. This can be seen especially in Zanzibar where statistics document a declining trend in annual catch. The total annual catch in Zanzibar was about 20,000 tons in 1988, but it has now dropped to less than 15,000 tons per year. The few detailed, long-term studies of some localised areas such as Chwaka Bay, Zanzibar and specific reef fisheries of Zanzibar confirm the declining trend. Interviews with elder fishermen also confirm that in the past they used to catch more and larger fish in near-shore waters compared to today.

According to government statistics, during the period between 1984 and 1995, annual fish catch ranged between 45,000 and 54,000 tonnes for the mainland. Also during this period, the number of fishermen increased each year. Until 1990, increased effort resulted in increased catches, however, during the last decade, catches have been in decline, perhaps signalling that fish stocks are over-exploited.

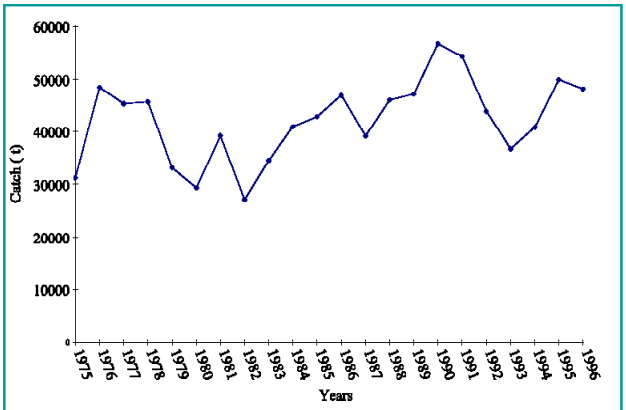
"Five years ago when we fished at night for tuna with our gill-nets we knew that if the fish did not get caught in the net the first time it swam past, it would later on be caught. Now if it does not get caught the first time it will be caught in the net of another boat." Makame Faki, Kigomani fisherman, Unguja



Annual fish landings, Zanzibar 1975-1995

Source: Jiddawi and Ngoile (1999)

Some specific fisheries have significantly declined. The Zanzibar purse seine fishery of small fish species in the open water (pelagic species) and the shark fishery are examples. The catch of small pelagic species by the boats of the Zanzibar Fisheries Corporation declined from 600 tons in 1986 to 91 tons in 1997. 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. The collection of lobsters and mangrove crabs is restricted to coral reef and mangrove areas respectively. Those who harvest these crustaceans are continuously searching for new fishing grounds possibly indicating that fished areas are being depleted. 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.



Annual fish landings for mainland Tanzania 1975-1995

These trends are worrisome, especially considering that the critical habitat for inshore fisheries, such as coral reefs and mangroves, are being degraded in many areas. In the marine ecosystem these various inshore habitats are

The condition of inshore marine fisheries is poor, due to harvest beyond sustainable levels. This is supported by scientific data showing a significant decline in catches over the last decade in several fisheries. The status of the offshore fishery is largely unknown, due to a number of reasons including lack of research vessels to carry out stock assessment in Tanzania's open waters

closely linked geographically and ecologically through the movement of many species, especially fish. Thus the loss of mangrove forests, for example, reduces vital nursery grounds for fish and crustaceans, and may cause erosion and sedimentation, degrading coral reefs, essential for inshore fish diversity and health.

The industrial **prawn fishery** has been more closely monitored and managed than the artisanal fishery because there are relatively few vessels, the home port is Dar es Salaam, where they are easily accessed, and the fishery is important for export earnings. A closed season between November-March and prohibition of night fishing are current management measures. There is concern over the long-term viability of the fishery, and conflicts with artisanal fishermen for the same resources exist. Total landings increased from 1,081 tons in 1984 to 2,190 tons in 1988, with a corresponding increase in effort from 10 to 13 trawlers. However, from 1990 onwards, landings have varied. Landings dropped from 2,015 tons in 1990 to 1,119 tons in 1992, despite an increase in the size of the fleet. This may indicate over-fishing in the trawling areas (mostly Rufiji and Bagamoyo). Another concern is the high percentage of catch from prawn trawlers that is discarded at sea (nearly a third). The discards consist of small immature prawns and other fish that have a low market value. Most discarded fish eventually die as they are usually injured beyond recovery.

Threats to Fisheries

Overfished reefs identified in the village surveys

- Nyuli reef (Muheza)
- Shengo reef (Tanga municipality)
- Lukumbi, Nondo, Jiwe la Selemani, Nahumbu (Lindi)
- Mziwila, Dema, Mnito, Mmongo and Oatakua reefs (Mtwara)
- Matumbini, Kwata and Utumbini reefs (Pemba Mkoani)
- Dambwe reef (Pangani) closed for conservation

The demand for fishery resources has been gradually increasing with concurrent increase in population and tourism growth. This has caused an increase in fishing pressure and the use of gear and techniques that cause damage to reefs. Most of the destructive methods are illegal, but continue to be used due to lack of surveillance, enforcement and public awareness. The common destructive methods are the use of dynamite fishing, drag nets (juya la kigumi), fine-meshed fishing nets, spearguns, beach seine and poison.

Village perceptions
The major thretes to marine fisheries were identified as:

- *Overfishing*
- *Siene netting*
- *Sedimentation*

The use of dynamite was discussed earlier. The use of dragged nets is one of the most difficult destructive fishing methods to control because the net used is not illegal. It is the action involved in the technique of using the net that is a problem – dragging such nets over corals and smashing coral with sticks to chase away hiding fish – and causes severe localised destruction. The legislation over use of such nets is confusing

The main **threats** to marine fisheries resource in Tanzania include destructive fishing practices, coastal population growth and increased demand for fishery products, and ecosystem degradation (Loss of mangrove and coral reef habitats)

and needs to be re-examined. The use of poison leads to indiscriminate destruction of fish breeding and nursery grounds and has seriously affected populations by destroying fish larvae and juveniles. Mangrove cutting and loss of mangrove habitat has a similar impact on fisheries. Mangroves are an irreplaceable part of the fish life cycle, providing nursery and breeding grounds for many ecologically and economically valuable fish and prawn species.

MANAGEMENT OPTIONS

Monitoring, control and surveillance: There is a need to establish a reliable fisheries data collection system. Accurate data on fishing effort (numbers of fishers, boats, nets) and weight of catches landed are important for understanding the fisheries of the coast and for effective management. There is also a need for increased monitoring and surveillance on the part of village and local authorities to increase compliance with existing laws and regulations governing fisheries.

The use of by-laws concerning localised harvest restrictions, seasonal closures and gear restrictions should be promoted. There is also a need to introduce size limitations on the harvest of marine products (such as sea cucumbers and sharks), and to examine and document the movement of migratory fishermen in order to better understand the role they play in exploiting the fisheries of the country.

Community awareness and management: Public education and awareness building efforts are important to raise the public's knowledge of fishery laws and their justification. Also needed is extension of good practices, such as avoiding the capture or collection of juveniles. Community-based marine reserves and protected areas have been proven to be an effective way to conserve and restore marine diversity and fish populations.

OTHER MARINE LIVING RESOURCES

Dolphins, Zanzibar

Indicators — Other marine living Resources
- Sighting and diversity of marine mammals
- Marine mammal by-catch
- Turtle sightings, diversity and by-catch
- Seabird sightings and diversity
- Seaweed and seagrass abundance

In addition to mangroves, coral reefs and fisheries, there are several other marine living resources in Tanzania coastal waters. These include: plankton, seaweeds, seagrasses, benthic fauna, marine turtles, marine mammals and coastal birds. These living resources play a major role in the health and functioning of coastal and marine ecosystems and to the economies of coastal people.

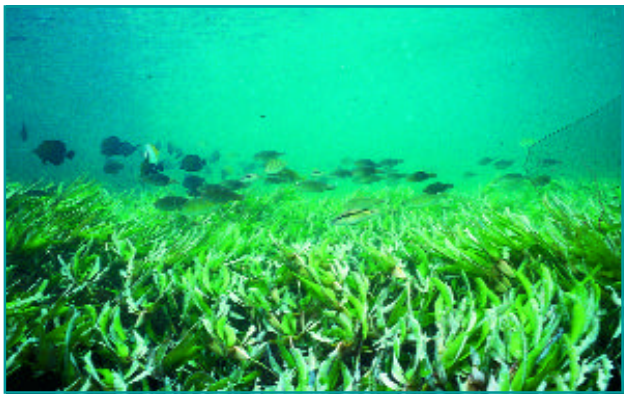
Plankton is comprised of two major components: phytoplankton and zooplankton. Collectively they are very important in the food chain and hence ocean productivity. Many fish and invertebrates are dependent on plankton for food. Phytoplankton growth is usually limited by the availability of nutrients in the

water. Blooms occur in tropical coastal waters when nutrient level are high (e.g. from pollution) and can lead to increased productivity and occasionally to contamination of shellfish or massive fish kills.

Seaweeds are plants, known as algae. Of the several hundred different species of seaweeds in the country, those of the genus *Eucheuma*, are the most utilised by humans. They are used to produce cosmetics and food derivatives, are used in health foods and have medicinal uses. Naturally growing *Eucheuma* species have been harvested for export trade for over four decades. Culture technology was established recently because the supply of wild stocks of *Eucheuma* does not meet the demand for the product. Currently, seaweed farming is increasingly becoming an important economic activity in many coastal communities of the country, particularly Zanzibar, where women are the main producers. Over 3,000 tonnes are produced each year.

Plankton, seaweeds, seagrasses, benthic fauna, sea turtles, marine mammals, and marine birds are just part of the other marine living resources available in Tanzania coastal waters. They play a major role in the sustainablity of coastal ecosystems and the livelihood of many coastal communities as a source of food and income

Seagrass communities in Tanzania's coastal waters are represented by 12 species. Seagrasses form dense beds that cover large areas of sandy or muddy coastal bottom, from the mid tide mark to a depth of 20 m or more. Their importance results from their ecological interactions with other ecosystems in the marine environment, especially mangroves and coral reefs, and in their wide range of physical functions. Their most notable role is to provide breeding, nursery and feeding grounds for many invertebrates and fish species. Seagrass beds also support complex food webs both through dead and living biomass. The fish and shrimp communities associated with seagrass beds are important to both the artisanal and industrial fishery. The main physical function of seagrasses is derived from the ability of the roots to bind sediments, thereby reducing re-suspension and lateral movement of sand and mud along the shores. In this way, seagrass beds reduce coastal erosion.



Seagrass, Mafia

Benthic fauna commonly found in Tanzania is comprised of several invertebrate groups of animals, such as worms, crustaceans, molluscs, sea cucumbers, starfish and sea urchins. Some of these are of commercial importance to coastal communities. For example, several hundred species of mollusc are collected either for food (e.g. oysters, mussels, and cockles) or for sale of their attractive shells (e.g. cowries). Starfish are collected and dried for sale as curios to tourists, and sea cucumbers are boiled and dried for export where they are a traditional food item (known as beche-de-mer or trepang). Marine invertebrates play important roles in the ecosystems they occupy. For example, certain shells are predators of sea urchins and starfish that degrade coral reefs when present in large numbers.

Marine turtles are represented in Tanzania coastal waters by five species. They spend their life in the sea and females come out on land only for nesting, during which the clutch of eggs is

buried high in the sand. Marine turtles feed on a variety of marine life including jelly-fish, sea-grasses and sponges. They have traditionally been a source of meat and eggs for coastal people around the world for hundreds of years, and their shell has been used for making combs and jewellery for many centuries. More recently, these ancient, long-lived reptiles have become an important tourist attraction, appreciated by visitors both underwater and when nesting.

Green Turtle on reef, Zanzibar

Coastal birds of Tanzania are varied in form and in the habitats they occupy. Open water areas such as the Zanzibar and Mafia channels and the Indian Ocean itself provide rich feeding grounds for true seabirds such as terns, gannets, brown noddies and boobies. Some of these are permanently present in Tanzania, nesting on small islands off the coast, such as Latham Island. Other coastal birds include waders and shorebirds that visit Tanzania each year between August and May to feed on worms and small crustaceans on mud flats and beaches along the shores. Seabirds have importance for coastal tourism and for biodiversity conservation. Further, coastal birds play a role in nutrient cycling. For example, the guano produced by coastal birds has been shown to be critical in maintaining coastal forests.

Marine mammals are frequently present in Tanzania's coastal waters. There are two main groups: the cetaceans, which comprise the toothed whales, including dolphins, sperm whales, and baleen whales, and sireneans which include the dugong. Dolphin species include the bottlenose, humpback, spotted and common dolphins. Sperm whales are normally migrants throughout the Indian Ocean and are only occasionally seen inshore. Baleen whales, of which the most common is the humpback whale, spend the summer months feeding in Antarctic waters, and the winter months in the warmer tropical waters off East Africa where the give birth and nurse their young.

Areas identified in the village surveys as having high diversity of other marine living resources

Seagrass beds
- *Kigomani (Mafia)*
- *Mkwaja, Lukumbi, Nondo, Mvinjeni and Ngululu (Lindi)*

Marine mammal habitat
- *Kwale and Koma Island (Mkuranga) dugongs, turtles*
- *Rufiji Delta area - dugongs*
- *Somanga and Mbuyuni (Kilwa) dolphins, dugongs*
- *Unguja West - dilphins*
- *Unguja North - dugongs, dolphins*
- *Kizimkazi (Unguja South)- dolphins*
- *Deep sea channel (Pemba) whales,*

STATUS AND TRENDS

The harvest of marine invertebrates, other than species of obvious commercial importance such as octopus, lobsters, prawns, mangrove crabs, is not monitored or controlled. It is therefore difficult to determine trends in populations and indeed the status of these resources. However, available data suggest that stocks of sea cucumbers, for example, have been drastically decreasing as a result of intensive collection. Similarly, extensive collection of molluscs for the ornamental shell trade has caused this resource to decline in certain areas.

Marine turtles continue to nest successfully on beaches of remote, smaller islands along the coast,

and in protected areas such as Mafia Marine Park, Saadani National Park, and the Misali Marine Conservation Area. However, the number of suitable, uninhabited beaches, is decreasing and it is feared that populations of marine turtle are also decreasing. Accidental catches in fishing nets are occasionally documented. The capture, slaughter and sale of marine turtles products notably decreased in Zanzibar following a successful outreach campaign during the 1990's and marine turtles are now regularly seen around coral reefs off Zanzibar.

Estimates of dugong numbers in Tanzania are difficult to obtain but it is unlikely that there are more than 100 individuals left in the country. The trends, based mostly on anecdotal evidence, indicate that their numbers have declined significantly over the past decades, possibly to the level where the populations cannot recover. The two locations where dugong populations are found in Tanzania are the Pemba–Zanzibar channels and the Rufiji–Mafia area. They have been hunted and killed for their flesh and oil.

Dolphins, porpoises, and baleen whales are not commercially exploited in Tanzania. With the moratorium on international whaling for humpback whales, the numbers visiting Tanzanian waters each year are likely to increase. Accidental catches of both whales and dolphins by fishing nets are a concern.

Village perceptions

The major thretes to other ***marine living resources*** *were identified as:*

- *Net fishing*
- *Bottom trawling*
- *Storms and wave action*

THREATS TO OTHER MARINE LIVING RESOURCES

The most frequent cause of pressure on other marine living resources that are currently exploited—such as shells, sea cucumbers, marine turtles, or dugong, is over harvesting.

Marine turtles are slaughtered for their meat, eggs and shell. Harvest and trade in turtle products is illegal in Tanzania but enforcement and compliance are limited resulting in a continued threat to these endangered species, especially on the mainland. The nets of prawn trawlers also entangle marine turtles notably around the Rufiji Delta.

Gillnets are used to catch large species of fish such as tuna and billfish, though these 1,000 m nets also accidentally catch marine turtles, dolphins and whales. The increased use of these nets in Tanzania is likely to increase the threat to these large animals. Threats to the remaining few dugongs include habitat degradation that might affect their food supply, direct hunting, fishing nets and dynamite fishing.

The main sources of pressure on the other marine living resources include unsustainable resource use and degradation of habitats by human factors (oil spills, chemicals, sand mining deforestation and dynamite fishing)

Intensive farming of seaweed can encourage the disease known as *Ice-Ice* that significantly reduced production in the Philippines. Conflicts between coastal tourism development and seaweed farms over the use of the shallow lagoons have already occurred in Zanzibar. Such conflicts will likely continue as both coastal tourism and seaweed farming expand.

Marine Species at Risk in Tanzania

In the marine environment, dugongs, turtles, swordfish, reef sharks, humpback dolphin, various sea cucumbers, and seahorse are considered endangered or threatened in Tanzania. Dugong populations used to inhabit the seagrass beds surrounding Kilwa and Mafia, and off the Tanga region coast. The loggerhead turtle (locally known as "mtumbwi" and "ranga") is considered vulnerable while the green turtle ("kasa" or "nduvi"), hawksbill turtle ("ngamba"), olive ridley turtle, and leatherback turtle are all endangered. The hawksbill turtle is considered to be critically endangered. The nesting populations of turtles have been declining rapidly due to incidental fish catch, hunting, and loss of nesting beaches. The alarming decline in sea turtle population may continue to extinction unless measures are taken to protect them

Management Options

Management options to ensure the diversity and condition of marine living resources in Tanzania include prohibition on commercial trade of marine turtle shells; public education and outreach on the importance of and threats to marine living resources; protection of critical habitats; enforcement of harvest limitations; and improved law enforcement.

Intensive seaweed farming should be discouraged to avoid *Ice-Ice* disease (the stressed condition of *Eucheuma*) and to reduce the negative environmental impact of Eucheuma on other marine flora and fauna.

Concentrated turtle breeding sites should be promoted in national nature reserves or parks, as should the use of Turtle Exclusion Devices (TEDs) in prawn trawler nets. Gillnet fishermen should be instructed in methods to release or resuscitate drowned turtles.

Since little is known of the role of sea cucumbers and molluscs in coastal ecosystems, the sales of shells and beche-de-mer should be restricted until sufficient information on their ecology and population dynamics are known.

WATER QUALITY

Ras Kilomoni, Dar es Salaam

Water quality is an important prerequisite for the social and economic development of coastal areas and the health of the people who make use of these waters. Coastal water quality can be reduced through the introduction of sediments, solid wastes or garbage, dissolved nutrients, organic wastes, sewage, chemical wastes and oil, among others. Some of these pollutants can cause serious health hazards to humans, marine life, and the productivity and health of coastal habitats, including coral reefs, mangroves, seagrass beds, intertidal sand and mud flats, and beaches. These habitats support various resources, both living and non-living that are vital to the economies of coastal communities and the nation as a whole.

Indicators — Water Quality
- Turbidity
- Odor
- Sediment load
- Algal growth

Pollutants like oil spills and industrial and municipal wastes can have serious effects on mangroves and seagrass beds, which in turn can affect fisheries resources. Excess nutrients in coastal waters and other water bodies, through sewage discharge, often leads to blooms of green seaweeds that upon their death and subsequent decomposition rapidly consume oxygen resulting in unsightly and often noxious smells on beaches where it occurs.

Water quality is important for food security and the general health of all coastal ecosystems. Water quality is intricately related to the well-being of all communities in Tanzania coastal areas

Status and Trends

In general, the coastal waters in most parts of Tanzania are in relatively good condition. However, studies have confirmed that waters in the vicinity of the urban areas of Tanga, Zanzibar and Dar es Salaam are polluted, and that along the coast, other smaller pollution hotspots also exist. With the steady growth of coastal populations and industrial and agricultural development of coastal and inland areas, pollution and degradation of water quality is expected to rise.

Tanga coastal waters witness the proliferation of seaweeds caused by discharge of nutrient-laden waters from a fertiliser factory as well as from municipal sewage. Coastal water pollution in Tanga is also affected by effluents from sisal processing factories. Up to twenty sisal plants discharge their wastes into the coastal waters via the Pangani, Sigi, Mruazi / Mnyuzi and Mkurumzi Rivers.

Zanzibar town waters have alarming levels of coliform bacteria - several hundred-fold above the internationally accepted levels for safe bathing. Nutrient levels are also higher than normal for tropical seawaters indicating inputs from human related activities.

The quality of Tanzania's coastal water is in general quite high. Exceptions are near-shore water fronting major towns, where pollution mainly from untreated domestic sewage is localized but severe. The current population increase in coastal towns is expected to increase pollution problems in coastal waters

Dar es Salaam domestic sewage waste is one of the leading sources of marine pollution in the city. The waste generated by 15% of the city residents who are connected to the sewer system is discharged into the sea untreated. As a result, the coastal waters of the city, especially the harbour area, are heavily polluted. High faecal and total coliform levels are a result of this sewage pollution. The situation is made worse by broken sewer pipes which discharge untreated sewage on mud flats near the harbour. This is now threatening invertebrates and fish resources in those areas. Seaweed blooms are a regular feature in the waters off the northern end of the beach of Ocean Road in Dar es Salaam.

Percentage Distribution of Private Household by type of Toilet

Region	RURAL			URBAN		
	Flush	Pit Latrine	None	Flush	Pit Latrine	None
Tanga	0.8	80.8	18.3	16.2	79.2	4.5
Coast	0.9	76.1	23.0	4.8	88.3	6.7
D'Salaam	3.8	80.9	15.2	15.9	83.1	1.0
Lindi	0.6	77.2	22.2	4.7	85.0	10.3
Mtwara	1.0	84.2	14.8	7.4	86.1	6.6

Source: Tanzania 1988 Census, Dar es Salaam

The majority of coastal communities use pit latrines for sewage disposal. In urban areas a small proportion of residents have access to modern toilet facilities but some have no means of disposal other than their immediate surrounding beach or bush. In rural areas an even greater proportion have no toilet facilities.

Around Dar es Salaam, the Msimbazi River and Creek are among the main vectors of pollution, carrying pollutants from various sources.

Village perceptions

The quality of Tanzania's coastal water was considered by most villages to be good. Some cases af high turbidity and sediment loads were reported.

However, it was suggested that the trend over the last ten years was a deterioration of water quality.

Oil pollution from a refinery at Kigamboni, and industrial wastes from Keko, Chang'ombe, Kurasini, Mtoni and Temeke are discharged untreated into the river and creek. The pollutants comprise toxic chemicals such as dyes, paint wastes, strong alkali solutions, pesticides, heavy metals, cyanides and detergents.

Studies have indicated various levels of heavy metal pollution in the Dar es Salaam harbour area. Commonly identified heavy metals found in the harbour include lead, zinc and copper. Some of these are derived from commercial shipping as well as the numerous shipwrecks that for decades have littered the harbour shores. Around Dar es Salaam numerous small landfill sites and garbage dumps are located on riverbanks. High concentrations of dissolved nutrients leach from these sites and end up in coastal waters via river runoff.

Coastal Industries in Tanzania and their Pollutants

Type of Industry	Example of Companies	Location	Pollution
Food Processing	Darbrew Ltd, Tanzania Breweries Ltd, CocaCola Bottles, Fahari Bottlers, Diaries and Flour mills	DSM	Organic matters, detergents, suspended solids, nitrogen and phosphorus compounds, and bacteria
Textile	Urafiki textiles, Karibu textiles Coastal Industrial Combined Ltd.	DSM Tanga	Organic matters, dyes
Power generation	TANESCO	DSM	Oil and lubricants
Metals	NECO, Steel cast, ALAF, Bicycle Company, Steel Rolling mills.	DSM Tanga	Solid wastes, suspended solids, zinc, chromium, iron, copper, acids, and alkalis
Petroleum	TIPER, Storage Tanks at Ports and Tanzania Zambia Pipeline	Lindi Tanga	Degradable matter, suspended solids, sludge, petrolium hydrocarbons, oils, greases, phenols, acids, alkalis, chromium zinc, manganese sulfur, lead, mercury and other metals

Type of Industry	Example of Companies	Location	Pollution
Soap and Detergents	Several Factories	DSM Tanga	Waste water, organic matter, phosphates, suspended solids, oils and zinc
Sisal	Amboni Ltd, Kikwetu Sisal Estate, Kigombe Sisal Estate.	Lindi Tanga	Organic matters, waste water, sisal organic wastes
Plastics	Amboni plastic, Tegry plastic, Simba plastic, Cotex	DSM Tanga	Solid wastes
Cement	Tanzania Portland Cement, Tanga Portland Cement	DSM Tanga	Dust and fumes
Cigarettes	Tanzania Cigarette Company	DSM	Dust and fumes

Threats to Water Quality

Untreated municipal and industrial wastes are currently the main threats to the quality of Tanzania's coastal waters in the urban areas of Tanga, Zanzibar and Dar es Salaam. Other coastal areas of Tanzania outside these major cities, though largely free from domestic wastes, do suffer from run-off of agricultural wastes, including pesticides and fertilisers, via rivers and streams. Most major rivers in the country drain agricultural lands and deposit their waste loads into coastal waters.

In addition to the transport of chemical wastes into the coastal waters of Tanzania, rivers also carry large quantities of **sediments** to the coast. Though such inputs can be a result of natural events such as heavy rains in upland areas, poor agricultural practices upstream have been known to play a leading role in degradation of coastal waters due to sedimentation. High sediment levels in rivers are often linked to deforestation and soil erosion. A direct consequence of this is the smothering of corals and other organisms, as well as the reduction of aesthetic value of the water, making it less attractive for activities such as tourism and general recreation.

The main sources of water quality problems in the coastal waters of Tanzania include domestic and industrial waste especially in Dar es Salaam, Zanzibar and Tanga; agro-chemicals particularly in Tanga; and, sedimentation problems at the entrances of large rivers.

Tanzania has coastal mineral and gas resources as well as a potential for oil reserves that could make significant contributions to the national economy. The Songo Songo gas field is the first to be developed. This will include large-scale offshore gas extraction and an extensive pipeline system that will deliver the product to Dar es Salaam. Though gas leaks are unlikely to cause seawater pollution, petroleum exploration in coastal regions including the Selous Basin, Rufiji River plain, Ruvu basin, and Mandawa basin may potentially be a source of oil pollution in the future.

Water quality problems identified by the village survey

Areas of heavy sedimentation
- Rufiji delta through Msambanyamani river (Mkuranga)
- Tidal flats off Mkuranga
- Njimbani river (Ilala)

Areas polluted by domestic and industrial waste
- Waters off Mkuranga
- Ocean road, Dar es Salaam (Waste Water)
- Njimbani river, Ilala - Dar es Salaam (Industrial waste)
- Ngombeni, Mkoani - Pemba (Domestic waste)

National waste management policy that holistically addresses the waste problem is an essential prerequisite for effective water quality management in the country. The policy should provide clear guidelines and address all issues pertaining to environmental as well as social aspects of waste management and the linkages between them. However, given limited resources available, it is also essential to prioritise management efforts.

The involvement of the local stakeholders is essential for the successful implementation of waste management goals. The national waste management policy should strive to develop and implement community-based activities and approaches to encourage environmental improvement and management at the local level. This should start with public education to build awareness on the issues pertaining to water quality. For example, an education/outreach program is needed to promote local awareness of the health risks associated with eating fish and shellfish from contaminated sites and the dangers of polluted waters. Public-private partnerships in wastewater management are paramount in setting up a successful water quality management program.

A national programme of water quality management should include a plan for water quality-monitoring and database management. In addition, targeted environmental studies should be undertaken to collect baseline data. Sufficient understanding and information is needed for effective decision making on water quality issues.

There is an urgent need for **municipal waste treatment** before it is discharged into the sea. Construction of primary and secondary waste treatment facilities is a priority. Existing leaks in sewage disposal pipes should be repaired and construction of new discharge pipes should take into consideration near shore water current patterns to ensure that treated sewage effluent is properly flushed out to the open ocean. The government should also encourage low cost, innovative **waste management technology** that will further prevent the reduction of water quality. This includes the use of composting toilets, and guidelines on the design and construction of wells and pit-latrines. The use of shallow wells should be discouraged.

Lack of resources has, at different times, been identified as a major factor that has contributed to poor water quality and waste management. An option to address this is to put in place a user-based cost recovery system for such services as water supply and sewerage.

COASTAL EROSION

Beach erosion, Zanzibar

The total length of the coastline in mainland Tanzania is about 800 km, extending from the border with Kenya in the north to Ruvuma River in the south. When the actual extent of the shoreline is considered and the three main islands of Pemba, Unguja and Mafia are included, the length increases to approximately 1,400 km.

Indicators — Coastal Erosion

- Annual rate of erosion or accretion
- Frequency of resource use and development activities that contribute to erosion/accretion

Wave action and onshore currents influence all shore types. The volume and flow of rivers also influence shores near estuaries. Sea conditions and river flow are in turn affected by the seasons. The effect of the physical movement of waters on the coast causes erosion - a condition whereby the shoreline position changes in space and time. This condition is most prevalent on stretches of shoreline comprised of sand beaches.

Erosion is generally a result of multiple causes that can act independently or in association. Natural causes can be due to physical conditions or the forces of nature. Natural forces are related to changes in climate, hydrology and coastal processes. For example, sediment transport by waves and currents can often lead to harbour siltation problems. The potential impacts of natural forces by themselves may not always be the greatest threat to the stability of coastlines. However, when they occur in conjunction with other factors, such as human activities, they can become a serious problem. Human-related causes of erosion include non-sustainable resource use and coastal development.

Coastal erosion has significant social, economic and ecological importance for coastal communities who depend on the coastline for their income, employment and subsistence. The coastline must be protected if the tourism business and industrial infrastructure are to be sustained in Tanzania.

The loss of coastal land and property (residential houses, offices, hotels, industries, agricultural land, etc.) is a major issue for coastal management. Given the potential socioeconomic impacts of coastal erosion, property owners normally adopt defensive measures that seek to maintain shorelines in their present position. This is achieved either by building protective structures or strengthening the coast through beach nourishment. However, since changes in shoreline can take place over both long and short time frames, it is important that the nature of the cause be understood before costly protective measures are attempted. For example, experience from Dar es Salaam and Bagamoyo has shown that groynes constructed to stem the movement of beach sand have not solved erosion problems.

STATUS AND TRENDS

Shoreline changes are widespread, but the erosion rate and character of Tanzania's coastlines vary from place to place and from season to season, depending on the specific coastal configuration, sedimentary characteristics and hydrodynamic conditions. A full assessment of the problem and suggestions for control measures has not been undertaken. In specific locations, erosion is known to be severe. For example, significant erosion over the last few decades has resulted in the loss of several buildings at Africana Beach Hotel and homes at Kunduchi beach area in Dar es Salaam where the beach is retreating at the rate of 4 meters per year.

Some of the more badly affected areas in Zanzibar include Maruhubi, Nungwi, Paje and Jambiani. Evidence of beach erosion at these sites is visible in the number of coconut and *Casuarina* trees that have been undercut and are collapsed.

Another example of severe erosion is the complete disappearance of Maziwi Island in 1987. This may have been the consequence of human-related causes such as the loss of surrounding coral reefs due to destructive fishing practices and sea level rise.

Areas threatened by shoreline erosion identified in the village survey

Potentialy threatened
- Rufiji (Simbaulanga, Bunduki, Vikacha and Nyamisati)
- Pangani
- Mtwara

Eroding areas that need immediate conservation and restoration
- Area between Msasani through Kunduchi to Bahari beach north of Dar es Salaam

Lack of understanding of the processes controlling coastal erosion often increases the damage that erosion causes to properties. Lack of understanding results in human settlement, construction and investment in potentially hazardous coastal areas and inappropriate coastal defense schemes.

Destructive use of marine resources such as over-exploitation of beach sand for building, the extraction of living coral from nearby coral reefs, mining of coral-rock cliffs, and mangrove cutting, often compound the effects of coastal erosion. Sand mining on riverbeds can lead to depletion of sand deposits and sediments that would otherwise be transported to neighbouring beaches. Excessive removal of groundwater can also contribute to coastal erosion.

The main human - related causes of shoreline erosion in Tanzania include loss of natural shoreline protection by clearence of vegetation and live coral extraction, loss of natural nourishment of beach sand by mining of sand on riverbeds, and construction of jetties and harbors causing a change in local sediment dynamics

The removal of seagrass beds for cultivation of seaweed or to create wider expanses of beach for tourism and recreation can destabilise the sand seabed and enhance the effects of water movement thereby increasing coastal erosion. Similar effects result from the removal of mangrove trees and beach vegetation close to coastal properties to create or increase beachfront.

MANAGEMENT OPTIONS

There are a number of management options that can contribute to reducing the effects of coastal erosion in Tanzania. They include guidance and education materials on the effects of different protective methods; use of development plans and zoning in coastal areas; enforcement of the no development buffer between the shoreline and development; and the enforcement of other laws pertaining to siting and construction on the shoreline.

The development of a formal strategy to addres issues related to zoning of coastal areas suitable for various activities is likely to reduce future problems. The current practice of permitting exceptions to existing regulations should be discouraged.

The preparation and promotion of materials on the effects of different protection methods on shoreline erosion and of the need for appropriate engineering designs based on solid scientific data should be encouraged as a means for protecting properties in erosion-prone areas.

Coastal development, Dar es Salaam

Tanzania Coastal Management Partnership (TCMP)

The Tanzania Coastal Management Partnership was established in 1997 to improve national coastal planning, policy and management, and to coordinate local and national coastal resource management. TCMP works with the existing network of ICM programs and practitioners to promote a participatory, transparent process to unite government and community, science and management, and private and public interests to wisely conserve and develop coastal ecosystems and resources.

Mafia Island Marine Park (MIMP)

This Park was established in 1995 under the National Legislation Marine Parks and Reserves Act of 1994. The initial management focus has been on the problem of dynamite fishing in the Park area. In the next several years, the MIMP will work closely with Mafia Island communities to revise the Park management plan and operationalize the Park Management Council.

Mnazi Bay Marine Park (MBMP)

Mnazi Bay is located close to the Tanzania-Mozambique border at the Ruvuma estuary in Mtwara. It covers a total area of over 200 km^2 with a local population of around 5000 people that directly rely on the reef for food and livelihood. The Park area is long (60 km) and narrow (3 km), encompassing a fringing reef along the outer mangrove island shelf.

Dar es Salaam Marine Reserve (DMR)

This marine reserve is located in the northern part of the city of Dar es Salaam. It includes Fungu Yasini, Mbudya, Bongoyo and Pangavini Islands. Conservation actions include coral reef restoration in collaboration with local fishing communities and promotion of ecotourism.

Tanga Coastal Zone Conservation and Development Program (TCZCDP)

This program was established in 1994 to promotes sustainable use of coastal resources in the Tanga administrative region. The program works at both district and village levels to address critical coastal issues. Conservation actions include control of destructive fishing practices, closure of reefs to replenish fish stocks, promotion of alternative livelihood options, such as mariculture, and mangrove planting. This demonstration program has shown that management of coastal resources and development activities can be effectively undertaken at the local level.

Kinondoni Integrated Coastal Area Management Programme (KICAMP)

This coastal management program of Kinondoni district in Dar es Salaam was initiated in 2000. The program has identified priority coastal issues and developed a strategy for addressing them. Priority issues include coastal tourism development, erosion and dynamite fishing.

Rural Integrated Project Support (RIPS)

RIPS is a rural development project located in Mtwara and Lindi administrative regions. The project works with coastal communities to reduce dynamite fishing and raise awareness about the importance of coastal resources.

Rufiji Environment Management Project (REMP)

REMP's goal is to promote the long-term conservation through wise use of the lower Rufiji forests, woodlands and wetlands. The project area is within ecologically rich Rufiji floodplain and several upland forests of special importance.

Mnemba Island Marine Reserve (MIMR)

Mnemba Island Marine Reserve was created for the purpose of reducing damage to the island's environment and marine life. The island is a breeding site for sea turtles.

Menai Bay Conservation Area (MBCA)

Menai Bay Conservation Area, gazetted as a conservation area in 1997, is located in the south west of Unguja Island. It encompasses an area of 47,000 ha. which holds extensive areas of coral reefs, sea grass beds and mangrove forests. Sixteen village communities reside within the protected area. The conservation areas was created after studies conducted in 1991 indicated that the area's coral resources were being rapid degraded and fish populations were declining as a result of damaging fishing methods. Management actions have targeted destructive fishing methods and overfishing. The long-term goal of the project is to conserve the biological process, productivity and eco-systems of the Menai Bay for the benefit of local people.

Chumbe Island Marine Park (CIMP)

Established in 1992, the park is managed by a private company with assistance from an advisory committee that includes representatives from government, the University of Dar es Salaam and local communities. In 1994, Chumbe Island was gazetted as a marine protected area that includes a reef sanctuary.

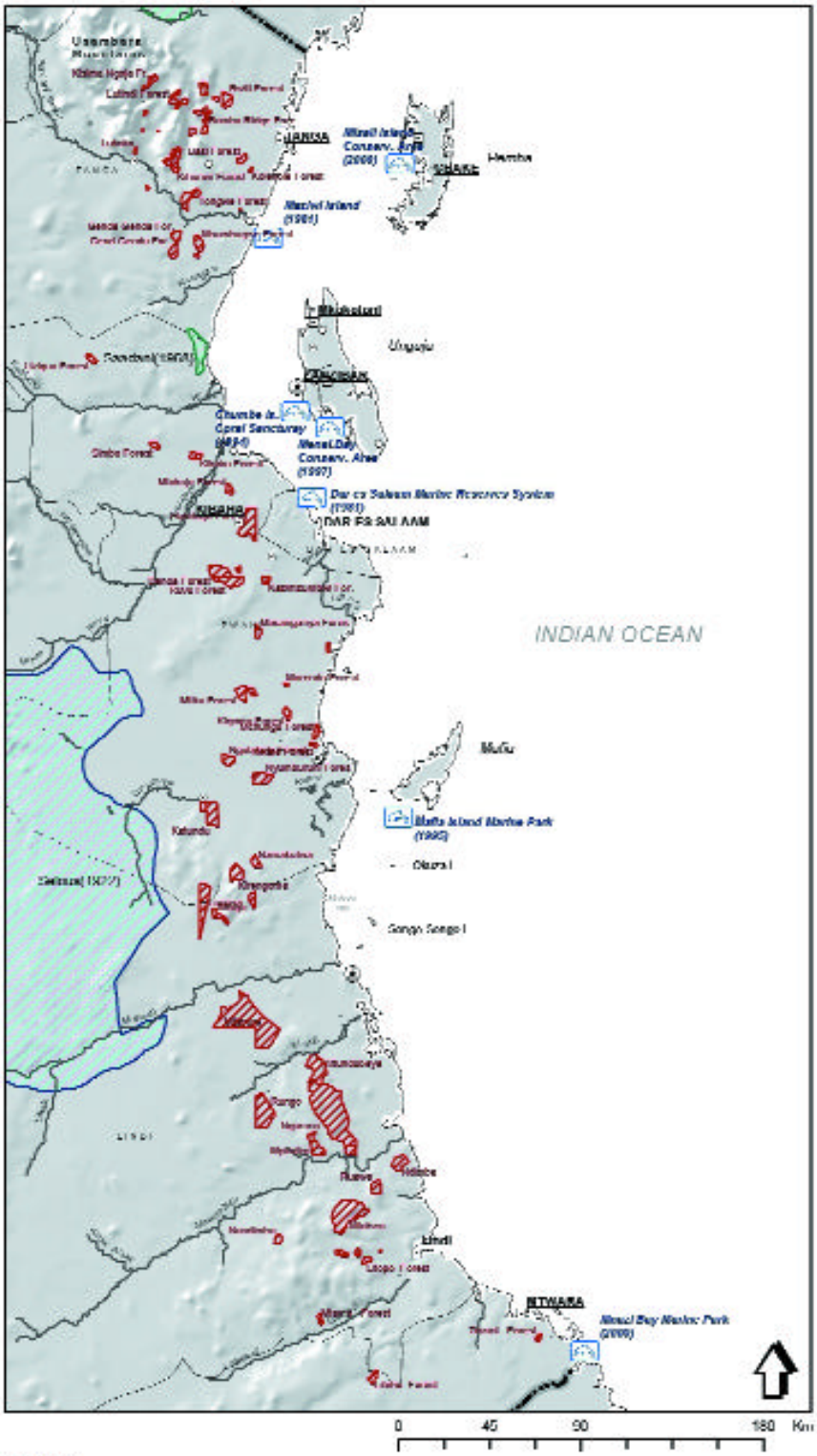
Chwaka-Bay-Paje Conservation Area (CBPCA)

The Chwaka-Bay-Paje Conservation Area has prepared a management plan and established a Coastal Resource Management Committee.

Misali Island Marine Conservation Area (MIMCA)

MIMCA's goal is to establish a financially self-sustaining marine and terrestrial protected area at Misali Island, Pemba, based on fishing and eco-tourism.

Breeding site for birds, Latham Island



Legend

- Country Boundary
- Regional Hq.
- District Hq.
- Conservation Areas
- International Convention
- Forest Reserve
- Marine Conservation Areas
- World Heritage Site

COASTAL PEOPLE

DEMOGRAPHICS

The five mainland coastal regions encompass about 15 percent of the country's land area and are home to approximately 25 percent of the country's population, or about 8 million people. At the present rate of coastal population growth there could be 16 million people living on the coast by the end of this decade.

Indicators — Demographics
- Village population
- Population density
- Migration / Immigration

The last national population census was in 1988. At that time, the growth rate for mainland Tanzania overall was 2.8 percent. The Table below shows population and population density for the year 2000 for mainland Tanzania coastal regions based on 1988 growth rates.

The 1988 census statistics show a significant rural-urban migration pattern, particularly to the city of Dar es Salaam. Major reasons are the lack of communication and transportation infrastructure in coastal communities and lack of livelihood opportunities. Especially in Mtwara and Lindi regions, cash crop plantations such as coconut and cashew nuts occupy large expanses of land leaving nowhere for the young to farm. Fishing along the coastline often provides little attraction due to the low level of technology and the poor condition of gear. It is not easy to make a living by fishing throughout the year. Reducing migration will require strengthening infrastructure, improving the productivity of current economic activities in rural coastal communities, and promoting alternative livelihood opportunities.

Village perceptions
In most of the coastal villages surveyed, population density, and migration are all increasing

Lifetime migration by region, 1988

Region	Lifetime in Migration	Lifetime out Migration	Net Lifetime Migration
Mtwara	46,299	144,988	-98,689
Lindi	95,200	145,031	-49,831
Tanga	98,747	150,915	-52,168
Coast	103,804	207,716	-103,912
D'Salaam	651,246	150,625	500,621

Source: Tanzania 1988 Population Census, Dar es Salaam. Lifetime migration refers to changes in individuals' regional domicile over their lifetime.

Population and population density by coastal region

Region	Land Area km^2	1988 Total Population	1988 % Growth rate	1988 Population Density per km^2	2000 Population (Predicted)	2000 Population Density per km^2
Coast	32,407	638,015	2.1	20	813,444	25
D' Salaam	1,393	1,360,850	4.8	977	2,430,500	1,745
Lindi	66.046	646,550	2.0	10	800,038	12
Mtwara	16,707	889,494	1.4	53	1,023,134	61
Tanga	26,808	1,283,636	2.1	48	1,671,027	62
Zanzibar	2,460	642,578	3.0	260	867,473	353
TANZANIA	881,300	23,174,336	2.8	26	31,400,138	36

Source: Tanzania 1988 Population Census, Dar es Salaam

Fish drying, Somanga Village (Kilwa)

ECONOMIC STATUS

Women preparing fish - Kilwa

Some of the coastal regions of Tanzania are among the most deprived in the country in terms of infrastructure, per capita income, human capabilities, survival mechanisms and wellbeing. This reality is becoming more widely understood thanks in part to several complementary policy planning initiatives devised to tackle poverty and other development problems. These initiatives should result in greater focus and increased commitment toward efforts that address the unique situation of coastal areas.

Indicators — Economic wellbeing
- Income
- Property ownership
- Quality of housing
- Food security
- Ability to save
- Access to credit facilities
- Local investments and access to markets and trade

The present Poverty Reduction Initiative and Strategy Paper (PRISP) cuts across many government agencies and involves much of the donor community. The poverty reduction initiative, co-ordinated by the Vice-President's Office, has developed indicators of poverty and established a Social Economic Database (SED) in the National Bureau of Statistics to better inform policy and decision making.

In terms of **income per capita**, the data show that, with the exception of Dar es Salaam, the mainland coastal regions rank low in the country compared to other regions. It is a fact that in rural areas, including rural coastal communities, incomes are lower and poverty is more widespread than in the urban centres. This indicates the magnitude of the challenges facing Tanzania and the importance of economic growth to poverty alleviation.

GNP per capita (1997), regional ranking and value

	Rank	Value
Tanga	5	112,777
Coast	7	124,188
Mtwara	9	126,873
Lindi	10	126,949
DSM	20	371,811

Rank "1" implies most deprived region and "20" least deprived region.

Per capita income in 1997 in the most deprived regions was 95,623 Tshs.

Source: Porvety and Welfare Monitoring Indicators, Vice President's Office

In the coastal communities surveyed for this report, estimates of typical income varied from high to low, but the median across all villages is

low to average. Whereas, five of the villages surveyed were ranked as high or very high in income level, eight of the villages categorised themselves as very low.

Village survey — income categories

Very low	<50,000 Tshs.
Low	50,000-100,000
Avarage	100,000-200,000
High	200,000-500,000
Very high	500,000-1,000,000

In most coastal villages, it was perceived that the trend in income had deteriorated in the recent past (over the past year). But over a longer time frame (ten years) villagers felt

The coastal village survey indicated that **housing condition** is poor. In most of the villages, poverty was manifested by poor credit and marketing facilities, little savings, and lack of property ownership and investments. However, in many villages the number and variety of groups engaged in the burgeoning informal sector is on the increase, particularly in the most recent past. This is a sign that the future holds more and better prospects.

Mafia Port

Food security, regional ranking

Tanga	1
Coast	4
Lindi	5
Mtwara	9
DSM	20

Rank "1" implies most deprived region and "20" least deprived region.

Source: Poverty and Welfare Monitoring Indicators, Vice President's Office

Severe **food scarcity** is not a frequently cited problem in the coastal communities surveyed. This contrasts from the actual status of the regions overall. Indeed Tanga, Coast (Pwani) and Lindi regions are among the most afflicted in terms of food security in the country. This may indicate that coastal villages have somewhat better food security than inland communities, because of the marine artisanal fishery.

In two of the villages surveyed there is a local food deficiency once every year or every other year. In most of the villages there has either never been a food shortage, or it occurs infrequently (once in ten years). However, if growth in agricultural yields and **fish catch** do not keep pace with population growth, the problems of food insecurity will become more severe in isolated rural coastal communities in the future.

Regional data also indicate that the **nutritional status** of residents of several mainland coastal regions is very poor overall. The percentage of children underweight (below 80 percent of normal weight) is an indicator of poverty and affects school enrolment and overall educational attainment. The national average of the per-

cent of children underweight is 9. Lindi, Coast (Pwani), and Mtwara regions are among the regions with a high percentage of underweight children, that is 12, 15, and 22 percent, respectively. The percentage is 3 and 5 percent for Tanga and Dar es Salaam regions.

Nutrition level, regional ranking

Lindi	6
Mtwara	9
Coast	11
Tanga	17
DSM	20

Rank "1" implies most deprived region and "20" least deprived region.

Source: Poverty and Welfare Monitoring Indicators, Vice President's Office

The major threats to economic status were perceived by villagers in the survey to be low income, lack of technology, environmental degradation and inflation. **Lack of technology** calls for the need to embark on concerted efforts to transfer knowledge and demonstrate low cost and appropriate technologies. To take advantage of the full benefit of new technologies will also require rural credit schemes to finance the growth and betterment of transportation, infrastructure and other facilities for marketing.

By **identifying environmental** degradation as an urgent threat to economic status, coastal villagers have recognised that economic well-being and the environment are intimately connected. Most rural coastal communities depend on seawater and land to generate income and subsistence. A decline in coastal ecosystem productivity has a direct negative impact on society. Hence, protecting environmental resources that people depend on for income generation and consumption is critical to the survival of coastal families, poverty reduction and slowing rural to urban migration.

The fishing community in Tanzania, as with many other tropical countries, is comprised mostly of artisanal fishers operating near the shores of the Indian Ocean. Fishing is their major preoccupation providing them with cash income and their main source of protein. Many take to the sea as ordered by custom but also because no other possibilities exist. It is therefore paramount that poverty alleviation management strategies should target **alternative income** generating opportunities to take pressure off the fragile near shore environment. Coupled with this, we must work toward more environmentally sustainable use of marine resources, and continue to advance the conservation of the coral, mangrove, seagrass and other habitats that coastal populations depend on. These actions are decisive for coastal wellbeing and fundamental for encouraging young people to remain in rural coastal villages rather than migrate to Dar es Salaam and other urban areas. The explosive urban growth in Dar es Salaam has not been matched with housing and sanitation infrastructure, leading to an increase in squatter settlements and environmental degradation.

INFRASTRUCTURE

Rufiji Ferry

Indicators — Infrastructure
- Road infrastructure
- Distance to fresh water
- Quality to water supply
- Access to electric service
- Distance to fuelwood supplies

Poor infrastructure, including roads, water supply, port facilities, electrical power, and telecommunications, is one of the causes of continuing poverty in coastal areas. Problems of infrastructure have a major impact on economic growth, decisions to migrate, health, education, and sanitation.

Only a very small percentage of rural coastal households have electricity. The percentage is higher in urban areas. Two thirds of the villages in the coastal survey indicated that there is no electricity use or that such use is very insignificant. In general, the **road system** is extremely poor in coastal regions. For example in the Coast (Pwani) region as a whole, 89% of the roads are constructed of either gravel or bare earth and are impassable during the rainy season. Despite their poor condition, in all coastal regions, roads are the most important means of transportation within regions and to other regions. In Lindi region, the poor condition of roads discourages traffic flow to other regions. The Dar es Salaam – Lindi road is the "lifeline" of the region's economy but is in appalling condition. Nine of the villages surveyed are not fully accessible by road for a greater part of the year.

The **port of Mtwara** is strategically well placed to serve cargo being transported to and from the regions of Mtwara, Ruvuma and Lindi, as well as the countries of Malawi and Zambia. This potential has not been achieved due to poor roads leading to Mtwara town. Moreover there is only limited commercial freight and passenger transport between the port of Mtwara and Dar es Salaam. During the rainy season, the passenger service by boat to Mtwara is the most reliable means of travel, though at times erratic.

Sailing, Kilwa

Lindi region has two ports—one in the town of Lindi itself and the other in Kilwa. However, they are serviced only by small vessels and merely link the districts within the region and do not link the region with other parts of the country.

The distance to and quality of **water** was considered by the villages surveyed to range from unsatisfactory to average. Nine of the villages considered it to be unsatisfactory and in one village it was ranked as very poor, or obtained with hardship. In this particular village (Kicharikani in Muheza district, Tanga region) it is an eight-hour walk to collect fresh water.

Fuelwood was viewed to be reasonably accessible overall in the villages surveyed. But there is a wide variation from place to place. Thus, six villages report that collecting fuelwood is a hardship, while seven others affirm the abundance of fuelwood. At the same time, all villages felt that fuelwood had become less accessible in the relatively recent past.

HEALTH

The majority of people along the coast are exposed to environmental and nutritional related health problems. Malaria and water borne diseases are typically the greatest threats to health.

Indicators — Health

- Distance to hospital
- Number of hospital stuff
- Quality of health service
- Prevalence of common diseases
- Health knowledge
- Use of Traditional healers
- Life expectancy
- Infant and child mortality rate

In most villages surveyed, distance to hospitals was perceived to be reasonable. Access to medicine, supplies and the number of doctors and nurses in relation to the population served were viewed by coastal villages as inadequate and in most places, were considered to be deteriorating over time.

Water and health service indicators

Region	Rural population with access to clean and safe water	Population per health facility
	1992	1996
Coast	40.1	4,816
D'Salaam	57.4	5,347
Lindi	49.5	6,108
Tanga	59.7	6,607
Mtwara	83.8	7,939

Source: Poverty and Welfare Monitoring Indicators, Vice President's Office, November 1999.

Health regional ranking

	Health Status	Health Services
Lindi	4	18
Mtwara	8	12
Coast	9	13
Tanga	13	13
DSM	13	13

Rank "1" implies most deprived region and "20" least deprived region.

Source: Poverty and Welfare Monitoring Indicators, Vice President's Office

In many of the villages there was a perception that heath status in terms of prevalence of common disease and life expectancy was deteriorating, with the exception of infant and child mortality, which was considered to be improving.

This is corroborated by official regional data, which indicate that the infant mortality rate in coastal regions has, on average, consistently improved from 1975 to 1995.

Villagers felt that their health knowledge is quite good and has increased over the past year or so. A parallel finding is that the use of traditional healers is perceived to have decreased over the past year in over half the villages surveyed.

Infant mortality rate by region (per 1,000)

Region	Infant Mortality Rate (/1000)		
	1975	1985	1995
Coast	121	113	105
Dar es Salaam	108	105	102
Lindi	151	140	129
Mtwara	161	138	119
Tanga	112	106	100
Mainland total	137	115	96
Pemba North	128	123	
Pemba South	123	119	
Unguja North	132	130	
Unguja South	121	123	

Kilwa Masoko Secondary School.

Lindi is considered to be the most deprived of the mainland administrative regions in education, as measured by primary school enrolment. The village survey did not include education indicators in this first state of the coast report, but villagers were asked about their perception of the underlying threats to poor education. The most frequently cited urgent threats to education in coastal villages were poverty and child labour, poor motivation and early marriage.

Gross Enrollment (prim. school), regional ranking

Lindi	2
Coast	9
Tanga	12
Mtwara	13
DSM	19

Rank "1" implies most deprived region and "20" least deprived region.

Source: Poverty and Welfare Monitoring Indicators, Vice President's Office

Gender Equality

Gender equality in decision making

Gender refers to the roles men and women play in a community; i.e. the differences in tasks, responsibilities, constraints and opportunities between both groups. These roles are deeply fixed in people's minds and hearts but can change and actually do change over time. Traditionally, women in coastal communities are mainly involved in household activities, including collection of fuelwood and water, production of food and subsistence fisheries, while men are mainly involved in cultivation of food and cash crops, fishing and small scale business and trade.

Indicators — Gender Equality

Relative role of women in income generation, land ownership, household activities, contribution to household expenditures, community decisions and natural resources management.

With only one or two exceptions, women's role relative to that of men is perceived to be very low in the villages surveyed in areas of income generation, land ownership, contribution to household expenditure, community decision making and natural resource management. Women's' role is deemed very high in time devoted to household activities. In most of the villages there is a recent trend of an increasing role of women especially in income generation, contribution to household expenditure and even community decisions.

The major threats to gender equality were perceived to be inadequate technologies for women, inadequate education and capacity, low representation of women in decision-making bodies, and early marriage.

Governance and Community Organisations

Village meeting, Tanga

Coastal villagers surveyed perceived that village, local, and central government are well

managed and active. But community organisations and village committees were not considered to be as strong. In four villages it was reported that there are no functioning community organisations or village committees. However, there is a trend across most coastal villages of increasing quality and quantity of community organisations, village committees, NGOs and donor-organised activities.

Indicators — Governance and Community Organisation

- Quality of village, local, and central government
- Number and quality of private, donor, and civil society groups (community organisations, village committees, religious groups, social clubs, and NGO's)

Community clubs and organisations in coastal communities build trust, civic cooperation, and overall "social capital". This is important for environmental planning and human development because it enhances problem solving capabilities and performance of institutions.

The major threats to governance and community organisations perceived to be limited funding, lack of coordination, conflicting interests and poor planning, and donor dependence and influence.

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