Income diversification and resource conservation among artisanal fishers at the Central Kenyan Coast. NIRP Final Report

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SUMMARY

There are an estimated 8-10,000 artisanal fishers on the Kenya coast, about 2-3,000 in the Kilifi and Malindi Districts. These artisanal fishers have received relatively little attention thus far but it is known that they face dwindling resources and heavy competition from tourism and human settlement. The main objective of this research was to increase the knowledge of social and economic conditions of fisher-folk. The focus was on income diversification of fishermen, the pressure on marine resources and the relation between the two. It was hypothesised that households with additional resources, notably non-maritime employment, strengthen their livelihood strategies and improve their household security. Furthermore, fishermen who succeed in diversifying their incomes will exact less pressure on marine resources and will have a more positive attitude towards conservation measures.

The research tackled the above subjects by means of interrelated surveys and studies. The project consisted of 10 research activities including four surveys on fishers, fish catches, traders and fisher households, respectively. The surveys were augmented by detailed studies on fish biology, fish traders, income diversification and resource conservation. Following the introduction (Ch.1) and literature review (Ch.2), the report begins with a survey among fishers at five coast tracts and describes their general characteristics (Ch.3). Next, the focus shifts to catches at four landing sites; amounts and composition (Ch.4). The following chapter focuses on the households of fishers and crew members compared with non-fisher households, assessing household incomes and their composition (Ch.5). The next chapter is concerned with environmental aspects of fishing and examines the relation between environmental awareness and income diversification of the fishers (Ch.6). Comprehensive summaries of the detailed studies are presented in the series of Appendices.

Lack of off-shore going vessels dictated that most of the fishing efforts were concentrated on- and inside the reef. Forty percent of the fishers reported that they had economic activities in addition to fishing. Closer examination showed that it was mostly the Mijikenda fishers who were farming and Bajuni/Swahili fishers much less so. There were large differences among the five coast tracts studied as well as large individual differences among fishers.

More than 100 fish species were identified during the study period. Species richness was highest in the two landing sites situated in Marine Park Areas (MPA's), Malindi and Mida.

However, the amounts of fish landed at these two sites were considerably lower than at the sites in Ngomeni and Takaungu that were not near MPA's. Apart from the differences among the landing sites, there were also considerable seasonal differences in catch.

Comparison of fisher households (captains & lone fishers) with crew households and non-fisher households revealed that fishers received slightly higher incomes from fishing than their crews but crews had higher incomes from non-fishing activities and, in total had a higher income than fishers. Fishers and crews, together, had a considerably higher income than non-fishers who received only two-thirds of the income of the others. Single livelihood fishers earned better incomes than multiple livelihood fishers while the opposite was the case among crew members where a diversified livelihood resulted in a better income.

Most fishermen in the survey were aware of degradation of marine resources and mentioned declining fish catches. The report discusses four ways of restricting fishing activities (a) number of fisher, (b) access to fishing grounds, (c) type of gear and (d) frequency of fishing. All indications were that the number of fishers was increasing because of the entry of many Mijikenda fishers into the arena and lax enforcement of regulations. Marine Parks posed effective restrictions on fishing grounds but they had distinct disadvantages for the fishers nearby and there existed considerable resentment against the Park among this group. Restrictions on fishing gear seemed to have an effect within the Reserves, areas that were patrolled by KWS wardens. In remote areas, fishermen rarely considered the environmental impacts of the gear they used. There were no indications that fishers with a multiple livelihood placed less pressure on the marine environment. If anything, the opposite was the case, as the latter group concentrated their fishing inside the reef.

The expectation that income diversification leads to less pressure on the marine environment was not confirmed. General and specific recommendations are included in the report. Lessening of pressure on the marine environment should focus on restricting the numbers of fishers and should, firstly, target the large number of 'new' fishers that enter the arena by toughening license requirements and local approval procedures. Although fishers express a willingness to conserve marine resources in various ways, they will only do so if they can expect income improvements in the short-term and have confidence in the long-term prospects.

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CHAPTER 1

INTRODUCTION

Rationale

Kenya has about 600 km of marine coastline where fishing is an important economic activity. While off-shore fishing is the domain of a few Kenyan vessels and some visiting factory trawlers from foreign countries, the local population is involved mainly in in-shore fishing. There are perhaps 8-10,000 artisanal fisher-folk along the entire Kenyan inshore waters although it is difficult to arrive at an accurate estimate.

The prospects of the fishing community are negatively affected by the destruction of coral reefs (as they are silted and plundered by both visitors and the local population), and the decline in mangroves (as a result of pollution and over-exploitation), the creation of marine parks and reserves, and the pollution of ocean waters. Both mangrove forests and coral reefs provide protection to the coastline against the sea, are rich depositories of biodiversity and offer breeding grounds for many marine species (Stuart & Stuart, 1995). An analysis by McClanahan and Obura (1995) indicated that inshore fishing for the whole of the Kenya coast was near its maximum sustainable yield. The implication of these changes is that fisher-folk basing their survival on the fish resource in the inshore waters

cannot expand to better their future unless, perhaps, they are enabled to venture further in the deeper waters. This demands sound management of the fishery and better understanding of the biology and ecology of the fish species that support the fishery, as well as detailed knowledge of the fishers and their livelihood strategies.

In spite of the impending plight of the fisher, little is being done. Fishers have been largely neglected and few, if any, alternative forms of livelihood are available to them. This is unlike the pastoralists, another minority group elsewhere in Kenya, which has, and still is, being well researched and additional options of livelihood are being examined. Existing knowledge about social and economic characteristics of in-shore fishing is small. The coral fisheries are characterised by a multitude of fish species. Earlier reports mentioned over 30 species in the Kilifi/Malindi waters (Nzokia 1984) but Richmond (1997) gave a much higher number. Equipment and gear owners with large traditional boats employ a crew of 4-5 people who conduct fishing on their behalf while small boat owners engage a crew of 1 to 2 that fishes hook and line. Fishers use various types of nets, lines, traps and spearguns among others. Catches range from large fish such as tuna, (small) sharks, and barracuda to kingfish, groupers and small fry. Lobster and crabs are mostly sold to hotels and restaurants. Another set of fisher-folk are available for hire by ornamental/aquarium fish dealers that export live fish to other parts of the world, especially Europe.

Little knowledge exists about the household income and income composition of fisher-folk. The impression is that it varies greatly between fishing villages and within villages. In some parts of the coast, fisher-folk are regarded as the poorest of the poor. Elsewhere, they are considered well-off even though research has shown that their standards of living are lower than that of others in the same locality (Mwadime, 1996). It is also unknown whether households are wholly dependent on fishing or only partly so, that is, whether they have other resources and, if so, the nature of these resources. The seasonality of fishing imposed by the weather conditions and the movements of fish stocks means that the fisher-folk are likely to be less engaged in fishing at certain times of the year. Activities during the low fishing season need to be documented.

With the inevitable decrease in fishing opportunities, developments in a number of directions can be envisioned. Possible scenarios are as follows:

- *Improvements in fishing methods.* Introduction of improved and sustainable fishing methods, in combination with improved care of breeding grounds to assure the long-term future of fishing as an economic activity, is a possibility, if not a necessity.
- *Use of illegal and destructive fishing methods.* There have already been reports of the occasional use of explosives (south coast), poisons (Ungwana Bay) and placing traps in breeding sites. Although the sales of shells and corrals are banned, they are still being collected.
- *Introduction of community participation.* In up-country game parks, local pastoralists are now recognised as stakeholders and receive financial benefits from the tourist sector. This system of payments does not exist in respect of marine parks.
- *Resistance to new parks and reserves among local populations.* This is already the case with the proposed Diani Reserve which has been rejected by the local population and which has left Kenya Wildlife Service with a major problem (King 2003).
- *Marine employment.* In Malindi Marine Park, the Bajuni fisher-folk were given permits to operate glass-bottom boats to take visitors for goggling on the reefs. A number of fisher-folk have found employment as crew of sport fishing boats, but such possibilities are few.
- *Non-maritime employment.* The possibilities for non-maritime employment will first and foremost depend on the existing opportunities in the local economy which are small, given the level of unemployment in this part of the country. Much will depend, however, on whether fisher-folk households already have footholds outside fishing. Some households may have land to cultivate or some household members may have alternative employment.

Research into the social and economic conditions of fisher-folk and their responses to the deteriorating situation is needed. This is necessary for the future of this group which has thus far received little political or research attention. It is also necessary for environmental concern, since fishing activities can potentially cause much damage. Hopefully, the fishers can also act as a positive force and become guardians and stockholders of the maritime heritage. Experience from elsewhere has shown that fisher-folk do not easily abandon the family profession in which they have been raised and in which they are training their children. For the moment, therefore, resource diversification of fisher-folk households appears to be the most promising strategy. In general, smallholder households in coastal Kenya try to diversify their incomes with income from food crops (subsistence), cash crops, livestock and non-farm employment. In addition, income diversification is an important factor in food security and household livelihoods (Hoorweg, Foeken & Klaver 1995). Information and understanding of the resource management and household strategies of local fishermen is vitally important.

The guiding hypotheses of the research are that:

- For a number of years, fisher-folk households can continue to draw their livelihood from fishing or maritime employment. Access to better fishing techniques and continued presence of desirable species in the catches (as a result of conservation measures), and favourable marketing structures, are all opportunities for continued engagement in fishing as a means of livelihood and employment for local people.
- Fisher-folk households, out of necessity, will have to enlarge their resource base if they have not done so already in the recent past. Households which avail themselves of additional resources, notably non-maritime employment, strengthen their livelihood strategies and improve their household security.
- Fisher-folk who succeed in diversifying their incomes and avail of economic alternatives will put less pressure on marine resources and will have a more positive attitude towards conservation measures.

Study Area

The East African coast stretches 5500 km, including Somalia, Kenya, Tanzania and Mozambique. The Kenyan coast covers around 600 kilometres from the Somali border in the north to the border with Tanzania in the south. The southern part, below Malindi, consists of tiers of Pleistocene reefs above and below sea level. North of Malindi, the coast is formed by broad sedimentary plains drained by the Tana and Athi-Sabaki rivers. These rivers dominate the coastline due to the sedimentation they bring. The continental shelf is narrow except off Malindi and the Tana River mouth (Obura 2001; UNEP 1998).

The Coastal Region lies generally low and is characterised by the extensive fossil reef, which lies a few meters above present sea level. The coastal plain is backed in the interior by a line of hills that rarely exceed 300m except in the southern parts where the Shimba Hills reach an altitude of around 1,000m above sea level. Further inland, the Taita Hills rise to an elevation of 1,500m above sea level (Foeken 2000). Most of the shoreline, apart from the Malindi area, is receding as a result of coastal erosion. Sand supplies from rivers and coral reefs are not sufficient to keep up with the rise in sea level, and the problem is further exacerbated by coastal development.

The climate on the Kenyan coast is dominated by large-scale pressure systems from the Western Indian Ocean and the two distinct monsoon periods. The north-east monsoon prevails from November-March, whereas the south-east monsoon prevails in May-October. The tidal range is about four kilometres. Land close to the sea receives about 1,000 mm of rain per year whereas a few kilometres inland it receives 700 mm per year. The shoreline exists of rocky fossil coral cliffs, mangrove stands and sandy beaches (Glaesel 1997; Obura 2001; UNEP 1998).

A fringing reef parallels the shore anywhere from 0.1 to 1.0 kilometre offshore. Coral reefs are often regarded as rain forests of the sea because of their biodiversity and also contains special habitats like tide pools. The shorelines are important fishing grounds for the artisanal fishermen (Aloo 2000; Obura 2000, 2001; UNEP 1998). There is evidence

that migratory fish stocks (non-residents), especially the pelagic species, only get caught when they traverse the inshore fishing grounds (McClanahan, 1995).

Marine resources also include sea grasses and seaweeds, mangroves, sea turtles, marine mammals, crustaceans and various billfish. Other features include the Lamu Archipelago with its extensive mangrove forests, the Tana River which is Kenya's largest river and discharges through a complex wetland system into Ungwana Bay, the Sabaki River which incorporates the Athi and Galana Rivers and discharges north of Malindi, the coral islands like Wasini Island, Chale Island and Funzi Island and Gazi and Funzi Bay (Aloo 2000; UNEP 1998).

Coast Province has five districts bordering the sea, namely from north to south: Lamu, Tana River, Malindi, Kilifi, Mombasa and Kwale. The study area is situated in Malindi and Kilifi districts, extending from Ras Ngomeni (the Ngomeni peninsula) to Takaungu Creek, a distance of roughly 100 km and consists of (5) coastal tracts with (2) landing sites each. From North to South these are the Ngomeni, Malindi, Mida, Kilifi[1] and Takaungu coast tracts. This coincides more or less with the coast of Kilifi and Malindi districts except for about 25 km north and 25 km south. This choice was made for logistic reasons and to ensure cultural consistency.

The Ngomeni coastal tract is characterised by the absence of the fringing reef, open access to the sea, mangroves, mud flats and sandy beaches. The two landing sites are situated opposite Robinson's Island and at Ngomeni village respectively. The Malindi coastal tract is near the Malindi National Reserve with one landing site in Malindi town at the very end of the reef which at this point is polluted and covered by sediments from the Sabaki River. The second landing, site, Mayungu, is a small cove in dry rocky land with the reef relatively far out. The Mida coastal tract consists of the Watamu landing site and Uyombo landing site both situated within in the Watamu Marine Park respectively. The first landing site is situated on a sandy beach with nearby coral rocks towering over the

1 The Kilifi coastal tract was part of the fisher and trader survey but not further included in the research activities (See Table 1.1).

sea. Uyombo lies at the entrance of Mida creek, a large estuary that is largely dry during ebb tide. The Kilifi coastal tract consists of two landing sites (Bofa and Kilifi Ferry) that are both within easy reach of Kilifi town. The first site is further up the coast with small rocky outcroppings, the second site is situated at the mouth of the deep Kilifi creek that serves as a harbour for coastal dhows and pleasure yachts. The Takaungu coastal tract is characterised by coral soils and palm cover and consists of landing sites at Takaungu town and Shariani. The coral reefs here are patchy in nature and further out to sea. Takaungu town is situated at a deep creek that falls largely dry at ebb tide; Shariani is on the seaside and has a steep rocky coast.

Study Outline

The aim of the project was to increase the knowledge of the social and economic conditions of fisher-folk. We analyzed their responses to the deteriorating situation in the fishing fields and studied how they can act as a positive force and as guardians and stockholders of the maritime heritage.

The research tackled the above subjects by means of interrelated surveys and studies. The project consisted of 10 research activities (RA) including four surveys on fishers, fish catches, traders and fisher households respectively (Table 1.1). The surveys were augmented by detailed studies on fish biology, fish traders, income diversification and resource conservation. The latter four studies were in the form of Masters theses of three Kenyan and one Dutch student.

The design of the detailed studies was guided by the baseline information from the surveys with focus on four landing sites that differed in nearness to marine conservation parks where fishing conditions were presumably better and that further differed in opportunities for alternative employment: Ngomeni, Mayungu, Uyombo and Takaungu. Sampling generally started from fishers at the four landing beaches and followed from there; for example to households (as in the diversification study) or to markets (as in the marketing study).

Table 1.1
Project Review: Research Activities and Landing Sites

	Research Activity (RA)								
	1	2	3	4	5	6	7	8	9*
Landing Site									
Mto Kilifi	V								
Robinson (Kenyaule)	V	V		V					
Ngomeni	V	V	V	V	V	V	V		
Kichwa Kate	V								
Mambrui	V								
Malindi (Mbuyuni)	V	V		V					
Mayungu	V	V	V	V	V	V	V		V
Watamu	V	V		V					
Uyombo	V	V	V	V	V	V	V	V	
Matsangoni	V								
Wesa	V								
Kilifi Bofa	V	V		V					
Kilifi Ferry	V	V		V					
Mnarani	V								
Takaungu (Chaurembo)	V	V	V	V	V	V	V	V	V
Vuma	V								
Shariani	V	V		V					
Misumanini	V								
Mtwapa	V								

* This study also included 2 research sites in Lamu not discussed in this report.

Legend

1 Landing Site Identification
2 Fisher Survey
3 Fish Catch Survey
4 Trader Survey
5 Household Survey
6 Fish Biology Study
7 Fish Marketing Study
8 Diversification Study
9 Marine Conservation Study

The full research project consisted of the research activities listed below. A specification of research activities and landing sites is given in Table 1.1.

RA1 *Landing site identification.* All official and unofficial landing sites in Kilifi and Malindi District were mapped and essential site-information recorded (See Appendix 9.1 for specification)

RA2 *Survey of fishers in 5 coastal tracts (10 landing sites).* At each coastal tract, 40 fishers were randomly selected and interviewed on topics such as type and frequency of fishing activities; crew and ownership arrangements and catch disposal (See Appendix 9.2 for method specification and sample characteristics).

RA3 *Survey of fish catches at 4 landing sites.* Fish catches were recorded over a period of 18 months twice a week (See also Appendix 9.3).

RA4 *Survey of fish traders in 5 coastal tracts (10 landing sites).* At each coastal tract, traders were randomly selected and interviewed about their buying and selling activities, storage and transport and destination of the fish (See also Appendix 9.4).[2]

RA5 *Comparative survey of households of fishers, crew members and non-fisher.* Heads of household and the wife were interviewed on living conditions, household composition, employment characteristics, farming activities, fishing activities, resource consciousness, resource conservation and food composition. (See also Appendix 9.5).

RA6 *Study of fish catch composition and reproductive biology of rabbitfish.* Fish catches at four landing sites were recorded and species determined in detail. Specimens of *Siganus sitor* (Rabbitfish), the most common species, were sampled, dissected and analysed for reproductive biology studies, notably gonad maturation stages and size at first maturity (See Appendix 9.6 for summary).

RA7 *Study of processing and marketing of fish.* Study of fish marketing channels, the choice of marketing channel and marketing constraints. Fish traders were

2 The results of this survey are not included in this report

sampled at four landing sites and queried about fish prices, buying and selling points, rate of turnover, fish processing, fish storage, and various socio-economic and household information (See Appendix 9.7 for summary).

RA8 *Study of income diversification in fisher households.* Study of the livelihood strategies of fishermen households at two landing sites. Data included semi-structured questionnaires, participant observation, life and career histories, network and genealogies and group discussions (See Appendix 9.8 for summary).

RA9 *Study of awareness of resource degradation and traditional conservation.* Study of fishing practices at two landing sites, the factors for choice of gear and the perceived impacts on coral reefs together with existing indigenous conservation, alternative income sources and conservation attitudes. Data included formal questionnaires, in-depth interviews, informal discussions and participant observation (See Appendix 9.9 for summary).

RA10 *Bibliography.* Compilation of bibliography of more than 300 titles on artisanal marine fisheries in Sub-Sahara Africa (See Appendix 9.10 for further information).

Report Outline

Chapter 2 presents a review of literature pertaining to marine fisheries in sub-Sahara Africa with sections on income diversification and resource conservation. Chapter 3 describes the characteristics of the fisher population along the Malindi-Kilifi coast, largely based on the fisher survey. Chapter 4 reviews the fish catches over an 18 months period, its composition and seasonal variation. Chapter 5 analyses the incomes, income composition and income diversification of fisher households compared with non-fisher households and is based on the household survey. Chapter 6 analyses the data from the fisher survey and household survey from a conservation point of view. Chapter 7 presents the conclusion and recommendations.

In an effort to keep the manuscript condensed, much of the background information has been included in the appendices. Appendices 9.2, 9.3, 9.4 and 9.5 present the

specification of methods and basic sample information for the surveys on fishers, fish catches, traders and households. Appendices 9.6, 9.7, 9.8 and 9.9 contain summaries of the four M.A./M.Phil. studies.

CHAPTER 2

LITERATURE REVIEW

Introduction

The coastal fisheries of Sub-Sahara Africa are exploited by local artisanal fishers; the more lucrative oceanic fisheries are harvested mainly by distant water fleets from Europe and Eastern Asia. Artisanal fishing and its associated economic activities are important to local economies (FAO 1997). The total number of full-time, part-time and seasonal fishermen in Africa is around 1.9 million, of whom 98 percent belong to the artisanal sector. Including the people involved in the processing and other related fish industries, this increases the number to nearly ten million people (Tvedten & Hersoug 1992). Since fish is a relatively cheap source of food in most countries, the importance of fish for the poorest sections of the population is considerable.

Despite the fact that most fishing activities in East African waters are small in scale and artisanal in nature, near shore fisheries are being overexploited along most of the mainland coast (Hinrichsen 1998). Kenya's coastal environment and its valuable resources are increasingly under pressure from human settlement and related developments. The coast accounts for nine percent of the Kenyan population. Marine

resource use is largely unregulated and the predominant near-shore activities include artisanal fishing, shrimp trawling, other commercial extraction and tourism. National, coastal and environmental legislation have resulted in overlapping and sometimes conflicting mandates in dealing with coastal and marine issues (Obura 2000, 2001).

Fishing at the Kenya Coast is influenced by two seasons: the *kusi* season, from March till September, characterised by the south-east monsoon and the *kaskazi* season, from October till February, characterised by the north-east monsoon. Although fish are generally more abundant in the cooler waters during the *kusi* season, this is not reflected in the fish catches. Catches are lowest during the *kusi* season and highest during the *kaskazi* season. This is due to reduced fishing effort, inability to fish beyond the lagoon and unwillingness to brave rougher waters, poor weather and fewer fish movements during the *kusi* season. Fish migration to other more productive areas causes the fish numbers on some fishing grounds to decline (Glaesel 1997:25, McClanahan 1996, Omar 2002:1,20, Tunje 2000:7, Versleijen 2001:5).

Fishing Methods

Fishing practices are largely traditional throughout most East African coastal waters although the lack of sophisticated gear has not prevented overharvesting. The types of

Table 2.1 *Vessels used along the East African Coast* [1]

ENGLISH NAME	SWAHILI NAME	DESCRIPTION
Canoe	*Mtumbi*	Dug out
	Hori	Plank built
Outrigger canoe	*Ngalawa*	
Vessel	*Mashua*	Large plank built fishing vessel, may be equipped with outboard motor or a sail
Sailing vessel	*Dhow/ Jahazi*	Only the smaller *dhow* are used for fishing

1 Abdullah *et al.* 2000; Glasesel 1997a, 1997b, Hoekstra 1990; Hoekstra *et al.* 1990, Hornell 1919, 1920 ; Lydekker 1919; Tunje 2000; and Versleijen 2001.

gear and vessels vary greatly. Abdullah *et al.* (2000) describe traps, nets, beach seining, hand lines, gill netting, seine netting, dynamite, *kigumi*[2] and pointed sticks for octopus used by the fishermen of Misali Island (Tanzania). Vessels include *hori*, *ngalawa*, *mtumbwi*, *mashua* and fishers may even go on foot.

Table 2.2 *Gear used along the East African Coast*[3]

ENGLISH NAME	SWAHILI NAME	DESCRIPTION
Basket traps	*Malema*	Placed during low tide with tunnel openings facing the shore
	Finge	Old form of basket trap, a stationary basket trap
	Mgono	Conical basket trap used in creeks
Fixed fence	*Uzio*	Fixed fence trap set up perpendicular to and up onto shore
Hand lines	*Mshipi wa mkono*	Hand lines with one ore more baited hooks are tossed into the sea from a dug out canoe or from a cliff on shore
Long line	*Kaputi*	A long line with a large number of hooks, used at various depths to catch larger fish
Gill nets	*Nyavu*	
Seine nets	*Juya*	Beach seine, even juvenile fish are caught due to the small mesh size
	Kigumi	Using large numbers of fishermen with poles and snorkelling gear a patch of reef is encircled by a weight seine net. Fishermen bet and break the coral scaring the fish into the net.
Cast nets	*Kimia*	A circular net which is tossed
	Jarife nets	
Sticks	*Konzo*	Sharpened sticks used to capture octopus
Speargun	*Bunduki*	Fish are shot by diving fishermen
Poison	*Utupa*	
Dynamite		

Howe (2001) mentions shellfish collection, whitebait fishing, traps, the use of seine and *jarife* netting, beach seining and snorkel and scuba fishing techniques in southern

2 Using large numbers of fishermen with poles and snorkelling gear a patch of reef is encircled by a weighted seine net. Fishermen beat and break the coral, scaring the fish into the net.

3 Abdullah *et al.* 2000, Glaesel 1997a, 1997b; Hoekstra 1990; Hoekstra *et al.*1990; Howe 2001; Masalu 2000; Muchiri 2001; Obura 2001; Okidi 1979; Tunje 2000 ;and Versleijen 2001

Tanzania. Masalu (2000) mentions this as well and adds dynamite fishing. Dynamite blasting is considered to be the environmentally most destructive method and is forbidden. Spearguns are also forbidden because of alleged environmental effects (Ide 1996). Muchiri (2001) and Obura (2001) list pullnets and gill nets, cast nets, seine nets, hand lines, spearguns and basket traps being used at the Kenya Coast. As increasing numbers of people head to the coast in search of work and new livelihoods, many turn to the sea as well. Unfamiliar with fishing techniques and conservation methods, they often use destructive methods such as fine-mesh nets, dynamite and poison (Hinrichsen 1998).

Different types of vessels used along the East African coast are listed in Table 2.1 while different types of gear are listed in Table 2.2. Vessels and gears can be owned commonly or individually with all possible combinations. In Zanzibar, sharing of gear is reportedly more common than sharing ownership of boats (Hoekstra *et al.* 1990).

Fisher Organisation

Artisanal fisheries are characterised by uncertainty. Men are poorly equipped for the dangers of the sea, gear has to be adapted, fishing techniques have to be diversified to match the seasonal changes and large numbers of species and a fisherman has to deal with a fluctuating income (Charles 2001:203-209). Furthermore, fishermen are dependent on middlemen and shipowners and their regular absence (due to long periods at sea and their migratory behaviour) makes them under represented in the political arena (Acheson 1981:277).

Fishermen enter into agreements with each other to constitute fishing institutions and to maintain certain rules to reduce risk. Crew organisations are a common phenomenon in African and global fisheries. Fishermen belonging to a crew are rarely paid in wage, but are paid a portion of the catch. There are several ways to divide the catch among crew members and the owner of the vessel and gear (Acheson 1981:278, see also Glaesel 1997, Klein 1999, Versleijen 2001: 95, Haakonsen, 1992: 42 and Jul-Larsen 1992: 81). Shares of the catch are distributed according to labour and capital contributed.

Relationships are commonly egalitarian, in that all crews have a captain but he hardly exercises his authority. This egalitarianism is caused by the need for a well-trained committed crew, the need to avoid disaster and increase fishing effectiveness. The organisation of the crew is diverse. Crew may consist of friends and non-kinsmen or of kinsmen. Some younger children in Kenya start fishing with their father, uncle or brother to learn the fishing and join another crew later.

In some fishing societies, the boat and gear are owned by members of the crew. However, fishing gear and vessels can also be owned jointly by lineage members, co-operatives, fisher organisations, village committees or be the property of businessmen and others (Acheson 1981). Versleijen (2001) mentions the village committee in Uyombo, which were provided nets to be used by the fishing community under supervision of the village committee. Ownership of gear can also rest with the *tajiri*. Glaesel (1997:58) described *tajiri* as a person involved in marketing the fish at most landing sites who are "often older, former fishers, or part owners of the boats fishers use". Versleijen (2001) presented a comparable definition, adding that the *tajiri* also provides credit to fishermen.

Besides crew organisation, fishermen organise themselves in other ways to reduce and deal with risk. Klein (1999) mentioned the strong sense of communal responsibility among fishermen at the Nigerian Coast and stated that among many villages, fishing retains features of a collective enterprise. Hinrichsen (1998) described a fisheries co-operation in Vanga (Kenya), which helped stabilise incomes of fishermen. Also Lopes *et al.* (1997) discussed collective action as a way to deal with risk. However, Knowles (1987) stated that the fishermen of Pate (Lamu, Northern Coast of Kenya) had minimal contact with the community, although they played an essential role in the community. The bond of companionship and brotherhood the fisherman develops with his fellow crew mates dominates and provides security to the fishermen. Religious practice separates the fishermen from the rest of the local community. The mystical and ritual role of seafaring in the Muslim maritime community, together with his economic contribution to the village, makes the fisherman a highly regarded person. However,

Versleijen (2001) in contrast, cited a fisherman that non-fishing villagers were incorporated into the *sadaka*.

Another way for fishing societies to cope with uncertainties and risk is through ritual and magic. This is underlined by the lack of ritual and magic in some lagoon fisheries where risks and uncertainties are lower. The quasi-ritual nature of fishing shows a concern with purity and pollution (Acheson, 1981:287). Tunje (2000) and Tunje & Hoorweg (2001) also mentioned taboos concerned with fisherman's personal safety at work, cleanliness and hygiene and fish handling. Chilundo & Cau (2000:9) discussed taboos concerning mussels exploitation in Mozambique.

Fishermen can also deal individually with risk, uncertainty and competition. Through skill, income diversification, capital management, innovation and technical change a fisherman can limit the risk and deal with competition. Skills are an important asset and often there is a reluctance to share information among fishermen (Acheson 1981). Another important way for fishermen to cope with uncertainty is income diversification (Okemwa, Ruwa & Mwandotto 1997: 329, Tvedten & Hersoug, 1992: 18). Although Glaesel (1997) stated that farming among *fishermen* is on the decline, Versleijen (2001) reported that farming by *fisher households* is on the increase. She concluded that households need to diversify their income, especially during the difficult *kusi* season. Those who cannot diversify their income have to rely on their relatives, who are also under financial pressure. Many people face the same problems and therefore for many households it is difficult to offer any assistance to others. Similarly, in times of economic distress, fishermen combine fishing with non-fishing activities. It should be noted that these trends work in reverse as well, that is, people involved in non-fishing activities start to fish in order to diversify their income.

Fishing success in the long-term is not only linked to skills but also to the ability to handle and invest the money generated. Versleijen (2001) mentioned that well-off fishermen in Takaungu were those who invested their money when their income was higher. Those who managed to dealt with their highly fluctuating incomes were the ones who coped

better financially during the *kusi* season.

Also the adoption of and access to new and more effective fishing gear and vessels is important for fishing success. However fishermen often reject innovations or do not have access to them due to a lack of money and geographical distance. Innovations are likely to be rejected when they are not profitable or incompatible with existing cultural patterns. Another point, which has to be taken into consideration, is that innovations may increase the output only when fish are abundant (Acheson 1981:293).

Role of Women

In most fishing societies, there is a stringent sexual division of labour: the men fish while the women mind the household. Various explanations have been given in the literature. It has been suggested that fishing requires stamina and strength, and women presumably do not have these qualities. Another explanation is that boats are small and there is no room for someone who cannot do their share of work. However, this is easily contested since there are cases where women do participate in fishing (Acheson, 1981: 298, and for example Touray (1996) on female fishers in the Gambia). Women are commonly engaged in the processing and marketing of the fish (Williams 1996 and Jallow 1996). Touray (1996) sums up activities carried out by women: unloading of fish from landing canoes, fish processing and fish marketing that form the link between production and consumption. Williams (1996) also underlined the importance of women's contribution in fisheries in West Africa. Nayak (2001) stated that the role of women is unrecognised and they are mainly considered as "wives of fishermen". Walker (2001) came to the same conclusions from a study on women and marine fisheries in Ghana.

Despite their involvement in activities of the sector, women's activities are often small-scale and their incomes small compared to their male counterparts. Women face various constraints, including lack of credit and training, inadequate markets and transport problems and, compared to male counterparts, do not have access to distant markets. However, their role is prominent in the household income diversification (Haakonsen 1992; Touray 1996).

Fish Marketing

Muchiri (2001) and UNEP (1998:63) stated that all artisanal fishermen take part of their catch home. Versleijen (2001), however, found that although many fishermen take a part of their catch home, there are some fishermen who sell their whole catch. The reason given is that the division of the catch is more difficult to do in fish then in cash.

Fishermen and middlemen establish strong and long-lasting relationships with each other. It is very difficult for fishermen to market their own fish. Fishermen who do often fish less to have time to market their fish. Another reason is that knowledge of several markets is needed for marketing of fish. Furthermore, links with middlemen may reduce the uncertainty of fish marketing and obtaining capital (Acheson, 1981:281). Middlemen can also provide financial participation in gear ownership. *Tajiri* provide loans as well but it is also common for fishermen to obtain capital by borrowing from businessmen and others outside the industry, like shop owners. Fishermen who use a boat or gear owned by a *tajiri* pay him with a share of the catch and always sell their fish to the *tajiri*. Other fishers sell to the *tajiri* as well. There are several reasons for a fisherman selling his catch to a *tajiri*. The *tajiri* might be the only one with a weighing scale and fishermen do not want to pay for the use of one; the *tajiri* was the first fish trader in the area and people continue selling their fish to him because they are used to this practice (Glaesel 1997; Versleijen 2001).

Acheson (1981) stated that fish prices are often unstable for unclear reasons. The unpredictability of prices make it difficult for a fisherman to estimate his income after a day of fishing. Reason for price instabilities can be traced to the periodic availability of various species of fish. Moreover, the inelastic demand for many species causes a proportional change in prices. According to Mlay & Mutsekwa (1993), price levels are expressions of the intensity of buyer competition on any given day. In addition, supply volume plays a strong role as well, as do costs of transport and processing of fish. Okidi (1979) remarked that fish traders at the Kenya Coast, before the establishment of co-operatives, realised large profits by buying at very low prices. Along the Malindi coast,

however, prices for many species were fixed for longer periods of time and were known byall.

Mlay & Mutsekwa (1993) reported that fish marketing in Tanzania is largely in the hands of private individuals and that a large proportion of fish is consumed within short distances of the landing sites, as transport is often very difficult. Most of the fish is consumed fresh while the rest is frozen, smoked, roasted, fried, sun-dried, salted and canned. The fish marketing business in Tanzania can be divided into three general categories; the sectors of small-scale trade, intermediate trade and commercial trade.

Okidi (1979) noted that fish dealers from Mombasa go to different landing sites each day. To avoid competition over the small quantities of fish and to keep down the prices, each dealer had his day at a given fishing centre. At some centres a dealer may have two days a week but at other centres only one day. Officials of Fisheries and Co-operative Departments supervise such schedules. The fishermen's co-operative societies have been formed to promote development of the traditional fisheries sector through two major strategies. They are to ensure systematic marketing and price stabilisation by receiving the fish and choosing the market. They should also serve as a vehicle for centralised co-operation for fisheries development.

Income diversification

Particularly during the *kusi* season, many fishermen households have to rely on additional sources of income. During the past years, fishermen have diversified their income more and for longer periods because of the degradation of marine resources and the increase in number of fishermen. For the Mijikenda who have been farmers previously, this is not a problem since they often continue cultivating next to their fishing activities. However, for the Bajuni and Waswahili, it involved a major change in livelihood strategies since they had usually relied solely on fishing or fishing related activities for their livelihood. Ways in which fishermen diversified their income were by such means as renting out houses and farming (Versleijen 2001).

However, one can distinguish a reverse type of income diversification as well. Due to declining employment possibilities and increasing pressure on land, more and more people turn to fishing for income or extra income. Often a farmer supplements his income from farming with fishing. The plot of land people own is often not of sufficient size to feed a whole family. Additional land is difficult to obtain due to an increasing pressure on land and land prices having risen while land availability has declined. This 'new' generation of fishermen often learn fishing from the already existing generation of fishermen from whom they usually differ in religion and ethnicity.

Resource Conservation

Marine waters have aspects of common property and open access. Where everybody can freely use the natural resources, the individual will try to maximise his profits from the resources while the community shares the costs. Bulte (1997:55) stated: "fishermen have no incentive to take into account the value of fish left in the sea or the shadow price of the resource". The assumption here is that access to the sea and harvesting of marine resources lacks regulation but the reality is more complex.

Although fish cannot be controlled, fishers can control who is allowed to fish and how (Ostrom 1999; Charles 2001). Two important types of regulation appear to exist across fishing communities (Acheson 1981:289). First, there exist informal rules concerning the gear that can be used and how it can be used. Second, laws have been passed to limit the access to fisheries, although political strength is needed to enforce regulations. There exist examples at the Kenyan Coast of fishermen (Wapemba) being chased away by the fishing community for using destructive gear (see Appendix 8.11). There are a number of Kenyan statutes which impinge directly or indirectly on the coastal and marine environment, its resources and their management. In Kenya, there are basically two layers of government: central government and local government. Central government is affected through Provincial administrations and the coastal areas of Kenya are administratively governed as the Coast Province. These mandates often overlap and lack mutual cohesion. The KWS regulations for Marine Parks and Reserves care listed in Appendix 8.12.

Lopes *et al.* (1997) also denied the claim that there is open access to marine resources in a study from Mozambique. Acheson (1981) mentioned temporary usufruct rights by the boat which reaches the fishing grounds first, a form of fishermen organisation which allows its members to take turns in exploitation and exclude outsiders. Glaesel (1997a, 1997b, 2000), McClanahan *et al.* (1997), Tunje (2000), Tunje & Hoorweg (2001) and Versleijen (2001) discussed the existence of indigenous ways of conservation and regulations concerning access to fishing grounds at the Kenya Coast. Most authors agreed that access regulations and (as such also) indigenous ways of conservation are on the decline. Western & Wright (1994) stated that traditional conservation often revolves around protecting religious sites and cultural symbols, which are believed to protect food supplies. Glaesel (1997:102) examined the regulations set by territorial group leaders to maintain control over and access to critical community resources through meditation with the spiritual world. She referred to sacred areas on land as well as in the sea (*kaya's and mzimu* in both areas extraction is not allowed) labelled by elders through visions in their dreams. Sacred areas are believed to be resting places of spirits. Those spirits have to be appeased through offers, which take place during *sadaka*. Sacred areas often include biologically important waters, for example fish breeding grounds. Spirit-based beliefs have shaped community resources management practices to include 'modern' ways of fisheries management such as closed seasons, limited access, size restrictions and protected areas. Chilundo & Cau (2000) and Bækgaard & Overballe (1992) discussed the sacred areas and access regulations by elders in Mozambique and found situations comparable to that described by Glaesel (1997) and McClanahan *et al.* (1997).

Traditional fishing rights used to exist in many parts of the world but have been eroded over time (WHAT 2000:8). They have lost their effectiveness because of (a) lack of legal recognition, (b) introduction of modern technologies, (c) lack of authority over the full range of fisheries resources and gear types, (d) lack of cohesion and (e) lack of power to control new entrants. Also Glaesel (1997) and McClanahan *et al.* (1997) discussed the conflicts arising from the *sadaka* and its declining importance and prevalence. Tunje (2000) and Tunje & Hoorweg (2001) pointed to the "disappearance and lack of

adherence of fishing taboos by some fishermen" and gave the following reasons: (a) fishing as a multi-ethnic activity, (b) fishing by youths, (c) formal education and (d) economic hardship. Versleijen (2001) also mentioned this process when she described the *sadaka* in Takaungu, which has almost totally disappeared and if performed, was attended only by a small percentage of the fishermen and therefore lacked any impact. Chilundo & Cau (2000: 1) stated that the non-recognition of community sense over ownership resources by the colonial and post-independence legislation in Mozambique has contributed to it's erosion. Davis & Gartside (2001) stated that the traditional governmental approach conflicted with an economically oriented way of management.

In contrast to this, Abdullah *et al.* (2000) were of the opinion that many of East Africa's valuable resource areas could, until recently, be defined as open access common property. Initiatives of local community members, government sympathisers and external agents have led to the establishment of various legal systems. Public regulation alternatives can be classified as follows (Tahvonen & Kuuluvainen 1995; Hartwick & Olewiler 1986; Conrad 1995, Horemans & Jallow 1997):

- *Closed seasons*: To limit harvesting during crucial periods when fish populations are breeding and spawning.
- *Closed Areas*: To limit the areas open for fishing.
- *Gear Restriction*: To limit the use of 'efficient' catching devices or try to preserve the habitat of the harvested population.
- *Limited entry*: To restrict the number of fishing vessels.
- *Catch quotas* aim to shorten the fishing period.[4] Individual, transferable quotas (ITQ) limit the level of harvest for each individual fisherman per fishing period.
- *Taxes*: can be imposed on the catch or on some harvesting input.
- *Establishing ownership*: forming co-operatives strengthens social pressure and may rule out "rape, ruin and run" behaviour that way.

The most commonly used device to limit access to the fishery is through fishing licenses.

4 See Charles (2001) and Cockcroft & Payne (1999) who described the use of allowable catches in the South African rock lobster fisheries

However, licensing the number of fishermen, boats or gear into a specific area does not create an incentive for the fisherman to limit fishing effort. This is the case with catch quotas. Output controls limit the catch and so limit the take-off of a fish species. However, introducing a quota system may result in dumping of by-catch when a fisherman does not have quota to cover the latter. Another option consists of gear restrictions, limiting the use of particular fishing equipment by either type or amount. In this way, a drawback of licensing is also covered, and technological change is accommodated. Another option to limit the pressure on fisheries resources is that of closed seasons. Two types of closed seasons exist (1) particular periods of the year are closed for fishing specific species, and (2) access to the fishery remains open, but the catch is limited by closing the season when the catch rate declines to a predetermined point. Closed areas are another option and have much the same effect as closed seasons of the former type (WHAT 2000: 33-38). Marine national parks are an example of closed areas (see also IOC 1995 and Charles 2001). All the five methods, quotas, licensing, gear restrictions, closed areas and closed season, need supervision and here another problem emerges, that is, poor enforcement of legal regulations.

Hauck & Sowman (2001:176) were of the opinion that co-management has emerged as a solution to over-exploitation, illegal use of gear and conflicts among conservationists and local communities in South Africa. Makoloweka & Shurcliff (1997) discussed the community-based approach used in Tanga to solve problems concerning declining catches, use of destructive fishing techniques, mangrove cutting and coastal erosion. They emphasised that, besides the local fishing community, the regional and district government officers and extension workers should also be incorporated. The co-management principle implies that more discretion should be left to individuals and firms to adapt their conduct to "the spirit of some public policy" (Jentoft, McCay & Wilson 1998; Dubbink & Vliet, 1996, see also Pomeroy & Berkes 1997, Sen & Nielsen 1996, Sverdrup-Jensen & Nielsen n.d.). It referred to a paradigm shift in natural resources management that supports the participation of resource users in decision-making and management (Hauck & Sowman, 2001:174).

Many conflicts in fisheries are the result of sectoral approach to coastal and marine resources management and improper or poor government policies. The coastal zone is extensively and increasingly used for a large number of activities by many different groups. These multiple activities are often not compatible and easily result in conflicts (Masalu 2000 and Charles 2001 who gave an overview of the conflicts arising in fisheries). Okemwa, Ruwa & Mwandotto (1997) underlined the need for a integrated policy framework to deal with conflicts concerning the use of coastal resources. With the lack of one regulatory body to adequately address coastal management issues it is difficult to find solutions to the conflicts.

Conflicts also exist among artisanal fishermen. Sverdrup-Jensen & Nielsen (n.d.) mentioned conflicts among fishermen from neighbouring countries due to the use of different and conflicting gear types. Lopes *et al.* (1997) discussed conflicts between migrant and resident fishermen on the coast of Mozambique. Tunje (2001) described the case of Pemba fishermen from Pemba on the Kenyan coast.

Conflicts also arise concerning the management of natural resources. In Kenya, conflicts exist between local fishermen and the Kenya Wildlife Service (KWS) over Marine Protected Areas. There are four Marine National Parks – those at Malindi, Watamu, Kisite and Mombasa. Their total area is 54 km^2 and all are managed by the Kenya Wildlife Service. Fauna and flora are fully protected inside the parks and the introduction of species is prohibited. In addition, there are five Marine National Reserves – Malindi, Watamu, Mpunguti, Mombasa and Kiunga. Their total area is 706 km^2 and the Kenya Wildlife Service administers them as well, with traditional fishing being allowed within their boundaries (UNEP 1998:91).

McClanahan & Mangi (2000) stated that Marine National Parks have advantages for local fishermen (see also Charles 2001 who listed the costs and benefits of Marine Protected Areas and Tunje & Hoorweg 2001). Using the example of Mombasa Marine National Park, they stated that marine protected areas enhanced local fisheries through emigration or spillover of exploitable fishes. They also described adaptations made at the same area

concerning complaints of fishermen after the gazettement of the Park. A study by McClanahan & Arthur (2001) of reefs between Malindi (Kenya) and Dar es Salaam (Tanzania) also supported the claim that Marine National Parks protect coral reefs and increase fish density.

The general feeling among fishermen, however, is that they are deprived of their best fishing grounds, for which they receive little compensation (Glaesel 1997; Versleijen 2001). Furthermore, the employment possibilities generated by the protected areas (managed by the KWS) are not to the benefit of the local fishing communities. For the KWS, the continuous poaching in the Park remains a problem. The use of illegal gear in the areas outside the Parks also remains a concern. Due to the declining income of the fishermen households, there are increasing calls for degazettement of at least part of the Parks (Hof *et al.* 1999, Versleijen 2001).

XX

CHAPTER 3

THE FISHERS

Introduction

It is difficult to establish the number of people directly involved in fishing because of the seasonality of the occupation. Many small-scale fishermen try to evade paying for licences; making the government number of registered fishermen to be lower than the actual number. FAO (1984) estimated the number of fishermen at the Kenya coast to be 12,000, operating 1,800 fishing vessels, while Ardill & Sanders (1991) gave a figure of 6,250 fishermen. Recent studies by Wamukoya *et al.* (1997) gave a figure of between 8,000 and 10,000 fishermen, operating 2,500 vessels, and, UNEP (1998) gave a figure of 5,000 fishermen, with 4,000 being artisanal. Using the 1997 figures, and assuming an equal number of people are employed in the processing and distribution of fishery resources, then about 20,000 people are today directly or indirectly employed in the fishing industry at the Kenyan coast. There are about 1,000 small-scale fishermen in Kilifi/Malindi, and about 1,500 in the Lamu district according to the Department of Fisheries (1996) but the number is likely to be much higher according to rough estimates of the fishers themselves, which arrive at 2-3,000 fishers for this part of the coast.

Table 3.1. Vessel by Coast Tract (%)

	Ngomeni (N=40)	Malindi (N=39)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=198)
Canoe	22.5	25.6	17.9	57.5	50.0	34.8
Dau	5.0	61.5	56.4	27.5	22.5	34.3
Jahazi	22.5	–	2.6	–	–	5.1
Mashua	42.5	10.3	7.7	–	5.0	13.1
Motorboat	–	2.6	5.1	12.5	17.5	7.6
Other	7.5	–	10.3	2.5	5.0	5.1
	100	100	100	100	100	100

Source: Fisher Survey VAR12-13

Table 3.2 Gear by Coast Tract (Rate) *

	Ngomeni N=40	Malindi N=40	Mida N=39	Kilifi N=40	Takaungu N=40	Total N=199
Beach Seines	10.0	–	–	7.5	7.5	5.0
Gill Net	90.0	50.0	69.2	77.5	62.5	69.8
Long Line	20.0	30.0	35.9	30.0	17.5	26.6
Hook & Line	57.5	57.5	66.7	32.5	67.5	56.3
Trap	–	25.0	10.3	5.0	2.5	8.5
Fence	–	–	–	2.5	–	0.5
Spear Gun	–	–	12.8	–	30.0	8.5
Other	–	–	–	5.0	–	1.0

* Multiple Response. Certain questions allowed for more than one answer by the respondent. This is indicated in the tables concerned with a footnote. These results are either expressed as rates (frequency/respondents; adding up to more than 1.0) or percentages (% of the respondents; adding up to more than 100).
Source: Fisher Survey VAR14-15-16

Table 3.3 Ethnicity by Religion (%)

	Islam (N=121)	Christian (N=46)	Afr. Trad. (N=30)	None (N=2)	Total (N=199)
Swahili	9.9	–	–	–	6.0
Bajun	58.7	–	–	–	35.7
Mijikenda	25.6	100	96.7	100	54.3
Other	5.8	–	3.3	–	4.0
	100	100	100	100	100

Source: Fisher Survey VAR8-10

This chapter is based mainly on the fisher survey (RA2; see Appendix 8.2), with additional information from the other studies. The fisher survey includes 199 respondents at 10 landing sites grouped in 5 coastal tracts.

Results

Table 3.1 and Table 3.2 present information on the types of vessels and gears that were used by the fishers included in the survey. Artisanal fishermen use mainly three types of vessels: *mtumbi*, *dau* and *mashua* (Tunje 2000). A mtumbi is a canoe of about 4 m. in length made of a tree trunk (but sometimes of planks in which case it is called *hori*). It has a curved bottom. It is propelled using an oar and is used mainly by *mpeke* net and handline fishermen inside the reef. Canoes are sometimes fitted with outriggers and small sails called *ngalawa*. *Dau (dhow)* are built from plankwood and have a flat bottom. They have an average length of about 5 meters, and are usually wind propelled by sail *(tanga)*. Dau are spacious making them suitable for *malema* (trap) fishers inside the reef. (*Jahazi* are a special type of dau). *Mashua* are fishing vessels used mainly for out-of-reef fishing. They are larger in size, about 10 meters in length, made from plank wood and have sails. They are preferred by night fishermen who use long lines and floating nets *(jarife)*. Most of the fishing vessels cannot venture in the open sea, restricting them to in-shore waters with the exception of *mashua* and motor boats, although lesser vessels will also venture out on the seas if the weather is suitable. Canoes and outrigger canoes account for about a third of the vessels, *dhow* for another third which means that about 75% of the craft are meant for reef and in-reef fishing (Table 3.1). Mashua account for some 13% of the craft and less than 10% of the fishing craft are motorised. Lack of off-shore going vessels dictates that most of the fishing efforts are concentrated inside the reef and that fishing is rarely undertaken outside the territorial waters. There are quite large differences between the coastal tracts depending on the marine environment.

The number of fishermen on board each boat depends on the size and type of boat (Omar 2002). In the case of small canoes, there are one or two fishermen, while in big canoes there are usually three fishermen. Mashua and motor boats carry a maximum of

Table 3.4 Age by Education (%)

	None (N=87)	Prim.1-4 (N=30)	Prim.5-8 (N=70)	Secondary (N=11)	Total (N=198)
<19 years	3.4	10.0	8.6	–	6.1
20-29 yrs	17.2	40.0	42.9	54.5	31.8
30-39 yrs	16.1	23.3	37.1	45.5	26.3
40-49 yrs	20.7	20.0	8.6	–	15.2
5-59 yrs	24.1	6.7	2.9	–	12.6
>60 years	18.4	–	–	–	8.1
	100	100	100	100	100

Source: Fisher Survey VAR6-9

Table 3.5 Ownership Boat by Coast Tract (%) *

	Ngomeni (N=20)	Malindi (N=19)	Mida (N=18)	Kilifi (N=29)	Takaungu (N=20)	Total (N=106)
Captain	40.0	52.6	61.1	55.2	20.0	46.2
Tajiri	50.0	21.1	16.7	44.8	55.0	38.7
Fellow Fisher	10.0	26.3	22.2	–	25.0	15.1
	100	100	100	100	100	100

* Captains only

Source: Fisher Survey VAR40

Table 3.6 Ownership Gear by Coast Tract (%)*

	Ngomeni (N=19)	Malindi (N=19)	Mida (N=18)	Kilifi (N=29)	Takaungu (N=20)	Total (N=105)
Captain	68.4	84.2	100	82.8	90.0	84.8
Crew	5.3	–	–	–	–	1.0
Tajiri	21.1	10.5	–	10.3	10.0	10.5
Fellow Fisher	5.3	5.3	–	6.9	–	3.8
	100	100	100	100	100	100

* Captains only

Source: Fisher Survey VAR42

six fishermen while outrigger canoes may carry up to three fishermen.

Fishing gear is both locally made and industrially manufactured. The local, traditional gear is usually home made from local materials and are generally cheap to make. They include portable traps (*malema*), fixed fences (*uzio*), spear guns (*bunduki*) and poison (*mchupa*). Portable traps are made of wood and reed strips which are woven, making some hexagon patterns with fairly large mesh. The fairly light weight of *malema* fish traps, coupled with their fairly large mesh sizes makes them environmentally friendly. Traps do not cause changes to the reef topography and aim at catching only fairly large sized fish. Fixed fences are made of sticks tied together tightly to make them long and strong. They are fixed on the sea floor aligned perpendicularly to the shore, and are set in the water up to ten metres from the beach. The extreme end, with a U-loop in the water, is most crucial, as it catches the fish. The spear gun is made of wood and rubber strips. A metal spear, used to hit the target, is propelled by a rubber band. In the context of this study, this gear is classified as 'traditional' because it is made out of local available materials, though it resembles the gun used in sport fishing.

Modern gears are manufactured industrially and have to be purchased. They include all types of nylon nets (gill nets, floating nets, sardine nets, and beach seines), long lines, hand lines and explosives.

- Gill nets (*mpeke*) have recommended mesh size of not less than 50 mm to allow small and juvenile fish to pass through. They are not destructive to the marine environment because they are used in shallow areas of the lagoon where there are no corals to damage the nets.
- Sardine nets have small mesh sizes measuring less than 2.5 inches, mainly used to catch small but mature fish such as sardines. The net is cast from a dau to enclose a shoal of fish that has been spotted.
- Beach-seines *(juya)* are extremely fine meshed nets that do not only catch fish of all sizes but also destroys juvenile fish and larval stages of fish. They also scrape the sea-bottom and physically destroy the corals and the reefs.

Table 3.7. Type of Fishing Grounds by Coast Tract (%) *

	Ngomeni N=40	Malindi N=40	Mida N=39	Kilifi N=40	Takaungu N=40	Total N=199
Beach	15.0	25.0	15.4	5.0	35.0	19.1
Inshore	37.5	12.5	7.7	72.5	25.0	31.2
Reef	60.0	72.5	82.1	52.5	57.5	64.8
Off-shore	50.0	47.5	38.5	–	15.0	30.2
Deep Water	70.0	75.0	89.7	67.5	97.5	79.9

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey VAR23-24-25

Table3.8 Number of Fishing Grounds Frequented by Coast Tract (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=39)	Takaungu (N=40)	Total (N=198)
1-2	10.0	2.5	–	2.6	–	3.0
3	85.0	95.0	100	97.4	100	95.5
4	5.0	2.5	–	–	–	1.5
	100	100	100	100	100	100

Source: Fisher Survey
VAR101

Table3.9 Number of Landing Sites Frequented by Coast Tract (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=39)	Takaungu (N=40)	Total (N=198)
1	40.0	35.0	20.5	48.7	20.0	32.8
2	55.0	17.5	25.6	43.6	50.0	38.4
3	5.0	47.5	53.8	7.7	30.0	28.8
	100	100	100	100	100	100

Source: Fisher Survey
VAR102

- The floating gill net *(jarife)* has large mesh sizes of more than 4 inches, and is used to catch larger pelagic fish mainly outside the reef. They are normally set in strategic places over night and the catch is collected the following day.
- Lines are non-destructive on two counts. They do not damage the reef structure. Even the fish sizes caught can be regulated by the size of the hooks used.

The most popular gear reported among the fishers sampled are gill nets followed by hand lines and hook and line which are in use by more than half the fisher (Table 3.2). Again, there are quite large differences between the coastal tracts depending on the marine environment and the vessels used.

Fisher come from different ethnic groups. Firstly, the Bajuni hail from the far north of the Kenya Coast and are the traditional fishermen. There are also some Arab and Swahili fisher, although their numbers are small. These groups are coast dwellers of long tradition and they account for about 40% of the sample (Table 3.3). Secondly, there are the Mijikenda who traditionally inhabited *kayas* on the coastal plateau and coastal range but have spread to the coastal strip during the last century. They have taken to fishing more recently, and, consequently, there are many first-generation fisher, but also a number of second-generation fisher. They already account for the majority of fisher in the study population with more than 50%.

The Bajuni and Swahili are Muslim without exception, the Mijikenda are a mix of mainly Muslims and Christians (Table 3.3). Most fishers are younger than 40 years of age and by and large have received little education – particularly the older fishers, although there are also younger fishers that have dropped out of school (Table 3.4). Most fishers live within half an hour's walk of a landing site.

Vessels are usually owned by one of the fisher (captain-owner); among the study population this occurred in 45% of the cases (Table 3.5). Many fishermen do not own boats; they borrow them from a *tajiri,* as occurred in almost 40% of the sample. A *tajiri* is a person who leases vessels and gears to fishermen on the condition that 20%-40% of

Table 3.10 Number of Fishing Trips by Coast Tract (%) *

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
3-5 trips/week	10.0	–	–	25.0	–	7.0
6 trips/week	40.0	35.0	56.4	55.0	30.0	43.2
7 trips/week	10.0	27.5	10.3	12.5	2.5	12.6
8+ trips/week	40.0	37.5	33.3	7.5	67.5	35.2
	100	100	100	100	100	100

* High Season
Source: Fisher Survey VAR34

Table 3.11 Number of Fishing Trips by Season (%)

	High Season (N=199)	Low Season (N=197)
3-5 trips/week	7.0	9.2
6 trips/week	43.2	54.3
7 trips/week	12.6	15.2
8+ trips/week	37.2	21.3
	100	100

Source: Fisher Survey VAR30-34

Table 3.12 Catch Disposal by Coast Tract (%) *

	Ngomeni N=40	Malindi N=40	Mida N=39	Kilifi N=40	Takaungu N=40	Total N=199
Home Consumption	100	100	100	100	100	100
Sales	100	100	100	100	100	100
Bait	52.5	47.5	43.6	32.5	30.0	41.2
Other	2.5	–	–	–	–	0.5

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey VAR54-55-56

the daily fish catch is for him and the remainder is shared among the fishermen manning the vessel (Glaesel 1997). The latter also incur the cost of maintaining the fishing equipment. There are however other ways of sharing the proceeds, which usually work to the greater benefit of the *tajiri*. The *tajiri* sustains the system by providing soft loans to fishermen in times of financial hardships, making them depend on him. This system has been cited by the fishermen as one of the major factors in their economic retardation. The *tajiri* may have difficulty collecting his share because fishers have ways of hiding the true amount of catch. In a number of cases boats are borrowed from fellow fishers (15%). The gear usually belongs to the captain; in 10% it was provided by a *tajiri* or in even fewer cases by another crew member (Table 3.6). There are differences between the landing sites. In Malindi and Mida the role of the *tajiri* is negligible. In Malindi this may be due to the presence of a co-operative and in Mida with the small scale of the fishing activities. In Ngomeni, Kilifi and Takaungu the *tajiri* plays a more important role, particularly in Ngomeni where gear is supplied by *tajiri* in 20% of the cases. This probably is because fishing here is with larger vessels and heavier gear which are costly.

The catch is usually divided as follows, although these arrangements are not fixed. The owner of the boat, the *tajiri* or the captain, takes 40-50% of the catch. The remaining half of the catch is divided in equal shares among the captain and crew members with an extra share for the owner of the gear. Sometimes, an experienced captain is entitled to an extra share when taking out an inexperienced crew.

The fishing grounds that are frequented are listed in Table 3.7 Fishers prefer to fish within the reef, that is, beach, in-shore and reef. Off-shore and deep waters are mentioned by many fishers but mostly as second or third choices (The multiple response format of the questions allows for this). Deep-sea fishing can be aimed at catching the larger pelagic fish. This fishing is mainly the reserve of the foreign sport fishers, though the artisanal fishermen also fish for them. Most of the local fishermen prefer not to venture in the deep-sea because of the poor quality of their crafts.

Table 3.13 Catch Processing by Coast Tract (%) *

	Ngomeni N=40	Malindi N=40	Mida N=39	Kilifi N=40	Takaungu N=40	Total N=199
Gutting	70.0	25.0	30.8	–	32.5	31.7
Drying	70.0	–	2.6	–	–	14.6
None	27.5	75.0	69.2	100	67.5	67.8

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey VAR60-61

Table 3.14 Catch Destination by Coast Tract (%) *

	Ngomeni N=40	Malindi N=40	Mida N=39	Kilifi N=40	Takaungu N=39	Total N=198
Consumers	7.5	–	–	–	–	1.5
Traders	47.5	57.5	89.7	90.0	43.6	65.7
Middlemen	60.0	57.5	89.7	32.5	43.6	56.6
Tajiri	32.5	42.5	10.3	12.5	56.4	30.8
Other	5.0	–		–	–	1.0

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey VAR62-63

Table 3.15 Problems Mentioned by Fisher by Coast Tract (%) *

	Ngomeni N=38	Malindi N=39	Mida N=39	Kilifi N=40	Takaungu N=40	Total N=196
Equipment	52.6	94.9	97.4	100.0	100.0	89.3
Financial	18.4	74.4	25.6	95.0	75.0	58.2
Transport	68.4	25.6	64.1	5.0	25.0	37.2
Marketing	97.4	20.5	28.2	2.5	5.0	30.1
Storage	34.2	5.1	30.8	5.0	15.0	17.9
Trawlers	60.5	–	–	–	5.0	12.8
Marine Park	–	–	43.6	–	–	8.7
Low Catch	2.6	–	–	–	–	0.5
Exploitation by Traders	–	–	–	–	2.5	0.5
Other	–	5.1	–	–	–	1.0

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey VAR116-117-118-119-120

Nearly all fishers reported that they frequent three different fishing grounds and this seems to be common, with little variation (Table 3.8). The number of landing sites frequented showed more variation with about one-third of the fishers always landing at the same site (Table 3.9) and two-thirds frequenting other landing sites as well. Almost half the fishers in Malindi and Mida – the tracts with the lowest catches; see Chapter 4 – mentioned that they landed their catch at three sites and this suggested that they migrated more often along the coast to fish elsewhere presumably searching for better grounds.

Fishermen generally fish for 6 days a week and rest for one day. Most fishermen go fishing once a day; one fishing expedition lasting for about four hours. Consequently, the number of fishing trips of most fisher is 6 times per week (Table 3.10). About a third of the fishers reported 8 or more trips per week which meant that they went out more than once a day or combined day and night fishing. This was the case particularly among the fisher in Takaungu and Malindi. Tunje (2000) noted a trend for fishermen from non-protected areas to go out more often than fishermen who operated in or near marine reserves. The frequency of trips showed a difference of about 10% between high and low seasons, not as great a difference as might be expected (Table 3.11).

The catch disposal was rather universal in that all fishers took some fish home for consumption and all sold fish. There were no fishers who fished only for subsistence needs (Table 3.12). The part of the catch usually taken home (locally referred to as *kitoweo*) has been estimated to account for 4% of the artisanal catches world-wide (UNEP 1998). Almost half the fisher kept some fish as bait for the next day. Two-thirds of the fisher sold the fish as is, the percentage was highest at sites that had ready access to markets; highest at Malindi and Kilifi, followed by Mida and Takaungu. In Ngomeni, the most remote tract, two-thirds of the fish was gutted and dried (Table 3.13).

The fish were almost always sold to traders and middlemen, hardly ever directly to consumers. In about a third of the cases, they were sold to *tajiris*. *Tajiris* acquired the right of first refusal of the catch of fisher, who either rented their boats or had been

Table 3.16 Fisher Reporting Sufficient Income from Fishing by Coast Tract (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
Yes	22.5	17.5	20.5	–	12.5	14.6
Almost/Not quite	67.5	80.0	69.2	100	80.0	79.4
No	10.0	2.5	10.3	–	7.5	6.0
	100	100	100	100	100	100

Source: Fisher Survey VAR72

Table 3.17 Economic Activities other than Fishing by Coast Tract (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
None	55.0	82.5	66.7	32.5	57.5	58.8
Farming	37.5	2.5	5.1	65.0	30.0	28.1
Self Employment	2.5	12.5	25.6	–	7.5	9.5
Wage Employment	2.5	–	2.6	–	5.0	2.0
Other	2.5	2.5	–	2.5	–	1.5
	100	100	100	100	100	100

Source: Fisher Survey VAR73

Table 3.18 Farm Size of Fisher by Coast Tract (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
No Farming Reported	60.0	92.5	79.5	35.0	70.0	67.3
0-1.9	–	2.5	5.1	2.5	–	2.0
2.0-2.9	7.5	5.0	–	7.5	15.0	7.0
3.0-5.9	12.5	–	7.7	10.0	10.0	8.0
6.0+	20.0	–	7.7	45.0	5.0	15.6
	100	100	100	100	100	100

Source: Fisher Survey VAR75R

P.S. Of the fisher farmer 72.3% have their farm through family ownership; 15.4% have bought land from the fishing proceeds; 12.3% have rebnted land.

assisted by them in the past (Table 3.14). Again, the latter occurred more often in Ngomeni, Kilifi and Takaungu for reasons noted above. Wamukote (2002) reported that at least half the traders were women. Women operated almost exclusively as small-scale traders or fishmongers who bought and processed mostly the small fish and sold them locally. Male traders played a number of roles; half of them were small-scale traders and fishmongers, more than a third operated as middlemen and 10% were large-scale traders.

Asked about problems they experienced, the fishers mentioned a number of obstacles, which ranged from low catches to cheating by traders (Table 3.15). Lack of equipment was most often mentioned and this was understandable because of the costs involved in replacing worn-out, damaged or lost nets. Next mentioned were financial problems, that is, low incomes and lack of money for equipment. There were, however, considerable local differences. Equipment problems were not mentioned as often in Ngomeni as elsewhere. Fisher in Malindi and Kilifi mentioned equipment and financial problems almost exclusively. In Mida, transport was a bottleneck which was not the case in Takaungu because matatu's and busses reached here. In Ngomeni, transport and marketing were mentioned most often as major problems. In addition, there were site-specific problems, notably the competition by trawlers that came close to the coast in contravention of regulations (Fulanda 2003). In Mida, there were complaints about the presence of the nearby Marine Park which occupied the best fishing grounds. These were off-limits to fishing and also made the fishers subject to frequent inspections by the game wardens of KWS.

Only 6% of the fishers stated that income from fishing was not sufficient to maintain their household. This did not mean that the other fishers were content. Only 15% reported that the fishing income was sufficient. The remaining 80% of the fishers replied that income was almost sufficient but not quite (Table 3.16). Differences among sites were not pronounced although this might have been expected from the poorer catches in Malindi and Mida. It is likely that the fishers from the two latter tracts often fished elsewhere, as suggested before, and increased their incomes in this way. Incomes from

Table 3.19 Farm Land by Ethnicity (%)

	Swahili (N=12)	Bajun (N=71)	Giriama (N=108)	Other (N=8)	Total (N=199)
Respondents with land	8.3	9.9	50.9	25.0	32.7
Respondents without land	91.7	90.1	49.1	75.0	67.3
	100	100	100	100	100

Source: Fisher Survey
VAR08-75R

Table 3.20 Membership of Co-operative by Coast Tract (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
Without Membership	90.0	50.0	64.1	80.0	62.5	69.3
With Membership						
No Benefits	10.0	40.0	25.6	20.0	20.0	23.1
Supply Gear Loan	–	7.5	7.7	–	17.5	6.5
Improved Marketing	–	2.5	2.6	–	–	1.0
	100	100	100	100	100	100

Source: Fisher Survey
VAR52-53

daily catches and household incomes are discussed further in Chapter 4 and Chapter 5.

Despite the insufficient incomes, 60% of the fishers limited themselves to fishing and did not engage in other economic activities. This percentage was highest in Malindi despite the employment opportunities that this town offers. Only 40% of the fishers reported that they engaged in other economic activities as well (Table 3.17). Of all fishers, 30% engaged in farming, even fewer engaged in wage or self employment. Those that reported farming and/or farming by the wife often had farms of more than 6 acres which was quite large by local standards (Table 3.18). The farmer/fishers in Kilifi had quite large farms for unknown reason. Likewise the fisher in Ngomeni but this was the most remote and least populated area. A closer look showed that it was mostly the Mijikenda fisher who farmed, and much less among the Bajuni/Swahili groups (Table 3.19).

Finally, the number of fisher who were members of a co-operative was quite low, only 20%. The percentage was higher in Malindi and Takaungu although, even here, only half the fishers were organised (Table 3.20). Of the ones who were organised, three-quarters complained about lack of benefits from their memberships. Only a quarter of the organised fishers (i.e. less than 10% of all fisher) mentioned loans for gear and improved marketing facilities as benefits.

Conclusion

The project started with a survey of fishers (Ch.3) that questioned fishing methods, fishing grounds, fishing frequency, catch disposal, problems, income and economic diversification. Lack of off-shore going vessels dictated that most of the fishing efforts were concentrated on- and inside the reef. Modern gear, gill nets and lines were most often in use while traditional gear such as traps and fences were on the decline. Fisher came from two main ethnic groups: in the study sample, the Mijikenda accounted for more than 50% and the Bajuni for 35%. More than half the fishers limited themselves to fishing and did not engage in other economic activities. Forty percent of the fishers reported that they had economic activities in addition to fishing. Of all fishers, about a

third engaged in farming, and fewer engaged in wage or self employment. Closer examination showed that it was mostly the Mijikenda fisher who were farming and Bajuni/Swahili fishers much less so. Lack of equipment was most often mentioned among problems followed by financial shortages, transport and marketing bottlenecks. There were large differences in fisher characteristics among the five coast tracts studied, namely, Ngomeni, Malindi, Mida, Kilifi and Takaungu which covered most of the Malindi-Kilifi coast. Within the coastal tracts there were also large individual differences.

CHAPTER 4

THE CATCHES

Introduction

In 1995, the quantity of fish landed in Kenya was 193,871 tons compared with 27,341 tons in 1975, twenty years earlier. Lake Victoria was the major source of fresh water fish accounting for 93% of all fish landed in that year. Marine catches have remained rather stable over the past 20 years at around 6,000 tons, with fluctuations between 4,000 and 7,000 tons. The value of all fish landed in 1995 was Ksh. 2,418 million. The marine sub-sector remains small and the overall value in 1995 was Ksh.162 million (Wamukote 2002).

The demersal or bottom-dwelling fish species dominate the marine catch accounting for about 40% of the total marine catches. There are more than fifty species of demersal fish, the most important of which are rabbitfish (Siganidae), scavengers (Lethrinidae), snappers (Lutjanidae), grunters (Pomasyidae), rock cod (Serranidae) and parrotfishes (Scaridae). The pelagic, or surface-dwelling fish, contributes approximately 35%, with at least thirty different species. Included in this category are cavilla jacks (Carangidae),

barracudas (Sphyraenidae), mullets (Mugillidae), bonitos (Scombridae), sailfish (Istiophorus) and kingfish (Menticirrhus). Sharks, rays and sardines accounted for 9% of the total catch in 1999. The crustacean category, composed of lobsters, prawns and crabs, contributed about 6% in the same year, while a miscellaneous category consisting of oysters, beche-de-mer, octopus and squids represented about 5% (Omar 2002 citing D.o.F Report 1999).

This chapter presents results of catch records that were collected over 18 months (Research Activity 3; See Appendix 8.3 for method specification) at the following coastal tracts (names of the actual landing sites in brackets): Ngomeni (Ngomeni), Malindi (Mayungu), Mida (Uyombo) and Takaungu (Takaungu). Weights were recorded with the names of the fish species noted to the best of the fishers' knowledge. The figures below are based on the 8,000 catch records collected over the 18 months. Local nomenclature often did not distinguish between the many species and for a period of four months the identification of fish species was done by a trained professional and the weighing of the catch done by research assistants (RA6, Appendix 8.6).

Results

The species diversity during the 18 month period amounted to 63 but during the 4-month period was 104. The difference occurred not because fewer types of fish were found caught but because the latter study made a conscious effort to distinguish between related species (for example, 7 different types of goat fish vs. goat fish in general). Combined, the list in Table 4.1 contains 113 species from more than 50 families.

Many of the species occurred but occasionally; only 32 species were present and reported in more than 0.5% of the individual landings (Table 4.2). From the breakdown by landing site it is evident that the differences in catch composition between the sites were great, not only between Ngomeni with its different ecology and the others but also among the other landing sites situated near the reef. The species diversity was lowest at Ngomeni (28 species) followed by Takaungu (31) and Malindi (35). The number was considerably higher in Mida with 47 species.

Table 4.1. List of fish species found in the Malindi-Kilifi marine waters.

ENG/COMMON NAME	KISW/LOCAL NAME	LATIN NAME
Anchovy	Dagaa/Mcheli	*Anchovieli indica*
Angelfish	Kitatange	*Honiochus acuminatus*
Baraccuda	Tengezi	*Sphyraena japonica*
Baraccuda	Tengezi	*Sphyraena jello*
Batfish	Tuguu	*Platax Pinnatus*
Blackskin	Fute	*Gaterin sordidus*
Bonito/Skipjack	Jodari	*Euthynnus pelamis*
Butterflyfish, threadfin	Kikorokoro	*Chaetodon auriga*
Caesio	Viunda/Mweru	*Caesio xanthonotus*
Catfish, eel	Ngogo/Mtonzi	*Plotosus arab*
Catfish, striped eel	Ngogo/Mtonzi	*Plotosus lineatus*
Cavillajack	Kisukari	*Elagatis bipinnulata*
Chubfish, brassy	Kufi/Kimbulimbuli/Kukusi	*Kyphosus vaigiensis*
Coris, queen	Mwenza mawe	*Coris formosa*
Damsel fish, black	Patima mashowera	*Stegastes nigricans*
Damselfish, false-eye	Patima mashowera	*Abudefduf sparoides*
Emperor, blackspot	Mchakufa	*Lethrinus harak*
Emperor, spangled	Changu macho	*Lethrinus nebulosus*
Emperor, variegated	Changu	*Lethrinus variegatus*
Filefish, barred	Gona/Sharifu	*Cantherhines dumerilli*
Filefish, broom	Gona/Sharifu	*Amanses scopas*
Filefish, honeycomb	Puju	*Cantherhines pardalis*
Filefish, spectacled	Gona/Sharifu	*Cantherhines fronticinctus*
Flathead fish	Vumbama	*Platycephalus crocodila*
Goatfish, dash-dot	Mkundaji	*Parupeneus barberinus*
Goatfish, double bar	Mkundaji	*Parupeneus bifasciatus*
Goatfish, Indian	Mkundaji	*Parupeneus indicus*
Goatfish, yellow stripe	Sonyo	*Mulloides flavolineatus*

Table 4.1. List of fish species found in the Malindi-Kilifi marine waters, continued

Grey skin	Fute moshi	*Gaterin batata*
Grouper, jewel	Tewa ndudu	*Cephalopholis miniata*
Grouper, peacock	Tewa shambaru	*Cephalopholis argus*
Grouper, redbanded	Tewa	*Caeruleo punctatus*
Grouper, redbanded	Tewa	*Epinephelus fasciatus*
Grouper, squaretail	Tewa moshi	*Plectropomus areolatus*
Grunter, spotted	Tamamba	*Pomadasys operculare*
Halfbeak	Chuchungi/Kidau	*Hemiramphus far*
Kingfish	Nguru	*Scomberomorus commerson*
Kingfish, blacktip	Kambisi	*Caranx sem*
Lemonfish	Nyeya	*Gaterin gaterinus*
Mackerel, little	Oona	*Rastrelliger kanagurta*
Marlin, black	Sulisuli	*Makaira indica*
Marlin, blue	Sulisuli mviringo	*Makaira nigricans*
Milkfish	Mwatiko	*Chanos chanos*
Minstrel	Fute	*Plectorhinchus schotaf*
Moony, silver	Pakawe	*Monodactylus argenteus*
Mullet	Mkizi	*Mugil cephalus*
Needlefish, crocodile	Mtumbuu	*Tylosurus crocodilus crocodilus*
Needlefish, yellow	Mtumbuu	*Strongylura leiura*
Parrotfish	Pono mwamba	*Callyodon guttatus*
Parrotfish, bullethead	Pono	*Scarus sordidus*
Parrotfish, christmas	Pono kasiki	*Calotomus carolinus*
Parrotfish, marbled	Pono	*Leptoscarus vaigiensis*
Parrotfish, stareye	Pono	*Calotomus carolinus*
Pursemouth	Chaa	*Gerres oyena*
Rabbitfish, forktail	Tafi mtunga	*Siganus argenteus*
Rabbitfish, starspotted	Tafi manga	*Siganus stellatus*
Rabbitfish, whitespotted	Tafi	*Siganus sutor*

Table 4.1. List of fish species found in the Malindi-Kilifi marine waters, continued

Ray, manta	Taa chui	*Manta birostris*
Ribbonfish	Panga	*Trichiurus lepturus*
Rock cod	Chewa/Tewa	*Epinephelus merra*
Rubber lip, blackspotted	Mleya/Nyeya	*Plectorbinchus gaterinus*
Runnerfish	Songoro	*Rachycentron canadus*
Sailfish	Sulisuli	*Istiophorus platypterus*
Sailfish	Sulisuli makuti	*Istiophorus gladius*
Sardine	Simu	*Sardinella melaneura*
Sawfish, largetooth	Papa upanga	*Pristis microdon*
Scavenger	Nyavi	*Lethrinus miniatus*
Sergeant fish, scissortail	Patima mashowera	*Abudefduf sexfasciatus*
Shark, basking	Papa usingizi	*Rhincodon typus*
Shark, blacktip reef	Papa	*Carcharbinus melanopterus*
Shark, tiger	Zambarani	*Galeocerdo cuvier*
Sicklefish, concertina	Shana	*Drepane longimanus*
Snapper, black spot	Tembo/Kungu	*Lutjanus ehrenbergii*
Snapper, blood	Tembo/Kungu	*Lutjanus sanguineus*
Snapper, blotcheye	Kifuvu/Kibaazi	*Myripristis murdjan*
Snapper, blue banded	Tembo-uzi	*Lutjanus kasmira*
Snapper, dory	Tembo/Kungu	*Lutjanus fulviflamma*
Snapper, hump-back	Runga/Ndawasho	*Lutjanus gibbus*
Snapper, one spot	Tembo/Kungu	*Luutjanus monostigma*
Snapper, speckled	Cheusi	*Lutjanus rivulatus*
Snapper, two-spot red	Tembo/Kungu	*Lutjanus bohar*
Soldierfish	Kibaazi/Kifu	*Holocentrus summara*
Spadefish	Tuguu/Kudusi	*Plataxorbicularis*
Stingray, blackspotted ribbontail	Nyenga	*Taeniura melanospilos*
Stingray, bluespotted ribbontail	Nyenga	*Taeniura lymma*
Streaker	Mshikashangwi	*Aprion virescens*
Surgeonfish, convict	Kangaja	*Acanthurus triostegus*

Table 4.1. List of fish species found in the Malindi-Kilifi marine waters, continued

Surgeonfish, powder-blue	Kangaja	*Acanthurus leucosternon*
Sweeper	Makarenge	*Pempheris ovalensis*
Sweeper, black-edged	Makarenge	*Pempheris mangula*
Sweetlips, black spotted	Mchone/Mleya/Kumba-maji	*Plectorhinchus gaterinus*
Sweetlips, grey	Mleya	*Plectorhinchus schotaf*
Tailfish, triple	Stefua	*Lobotes surinamensis*
Thornfish, straight-lined	Ngagu	*Terapon theraps*
Trevally, bluefin	Kolekole	*Caranx melampygus*
Trevally, bluefin	Kolekole	*Caranx stellatus*
Triggerfish, half moon	Kikande	*Sufflamen chrysopterus*
Triggerfish, red tooth	Kikande	*Odonus niger*
Trumpetfish	Mzu-moshi	*Aulostomus chinensis*
Tuna, yellowfin	Jodari	*Thunnus albacares*
Unicornfish, spotted	Puju	*Naso brevirostris*
Wahoo	Nguru ngazija	*Acanthocybium solandri*
Wrasse, cigar	Mbooya mvuvi	*Cheilio inermis*
Wrasse, goldbar	Bua	*Thallassoma hebraicum*
Wrasse, tripletail	Stefua	*Cheilinus trilobatus*
CRUSTACEA		
Crabs	Kaa	*Brachyura*
Lobster, ornate spiny	Kamba mawe	*Panuliura ornatus*
Lobster, painted spiny	Kamba mawe	*Panuliura versicolor*
Prawns	Kamba wadogo	*Penaeus indicus*
MISCELLANEOUS		
Beche-de- mer	Jongoo la pwani	Various
Octopus, whitespotted	Pweza	*Octopus macropus*
Squid, big-fin reef	Ngisi nyamvi	*Sepioteuthis lessoniana*
Squid, Indian	Ngisi	*Loligo duvaucelli*

Source: Omar (2002), Catch Survey, & Glaesel (1997)

Mullet were the fish most commonly reported from the Ngomeni area which has quite a different ecology from the other tracts. There is no fringing reef but open sea with waves rolling in from the Indian Ocean, long sandy beaches and mudflats with mangroves and salt farms. Kingfish, shark and lobster were also frequent in Ngomeni. In the Malindi and Mida coastal tracts, rabbitfish was most prevalent; present in half to three-quarters of the catches. In Malindi only one other species was frequent, emperor. In Mida, rabbitfish and emperors were by far the most common but there were also many parrotfish, snapper, goat fish, wrasse, rock cod and sweetlips. This landing site lies in a marine reserve, next to a marine park, and is situated where a large creek and sea meet. In Takaungu, rabbitfish and emperors were, again, prevalent but ribbonfish were reported most often – this fish swarms and breeds in this area. In Takaungu, the habitat consisted of the off-shore coral reef and a narrow, deep creek but there was no marine protected area nearby. Also present here were snapper and kingfish.

Weights of catches are listed in Table 4.3. Differences among the coastal tracts are pronounced. The Mida coastal tract, with the largest species variety (as noted above), reported the smallest quantities with 50% of the catches below 4.0 kg. Catches in Malindi were larger than in Mida (Average of 9.7 vs 4.7 kg) but still were low. Catches were substantially larger in Takaungu and Ngomeni (average of 18.8 and 25.6 kg, respectively). The explanation for Ngomeni was that the fisheries here were of a different nature, with larger vessels for the open sea, larger crews and, consequently, larger fish caught. High catches in Takaungu were also a result of larger vessels (including motor boats) operating from this site.

Catches translate into incomes which depend on the type of fish landed (fish are priced differently - for most fish there is a universal price), the number of crew who divide the catch and other shares for vessel, gear, captaincy etc. Most incomes per crew member per trip were modest, the overall average was 372 and 50% was below Ksh. 250 (Table 4.4). Assuming a 5-day fishing week, this amounted to Ksh. 1750 per week, which corresponded roughly with a later, independent estimate in Chapter 5.

Table 4.2 Catch Composition by Landing Site:
Number of times listed species was present in catch records (%).*

No	English	Ngomeni (N=1227)**	Malindi (N=1516)	Mida (N=1751)	Takaungu (N=942)	Total (N=5436)
22	Rabbitfish	3.4	59.0	75.8	17.4	44.6
8	Emperors	2.1	19.3	64.7	21.8	30.5
17	Parrotfish	0.4	1.6	32.6	3.2	11.6
27	Snapper	2.9	1.6	23.4	16.8	11.5
9	Goatfish	-	0.1	33.1	0.4	10.8
38	Wrasse	-	0.2	28.7	0.2	9.3
15	Mullet	35.5	0.1	0.7	3.9	8.9
23	Rod cod	2.8	1.6	15.2	4.4	6.7
11	Kingfish	12.8	3.1	0.7	10.8	5.8
34	Ribbonfish	0.1	0.1	0.1	30.2	5.3
47	Sweetlips	-	-	14.5	-	4.7
26	Shark	12.5	2.4	0.3	5.3	4.5
35	Squid	-	9.7	2.9	1.3	3.8
13	Lobster	11.8	0.5	0.1	0.4	2.9
20	Pursemouth	-	0.3	5.6	0.5	2.0
1	Barracuda	0.2	0.2	1.5	6.4	1.7
7	Crabs	6.7	-	0.1	-	1.5
31	Surgeonfish	0.1	-	4.5	-	1.5
16	Octopus	-	2.4	1.2	2.2	1.4
25	Scavenger	1.8	3.5	-	-	1.4
14	Minstrel	-	0.2	2.8	1.3	1.2
10	Halfbeak	0.2	0.1	2.9	-	1.0
46	Rayfish	-	-	1.4	2.7	0.9
55	Damselfish	-	-	2.7	-	0.9
28	Spotted Grunter	0.3	0.2	1.6	0.7	0.8
42	Catfish	1.3	0.1	1.0	0.2	0.7
37	Tuna	-	2.2	0.1	-	0.6
64	Triple tail wrasse	-	-	1.7	-	0.6
51	Soldierfish	-	-	1.7	-	0.6
5	Butterflyfish	0.1	0.1	1.3	0.3	0.5
19	Prawns	2.2	-	-	-	0.5
43	Unicornfish	-	0.7	1.0	-	0.5
Total number of species recorded		28	35	47	31	63

Source: Catch Survey: species that were present in 0.5% of the catch records or more
* Weighted Numbers ** N=Number of catch records VAR15-16-17-18-19-20-21-22-23

The lowest incomes were reported from the Mida area, followed by Malindi. These two areas had the lowest weights brought in and were situated in marine reserves with regular patrols by KWS wardens. The incomes in Ngomeni were considerably higher than in Malindi and Mida and corresponded with larger catches reported there. The highest incomes were reported from Takaungu.

Two distinct seasons are observed in the region due to weather conditions. The first, locally referred to as '*kusi*', is due to south-east monsoon winds, which blow from March to September. This period is characterised by a high cloud cover, rainfall, river discharge and terrestrial runoffs, cool waters and a deep thermocline. The second locally referred to as '*kaskasi*', is due to north-east monsoon winds and it runs from October to February. During this period, fish catch and reproduction is highest (McClanahan 1988).

Table 4.5 presents a seasonal overview of species diversity, catch weights and incomes for the whole study area. The species diversity varied from a low of 34 in May to a high of 48 in November. The weight caught per trip showed a pattern of high catches form October to April and low catches during July, August and September (highest catch in May occurred at Takaungu). From these data it was not possible to tell whether the differences were the results of changes in the presence of species due to weather conditions or due to changes in fishing practices during the respective seasons. Not surprisingly, incomes showed the same seasonal pattern with very low incomes in July to September.

Breakdown by landing sites revealed a more complex picture. The series of graphs in Figure 4.1-4.4 shows the abundance of the 3 or 4 most prevalent species by season. In Ngomeni, mullet, the leading fish caught in this area, had a relatively low presence from April to June. During that period, however, kingfish and shark were reported more frequently. In Malindi, rabbitfish and emperor showed distinct seasonal patterns with low catches in July to September, and there were no compensatory trends noted. In Mida, rabbitfish, the most common catch, was least frequent from January to March and the second, emperor, showed essentially the same pattern. Goatfish and parrotfish, also

Table 4.3 Catch Weight/Trip by Landing Site (kg)*

	Ngomeni (N=1227)**	Malindi (N=1506)	Mida (N=1728)	Takaungu (N=941)	Total (N=5401)
Average	25.6	9.7	4.7	18.8	13.3
(s.d.)	(17.0)	(9.9)	(5.1)	(17.8)	(15.0)
Distribution					
<1.9	-	5.4	16.4	1.3	7.0
2.0-2.9	0.7	10.1	20.8	3.3	10.2
3.0-3.9	1.1	13.5	17.1	6.7	10.7
4.0-4.9	2.1	8.7	12.4	5.1	7.7
5.0-6.4	5.6	14.1	14.6	11.2	11.8
6.5-9.9	8.4	11.0	11.1	9.8	10.2
10.0-12.9	10.3	13.5	3.3	10.9	9.1
13.0-19.9	16.8	10.2	2.5	18.9	10.7
20.0-32.4	23.0	10.1	1.4	15.5	11.2
32.5+	31.9	3.4	0.4	17.3	11.3
	100	100	100	100	100

Source: Catch Survey VAR12T-12CAT
* Weighted Numbers ** N=Number of catch records

Table 4.4 Income /Trip/Crew Member by Landing Site (sh.)*

	Ngomeni (N=1227)	Malindi (N=1516)	Mida (N=1748)	Takaungu (N=728)	Total (N=5218)
Average	580	298	158	692	372
(s.d.)	(381)	(299)	(125)	(592)	(394)
Distribution					
-64	0.2	11.4	14.0	1.2	8.2
65-97.4	0.4	11.6	16.2	3.3	9.4
97.5-129	1.3	10.2	14.6	5.2	8.9
130-174	2.7	8.5	23.3	6.6	11.8
175-215	4.0	13.9	10.9	5.8	9.4
216-292.4	9.9	8.8	9.9	11.3	9.8
292.5-374	12.5	11.2	6.7	8.6	9.6
375-499	22.9	8.7	2.8	11.0	10.4
500-772.4	25.3	8.3	1.2	13.9	10.7
772.5+	20.9	7.4	0.5	33.0	11.8
	100	100	100	100	100

Source: Catch Survey VARINCT-INCCAT
* Weighted Results ** N=Number of catch records

showed seasonal variation with low presence in catch records from July to September. Finally, in Takaungu, the catch was dominated by ribbonfish from June to September. Emperors showed essentially the opposite (compensatory) pattern. Rabbitfish and snapper were low from August to December. Again, from these trends, it was not clear whether the respective species were less/more abundant during these periods or whether the trends reflected changes in fishing behaviour of the fishers.

In terms of total catch, results are presented in Figure 4.5. In Mida, the weights landed were very low and varied between an average of 3.5 and 6.2 kg throughout the year. Catches in Malindi were also low but there was a distinct seasonal pattern with best catches from October to February. In Ngomeni, catches were low during two periods, namely December to January and July to September; there were considerable fluctuations the rest of the year. The Takaungu catch patterns fluctuated most. Catches were low in the period July till November but rose steeply to an average of 55 kg in April. This results was not caused by outliers, as high catches were reported by many fishers during that month, but was a consequence of vessels used at this site, such as motorboats.

Incomes of the fisher per trip in the four landing sites corresponded with the catch weight trends (Figure 4.6). Fisher incomes in Mida were the lowest and were so throughout the year. Incomes in Malindi were also low during much of the year but there was an increase from October to January. Incomes in Ngomeni were higher with monthly fluctuations, being lowest from July to September. The pattern in Takaungu was very skewed with very high incomes from February to May. Incomes were low from June to November, and were of the same level as in Mida and Ngomeni.

Conclusion

More than 100 fish species were identified at four selected landing sites during the study period. Species richness was highest in the two landing sites situated in Marine Park Areas (MPAs), Malindi and Mida. The amounts of fish landed at these two sites were, however, considerably lower than at the sites in Ngomeni and Takaungu that are not near

Table 4.5 Catch Diversity, Catch Weight and Income by Season *

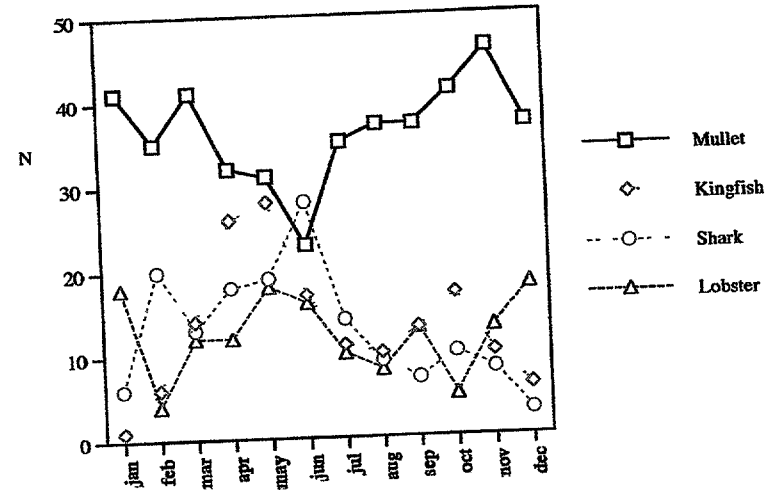
		No. of species in catch records	Catch Weight /Trip (av.) (kg)	Income/Trip /Crew Member (av.) (sh)
jan	N=444**	36	14.7	402
feb	N=465	41	17.0	392
mar	N=489	37	13.2	413
apr	N=465	36	19.6	541
may	N=527	34	12.4	374
jun	N=477	37	11.5	347
jul	N=428	43	9.5	276
aug	N=455	45	8.9	274
sep	N=404	44	8.8	260
oct	N=416	47	13.9	389
nov	N=447	48	14.5	399
dec	N=421	41	15.1	387
Total (s.d)	N=5436	63	13.3 (15.0)	372 (394)

Source: Catch Survey VAR15-16-17-18-19-20-21-22-23-VAR12T, INCT
* Weighted Results ** N=Number of catch records

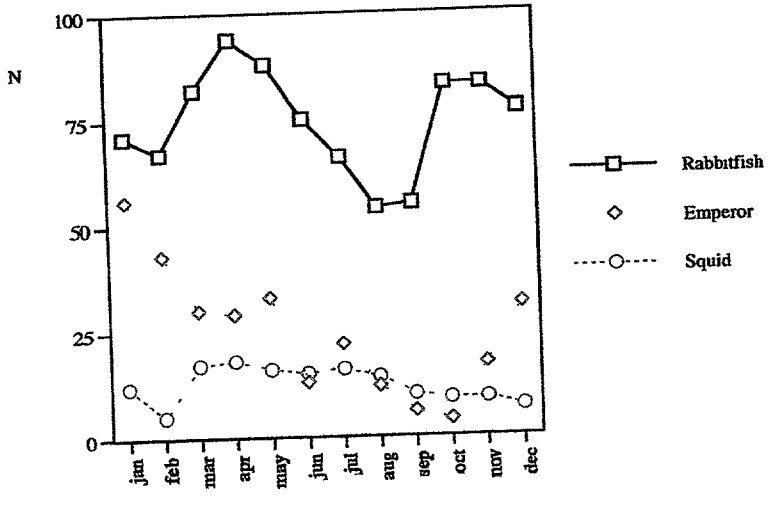
MPA's. Incomes per crew member per trip reflected the same differences, being highest in the non-protected areas and far lower in the protected sites. This confirmed earlier observations that marine protected areas resulted in greater fish density but that more fishers were concentrated in smaller areas, resulting in lower catches (McClanahan & Mangi 2000)

Apart from the differences among the landing sites, there were also considerable seasonal differences in catch. Species diversity ranged from 34 in the months of May to 48 in November. The catches (and) incomes) were generally low in the period July to September but higher in the period October to April. The average income per crew member per trip in the lowest quarter (July to September) was only 60% of that in the highest quarter (February to April). Fisher livelihoods showed large differences between seasons, among sites and among individuals.

Figure 4.1-4.4
Catch Composition for Main Species by Season
(N=Number of times that species was reported in catch records)

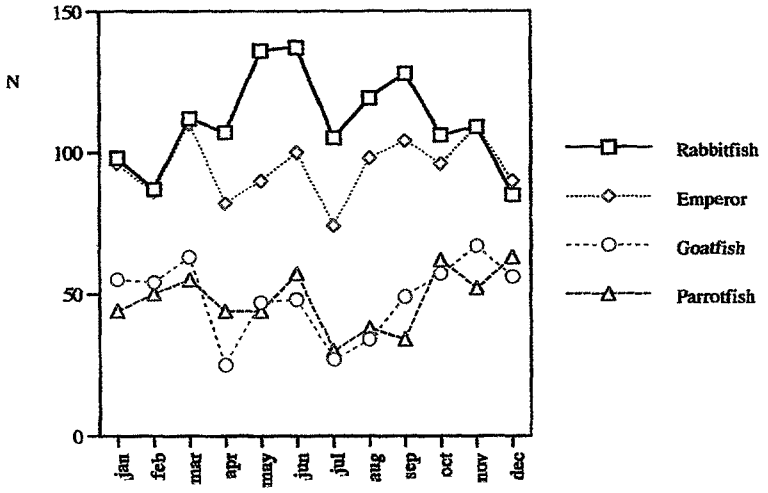


4.1 Ngomeni
* Average (weighted) number of monthly catch records is 102

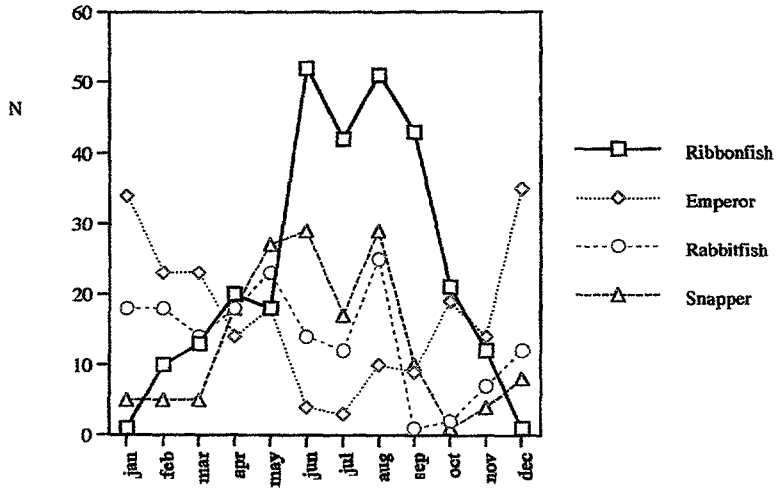


4.2 Malindi
* Average (weighted) number of monthly catch records is 126

Figure 4.1-4.4, continued
Catch Composition for Main Species by Season
(*N=Number of times that species was reported in catch records*)



4.3 Mida
* Average (weighted) number of catch records is 144.



4.4 Takaungu
* Average (weighted) number of monthly catch records is 78.

Figure 4.5
Catch Weight by Landing Site and Season (av.)

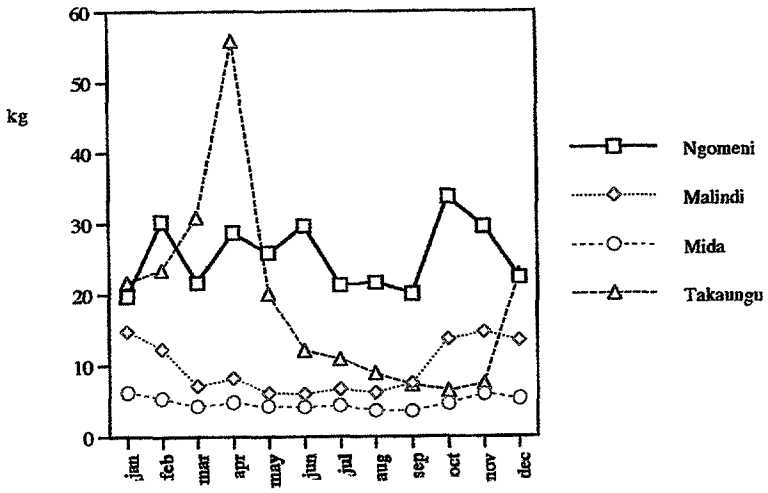
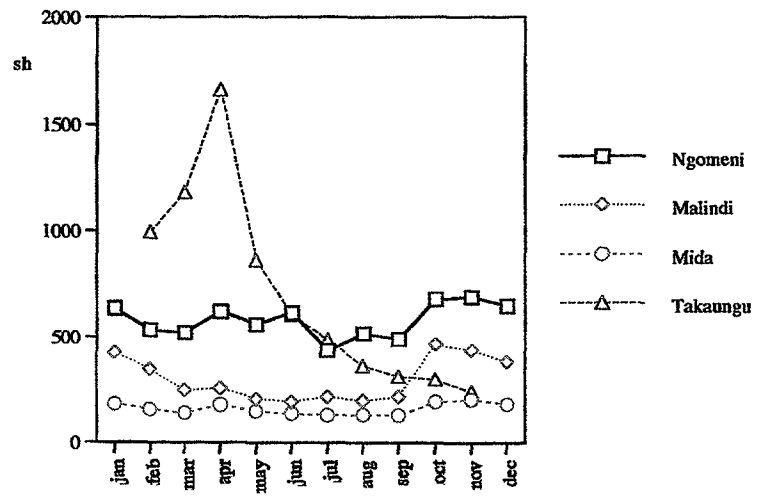


Figure 4.6
Income/Trip/Crew Member by Landing Site and Season



CHAPTER 5

THE HOUSEHOLDS

Introduction

This chapter focuses on households of fishermen. Information was drawn from the household survey (See Appendix 8.5 for methods) which included three groups: (1) fisher contacted at the landing sites and interviewed at their homesteads (N=84, consisting of 58 boat captains and 26 lone fisher);[1] (2) crew members who were living near the fisher captains (N=50); (3) neighbouring households where the head of the household was not a fisher (N=80).

Results

Demographic characteristics such as marital status of the head and household size showed only small differences among groups (Table 5.1-5.2). The quality of housing and hygiene conditions were slightly better among the non-fisher. There was no difference in material conditions between the two fisher groups.

1 This group will be referred to as Fisher. Lone fisher work independent without a crew.

Table 5.1 *Marital Status by Study Group* (%)

	FISHER N=84	CREW N=46	NON-FISHER N=80	TOTAL N=210
Single	13.1	6.5	11.3	11.0
Married, monogamous	72.6	73.9	60.0	68.1
Married, polygamous	7.1	6.5	12.5	9.0
Divorced	4.8	6.5	5.0	5.2
Widowed	2.4	6.5	11.3	6.7
	100	100	100	100

Source: FAM Survey: VAR15

Table 5.2 *Household Size and Material Conditions by Study Group* (average; s.d.)

	FISHER N=83	CREW N=50	NON-FISHER N=80	TOTAL N=213
Household Size	7.6 (4.5)	7.9 (5.8)	6.8 (4.8)	7.3 (5.0)
House Quality [1]	.45 (.83)	.52 (.93)	.86 (1.10)	.62 (.98)
Hygiene [2]	.74 (.71)	.62 (.67)	.85 (.81)	.75 (.74)

Source: Hhld Survey: VAR25R; HSQUAL, HYGIENE

1) House Quality score increases with 1 point for presence of walls (cement/coral/blocks); house roof (mabati); house floor (cement) respectively (min. score=0; max. score=3)

2) Hygiene score increases with 1 point for presence of latrine and improved water source (covered well, pipe, tank) respectively. (min. score=0; max. score=2)

Table 5.3 *Rate of Economic Activities of Head Household by Study Group* (Rate)*

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Fishing	.92	.76	–	.53
Farming	.51	.48	.51	.50
Wage Employment	.04	.04	.33	.15
Self Employment	.11	.20	.52	.28
Total	1.57	1.48	1.36	1.47

* Multiple Response (See Note Appendix 8.2)

Source: Hhld Survey: VAR27A-27B-27C

Table 5.3 lists the economic activities of heads of households in the respective groups.[2] The heads of the fisher group, on average, mentioned 1.57 economic activities which means that almost 60% had an activity additional to fishing. For the crews, the figure was 1.48 and for non-fisher it was 1.36 activities. About half the fisher and crew reported that they also engaged in farming; the rate of wage employment was low although higher among crews (15% and 24% respectively). The non-fisher households engaged in farming and/or employment of some kind (85%: 52% were self-employed which in practice varied greatly in type and importance).

Diversification as a livelihood strategy should not be viewed only from the perspective of the heads of households. The economic activities of wives and other adults in the house also need be taken into consideration although it would be wrong to assume that these income sources are pooled in one common household budget. About 24% of the wives to heads reported no economic activity other than household chores, about 60% mentioned farming while about 30% mentioned various other activities such a fish trading, vegetable and food selling, makuti plating and other handicrafts (Table 5.4).[3] The other adults in the households (usually the grown-up children) were involved in fishing and farming (Table 5.5), much as the heads, but were more often involved in wage employment.[4]

The crews reported the highest rate of activities by the wives; the wives of the fisher and non-fisher were less active. The crew households also reported the highest rate for other adults (particularly farming) with 2.5 activities followed by the fisher group (1.8) and the non-fisher (1.1).

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2 The fishermen contacted at the landing site and followed to the homestead were not always the head of the household but were also, for example, a son living with his parents. This is the reason why not all heads reported fishing as an economic activity (Table 5.3).

3 A rate of .37 and .18 for all household equalled 58% and 29% of the households with wives present.

4 Fish trading, perhaps surprisingly, was not an important activity in the households surveyed except among the crews where 15% of the wives were so engaged.

Table 5.4 *Economic Activities of Wife to Head by Study Group* (Rate) *

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Farming	.40	.40	.31	.37[3]
Wage Employment	.01[1]	–	.01[1]	.01
Self Employment [2]	.12	.28	.19	.18[3]
Total Econ. Activities	.54	.68	.51	.56

* Multiple Response (See Note Appendix 8.2)
Source: Hhld Survey: VAR84A-84B-84C
1) N=1.
2) Includes fish trading, vegetable /food selling, makuti plaiting and other handicrafts.
3) A rate of .37 and .18 for all household equals 58% and 29% of the households with wives present.

Table 5.5 *Economic Activities of Other Adults by Study Group* (Rate) *

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Fishing	.64	.74	.06	.45
Farming	.67	1.04	.40	.65
Wage Employment	.25	.36	.38	.33
Self Employment	.21	.32	.26	.26
Total Econ. Activities	1.77	2.46	1.10	1.68

* Multiple Response (See Note Appendix 8.2)
Source: FAM Survey: VAR17A-17B-17C-27

Table 5.6 *Farm Size by Study Group* (%)

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
No farmland	34.5	38.0	27.2	32.6
<= 1.9 acres	11.9	–	8.6	7.9
2.0-2.9 acres	11.9	18.0	12.3	13.5
3.0-5.9 acres	19.0	12.0	18.5	17.2
6.0+ acres	22.6	32.0	33.3	28.8
	100	100	100	100

Source: Hhld Survey
VAR28R

After fishing, farming was the activity mentioned most often (See Table 5.6-5.8). Roughly two-thirds of the fisher households were involved in farming; one-third reported that they have no land. The non-fisher had land more often and tended to have larger plots. The land was used to cultivate food crops mostly used for home consumption with little or none sold. Almost half the households cultivated tree crops and about one-third of the households sold some of this harvest. The ownership of livestock varied little around an average for cattle of 10%, goats-sheep (46%) and chicken-ducks (56%). The sale of milk and eggs was almost negligible.

Adding the activities of all household members together (Table 5.9), the average number of economic activities per household was 3.7 with considerable differences among the three groups. The crew households were the most active with 4.6 activities, followed by the fisher group with 3.9. The non-fisher households were lowest with 3.0 activities. The difference occurred because of the differences in rate of (1) farming which is highest among the crew, (2) self employment which is higher among crew and non-fisher and (3) wage employment which is highest among non-fisher.

Few households (10%) reported that they had sufficient income (Table 5.10). Almost three-quarters (74%) reported that they managed to earn only half, or less, of what they needed. The largest difference occurred between the fisher and the non-fisher; 20% of the former group stated that they earned less than half of the amount they needed, while this was 40% among the non-fisher.

In all cases, respondents were asked to give an estimate of the income from fishing, farming and the various forms of employment, together with estimates of income of wives and resident children. Table 5.11 presents data on the average income of the three groups and its composition . The fisher group reported a higher income from fishing than the crews, with a difference in the order of 10%. This was not surprising since they were

Table 5.7 *Agricultural Production of Study Groups* (%)

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Cultivation Food Crops	60.7	58.0	69.1	63.3
Cultivation Tree Crops	47.6	46.0	48.1	47.4
Sale Food Crops	2.4	6.0	11.1	6.5
Sale Tree Crops	34.5	30.0	38.3	34.9

Source: Hhld Survey
VAR29-31-33-30-32-34

Table 5.8 *Livestock Production of Study Groups* (%)

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Cattle Ownership	8.3	10.0	13.6	10.7
Shoats Ownership	45.2	44.0	48.1	46.0
Ducken Ownership	52.4	62.0	56.8	56.3
Sale Milk	7.1	6.0	3.7	5.6
Sale Eggs	–	–	2.5	0.9

Source: Hhld Survey
VAR35-36-37-40-42

Table 5.9 *Economic Activities of Household Members by Study Group* (Rate) *
(Activities heads of household, wives and other adults aggregated)

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Fishing	1.56	1.50	.06	.98
Farming	1.58	1.92	1.21	1.52
Wage Employment	.30	.40	.73	.48
Self Employment	.44	.80	.96	.72
Av No Activities/Hhold	3.88	4.62	2.96	3.71

* Multiple Response (See Note Appendix 8.2)
Source: FAM Survey: VAR17A-17B-17C-27

usually the owners of the boats and customarily received a share of the catch for that.[5] Crew households, however, had higher incomes from self employment, farming and children and arrived at a higher total income than the fisher. Fisher and crew together had a considerably higher income than the non-fisher who realised only two-thirds of the income of the others. This group had income from wage labour, self employment, farming and activities by the wife, in that order. Although the non-fisher had an income that was more evenly spread[6] than that of the fisher and crew[7], their total income was considerably lower. A tentative conclusion is that income diversification is beneficial as long as it is done in combination with a substantial fishing income. Diversification by itself is not desirable but if done in combination with fishing may indeed be attractive.

In further analysis, the groups of fisher and crew were subdivided into household, where the heads concentrated on a 'single livelihood' versus heads aiming at a 'multiple livelihood' (Table 5.12). About 40% of the cases relied on fishing only while 60% had one or more additional activities. There was little difference in livelihood strategy when 'fisher' and 'crew' were compared. It was also evident that most respondents of Bajun origin restricted themselves to fishing (Table 5.13). Among the respondents of Mijikenda origin, the majority had a multiple livelihood.

The income composition of the four resulting groups is presented in Table 5.14. Figures for income from fishing were quite consistent. The fisher group that focused on only fishing had the highest income from fishing (sh.1718), followed by crew that were only involved in fishing (sh.1352). Groups that aimed to diversify their income had the lowest incomes from fishing. The picture changed, however, when examining total incomes which were not easy to interpret because the trends were different within the two sub-groups.

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5 The Fisher group consisted of boat captains and lone fisher whose incomes from fishing were nearly the same (sh.1424 vs. sh.1390), which supports the decision to group them together.
6 Highest contribution by a single activity was 38%.
7 Highest contribution by a single activity was 75% and 62% respectively.

Table 5.10 *Reporting Sufficient Income by Study Group* (%)

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Yes	13.4	6.0	8.8	9.9
More than Half	14.6	20.0	15.0	16.0
Half	50.0	40.0	36.3	42.5
Less than Half	18.3	24.0	30.0	24.1
No	3.7	10.0	10.0	7.5
	100	100.0	100	100

Source: Hhld Survey: VAR51

Table 5.11 *Income Composition by Study Group* (average; sh/week)

	FISHER N=84	CREW N=50	NON-FISHER N=81	TOTAL N=215
Fishing	1378	1212	37	834
Farming	185	245	171	193
Wage Labour	44	4	342	147
Self Employment	23	110	497	222
Income Wife	121	140	158	139
Income Children	95	229	99	128
Total (s.d.)	1844 (1112)	1940 (1282)	1303 (969)	1663 (1135)

Source: Hhld Survey: VAR43T-44T-45T-46T-47T-48T-49T

Table 5.12 *Livelihood Diversification by Study Group* (%)

	FISHER N=84	CREW N=50	TOTAL N=134
Single Livelihood [1]	40.5	42.0	41.0
Multiple Livelihood [2]	59.5	58.0	59.0
	100	100	100

Source: Hhld Survey: VARDIV/VAR4

1) Heads of h.holds reporting no economic activities but fishing

2) Heads of households reporting other economic activities in addition to fishing

Among the fisher, a single livelihood gave a better income than a multiple livelihood.[8] The opposite was the case among crew members where a multiple livelihood gave a better income. A possible explanation for this occurrence is that captains and single fisher had to invest time and effort into the repair and maintenance of equipment to be successful and required time to organise the daily fishing trips and the sale of the catch. This costs time which cannot be invested in other economic activities and, consequently, income from fishing activities decreases accordingly. Among crews, the opposite was the case. Crew with multiple livelihoods managed to use the remaining time more economically, adding 50% to their fishing income with non-fishing activities. This was further reinforced by higher incomes from adult children.[9] Being a fisher with a single livelihood offers the best income opportunities followed by crew members with a multiple income.[10]

Further, detailed analyses of household resources and income diversification reported in the case studies are lodged in Appendix 8.8 and 8.9.

Conclusion

The household survey had a different design from the other surveys. Fishers (captains and lone fisher) that had been seen frequently at one of the four landing sites were followed to their homes. For comparison purposes, crew members living nearby and non-fisher neighbours were also interviewed about economic activities of wives and other household members, incomes and income composition. About a quarter of the wives of heads of households reported no economic activity other than household chores, more than half mentioned farming while about a third mentioned various other activities such a fish trading, vegetable and food selling, makuti plating and other

8 Incomes from farming listed under 'single livelihoods' may consist of passive incomes from agriculture such as rent income from land or trees.

9 It should be noted that, in the end, the group that came out ahead were the crew with multiple incomes, although their advantage occurred largely because of income from children. In the eight households in the study with children earning more than sh.1000/week, six were in the group of diversified crew.

10 Disregarding incomes from adutl children

Table 5.13 *Ethnicity by Livelihood Diversification* (%)

	SINGLE LVLHOOD (N=55)	MULTIPLE LVLHOOD (N=78)	TOTAL == (N=133)
Swahili	3.6	1.3	2.3
Bajun	30.9	3.8	15.0
Mijikenda	54.5	92.3	76.7
Pemba	7.3	1.3	3.8
Other	3.6	1.3	2.3
	100	100	100

Source: Hhld Survey
VARDIV/VAR10

Table 5.14 *Income Composition of Fisher Groups by Livelihood Diversification* (average; sh/week)

	FISHER		CREW		TOTAL
	Single Lvlhood (N=34)	Multiple Lvlhood (N=50)	Single Lvlhood (N=21)	Multiple Lvlhood (N=29)	== == (N=134)
Fishing	1718	1147	1352	1110	1316
Farming	65	266	33	398	207
Wage Labour	–	74	–	7	29
Self Employment	–	38	–	190	55
Income Wife	154	98	171	117	128
Income Children	63	116	24	378	144
Total (s.d.)	2000 (1185)	1739 (1059)	1581 (861)	2200 (1477)	1880 (1175)

Source: Hhld Survey
VAR43T-44T-45T-46T-47T-48T-49T/VARDIV/VAR4

handicrafts. Other adults in the households (usually the grown-up children) were involved in fishing and farming, much as the heads, and also in wage employment.

Crew households were the most diversified in employment, followed by fisher and non-fisher in that order. The difference occurred because of differences in rate of farming which is highest among the crew, self employment which is higher among crew and non-fisher and wage employment which is highest among non-fisher, but the latter did not have fishing as a source of income. Fishers received slightly higher incomes from fishing than their crews but crews had higher incomes from non-fishing activities, from self employment, farming and children and had a higher total income than fishers. Fishers and crews, together, had a considerably higher income than non-fishers who received only two-thirds of the income of the others. This group had income from wage labour, self employment, farming and activities by the wife, in that order. Although the non-fisher had an income that was more evenly spread than that of the fisher and crew, their total income was considerably lower.

XX

CHAPTER 6

THE ENVIRONMENT

Introduction

Rapid population growth on the East African coast has increased the demand for fish and, consequently, has increased pressure on in-shore fishery resources. Artisanal fishermen can cause degradation of the reef resources in several ways. Intensive fishing can (1) reduce local biodiversity through decreased overall fish population, as a result of fishing for consumption, and (2) alter the ecological balance, resulting in fewer, highly competitive species. The removal of keystone fish species can also alter reef ecology. For example, the removal of finfish can affect reef fauna adversely and cause imbalance in the reef ecological processes. Removal of sea urchin predators can result in a high sea urchin population, which is associated with low coral cover, topographic complexity, and reduced calcium deposition (McClanahan & Obura 1995). Fishing for juvenile fish and for highly reproductive, dominant fish species can also cause changes in the reproductive cycles, preventing population recovery. Destructive fishing practices, such as the use of explosives, seine nets and poison also can alter the topographic and ecological balance of the reef.

Table 6.1
Fish Trends by Type of Livelihood (%)

	SINGLE LVLHD N=35	MULTIPLE LVLHD N=48	TOTAL == N=83
Decreasing Catch	82.9	97.9	91.6
Constant	11.4	2.1	6.0
Increasing Catch	5.7	–	2.4
	100	100	100

Source: Hhld Survey; VAR74

Table 6.2
Estimated number of fisher operating from coastal tracts and ethnic composition*

	Ngomeni	Malindi	Mida	Kilifi	Takaungu	Total
Estimated number	398	492	347	330	234	1801
Bajuni & Swahili	47.5	47.5	48.7	32.5	32.5	41.7
Mijikenda & Other	52.5	52.5	51.3	67.5	67.5	58.3

* Ethnic composition taken from Table A.4
Source: Fisher Survey; VAR11

Table 6.3
Willingness to Stop Fishing by Type of Livelihood (%)*

	SINGLE LVLHD N=34	MULTIPLE LVLHD N=50	TOTAL == N=84
Age Reasons	73.5	70.0	71.4
Alt. Employment	58.8	52.0	54.8
Low Catches	2.9	–	1.2
Never	8.8	16.0	13.1

* Multiple Response (See Note Appendix 8.2)
Source: Hhld Survey; VAR79A-B-C

This chapter discusses the environmental aspects of the artisanal fisher activities with special attention to the question whether economic diversification can lessen the pressure on the marine environment. The information comes from the fisher survey (RA2) and the household survey (RA5) and the case studies by Versleijen (RA8) and Tunje (RA9). All four studies included questions on the pressure that fishing activities pose on the marine environment. The survey samples comprised all fisher in the fisher survey (N=199) but only comprised the group of fisher (captains and lone fisher) in the household survey (N=84). For purposes of analysis, the samples have been divided in fishers with a single livelihood and fishers with a multiple livelihood. Single livelihood means that the fisher himself did not have any other economic activity, not even farming. Multiple livelihood means that the fisher himself did have another economic activity in addition to fishing (See Table 5.12 & Appendix 8.2).

Results

Artisanal fishermen in Kilifi/Malindi appreciated the important role that the reef plays in their fisheries. Fishermen knew that reefs were the fish 'houses' where fish spawn and breed. Destructive practices of reefs were not condoned by local fishermen because they were aware that destroying the reef was tantamount to destroying their livelihood. Local fishermen were also aware of the declining resource base (McClanahan *et al.* 1997) as indicated by declining fish catches, and attributed this to degradation of fishing grounds due to over-fishing. Most fishermen in the survey were aware of degradation of marine resources and mentioned declining fish catches (Table 6.1). The fishermen themselves stated various reasons for the declining fish catches. An increased number of fishers, the gazettement of the No Take Areas, weather (connected to the increased roughness of the sea) and competing fisheries such as trawl fishing were mentioned.

Modern forms of marine conservation try to restrict or limit the impact of heavy fishing in a number of ways, in particular restrictions on (a) number of fisher, (b) access to fishing grounds, (c) type of gear and (d) frequency of fishing. The prevailing fishing methods have been described in Chapter 3, notably in respect to fishing grounds, gear type and

fishing frequency.

Fisher Number

To fish on the Kenya Coast, a fishing license is required. A fishing license can be obtained from the Fisheries Office at Kilifi for 100 shillings (about $1.25) and is valid for a year. However, since controls are not tight, many fishermen do not possess a license. The official estimates of the number of fishers were therefore on the low side. The latest available estimate of the Dept. of Fisheries (1996) referred to 1,000 fisher along the Malindi and Kilifi coasts combined. However, estimates of the number of fishers at the ten landing sites by the respondents were at least double that figure (Table 6.2). The total of 1,800 fishers should be increased for the nine landing sites that were not included in the studies (Table 1.1) as well as other smaller, unknown landing sites. The largest numbers of fisher were reported for Ngomeni and Malindi where Bajuni/Swahili fishers still constituted half the number. In Kilifi and Takaungu the majority of fishers were already Mijikenda.

At most landings sites there were fisher committees, each with a chairman. New fishermen who wanted to fish at Takaungu, for example, had to obtain permission from the chairman. The chairman introduced new fishermen to the other fishermen and the chief. The only reasons to deny someone permission to fish was in the gear used and the reputation of the fisherman. Local residents who wanted to fish had to pass through the chairman as well. However, the chairman admitted that not all the people who were fishing at Takaungu had his permission. But, as long as they did not use destructive gear and did not cause trouble, this was not serious a problem. Fishermen elected a chairman every five years. The chairman of Takaungu at the time of the study had already served for ten years (he was elected twice) and new elections were postponed since no one thought there was a the need for them.

A village committee existed in Uyombo, in which most fishermen from outside Uyombo were members as well. The role of this committee was mainly to facilitate communication, to disseminate information and to represent themselves to external

actors. Often internal discussions and meetings with officials were held, especially regarding the Marine Park. Also, new fishermen requested approval from the committee in order to fish. Complaints were made to the committee who dealt with them. The committee in Uyombo was quite efficient; an example of this was the action against the Wapemba fishermen in the past and discussions concerning the Marine Park, which were taking place during this research.

During the *kaskazi* season, the Kenya Coast was visited by a group of fishermen known as the Wapemba, who originated in the Island of Pemba near Zanzibar. In the search for better fishing grounds, the Wapemba spread along the Tanzania and Kenya Coasts (King 2003). The traditional fishing gear of the Wapemba consisted of the *juya*, a small mesh size seine net, which is highly destructive that had caused over-fishing at the fishing grounds at Pemba . In fact, some fishermen mentioned the Wapemba as the main cause of the decline in fish stock. The *juya* nets caught even immature fish, which were thrown back into the sea. Although the *juya* nets used by the Wapemba were forbidden, the Wapemba still used them. This was highly frustrating for local fishermen since they claimed that whenever they used an illegal gear (for example the speargun) they were caught and fined. They felt that the government should do something about these foreigners emptying the Kenyan seas, while it was becoming more difficult for a Kenyan fisherman to make a proper living. Although fishermen of Takaungu did not want the Wapemba to operate at their landing sites, it was difficult to stop them, since they were seasonal fishermen not living at or near Takaungu. However, there have been confrontations between local fishermen and the Wapemba, sometimes with physical violence. In Uyombo, the Wapemba were not liked either. However, the fishermen at Uyombo found a way of solving the problem. In a communal action with the Kenya Wildlife Service and the local police, the Wapemba were literally chased away (See Appendix 8.11). This had such an effect on the Wapemba fishermen that they have not returned to the landing site since.[1]

1 In nearby Mayungu, on the other hand, the fishermen team up with the Wapemba.

An increased number of fishermen was mentioned most frequently as the cause of declining fish catches. The increased number placed more pressure on marine resources, as was the case In Uyombo. If indeed this was considered to be a major reason of declines in income, why did new fishermen join and why were new fishermen approved. The answers mainly referred to open access to fishing and lack of alternative employment.

> *"Everybody can start fishing whenever he wants and in the way he wants. It is not like you have to look for it a long time and to go through a lot of trouble."* (Mijikenda fisherman, Takaungu)

> *"If there were other jobs I would do something else, but you know it is hard to find a job these days, even the tourist hotels are not offering many jobs anymore"* (Mijikenda fisherman, Takaungu)

> *"My family is a family of farmers. When I was born, there was no fisherman in the family. We had been farming for a long time, my grandfather and his father and so on. Since they could live very well from farming, why should they do something else which they do not know how to do! But when I was young, the harvest was not that good anymore and it would become a problem for me to live from farming alone when I wanted to start a family. So I started fishing. Another fishermen took me out end taught me how to do it. And some of my sons started to help me fishing and they will become fishermen as well!"* (Mijikenda Fisherman, Uyombo)

> *"You know when you reach a certain age you have to start earning money for yourself, you cannot always depend on your father. So I wanted to earn my own money, well fishing was my only possibility."*(Mijikenda fisherman, Takaungu)

> *"We do not own the sea, it is the KWS who thinks you can own sea! Sea is of everybody; so one fisherman can never deny another fisherman to go fishing. Unless that fisherman must be fishing in a way that is not accepted by the fishermen. You know like the Wapemba, we chased them because they were ruining everything!"* (Bajuni who used to be a fisherman, Uyombo)

Asked about their willingness to stop fishing permanently, only 13% of the fisher responded negatively (Table 6.3). This was an unexpected low percentage. Old age was mentioned as the foremost reason to retire from fishing. It was surprising that more than 50% of the fisher were willing to take alternative employment, with was no difference between fisher with a 'single' livelihood and fisher with a 'multiple' livelihood, although

the latter stated more often that they would 'never' stop .[2]

Fishing Grounds

Restricting access to fishing grounds was an important conservation measure. There were traditional restrictions but they have fallen into abeyance and, more recently, official 'No Take Areas' have taken that function. Most authors agreed that traditional restrictions on fishing grounds have largely disappeared (See Appendix 8.9). The *sadaka* which was practised in former days is an example. *Sadaka* refers to the traditional ceremony in which certain areas of sea were designated as off-limits for local fishermen. In Takaungu, *sadaka* used to be part of the fishermen's life until this changed recently. In November 2000, some fishermen decided to carry out another *sadaka*, however, only nine fishermen participated. The reasons why the nine fishermen participated were: (1) they used to do it and therefore they should continue; and (2) the Gods had to be pleased so the fishermen would have a higher catch. All nine fishermen were above forty years of age and were Muslim. The ceremony consisted of eating on the beach, giving some food to the sea and not fishing on that spot on the day of the ceremony. However, this last rule was only for fishermen involved in the ceremony. Nowadays various views exist on the way ceremonies were or should be conducted.

> *"We used to prepare food and invite other fishermen, take the food to the beach and eat all together and go home, the leftover of food is given to the sea."*(Mazrui fisherman, Takaungu)

> *"Food is prepared with fish. This is done on the beach and the fishermen invited some (not fishing) villagers and together they eat the food."* (Mijikenda fisherman, Takaungu)

> *"Some Mavumba (grinned fish which has a very strong smell, the smell is the important thing of it, it can be rotten fish as well) are taken to the sea and some words are said and celebrations are done. This can be anywhere in the sea, the place is chosen by all the fishermen together."* (Mijikenda fisherman, Takaungu)

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2 The two groups did not differ in the kinds of problems they experience (Table 6.14)

Table 6.4
Target Fish by Type of Livelihood (%) *

	SINGLE LVLHD N=117	MULTIPLE LVLHD N=82	TOTAL == N=199
Small Size (<20 cm)	5.1	8.5	6.5
Medium Size (20-50)	93.2	91.5	92.5
Large Size (>50 cm)	71.8	56.1	65.3
Prawns	–	3.7	1.5
Octopus	30.8	30.7	30.7
Lobster	6.8	13.4	9.5
Crab	3.4	8.5	5.5

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey: VAR20-21-22

Table 6.5
Fishing Grounds by Type of Livelihood (%)*

	SINGLE LVLHD N=117	MULTIPLE LVLHD N=82	TOTAL == N=199
Beach	18.8	19.5	19.1
Inshore	19.7	47.6	31.2
Reef	66.7	62.2	64.8
Off-shore	34.2	24.4	30.2
Deep Water	84.6	73.2	79.9

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey; VAR23-24-25

Table 6.6
No. Fishing Grounds and No. landing Sites by Type of Livelihood (av/s.d)

	SINGLE LVLHD N=117	MULTIPLE LVLHD N=81	TOTAL == N=199
No.Fishing Grounds	3.0 (.29)	3.0 (.16)	3.0 (.25)
No. of Landing Sites	2.1 (.77)	1.7 (.75)	2.0 (.79)

Source: Fisher Survey: VAR101-102

"The fishermen go to the beach with rice. A few fishermen go out fishing. When the fishermen are back, the catch they have is prepared and taken together with the rice. The fishermen and some other villagers (especially young children) eat and celebrate together. After the ceremony the leftover of the food and the fish is divided and taken home. On the day of the ceremony only the fishermen who go for the fish for the ceremony are fishing. Before the conducting of the ceremony, the gods have to be pleased. The elder fishermen have to speak some words and then some rice and fish has to be given to the sea. They used to conduct the ceremony, but now three years have passed without conducting the ceremony, it is like people care less about it." (Bajuni fisherman, Takaungu)

"The ceremony used to be conducted every year to please the gods, regardless of a high or a low catch. In those days most fishermen were Muslims and they all agreed that the ceremony should be performed, nowadays however there are a lot of non-Muslim fishermen. There is no co-operation between the fishermen anymore and the non-Muslim fishermen are afraid that when they conduct the ceremony a few days afterwards a non-Muslim might drown in the sea." (Mazrui fisherman, Takaungu)

"When there is a high catch, the fishermen gather at the beach and roast and eat the fish all together, but this is not anymore." (Mijikenda fisherman, Takaungu)

"There is a ceremony in which blood should be given to the sea. A goat is slaughtered and prepared and eaten. Some is given to the sea. Elder fishermen say some words to the gods of the sea to ask them for a higher catch. After the ceremony there should not be fished at the spot of the ceremony for a week. This ceremony is not there anymore, the fisherman have become to many and are not co-operating anymore, the elder fishermen who were always arranging this have died years ago. I think the last ceremony like this must have been 10 years ago." (Mazrui fisherman, Takaungu)

Most fishers frequent two or three different types of fish habitats including the beach, in-shore grounds, the reef itself, off-shore grounds and deep waters. The first three grounds were mentioned by nearly all fishers; at times many (4 out of 5) also ventured into deep waters, that is, outside the protection of the reef. Fisher with a single livelihood travelled to deep waters more often than fisher with a multiple livelihood. The latter fished more often in-shore (Table 6.4). This was interpreted in two ways, namely that catches of in-shore fisher were insufficient and forced either fisher to find other work or for fisher with only a fishing income to go far out to sea to increase their income.

Table 6.7 Space Restrictions Kaskasi by Type of Livelihood (%) *

	SINGLE LVLHD N=35	MULTIPLE LVLHD N=49	TOTAL == N=84
Beach	60.0	61.2	60.7
In-Reef	62.9	57.1	59.5
Reef	37.1	28.6	32.1
Out-Reef	25.7	24.5	25.0
Deep Water	31.4	44.9	39.3
Marine Park	48.6	55.1	52.4

* Multiple Response (See Note Appendix 8.2)
Source: Hhld Survey; VAR72A-72B-72C-72D

Table 6.8 Space Restrictions Kusi by Type of Livelihood (%) *

	SINGLE LVLHD N=35	MULTIPLE LVLHD N=48	TOTAL == N=83
Beach	17.1	22.9	20.5
In-Reef	17.1	14.6	15.7
Reef	42.9	33.3	37.3
Out-Reef	65.7	77.1	72.3
Deep Water	88.6	85.4	86.7
Marine Park	48.6	60.4	55.4

* Multiple Response (See Note Appendix 8.2)
Source: HHld Survey; VAR73A-73B-73C-73D-73E

The target fish is of importance in the fishing grounds frequented (Table 6.5). There was little difference in fish caught between fishers with a single and a multiple livelihood; nearly all mentioned fish of medium size and a third mentioned octopus. The only difference between 'single livelihoods' and 'multiple livelihoods' was that the former mentioned large-size fish more often and the latter mentioned lobster and crab more often.

Number of fishing grounds frequented was quite stable with an average of three and there was no difference between the two groups that differed in livelihood strategy (Table 6.6). But there was a difference in the number of landing sites frequented, albeit small, with fishers with a multiple livelihood reporting fewer landing sites which is understandable if they had other work as well.

Another way of looking at the issue of fishing grounds was to examine the grounds not frequented at different times of the year. In this respect, there was a difference between the *kaskasi* (high) season and the *kusi* (low) season. During the low season, fisher avoided the deep water and out-reef areas. During the high season fisher avoided the beach and in-reef areas (Table 6.7-6.8). Fishers with a multiple livelihood avoided the out-reef and deep waters more often then fishers who concentrated on fishing only.

A Marine National Park is an area in a marine environment where the marine resources are protected by not allowing fishing activities or any other form of extraction; these areas are also referred to as no-fishing zone or no-take zone. Adjacent to the Park are the Marine Reserves[3] where fishing by artisanal fishermen is allowed, but restricted by the regulations stipulated in the Fisheries Act (Government of Kenya, 1991). To reach the Reserves the fishermen are allowed to pass through the Park with their vessels. MPA's are managed by the Kenya Wildlife Service (KWS) and, therefore, are governed by KWS regulations (See Appendix 8.12). The supervision in the MPA's is stringent as the KWS

3 Marine National Parks (MNP) and Reserves (MNR) together are referred to as Marine Protected Areas (MPA's).

patrols regularly. The aim of Marine Protected Areas is to conserve the marine and coastal biodiversity and related ecosystems. In unprotected areas, fishing takes place with little government intervention. Although fishermen here are supposed to follow the general regulations, supervision is low. The study area contained one large MPA consisting of the Watamu Marine National Park and the Malindi Marine National Park, established in 1968. The two parks were surrounded by the Malindi-Watamu Marine National Reserve. The coastal tracts of Malindi (Malindi and Mayungu) and Mida (Watamu and Uyombo) were situated in or next to this MPA.

Marine National Parks and Reserves hold advantages and disadvantages for fishermen living nearby. The main disadvantage for fishermen is that their fishing grounds decrease since a part is designated as a Marine National Park. Often, Marine Parks are established on what the fishermen refer to as 'the best fishing grounds', often the breeding and spawning places of the fish. Areas unsuitable for fishing by local fishermen are unlikely to be suitable for the establishment of a Marine Park, because they are often characterised by low marine resources and are difficult to reach. One of the advantages of Marine National Parks, next to the already mentioned increase in species diversity, is the 'spill-over effect' from which the fishermen around the Marine National Park benefit. The fish density inside the Marine National Park increases because of the conservation and is supposed to enlarge the fish density of the area surrounding the Marine National Park (Hof 1999; McClanahan *et al.* 1999). However, this effect can be nullified by the concentration of more fishermen into a smaller area (McClanahan and Mangi 2000). In fact, among the fishermen in Uyombo there was considerable resentment against the Park and KWS wardens (See Appendix 8.8). On the other hand, Malleret-King (2003) concluded from her study at the South Coast of Kenya that fisherman households fishing near the Kisite Marine National park were more food secure than others.

Fishing Gear

Fisher were flexible in their use of gear, although they usually had strong preferences for certain gears based on their experience and expected catches. About 70% of fisher used more than one gear while only 30% used only one (Table 6.10). Gears differ greatly on

their effect on the environment, some being destructive others not. Three types of destruction by fishing were distinguished: (1) damage to marine environment; (2) capture of non-target species; and (3) capture of immature target species. Not only the type of gear used but also the area where it was used and the way it was used, determined whether a method was destructive. Traditional gears, which were on the decline, were generally considered less destructive to the marine environment than modern gear.

Traditional gears included traps, fences, spearguns and poison. The portable fish traps *(malema)* are fairly light and can be used on the reef without any adverse effects. Spearing was considered destructive to the corals because the fisherman using it has to snorkel under water and 'hunt' for fish. Although the method is not damaging in itself, the fishermen sometimes used long metallic rods *(mkonjo)* to break the corals where fish take refuge. Spears also damage corals when they miss the target. Fishermen who used the speargun and the stick were mostly younger fishermen as these fishermen had to be fit to swim long distances and chase and catch the fish. Traditional fish poison *(mkanga* or *mchupa)* is destructive not only to the fishery resources, but also to the other marine organisms and birds which eat dead fish. Though none of the fishermen admitted using poison, it was learnt that it was used in the northern parts of the Malindi coastline.

Modern gear included nets, lines and dynamite. The use of gill-net *(mpweke)*, which requires fisherman to drive fish to the net, is destructive only if it involves excessive walking on the reef crest. However, since it is used in areas where corals are absent, it rarely causes destruction. Beach seines are destructive because they have very small mesh sizes *(juya)*, which catch even undersized fish juveniles. The net is also dragged on the seabed, altering its topographic structure. These nets, with mosquito net mesh sizes, do not allow young and immature fish to swim through. In Kilifi/Malindi, these nets were used by Wapemba fishermen. Baited hook and line *(mshipi),* when used without overturning the corals, is not destructive. Explosives *(baruti)*, whose use is forbidden, destroy the coral reef and kill fish and other marine life. They are particularly destructive

Table 6.9 Vessel by Type of Livelihood (Rate) *

	SINGLE LVLHD N=117	MULTIPLE LVLHD N=82	TOTAL == N=199
Canoe	31.6	39.0	34.7
Dau/Jahazi	47.0	28.0	39.2
Mashua	10.3	17.1	13.1
Motorboat	6.0	9.8	7.5
No Vessel	5.2	6.0	5.5
	100	100	100

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey VAR12-13

Table 6.10 Gear by Type of Livelihood (Rate) *

	SINGLE LVLHD N=117	MULTIPLE LVLHD N=82	TOTAL == N=199
Beach Seines	.03	.07	.05
Gill Net	.64	.78	.70
Long Line	.27	.26	.27
Hook & Line	.59	.52	.56
Trap	.13	.02	.09
Fence	–	.01	.01
Spear Gun	.05	.13	.09
Other	–	.02	.01
All Gear	1.71	1.81	1.78

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey; VAR14-15-16

Table 6.11 Net Mesh Size by Type of Livelihood (Rate) *

	SINGLE LVLHD N=78	MULTIPLE LVLHD N=68	TOTAL == N=146
< 1 inch	–	.07	.03
1.0-2.5	.81	.74	.77
3.0-4.5	.77	.68	.73
5.0-6.5	.39	.24	.32
All Nets	1.97	1.73	1.85

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey; VAR17-18-19

because they reduce the reef to a layer of loose rubble, consisting of small pieces of coral, much of which die. This has other effects such as loss of habitat and indiscriminate killing of fishes, reducing recruitment into the fishery. Though none of the fishermen admitted to this, dynamite was, apparently, used clandestinely on a small scale between Mayungu and Watamu.

Generally, any method that involves walking or standing on the shallow reef crest, overturning the boulders and dragging the gear over the reef destroys the coral reef is considered as destructive. These methods lead to loss of topographic diversity, decreased habitat diversity and, consequently, fewer habitats for fish.

Fishing methods differed considerably among coastal tracts (Chapter 3) and were related to local marine geography and fish abundance. Comparison of fishers with single and multiple livelihoods showed some differences in vessels and gear. Fishers who concentrated on fishing only used dhows more often, while fishers with multiple livelihoods used canoes, mashuas and motorboats more often (Table 6.9).

Fishers with a multiple income used beach seines and spear guns more often but differences were small (Table 6.10) while fishers with a single livelihood used traps and lines more often. Diversified fishers used gill nets more often. There was a tendency for multiple income fisher to use nets with larger mesh sizes while only single income fisher used nets with very small mesh size, although this was reported In only 7% of the cases (Table 6.11).

Fishing Frequency

A final factor deciding the pressure on the marine environment was the frequency of fishing, that is, the frequency with which fishers set out to sea. Fishing frequency was decided by the type of gear, type of vessel, age of fisher and richness of the resource. Most fishermen went fishing once a day for 5 or 6 days a week; one fishing expedition lasted for about four hours. About a third of the fishers, however, reported 8 or more trips per week which meant that they went out more than once a day or combined day

Table 6.12 Fishing Frequency by Type of Livelihood (av/s.d.)*

	SINGLE LVLHD N=117	MULTIPLE LVLHD N=82	TOTAL == N=199
No. Trips/Week (H.S.)	8.3 (2.9)	8.0 (3.0)	8.2 (2.9)
No. Trips/Week (L.S.)	7.2 (2.3)	7.2 (2.8)	7.2 (2.5)
Duration High Season	5.4 (2.0)	5.4 (1.7)	5.4 (1.9)
Duration Low Season	3.8 (1.3)	4.0 (1.1)	3.8 (1.2)

Source: Fisher Survey; VAR230-34-108-112

Table 6.13 Off-Fishing Activities by Type of Livelihood (Rate) *

	SINGLE LVLHD N=33	MULTIPLE LVLHD N=47	TOTAL == N=80
Farming	.03	.32	.20
Boat/Gear Repair	.52	.32	.40
Prayers	.55	.21	.35
Resting	.55	.66	.61
Family Oblig.	.21	.36	.30
Other	.06	.00	.03
All Econ. Activities	1.92	1.87	1.89

* Multiple Response (See Note Appendix 8.2)
Source: Hhld Survey VAR71A-71B-71C-71D

Table 6.14 Problems by Type of Livelihood (%) *

	SINGLE LVLHD N=114	MULTIPLE LVLHD N=82	TOTAL == N=196
Equipment	89.5	89.0	89.3
Financial	57.9	58.5	58.2
Transport	38.6	35.4	37.2
Marketing	26.3	35.4	30.1
Storage	12.3	25.6	17.9
Trawlers	13.2	12.2	12.8
Marine Park	13.2	2.4	8.7
Other	2.7	1.2	2.0

* Multiple Response (See Note Appendix 8.2)
Source: Fisher Survey VAR116-117-118-119-120

and night fishing (Table 3.10). This was the case particularly among the fisher in Takaungu and Malindi. Fisher in the larger boasts usually went out only once a day while older fisher tended to have a lower number of trips. Tunje (2000) noted a trend for fishermen from non-protected areas to go out more often than fishermen who operated in or near marine reserves. The frequency of trips showed a difference of about 10% between high season and low season (Table 3.11), not as great a difference as was expected.

Table 6.12 presents further information on the fishing frequency during the high and low seasons, notably the duration of the fishing season and the number of trips per week. Differences between the two groups of fishers were minor. Duration of the high season was about 5.5 months, the low season almost 4 months and about 2.5 months without fishing activities. Frequency of fishing during the seasons differed slightly with 8.2 in the high season and 7.2 in the low season and, again, without differences between fishers with single and multiple livelihoods.

There were differences between the two livelihood strategies in activities during non-fishing days (Table 6.13). The former were busy mainly with resting, prayers and boat or gear repair. For fishers with multiple income sources it was resting, boat and gear repair and farming. They should have mentioned farming more frequently but they probably did not regard days working on the farm as days-off.

Conclusion

Most fishermen in the survey were aware of degradation of marine resources and mentioned declining fish catches. A high number of fishers expressed an interest to abandon fishing for other employment if available. The report discussed four ways of restricting fishing activities (a) number of fisher, (b) access to fishing grounds, (c) type of gear and (d) frequency of fishing.

All indications were that the number of fishers was increasing because of the entry of many Mijikenda fishers into the arena and lax enforcement of regulations. Marine Parks

pose effective restrictions on fishing grounds but they have distinct disadvantages for the fishers nearby and there existed considerable resentment against the Park among this group. Restrictions on fishing gear seemed to have an effect within the Reserves, areas that were patrolled by KWS wardens. In remote areas, fishermen rarely considered the environmental impacts of the gear they used.

Analysis compared fishers with a single livelihood (fishing only) with fishers with a multiple livelihood (with additional economic activities). The groups differed but only slightly in vessels and gear used, although the latter group used beach seines and spear guns slightly more often. Fishers with a multiple livelihood fished in-shore more often than those with a single livelihood who travelled to deep waters more often. Fishers with a single livelihood reported a larger number of landing sites they frequented. Together, this indicated that fishers with a multiple livelihood focused more on less fishing areas and less landing sites area and, consequently, put more pressure on the marine environment. There was no difference between fishers with a single and those with a multiple livelihood in the frequency of fishing. It is unlikely that diversification will lessen the number of fishers because of the inflow of a generation of 'new' fishers i.e. the Mijikenda who diversify from farming into fishing.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

There are an estimated 8-10,000 artisanal fishers on the Kenya coast, about 2-3,000 of them in the Kilifi and Malindi District. These artisanal fishers have received relatively little attention so far but it is known that they face dwindling resources and heavy competition from tourism and human settlement. The main objective of this research was to increase the knowledge of social and economic conditions of fisher-folk. The focus was on income diversification of fishermen, the pressure on marine resources and the relation between the two.

Fisher households can continue to draw their livelihood in fishing or maritime employment for a number of years. Access to better fishing techniques and improved marketing structures offer opportunities for continued engagement in fishing as a means of livelihood and employment for local people. Sooner or later, however, fisher households, out of necessity, will have to enlarge their resource base if they have not done so already. Households which avail themselves of additional resources, notably non-maritime employment, strengthen their livelihood strategies and improve their household security. Fishermen who succeed in diversifying their incomes and increase

their economic alternatives will exact less pressure on marine resources and will have a more positive attitude towards conservation measures.

The research tackled the above subjects by means of interrelated surveys and studies. The project consisted of 10 research activities including four surveys on fishers, fish catches, traders and fisher households respectively. The surveys were augmented by detailed studies on fish biology, fish traders, income diversification and resource conservation.

The project started with a survey of fishers (Ch.3) that questioned fishing methods, fishing grounds, fishing frequency, catch disposal, problems, income and economic diversification. Lack of off-shore going vessels dictated that most of the fishing efforts were concentrated on- and inside the reef. Modern gear, gill nets and lines were most often in use while traditional gear such as traps and fences were on the decline. Fisher came from two main ethnic groups: in the study sample, the Mijikenda accounted for more than 50% and the Bajuni for 35%. More than half the fishers limited themselves to fishing and did not engage in other economic activities. Forty percent of the fishers reported that they had economic activities in addition to fishing. Of all fishers, about a third engaged in farming, and fewer engaged in wage or self employment. Closer examination showed that it was mostly the Mijikenda fisher who were farming and Bajuni/Swahili fishers much less so. Lack of equipment was most often mentioned among problems followed by financial shortages, transport and marketing bottlenecks. There were large differences in fisher characteristics among the five coast tracts studied, namely, Ngomeni, Malindi, Mida, Kilifi and Takaungu which covered most of the Malindi-Kilifi coast. Within the coastal tracts there were also large individual differences between fishers.

More than 100 fish species were identified at four selected landing sites during the study period. Species richness was highest in the two landing sites situated in Marine Park Areas (MPA's), Malindi and Mida. The amounts of fish landed at these two sites were, however, considerably lower than at the sites in Ngomeni and Takaungu that are not near

MPA's. Incomes per crew member per trip reflected the same differences, being highest in the non-protected areas and far lower in the protected sites. This confirmed earlier observations that marine protected areas resulted in greater fish density but that more fishers were concentrated in smaller areas, resulting in lower catches (McClanahan & Mangi 2000).

Apart from the differences among the landing sites, there were also considerable seasonal differences in catch. Species diversity ranged from 34 in the months of May to 48 in November. The catches (and incomes) were generally low in the period July to September but higher in the period October to April. The average income per crew member per trip in the lowest quarter (July to September) was only 60% of that in the highest quarter (February to April). Fisher livelihoods showed large differences between seasons, among sites and among individuals.

The household survey had a different design from the other surveys. Fishers (captains and lone fisher) that had been seen frequently at one of the four landing sites were followed to their homes. For comparison purposes, crew members living nearby and non-fisher neighbours were also interviewed about economic activities of wives and other household members, incomes and income composition. About a quarter of the wives of heads of households reported no economic activity other than household chores, more than half mentioned farming while about a third mentioned various other activities such a fish trading, vegetable and food selling, makuti plating and other handicrafts. Other adults in the households (usually the grown-up children) were involved in fishing and farming, much as the heads, and also in wage employment.

Crew households were the most diversified in employment, followed by fisher and non-fisher in that order. The difference occurred because of differences in rate of farming which is highest among the crew, self employment which is higher among crew and non-fisher and wage employment which is highest among non-fisher, but the latter did not have fishing as a source of income. Fishers received slightly higher incomes from fishing than their crews but crews had higher incomes from non-fishing activities and had a

higher total income than fishers. Fishers and crews, together, had a considerably higher income than non-fishers who received only two-thirds of the income of the others. This group had income from wage labour, self employment, farming and activities by the wife, in that order. Although the non-fisher had an income that was more evenly spread than that of the fisher and crew, their total income was considerably lower.

Further analysis examined incomes of fishers with single livelihoods and with multiple livelihoods. About 60% of fishers relied only on fishing while 40% had one or more additional economic activities. Single livelihood fishers earned better incomes than multiple livelihood fishers. The opposite was the case among crew members where a diversified livelihood resulted in a better income. Apparently, crew members with a diversified livelihood had more time for other economic activities than their counterparts.

Artisanal fishermen appreciated the important role that the reef plays in fisheries. Fishermen knew that reefs were the habitats where fish spawned and bred. Destructive practices of reefs were not condoned by local fishermen because they were aware that destroying the reef was tantamount to destroying their livelihood. Most fishermen in the survey were aware of degradation of marine resources and mentioned declining fish catches. Fishermen themselves stated various reasons for the declining fish catches. An increased number of fishers, the gazettement of the No Take Areas, weather (connected to the increased roughness of the sea) and competing fisheries such as trawl fishing were mentioned. A high number of fishers expressed an interest to abandon fishing for other employment if available. The report discussed four ways of restricting fishing activities (a) number of fisher, (b) access to fishing grounds, (c) type of gear and (d) frequency of fishing.

All indications were that the number of fishers was increasing because of the entry of many Mijikenda fishers into the arena. Restrictions on the number of fishers were controlled through government fishing licenses and the approval of fishermen committees, although the implementation of these restrictions were generally lax. There were also seasonal fluctuations because of weather and fishing conditions, but they were

less mentioned.

Restrictions of fishing grounds used to exist as part of traditional ceremonies but these were on the wane. Nowadays, Marine Parks have taken this role but they have distinct disadvantages for the fishers nearby and there existed considerable resentment against the Park among this group.

Fishers were flexible in their use of gear although they usually preferred gears based on their experience and expected catches. Traditional gears were generally less destructive for the marine environment but were used only by few, often older, fishers. Restrictions on fishing gear seemed to have an effect within the Reserve, areas that were patrolled by KWS wardens. In remote areas, fishermen rarely considered the environmental impacts of the gear they used.

As regards to fishing frequency, a third of the fisher reported that they went fishing more than once a day. This was particularly the case in Takaungu, a tract where there was no MPA nearby. During the low season, the frequency of fishing was less than in the high season, but only by about 10%.

Analyses compared fishers with a single livelihood (fishing only) with fishers with a multiple livelihood (with additional economic activities) with the expectation that fishers with a multiple livelihood would exact less pressure on the environment. The groups differed but only slightly in vessels and gear used, although the latter group used beach seines and spear guns slightly more often. Fishers with a multiple livelihood fished in-shore more often than those with a single livelihood who travelled to deep waters more often. This occurred during both the high and low seasons. Fishers with a single livelihood reported a larger number of landing sites they frequented. Together, this indicated that fishers with a multiple livelihood focused more on less fishing areas and less landing sites area and, consequently, put more pressure on the marine environment. There was no difference between fishers with a single and those with a multiple livelihood in the frequency of fishing. It is unlikely that diversification will lessen the

number of fishers because of the inflow of a generation of 'new' fishers i.e. the Mijikenda who diversify from farming into fishing.

The first of our hypotheses predicted that households with additional resources, notably non-maritime employment, would strengthen their livelihood strategies and improve their household security. This hypothesis was confirmed among the fisher crews where the multiple livelihood resulted in higher incomes. Among the captains/lone fisher group, however, the opposite was the case: here fishers who focused only on fishing had higher incomes than colleagues who had additional economic activities. Being a fisher with a single livelihood offered the best income opportunities, followed by a crew member who had a multiple income.

The second hypothesis predicted that fishermen who succeed in diversifying their incomes will put less pressure on the marine resource and have a more positive attitude towards conservation measures. From the results there were no indications that fishers with a multiple livelihood placed less pressure on the marine environment. If anything, the opposite was the case, as the latter group concentrated their fishing more inside the reef, did not use less destructive gear and their frequency of fishing was not less than fishers with a single livelihood.

It appeared that income diversification was beneficial as long as it was done in combination with a substantial fishing income. Diversification was not desirable by itself, but could be attractive if done in combination with fishing. It also appeared that diversification was beneficial for crew members but not for the fisher group, captains and lone fisher. However, the expectation that income diversification leads to less pressure on the marine environment was not confirmed. In fact, a scenario can be foreseen where employment opportunities will attract people to the coastal strip where they will fish as an additional source of income. Paradoxically, this would lead to increased pressure on the marine environment.

General recommendations are listed below. Specific recommendations following from

the individual studies on fish biology, fish trade, income diversification and marine conservation are given with the respective summaries in Appendix 8.6, 8.7, 8.8 and 8.9.

Artisanal coastal and inland fisheries have been relatively neglected in policy, while in fact there is a need for integrated approaches to fisheries, agriculture, water and other sectors to be adopted in development policy and planning (Payne 2000).

Development policies should support environmental programmes that aim to reduce the pressure on in-reef resources.

For development policies, it is important to realise that not all fishers are full-time, some are part-time or occasional. Therefore, the interdependence of fishery with agriculture or petty trading should be recognised, as well as the need of a well integrated cross-sectoral development policy.

Creating income opportunities in coastal communities, although desirable from the viewpoint of local development, cannot be expected to result in a lessening of the pressure on marine resources.

Lessening of pressure on the marine environment should focus on restricting the numbers of fishers and should, firstly, target the large number of 'new' fishers that enter the arena by toughening license requirements and local approval procedures.

It is important that implementing agencies utilise the co-management principle which implies that more discretion should be left to individuals and firms to adapt their conduct to the spirit of public policy (Jentoft, McCay & Wilson 1998).

Development policies and projects should take account of the priority areas that fishers themselves feel are important, namely equipment, financial, storage and transport facilities.

Although fisher express a willingness to conserve marine resources in various ways, they will only do so if they can expect income improvements in the short-term and they have confidence in the long-term prospects.

Development policies and projects should be designed bearing in mind that there are large differences between landing sites along the coast.

Development policies and projects should be designed to deal with the large seasonal variations in catches and fishing incomes.

Implementing agencies should be aware of the large amount of resentment that Marine Parks generate among the fisher populations nearby.

8. APPENDICES

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Appendix 8.1 (RA1)

Landing Site Identification

Method

During the identification stage, April-May 1999, all official and unofficial landing sites in Kilifi and Malindi District (about 150 km coastline) were mapped and essential site-information recorded (e.g. number and types of boats; fisher residence; fisher ethnicity; public services; road access; cooler facilities; number and types of traders; gender of traders; other fisher-related economic activities; period of peak activity; and other unique characteristics).

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Appendix 8.2 (RA2)

Fishers Survey

Method

The fisher survey was done between June and October '99 and covered 5 tracts of coastline, each represented by 2 landing sites, as follows: Ngomeni (Robinson & Ngomeni), Malindi (Mbuyuni & Mayungu), Mida (Watamu & Uyombo), Kilifi (Bofa & Ferry) and Takaungu (Takaungu & Shariani). At each landing site 20 fishers were randomly selected and interviewed, either on-site or at their homes, resulting in 40 fishers for each coast tract. They were interviewed by one of the research assistants in the vernacular. The following information was covered: type and frequency of fishing activities; standard catch data; crew and ownership arrangements; socio-economic and household characteristics; catch utilisation (subsistence/ sales characteristics). In total, 199 interviews were conducted.[1] There were only small differences in respect of the basic demographic characteristics between coast tracts (Table A1-A4).

For purposes of analysis in Chapter 6 the sample was subdivided in fishers with single livelihood and fisher with multiple livelihood. Single livelihood means that fishers did not list any other economic activity, not even farming. Diversified livelihood mean that fishers did report one or more economic activities next to fishing. This resulted in two groups with the following number of respondents: single livelihood (N=117) and multiple livelihoods (N=82). Basic characteristics of the two groups in respect of ethnicity and landing site are given in Table A5-A6.

1 Certain questions allowed for more than one answer by the respondent. This is indicated in the tables concerned with a footnote – Multiple Response. These results are either expressed as rates (frequency/respondents – adding up to more than 1.0) or percentages (% of the respondents – adding up to more than 100).

Table A1 *Fisher Population by Coast Tract and Residence* (%)*

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
Within 3km of Landing Site	87.5	100	100	47.5	95.0	85.9
More than 3km from Landing Site	5.0	–	–	52.5	5.0	12.6
Elsewhere	7.5	–	–	–	–	1.5
	100	100	100	100	100	100

Source: Fisher Survey (VAR5R/65)

Table A2 *Fisher Population by Coast Tract and Age* (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
<19 years	2.5	12.5	7.7	5.0	2.5	6.0
20-29 yrs	37.5	25.0	30.8	37.5	30.0	32.2
30-39 yrs	35.0	30.0	17.9	15.0	32.5	26.1
40-49 yrs	10.0	7.5	15.4	20.0	22.5	15.1
5-59 yrs	10.0	12.5	12.8	17.5	10.0	12.6
>60 years	5.0	12.5	15.4	5.0	2.5	8.0
	100	100	100	100	100	100

Source: Fisher Survey (VAR5R/6)

Table A3 *Fisher Population by Coast Tract and Education* (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=39)	Total (N=198)
None	45.0	45.0	38.5	57.5	33.3	43.9
Primary 1-4	20.0	10.0	10.3	7.5	28.2	15.2
Primary 5-8	30.0	40.0	41.0	27.5	38.5	35.4
Secondary	5.0	5.0	10.2	7.5	-	5.5
	100	100	100	100	100	100

Source: Fisher Survey (VAR5R/9)

Table A4 *Fisher Population by Coast Tract and Ethnicity* (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
Swahili	–	–	–	10.0	20.0	6.0
Bajun	47.5	47.5	48.7	22.5	12.5	35.7
Mijikenda	47.5	45.0	51.3	65.0	62.5	54.3
Other	5.0	7.5	–	2.5	5.0	4.0
	100	100	100	100	100	100

Source: Fisher Survey (VAR5R/8)

Table A5 *Fisher Population by Type of Livelihood by Ethnicity* (%)

	Bajuni /Swahili N=83	Mijikenda /Others N=116	Total == N=199
Single Livelihood	78.3	44.8	58.8
Multiple Livelihood	21.7	55.2	41.2
	100	100	100

Source: Fisher Survey (VAR8/VARDIV)

Table A6 *Fisher Population by Type of Livelihood by Coast Tract* (%)

	Ngomeni (N=40)	Malindi (N=40)	Mida (N=39)	Kilifi (N=40)	Takaungu (N=40)	Total (N=199)
Single Livelihood	55.0	82.5	66.7	32.5	57.5	58.8
Multiple Livelihood	45.0	17.5	33.3	67.5	42.5	41.2
	100	100	100	100	100	100

Source: Fisher Survey (VAR5R/VARDIV)

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Appendix 8.3 (RA3)

Fish Catch Survey

Method

Fish catch data were recorded between May '99 and March '01 at four of the ten landing sites in the fisher survey: Ngomeni, Mayungu, Uyombo and Takaungu (In Takaungu, data collection was stopped in April 2000 because of personnel problems). They were recorded by local assistants, twice weekly, on random days for all fishers who brought in catches on these days. Essential information was recorded including date, vessel, crew, gear used, fishing grounds, fish catch, fish species and income. By the end of March 2001, 8,164 records had been compiled. Specification of the original number of observation days and number of records collected is given in Table A7.

- Some crew sizes were extremely large – up to 35 members. This occurred, for example, in groups of divers that were commercially organised and that were taken by motorboats to the grounds. The group included other exceptional forms of fishing as well. Observations on the landings of large crews of 6 members or more were excluded (N=191).

The remaining data were treated in four steps as follows

- In Ngomeni, Mayungu and Uyombo; the months of May '99, Jun '99, Jan '01, Feb '01 and Mar '01 were characterised by low numbers of observations. These data were omitted from the analysis.
- As a result, observations in Ngomeni, Mayungu, Uyombo covered 18 months with the months of July-December represented twice. To arrive at a representative yearly estimate, the latter months were weighted with a factor of 0.5.
- In Takaungu, observations covered exactly one year but the number of observations was low in May '99 and April '00. The latter observations were weighted with factors of 4.5 and 2.25 respectively.

The weighted numbers resulting after the various procedures are presented in Table A8.

Table A7 *Number of Observation Days by Research Site by Month*

	NGOMENI	MAYUNGU	UYOMBO	TAKAUNGU	Total
May'99	-	-	-	2	2
Jun'99	1	3	3	10	17
Jul'99	9	9	9	6	33
Aug'99	10	10	8	10	38
Sep'99	10	8	9	9	36
Oct'99	8	7	8	9	32
Nov'99	10	9	9	10	38
Dec'99	8	10	8	9	35
Jan'00	8	9	8	8	33
Feb'00	10	8	9	9	36
Mar'00	10	8	9	9	36
Apr'00	9	9	8	4	30
May'00	10	10	9	-	29
Jun'00	9	8	9	-	26
Jul'00	9	10	8	-	27
Aug'00	10	8	9	-	27
Sep'00	10	8	9	-	27
Oct'00	10	8	10	-	28
Nov'00	10	9	8	-	27
Dec'00	8	9	7	-	24
Jan'01	6	9	3	-	18
Feb'01	-	8	-	-	8
Mar'01	-	4	-	-	4
Total Days	175	181	160	95	611
Total Months	20	22	20	12	23
Total Records	1851	2689	2720	904	8164

Source: Catch Survey
Observation Day = Day that a set of records was collected
Record = Particulars of one catch landing by one fisher (& crew, if applicable)

Table A8 *Number of Weighted Catch Records by Landing Site*

	NGOMENI	MAYUNGU	UYOMBO	TAKAUNGU	Total
Raw Number	1851*	2542*	2677*	903**	7973
Weighted Number	1228	1520	1751	1011	5510

Source: Catch Survey * Period July '99 - Dec '00 ** Period May '99 - April '00

Appendix 8.4 (RA4)

Fish Traders Survey

Method

The trader baseline covered the same 5 coastal tracts as Study 2, that is, consisted of 10 landing sites; this survey was done between December '99 and March '00. At each landing site traders were randomly selected and interviewed either on-site or at their homes. The objective to interview 25 traders at each site was not realised because of few traders at certain sites and the following numbers were realised for the respective coast tracts: Ngomeni (N=32), Malindi (N=42), Mida (N=37), Kilifi (N=43) and Takaungu (N=32). They were interviewed by one of the research assistants in the vernacular. The following information was covered: buying and selling information (prices, volumes, composition), storage and transport, destination as well as socio-economic household characteristics. In total, 186 interviews were collected. There were only small differences between coast tracts in respect of the basic demographic characteristics of age and education (Tables A9-A12).

Table A9 *Trader Population by Coast Tract and Residence* (%)*

	Ngomeni (N=32)	Malindi (N=42)	Mida (N=37)	Kilifi (N=43)	Takaungu (N=32)	Total (N=186)
Landing Site & Nearby Village	56.3	21.5	35.1	4.7	28.1	27.5
Nearest Village at Tarmac Road	9.4	21.4	5.4	11.6	34.4	16.1
Urban Centre	12.5	50.0	48.6	55.8	3.1	36.6
Other	21.9	7.1	10.8	27.9	34.4	19.9
	100	100	100	100	100	100

Source: Trader Survey (VAR5R/82)

Table A10 *Trader Population by Coast Tract and Age* (%)

	Ngomeni (N=32)	Malindi (N=41)	Mida (N=36)	Kilifi (N=42)	Takaungu (N=32)	Total (N=183)
<19 years	6.3	2.4	2.8	7.1	9.4	5.5
20-29 yrs	43.8	56.1	36.1	38.1	34.3	42.1
30-39 yrs	25.0	29.3	19.4	26.2	37.5	27.3
40-49 yrs	12.5	7.3	22.2	21.4	12.5	15.3
5-59 yrs	9.4	4.9	11.1	7.1	3.1	7.1
>60 years	3.1	–	8.3	–	3.1	2.7
	100	100	100	100	100	100

Source: Trader Survey (VAR5R/7)

Table 11 *Trader Population by Coast Tract and Education* (%)

	Ngomeni (N=32)	Malindi (N=42)	Mida (N=36)	Kilifi (N=43)	Takaungu (N=31)	Total (N=184)
None	37.5	28.6	44.4	41.9	32.3	37.0
Primary 1-4	18.8	4.8	16.7	7.0	12.9	11.4
Primary 5-8	31.3	57.1	30.6	37.2	54.8	42.4
Secondary	12.5	9.5	8.3	14.0	–	9.2
	100	100	100	100	100	100

Source: Trader Survey (VAR5R/10)

Table A12 *Trader Population by Coast Tract and Ethnicity* (%)

	Ngomeni (N=32)	Malindi (N=42)	Mida (N=37)	Kilifi (N=43)	Takaungu (N=32)	Total (N=186)
Swahili	3.1	11.9	2.7	–	9.4	5.4
Bajun	34.4	28.6	43.2	7.0	–	22.6
Mijikenda	59.4	54.8	54.1	90.7	87.5	69.4
Other	3.1	4.8	–	2.3	3.1	2.7
	100	100	100	100	100	100

Source: Trader Survey (VAR5R/9)

Appendix 8.5 (RA5)
Household Survey

Method

Four study locations were selected to represent important factors in marine fisheries: marine protected areas and employment opportunities (Ngomeni, Mayungu, Uyombo, Takaungu).

This study comprised of three groups, fisher, fisher crew and non-fisher. Selection of the fisher group was based on the continuous catch data from fisher captains and single fisher at four landing sites (RA3; see Appendix 8.3). The first step was to identify fisher who were seen regularly at landing sites by the field assistants. Lists were made of fisher who appeared more than 20 times (20+), 15 times (15+) and 10 times (10+) in the catch records until then. Selection concentrated at first on fisher (20+); once this group was exhausted fisher (15+) were accepted and finally fisher (10+). Selected fisher were met either at the beach or at home (group 1). In the case of boat captains, they were asked to identify the household of a regular crew member living nearby (group 2) and the nearest non-fisher household (group 3).

Data were collected from October '00 to March '01. The following areas of information were covered: living conditions, household composition, employment characteristics, farming activities, fishing activities, fish conservation and food consumption. In all households, the head of the household and his wife were interviewed (and the fisher concerned if not head of the household). Interviews were conducted by one of the research assistants in the vernacular. A total of 215 households were identified and interviewed (85 fisher, 49 crew, and 81 non-fisher households). Differences between study groups in respect of basic demographic characteristics of age, education and ethnicity were small (Tables A13-A15).

Table A13 *Age Head of Household by Study Group* (%)

	Fisher-(Capt) (N=84)	Fisher (Crew) (N=46)	Non-Fisher (N=80)	Total == (N=210)
0-19 yrs	3.6	4.3	–	2.4
20-29yrs	20.2	32.6	20.0	22.9
30-39yrs	32.1	26.1	30.0	30.0
40-49yrs	21.4	17.4	28.8	23.3
50-59yrs	8.3	13.0	8.8	9.5
60+yrs	14.3	6.5	12.5	11.9
	100	100	100	100

Source: FAM Survey
VAR11R

Table A14 *Education Head by Study Group* (%)

	Fisher-(Capt) (N=84)	Fisher (Crew) (N=46)	Non-Fisher (N=80)	Total == (N=210)
None	36.9	28.3	27.5	31.4
Primary 1-4	20.2	26.1	13.8	19.0
Primary 5-8	36.9	39.1	42.5	39.5
Secondary	6.6	6.5	16.3	10.0
	100	100	100	100

Source: FAM Survey
VAR16R

Table A15 *Ethnicity Head of Household by Study Group* (%)

	Fisher-(Capt) (N=83)	Fisher (Crew) (N=50)	Non-Fisher (N=80)	Total == (N=213)
Swahili	2.4	2.0	1.3	1.9
Bajun	15.7	14.0	5.0	11.3
Mijikenda	77.1	76.0	78.8	77.5
Pemba	3.6	4.0	–	2.3
Coast	1.2	2.0	3.8	2.3
Other	–	2.0	11.3	4.7
	100	100	100	100

Source: Hhld Survey
VAR10

Appendix 8.6 (RA6)

Fish Catch Composition and Reproductive Biology of *Siganus Sutor*

(Summary)

Mas-ad Omar Mohammed [1]

Introduction

Catch composition of fish landed by artisanal fishermen along the Malindi-Kilifi inshore waters and fish production trends were studied for a period of six months between August-2000 and January-2001. These months covered both the low and high fishing seasons.

Method

Samples were obtained from four landing sites, namely Ngomeni, Mayungu, Uyombo and Takaungu. Quantity (kg) and value (sh) of catch were recorded. Sampling was done twice weekly for each landing site (approximately 20 records per landing site) and in total, about 4,000 observations were recorded. Specimens were identified to species level, using relevant field guides (FAO's checklist of species identification 1985; Smith's Sea Fishes 1991; guide to the seashores of Eastern Africa, Richmond, 1997).

Further analysis was done on the reproductive biology of *Siganus sutor* (rabbit fish, the most commonly landed fish species) with the aim of examining whether heavy fishing of this species was affecting its maturity patterns. Data were collected twice a month for a period of four months (November-February) from rabbitfish sampled mainly from *lema* traps at Mayungu landing beach.

Measurements included total length (cm), standard length (cm), weight of fish (g), gonad weight (g), sex and fecundity. A fish measuring board was used in the field to measure the total and standard lengths to the nearest 1 cm. Individual fish were weighed to the nearest 1 g using a top-loading balance. Gonads were removed, placed into vials and stored on ice and in the laboratory they were weighed to the nearest 0.1 g using an analytical balance. The ovarian maturation cycle was determined using histological techniques and size at first maturity was established.

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1 Mohammed M. O. (2002). *Fish Catch Composition and Some Aspects of Reproductive Biology of Siganus sutor along the Malindi-Kilifi Marine Inshore Waters.* (M.Phil thesis). Moi University, Department of Fisheries

Results

One hundred fish species belonging to more than fifty families were recorded. The demersal fish constituted 42% of the catch, pelagics followed with almost 15%, sharks/rays and sardines with 11%, crustacea with 11%, others with 14% and the miscellaneous category with 7%. Mullet and ribbon fish were most abundant in Ngomeni and Takaungu and rabbitfish in Mayungu and Uyombo.

Production estimates for the landing sites showed that Ngomeni landed by far the highest amount in weight. This was because mostly pelagic fish were landed at this site. These fish are much heavier than demersal fish and fetched almost double the price.

The study identified seven gonad maturation stages in *Siganus sutor*. The fish spawned during the months of January/February. This months were established by the (1) temporal variations in the condition factor and the relative weight of the gonads; and (2) progression of peaks of maturity stages with seasonal occurrence of spent fish in the samples.

The fecundity of the species was estimated at 170,000 to 781,000 oocytes (mean 506,000 ± 30,327) in fish between 17 and 24 cm. The relationship of fecundity with total length and that of fecundity with body weight were curvilinear. The regression equations are as follows.

$$\text{Log } F = 2.953 + 1.958 \log L \qquad r^2 = 0.6151 \ (n=33).$$

$$\text{Log } F = 3.933 + 0.751 \log W \qquad r^2 = 0.6008 \ (n=33).$$

The size at first maturity was approximated at 17.5 cm TL (12.8 cm SL) for females and 17.0 cm TL (12.2 cm SL) for males. This represented a reduction from 18.0 cm SL for both females and males reported by Ntiba (1986). Therefore the hypothesis that intensive fishing of the species *S. sutor* was affecting some aspects of its reproductive biology holds.

The gonad maturation cycles for both males and females followed essentially the same pattern where the lowest GSI was recorded during spawning. The overall sex ratio of the population was not significantly different from the expected 1: 1 ratio.

Conclusion

Marine inshore water along the Malindi-Kilifi coastal region contains more than one hundred species of fish. The existing fish identification system is inadequate because most fish are grouped into major categories or referred to by inconsistent regional common names. There is an urgent need to classify these fish properly in accordance with taxonomy.

Fishing vessels and gear employed by the artisanal fishers in Malindi and Kilifi are outdated. Perhaps the most important note is that the gears used are largely passive. Fishermen travel to the same fishing grounds daily and use the same types of vessels and gears to catch fish.

Sustainable production levels of reefs and lagoons are not ascertained and fishing usually results in disappointing returns as production trends fluctuate highly. Despite low income and deteriorating conditions, fishermen are often unable to leave fishing given the lack of job opportunities elsewhere and the generally low value of fishing gear in the second hand market.

Size at first maturity indicated that the fish is maturing at a smaller size than it was almost a decade ago. This supports the hypothesis that the population of *Siganus sutor,* that continues to be fished excessively, is under pressure.

Recommendations

- It is necessary to study the species composition in depth over several annual cycles to establish the species richness in the area. Furthermore, fish scouts recruited by the Fisheries department should be provided with prior training on making proper recordings of data at fishing sites.
- The relevant authorities (e.g. Fisheries department) should interest fishers in new equipment, initiating changes in both vessels and gears. For example, the use of FADs (Fish Aggregating Devices) for artisanal fisheries. Additionally, a sense of pride in fishing should be instilled through awareness programs. To improve on the amount of fish caught, traditional work habits of the Malindi-Kilifi coastal fisher should be modified. For example, fishers could concentrate on setting traps and nets during daytime low tide and retrieving them during the next daytime low tide, thus allowing for increased night fishing.
- The rationale of legislation on mesh size for nets and having closed seasons when fish spawn should be explained to local fishers. However, they will abide by legislation only if they are making a reasonable living. Otherwise, they will continue to destroy their local marine environment. An immediate assistance that can be extended to the artisanal fishers is reviving the co-operative systems, which ensures catch prices and improves transport and marketing methods.
- Despite having a coastline of almost 680 km, Kenya's marine fishing has not matched inland catches for many reasons. These include over-exploitation of the inshore fish and inability to exploit the off-shore fish stocks. It is recommended that

more off -shore vessels be used as practised in Senegal (Tall & Guèye 1992) and, hence, ease the pressure on the in-shore marine resources.

- Promotion of fisheries based on under-utilised species can improve the management of the coastal fisheries.
- Future studies on other aspects on the biology of the *S. sutor* are needed, as for example, the causes of atresia of oocytes and its effects on fecundity and age and growth of the species using daily bands on the otoliths, feeding habits and behaviour. Studies of other siganids are also recommended to gather overall insight in the biology of the entire family of this important fish. Finally, a year round study conducted on selectivity of the *lema* trap and hence the fishery of the siganids in general.

Appendix 8.7 (RA7)
Processing and Marketing of Fish
(Summary)
Andrew Wamukote[1]

Introduction

The marine fisheries sub-sector, although a significant source of livelihood and employment, continues to contribute a minor percentage of the fish produced in Kenya. The main objective of the research, carried out in Malindi and Kilifi districts, was to analyse the marketing system of fish. Specific objectives were to identify fish marketing channels, the factors determining the choice of a market channel and constraints in the marketing system.

Method

Fish traders at four landing sites were surveyed between October 2000 and March 2001 (Ngomeni, Mayungu, Uyombo and Takaungu). Market centres were selected in close proximity to the four landing sites (Ngomeni, Malindi, Matsangoni and Takaungu). Traders were selected randomly and interviewed once by means of a structured questionnaire. Most questions dealt with the situation on the day of the interview although some questions related to the past. A total of 231 traders from all the landing sites and market centres were sampled. Data collection techniques included structured questionnaires, interviews, observation, and the use of secondary data from various sources.

Results

Traders interviewed ranged from 19 to 60 years of age, with the majority of the traders between 20 and 29 years old. This age bracket included the most active members of society. An almost equal number of male and female traders operated at the sampled sites. Gender was not a limiting factor in fish marketing but female traders focused mainly on small fish and small quantities for local sales. Men bought and sold the larger fish and an increase in male traders meant a an increase in quantity of fish traded. Traders from the Mijikenda ethnic group were the majority followed by Bajuni. About 43 percent of the traders had attained up to primary school education while 30 percent did not have any formal education. The majority of the traders were Muslims. Generally, there were low levels of education among the traders.

1 Wamukote A.W. (2002). *Processing and Marketing of Fish among the Coastal Fisher-Folk.* (M.Phil thesis). Moi University: Department of Environmental Economics

Fish traders were categorised into small-scale traders, fishmongers, middlemen and large scale-fish traders. In total six fish marketing channels were identified. These channels were reduced to two main channels, a channel for fresh fish and a channel for processed fish. The processed fish channel was manned by fishmongers who, after buying the fish, fried them and sold them not far from their respective landing sites. The fresh fish channel was dominated by the other trader categories. Middlemen and large-scale traders in particular sold fish at Mombasa and even Nairobi. The channel that carried the largest volume of fish was fisher>small-scale traders>middlemen> large-scale trader>consumer.

Using logistic analysis, the factors determining the choice of a marketing channel were found to be ownership of storage facilities, profit margin and time taken to selling. Constraints in the marketing system related to infrastructure and socio-economic factors. In particular ownership of fish storage facilities was among the constraints of fish marketing apart from household size.

Local fish processing was mainly frying fish using wood for fuel. On average, about 4 kilograms of wood were used per day for fish processing purposes. The traders used wood acquired locally from farms, on the roadside, in the forest or bought from fuelwood dealers to fry or smoke the fish which they later sold to consumers around the landing sites. Some of the traders involved in fish processing used coconut husks, which were available on their farms. Fuelwood dealers who sold to fishmongers were very few. Because fuelwood could be acquired cheaply without necessarily being bought, over-utilisation of fuelwood is a threat.

Conclusion

Contribution of marine fisheries to the overall fish production in Kenya is low and continues to decline. Majority of traders fell into the category of fishmongers who dealt in small quantities of processed fish and small-scale traders who dealt largely in fresh fish. These two trader categories dealt in comparatively small quantities of fish. A few large-scale traders dealt not only in large quantities of fish but also in fish species of high value (lobsters, prawns, squids).

Fish from the study areas served mainly the population around the landing site with a small quantity reaching Mombasa and Nairobi. This was because most of these traders lacked fish storage facilities. Ownership of fish storage facilities was also a conspicuous constraint in fish marketing. This, coupled with poor condition of roads to market centres and landing sites, hindered the supply of fish to the market. In most cases traders were forced to walk long distances to sell and deliver fish.

Factors determining the choice of marketing structure in Malindi and Kilifi districts were the ownership of storage facilities, time taken to selling and gross profit margins. Ownership of fish storage facility doubled as a constraint in fish marketing. Household size was also a constraint.

Processing was, to a great extent, traditional. Traders used fuel wood acquired from local farms on the roadside, in the forest and bought from fuel wood dealers to fry or smoke the fish which they later sold.

Recommendations

- Improvement in the level of literacy and training of fish traders will improve fish marketing by providing them with necessary skills.
- Revitalisation of co-operative societies could help traders through information gathering and marketing of products. This will not only ensure better remuneration to the traders but may also improve the general fish marketing system.
- Credit facilities will help, in particular, small-scale traders and fishmongers who form the bulk of fish traders but who deal in comparatively small quantities of fish. Credit could help in acquiring storage facilities, improve means of transporting fish and boost the volume of fish traded. Credit facilities can be made available through co-operative societies.
- Upgrading of feeder roads to improve access to landing sites and market centres could greatly improve the fish marketing system. Fish exports could be improved by aggressive marketing of Kenya's marine fish and fish products abroad.
- Establishing woodlots on traders' farms and adapting technology that ensures sustainable use of fuel wood could provide fuel wood security. Venturing into industrial fish processing could improve fish marketing.

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Appendix 8.8 (RA8)
Livelihood Strategies and Income Diversification
(Summary)
Nicole Versleijen[1]

Introduction

Fish stocks are declining on the Kenyan coast putting more pressure on the livelihood strategies of fishermen. To sustain their livelihood, fishermen have to diversify their sources of income. In most cases this is done by farming, especially by the cultivation of cash crops. However if the trend of declining fish stocks continues, this will not be enough to support the households. Livelihood strategies in two landing sites were examined and compared.

Method

This study focused on artisanal fishermen and their households in Kilifi and Malindi Districts: their livelihood strategies and their attitudes towards resource conservation, indigenous conservation practices and the presence of the Watamu Marine National Park. Data were collected through questionnaires, participant observation, life and career histories, network analysis and genealogies in Uyombo and Takaungu with additional information from fishers in Watamu Marine National Park. Discussions were held with the fishermen, Kenya Wildlife Service employees and people employed at the Watamu Marine National Park. The period of study was June-October 2000 and included 21 respondents from Takaungu and 23 from Uyombo.

A number of differences existed between the two sites: (1) Uyombo was situated near a Marine National Park and Takaungu was not; (2) Takaungu was a small town, whereas Uyombo was a small village; (3) Takaungu had a history as being a fisher community whereas Uyombo lacked this history; (4) in Takaungu, employment possibilities besides fishing and farming existed or were relatively nearby but this was not the case in Uyombo; and (5) most fishermen from Takaungu were born in Takaungu and were living in Takaungu whilst most fishermen in Uyombo were living away from the landing site and were not born there (See also Appendix 8.13).

1 Versleijen N. (2001). *An Empty Sufuria: The Effects of a Marine National Park on the Livelihood Strategies and Income Diversification of Fisherman Households at the Kenya Coast.* (M.A. thesis). Wageningen University:

Fishing at both landing sites was dominated by men. Women were involved in the marketing of fish usually as fish mongers. Fishermen ranged in age from 10 to over 70 years. However, boys of around 10 years were often fishing with their father or experienced fishermen. Many of the older fishermen fished rarely and irregularly. The most active fishermen were between 20 and 40 years of age. Very young fishermen and older fishermen either lacked the experience or the physical strength. Fishermen at both sites were mainly of Mijikenda origin. In Takaungu, most fishermen were Muslim whereas in Uyombo most fishermen followed traditional African religion. In Takaungu, many Mijikenda converted to the Islam for various reasons, one being social status.

Fishing Practices

Fishing activities were influenced by the prevailing winds. During the ***kaskazi*** season, fishing activities were high, and during the south east winds, ***kusi***, fishing activities were low. This made ***kusi*** the most difficult period to sustain a living. Fishing declined on Fridays, especially in Takaungu, where most fishermen were Moslems. Friday is their day of prayers. Fishermen also did not fish on certain days for reasons of religion, sickness, resting, commitments at home and travelling. In Uyombo, fishermen often fished at night, especially the speargun fishermen. This resulted in higher catches and less interference from the KWS. Also, fishermen did not fish in areas they could not reach with their vessels and, in the case of Uyombo, the Marine Park.

There were few differences in fishing practices between the sites, except in the frequency of certain gear. Spearguns were used more frequently at Takaungu than at Uyombo since the fishermen described it as a very effective method. However, in Uyombo the regulations were enforced while control of the speargun was rare in Takaungu. Fishermen preferred the gear in which they were experienced and, related with this, promised them the highest catch. Most fishermen started fishing at a young age, on-the-job training by assisting their father, their uncle or friends. They gained experience in the use of a certain gear during this period and they kept on using it. Whether gear is environmentally friendly or legally allowed was usually not taken into account. Costs of the gear was considered. ***Malema*** were obtained at low costs since it was made by the fishermen themselves from local materials. Nets had to be purchased and cost more. Although spearguns were locally made, the need for a flashlight and batteries to fish at night increased the costs of this particular gear.

The catch at Takaungu was generally higher than at Uyombo. Fishermen in Takaungu referred to day catch incomes of 1,000 shillings regularly while the fishermen in Uyombo usually had catches of 300 shilling or thereabouts. However, the variety of species was more than twice as

high in Uyombo than in Takaungu.

Reasons to become a fisher seemed the same in Uyombo and Takaungu. There were hardly any other jobs available. In Uyombo, fishing was often the only option people had, while in Takaungu there were other options, for example block cutting in the local quarry. Fishermen taught new fishermen how to fish. Many of these 'new' fishermen first became migrant fishermen who fished elsewhere along the coast for periods of days or weeks. From the moment they faced family responsibilities, they tended to become permanent at one landing site and, in turn, taught new fishermen how to fish.

Migration along the coast to fish elsewhere was more common among the fishermen of Takaungu than among the fishermen in Uyombo. Seven of the fishermen from the sample had only been fishing at Uyombo. In Takaungu there were only two fishermen. This can be explained by several facts. One of the two fishermen in Takaungu as well as three of the fishermen from Uyombo had dropped out of school to supplement their parents' income with fishing. These fishermen were often the eldest son in their household and helped their parents on the *shamba*. They would not be likely to leave their parents household until one of their brothers would reach the age at which they could earn income. Another reason might be that for certain vessels like *mtumbwi* and the smaller *dhows* it was hard to leave Uyombo. Just outside the entrance of the creek, the sea is very rough and since the other way out was blocked by the Marine Park, a fisherman required to have a second vessel to fish elsewhere.

Income Diversification

The fishermen studied in Uyombo, except one, had at least two sources of cash income. The only household which did not have a second source of cash income was assisted monthly by a brother of one of the household members. All households, except two, had at least two sources of food income. In the two households that did not, one household only cultivated cash crops on the *shamba* and the other was saving money to buy a *shamba*. In Takaungu, all households, except two, had at least two sources of cash income. One of those two had to buy on credit during *kusi* season but the other managed without. All the households, except two, had a food income from at least two sources. These two households did not have shambas as *"we do not need it"*. In Takaungu, the households were more secure of their income than in Uyombo.

All households with a *shamba* in Takaungu cultivated food crops and five households (out of eight) raised cash crops. In Uyombo, nine out of 10 households cultivated food crops and seven out of 10 did raised cash crops. Whereas in Takaungu only three households grew

coconut trees to sell products from it, in Uyombo all the households with cash crops (seven) grew coconut trees to make money. The main advantage of growing coconut trees was that one can obtain cash at any time of the year. All seven households in Uyombo made and sold *makuti* during *kusi* season while, in Takaungu, this was not necessary for the households with cash crops.

In Uyombo, fishermen who did not live at the landing site, except for one, lived at the homestead where they grew up. In some cases the father had passed away while in some cases the father or the mother were still alive. In all cases, these fishermen were cultivating a *shamba* which belonged to their fathers. If they had not cultivated their father's *shamba*, they would have been forced to find alternative sources of income to save money for a *shamba* and sustain their livelihood.

In Uyombo, three households were assisted by people from outside the household and two households assisted somebody else outside the household. In Takaungu, one household was assisted from outside and four households assisted somebody else. This confirms that the households in Takaungu were somewhat better off than in Uyombo. Most fishermen households from Uyombo needed their second source of cash income to meet household demands and to allow their children to go school. In Takaungu, the second cash income was needed less in the short-term. Consequently it could be invested, for example, in the purchase of livestock. Also more requests for help from relatives were made in Uyombo than in Takaungu while in Takaungu more people outside the household were assisted. This reflected the severity of the situation in Uyombo where people were less able to help and more in need of help. In Takaungu people expected they would have someone on whom they could rely in times of need since they had assisted other people. This was not the case in Uyombo.

An important factor that decided the level of household resources was the domestic phase. A household with little children has a few people contributing to production (e.g. the father and the mother) and many people consuming. When the children grow up, this changes and they produce more than they consume. When the parents are old and their children move out of the household or are married and have children themselves, the wealth of the household decreases and the consumption is higher than the production again (Chayanov 1966; Durrenberger & Chayanov 1984). Households in the first domestic change were more vulnerable in Uyombo than in Takaungu. As already mentioned, people had more chances to find assistance in Takaungu than in Uyombo. Takaungu also offered more employment possibilities. A fisherman could start block cutting at Timboni during *kusi* season, for

example, in order to overcome this low catch period.

Households had a need to diversify their income. The most difficult periods for a household were the first and third domestic stages and the *kusi* season. Fishermen were aware of these problems and tried to avoid them in several ways. Arrangements were made to avoid entering an unprofitable domestic stage, for example, by keeping adult children in the home. A fisherman household could start more income generating activities, however these were limited. To rely on social relations and count on assistance from a friend or relative was increasingly difficult. Many people were facing the same problems and, thus it was difficult to provide assistance.

Resource Conservation

It is generally thought that fishermen regard fishery resources as common property with free and unregulated access, often referred to as open-access. The seas are open and do not belong to any particular individual fisherman or community. This kind of situation can easily lead to overexploitation of the resources (Hardin 1968). The individual will try to maximise his profit from the resources while the community shares the costs. In this line of thinking, limited access will be the best way to manage the marine resources. But can one really talk about profit maximisation while, for most of the fishermen, fishing is merely a way of surviving? There may be factors which force local resource users to use the resources beyond their sustainable use. Taking employment possibilities into consideration, the motive of limited access in order to protect marine resources loses its justification. Equally important are the capacities of the actors involved and the situations and relations in which they are embedded. An example of this is the arrival of the Wapemba in Uyombo. The fishermen felt the need to defend 'their resources'. However, if the Wapemba would have fished with less destructive gear, they would probably have been tolerated.

Fishing and cultural traditions in Diani-Kinondo area were studied by McClanahan *et al.* (1996, 1997). This area is mainly occupied by the Digo and ceremonies generally began at sacred sites on land (*kaya* or the related *mizimu*) and continued at sacred sites at sea (*mizimu*). Secret sites used in these *sadaka* were very old. The specific sites on land or at sea were originally selected generations ago by elders who had visions in which spirits came to them and told them to perform certain acts and catches would increase and problems would be solved. Areas of sea which were viewed as places of unusual phenomena, particularly dangerous areas or areas inhabited by sea spirits were avoided by the Digo fishermen and served, therefore as small, self imposed marine protected areas. This conservation may have been largely achieved by fear or respect the fishermen had for the inhabiting spirits in the *mizimu*. However,

midway in the 20th century, the elders relaxed the rules about fishing around *mizimu* as catches declined and fishermen fished everywhere.

It is certain that ceremonies have taken place in Takaungu in the past (Glaesel 1997). It is also certain that no ceremony took place in Uyombo. This means that in Takaungu indigenous forms of conservation existed but they never existed in Uyombo. Nowadays, this situation is reversed with the presence of the Watamu Marine National Park. Fishermen are concentrated in a smaller area and as a result, this smaller area is overexploited. KWS makes sure that conservation practices are abided by in Uyombo. Fishers in Takaungu do not practice conservation methods explicitly anymore.

One reason for the disappearance of ceremonies as indigenous ways of conservation is that fishing has become a multi-ethnic activity (Glaesel 1997). Fishing used to be dominated by Bajuni and Swahili. Their beliefs and practices were related to their way of living near the sea. The origins and beliefs of the Mijikenda (except the Digo) were never connected to the sea. When they started fishing, they valued these ceremonies less and since the ceremonies required an effort of all fishermen together, the ceremonies lost their value. Also religion played a role here. When Christian fishermen entered the scene, practices and beliefs of the Bajuni and Swahili were seen as unchristian, so Christian fishermen did not want to co-operate in their ceremonies. An additional cause is that more and more young people were involved in fishing who rejected the customs of the older fishermen. Some fishermen from Takaungu stated that they could not do anything about conservation. Conservation could only be practised in traditional ways by wealthy fisher, i.e. if catches are high throughout the year. Nowadays, not fishing for a day would have an immediate effect on their household income and the subsistence of their household. Households have to be fed each day and therefore, these indigenous ways of conservation were not suitable anymore.

The conflict with the Wapemba showed that there were internal regulations among fishermen. The chairman of the fishermen committee in Takaungu explained that anybody who was fishing with destructive fishing gear would be held accountable. Also, the chairman of the village committee of Uyombo said that people using destructive gear were made aware of the effects of their fishing. Natural resource management was often subjected to this kind of normative regulation. Fishermen saw themselves confronted with a legal pluralism and had to find a way to deal with this. Several ways of regulation came under pressure when other ethnic groups and religions entered the fisheries in Takaungu and Uyombo. Also the national and international resource management, through Acts and Parks and Reserves, created a pluralism which made it difficult for the fishermen to deal with. Often fishermen did not know

all the existing regulations and they seldom knew the reasons behind certain regulations. This legal pluralism also caused problems with defining the positions of owners, users and others. According to the fishermen, the sea cannot be considered to be private property, therefore the right of alienation was not in question. However, considering the Marine National Parks and Reserves, the Government of Kenya gave the rights of access, withdrawal, management and exclusion to the KWS. This caused animosity of the fishermen towards KWS and, thus, conservation.

The attitudes towards conservation of the fishermen of Takaungu and Uyombo differed considerably. In Takaungu, most of the (younger) fishermen admitted that there was a need for conservation. However they were also aware that whatever form the conservation takes, they will not be able to practise their fishing anymore. The only alternative they envisioned was to move people away from fishing by offering other employment. However, given the declining employment opportunities, it was predicted that more people will start fishing in the near future. People who have no other income turn to fishing and, consequently, an even higher pressure is put on marine resources. In Uyombo, people were generally adverse to conservation. According to most of the fishermen it was logical that their catches were low since there were too many fishermen in a small area, which was limited by the Marine Park as well as by rough seas. The downward spiral of declining fish stock - less income - more school drop outs - more fishermen - more exploitation of fish stocks was very strong in Uyombo. But in Takaungu it was also present. McClanahan (1996) also claimed that Marine Parks "are useful if they somehow increase the total fisheries production of the region, but they may otherwise concentrate fishermen into smaller areas, causing increased overexploitation in unprotected areas".

Fishermen of Uyombo generally had a negative attitude towards the Watamu Marine National Park. They were of the opinion that they have not (directly) benefited from its presence. The fishermen suggested various ways in which they can benefit from the Park. First of all, parts of the Park should be opened for fishing during *kusi* season. Second, the fishermen should receive parts of the gate collections of the KWS. Third, employment at the Watamu Marine National Park or related employment, like in hotels, should be offered to fishermen since they were deprived of income by the Park. A Marine Park generates employment, but this employment was often not available to the fishermen, since they lacked sufficient education and starting capital. Therefore, the benefits of the Marine Park for the fishermen were few and this has resulted in anger and aggression towards the Marine Park.

To understand the adverse attitude of fishermen towards conservation in general and the

Watamu Marine National Park specifically, it is necessary to examine the relations between the KWS and the fishermen and the conflicts that arose. The interests of the KWS and the fishermen are almost contradictory. Whereas the fishermen want to catch as many fish as possible and improve their income, the KWS wants to control and limit fishing activities. A clear example of this conflict is when fishermen are caught fishing illegally in the Watamu Marine National Park. Fishermen claim that they are arrested and harassed when just passing through the Marine Park and are accused of fishing inside the Marine Park. They even complained about beatings and being deprived of fishing gear and vessels, making their relationship with the KWS extremely tense.

Clearly, the attitudes towards conservation are affected by the presence of the Marine Park. A more positive attitude towards conservation existed in Takaungu than in Uyombo, only they did not know how this should be done. In Uyombo, many fishermen abandoned the idea of conservation, claiming that it was an idea of the *wazungu* (white man) and the government who only wanted it for their own good. The Marine Park was, therefore, not only reflected in their fishing activities but also in their general thinking. As a result, they were less likely to participate in conservation programmes when they are offered to them.

In order for fishermen to play an active role in the conservation of marine resources in the future, it is important they have a positive attitude towards conservation. The need for conservation was hardly denied by the fishermen, most of them agreed that it was important for their future livelihood strategies. Many fishers were ready to undertake conservation projects if they would improve their living standards. However, most fishermen, especially those in Uyombo, were forced into a situation which did not allow them to look at the long-term. Their main aim was to meet the short-term demands of their households.

Conclusion

Coastal communities depend heavily on marine resources for their subsistence. Therefore, it is important that effective management strategies are put into practice to ensure sustainability. Effective management can only arise from within the community or at least at the community level rather than international or national levels (Western 1994). Successful management strategies of fishery resources must be accepted by the people involved and, in particular, at the grassroot level where the resource users are. The resource users, the fishermen, have to be involved in decision making and regulations. Concerned authorities should shift the management of resources partly from government institutions to the local fishing communities. This means that the fishermen have to be willing to co-operate.

Most fishermen are aware of their situation. They are aware that something should be done about the declining fish stocks. However, the question is what. Each way of conservation will interfere with their fishing and therefore is not a solution for them. More employment opportunities might withdraw people from fishing and, as such, lessen pressure from marine resources. However, since the employment possibilities remain limited, more and more people will turn to fishing to obtain at least something to eat. Another necessity for grassroot management is that fishermen form committees or co-operatives. In Uyombo, this is the case but in Takaungu this still had to be established.

Income diversification is a way to deal with declining incomes. Two types of income diversification are evident. In the first, there are the Swahili and the Bajuni who are primarily fishermen and supplement their income by farming. In the second, there are the Mijikenda who are primarily farmers and who supplement their income by fishing. This is an important distinction which should be kept in mind when considering management strategies. Income diversification of fisherman households could also be regarded as a way of conservation, a way of relieving the pressure on marine resources.

According to fishermen, the creation of a Marine Park is not the proper solution. First of all, the fish stocks are still declining after the gazettement of the Marine Park. Second, the fishermen are left with a small area in which to fish, making the density of fishermen in this area very high. Another point is that the existence of a Marine Park seems to make the fishermen adverse to conservation. They only associate conservation with the Marine Park and, therefore, with low fish catches. They do not see the introduction of conservation but rather the abolition of conservation (i.e. the Marine Park), as a solution to their problems. This attitude might change if the fishermen benefit from the Marine Park. Ways in which the fishermen see benefits are: allowing fishermen to fish in the Marine Park seasonably, derive parts of the entrance fees for the benefits of the fishing community, and alternative employment for the fishermen.

Recommendations

Fishermen are trapped in a cycle of poverty. They are socially and economically marginalized. This is a result of limited ways of income diversification and low incomes which forces them to fish in such a way and to such an extent that it causes degradation to marine resources. This, in turn causes their incomes to decline further. To break this cycle, fishermen should change their attitude towards conservation. Also their incomes should be improved from alternative sources. Following are suggestions on how to reach better conservation of marine resources while dealing with the deprived situation of the fishermen

- Fees from Marine Parks to be used to increase the welfare of the fishermen in the area.
- A better relation between fishermen and the KWS to be established through a change of the attitude of the KWS towards the fishermen and the fishermen towards KWS.
- Sponsoring to be arranged for primary education of fishermen and members of their household to give them a better opportunity for an alternative job.
- Information and training on how to apply for a job to be given to the fishermen and the members of their household.
- Fishermen willing to diversify but who lack the capital to start self employment to receive financial assistance.
- The management of fishery resources and related areas to fall under the jurisdiction of one organisation which consults the local population in times of decision making. Presently, the protected areas fall under the responsibility of KWS while the unprotected areas fall under the responsibility of the Department of Fisheries (D.o.F.).
- Similarly, the management of marine resources should be handled by one ministry instead of the two ministries (the Ministry of Agriculture and Livestock Development and the Ministry of Environment and Natural Resources), as is practised today.
- Information on and discussion with the fishermen concerning policy, regulations and implementation to take place.
- More employment possibilities should be created for fishermen who are willing to take other employment.
- More studies are needed on fisheries to provide the necessary information for the management of marine resources.

Appendix 8.9 (RA9)

Fisher Awareness of Resource Degradation and Traditional Conservation

(Summary of Malindi-Kilifi Results)

Joseph Tunje [1]

Introduction

The study focused on fishing methods of artisanal fishermen and to what extent these practices contribute to coral reef degradation. Fishing methods, reasons for their choice, and their impact on coral reefs were investigated. Indigenous environmental conservation efforts, fishermen's alternative sources of income, and attitudes towards environmental conservation were also studied.

Method

Studies commenced in August 1998 and data collection was completed by February '99. Main study sites were Malindi District (Mayungu), Kilifi (Takaungu), and Lamu (Kiunga and Mkokomi); additional information was collected in Uyombo and Shela landing sites. The study was designed to allow comparison of Lamu vs. Malindi and Park vs. Non-Park conditions.

This summary is restricted to the findings for the Malindi and Kilifi sites. One site (Mayungu) is in a Marine Reserve, the other (Takaungu) is not. Respondents include fisher folk (N=25 at both sites), KMFRI and Department of Fisheries officials. Methods included formal questionnaires, in-depth interviews, informal discussions and participant observation.

Fishing Practices

Fishing activities are dictated by prevailing winds. During the ***kusi*** season, when the winds come from the south-east, fishing activities are low, and mainly conducted in-reef. The inshore fishery resources are under pressure during this season. Fishing activities are high during the ***kaskazi*** season; a time when fishing is done both in- and out- of-reef areas.

Fishermen ranged in ages from below 14 to over 70 years. However, most fishermen were middle-aged ranging from 31 to 45 years. Fishermen in this age bracket were also the most

1 Tunje J.G. (2000). *Reef Fisheries in Kilifi and Lamu Districts: Fishing Practices, Awareness of Resource Degradation and Traditional Ways of Conservation among Artisanal Fishermen.* (M.Phil. thesis). Moi University, School of Environmental Studies

productive. There were few elderly fishermen over 46 years in age. At that age, many preferred to 'retire' due to less physical energy, but also because they were becoming less productive. Fishermen may start fishing at an early age of about 14 years, usually with their fathers or relatives. Older fishermen usually trained the young fishermen in the use of a particular gear type that was socially accepted and with some sense of resource conservation.

Most fishermen fished once a day (48%); one fishing expedition lasted about four hours. They generally fished for 6 days in a week and rested one day. However, this was mainly in areas where the resource was healthy. In areas where the resource was poor, many fishermen were compelled to fish twice a day, or engage in day and night fishing. This potentially overstressed the resource which further contributed to its poor status, that is, low catches and low incomes. This triggers a cycle which will eventually end with degradation of the resource. In general, frequency depended on richness of the resources and accessibility, the type and size of the fishing vessel, and the distance the fisher had to cover. Fishing frequency was low on Fridays when fewer fishers fished since many were Muslim. Fishers of other religions rested on unspecified days, perhaps when they were tired or wanted to spend time with their families.

Gears can be divided into traditional, local-made gear and modern, manufactured gear. Traditional gear such as fish baskets *(malema),* fish fences *(uzio)* and spearguns were declining in use. These gears have become less effective and less efficient following the depletion of the fishery resources within the reef. Furthermore, spearguns were prohibited in a marine reserve, however, some fishermen used them at night. Traditional poisons and explosives, also illegal and destructive, were used sometimes by fishermen who could not afford fishing gear.

Modern, manufactured gear, i.e. nets and lines made of nylon, were preferred by the fishermen. Nets were most common with the ***mpweke*** (gill) net preferred. Many fishermen (42%) restricted themselves to fishing nets with mesh sizes between 3.0 and 6.5 inches. Fishermen argued for the use of this type of fishing gear because it aims at catching only big and mature fish, leaving small juveniles to pass through. Fishermen also used such mesh sizes because they were recommended by the government. According to the Fisheries Act (Kenya 1991), it was illegal to use a fishing net of mesh size less than 50 mm, unless used for catching sardines (*sim sim*) which grows to approximately 2 inches.

The use of beach-seine *(juya)* nets, which are usually very long nets (sometimes as long as 100m) with very small mesh sizes, was particularly common in Lamu. These nets were dragged along the sea-bed, harvesting targeted and non-targeted fish species alike. They destroyed

corals which are fish breeding, feeding and spawning grounds. By-catch of non-targeted fish species and immature fish may comprise up to 90% of the contents of the net (Don 1990; Obura *et. al.* 1996).

Spear guns can be destructive and were not allowed. Fishermen using this gear sometimes stepped on the corals as they snorkelled in the water. The arrow used can damage the coral when missing its target. The spear gun is often used in combination with a metallic rod *(mkonjo)* which is used to break and (or) overturn the corals where fish seek refuge. However, when used with care, spear guns can be sustainable in exploiting coral reef fishery resources and aid with selective exploitation.

There was some use of traditional fish poison along the upper parts of the Malindi coastline. This method of fishing indiscriminately kills coral reef organisms, including fish. The northern parts of Malindi district are remote and inaccessible, and hence regular patrols by the Fisheries Officers are difficult.

The choice of the fishing gear was determined mainly by the fisher's knowledge and gear experience. Also, fishermen used gear which gave them relatively high fish catches. The price of the gear was another factor that influenced choice. Most fishermen rarely considered the environmental impacts of the gear they used. However, regular patrols by the KWS officers in the reserves has contributed to the fishermen using mainly the recommended gear, particularly the gill nets. This is in contrast to the situation in the unprotected areas where fishermen used all sorts of fishing gear, including nets of small mesh-size.

Some low-income fishermen used traditional fish traps *(malema)*; and most did not engage in economically productive tasks on days off from fishing. The number of fishing trips per day was higher among low-income fishermen. Fishers reported decreasing trends in fish catches over the period they have been fishing, in particular, fishermen from low-income brackets. Better incomes were realised by fishing outside the reefs in both the ***kusi*** and ***kaskazi*** seasons. However, fishers often did not exploit these resources because their vessels were unsuitable.

Income Diversification

Generally, fishermen earned higher monthly incomes than, for example, government servants in job groups A-C who did not earn more than Ksh. 4,000. Fishermen were lowly educated and many worked less hours a week (4 hours for 6 days – JT) than government civil servants who may have had some secondary education and work for more hours (8 hours for 5 days a

week). Thus, it appears that fishermen should not complain of low incomes from fishing but they were trapped in economic and social backwardness.

Though fishermen worked for relatively few hours, occasionally they opted to take off a number of days, particularly after landing a very good catch. When not fishing, fishermen are engaged mainly in resting (21%), prayers at the mosque (27%) and gear repair (17%). Farming was mentioned by 35% of the respondents.

Most fishermen did not engage in other work when off; many claimed that fishing is very tiring and exhaustive. Except for a few, fishermen were not economically productive on the days when not fishing. This has contributed to their entrapment in the low income brackets and their marginalization, both socially and economically. However, some attempted to improve their financial situation, mainly by farming.

Fishing remained the major source of income. All fishers said that they needed financial help at certain times. The majority of fishermen, 62%, reported a need for financial assistance during the *kusi* season. Clearly, fishing activities or returns were low during this season, affecting incomes adversely and, hence the need for financial help. Others took a longer-term view and mentioned need of help during their old age (20%). Twelve percent needed help when problems arose. Fishermen also needed financial help when the gear needed repair.

Above age 40, about one-third of the fishermen reported financial help from working children, and this percentage can be expected to increase with age. Among the fishermen who received financial aid from their working children, 58% earned high incomes of more than Ksh 6,000 per month. Most of the fishermen who were not recipients of funds from working children tended to earn lower incomes (71%). It is possible that either the funds from children were invested in fishing equipment (gear and craft), thus making such fishermen earn higher income or that richer fishermen have richer children who support them more in non-fishing areas. Also, the lack of financial support to most low income fishers hampered improvement in their fishing techniques, hence perpetuating their low incomes. The few fishermen in the low income bracket who did receive funds from children admitted spending them on household expenses (mainly food and clothing) and not on fishing. The results, however, may also mean that fishermen with higher fishing incomes were able to invest in their children's' education who are then able to find jobs in the formal sector and help their parents.

Fishermen were asked if they would diversify to other income sources and reduce their exploitation of fishery resources if given certain incentives such as soft loans. The majority of

the fishermen (84%) were ready to reduce fishing frequency and consider alternative sources of income. This could mean that with improved household income, fishermen can be encouraged to venture into other economic activities, thereby reducing their fishing activities, and thus contributing towards the conservation and sustainability of the fishery resource. The few fishermen (16%) who were not willing to reduce fishing frequency were uncertain about the continuity of the promised incentives. Some argued that they had been promised the same in the past but nothing has materialised. Some fishermen said that they were not willing to diversify because there was nothing else they can do as they have been fishing since their childhood.

Resource Conservation

Fishers from reserves used mainly recommended gear. Nets of small mesh sizes, capable of catching small immature fish, were used mostly in unprotected areas. It should be mentioned that most fishers did not consider the environmental impacts of their gear. The large majority of fishermen (78%) considered the beach-seining *(juya)* method to be the most environmentally destructive; harmful to the coral reef and fish juveniles. *Mpweke* gill nets were perceived as environment friendly.

Fishers in the reserves were subject to more enforcement of the regulations by KWS personnel and they were aware of resource degradation caused by their gears. This situation was in contrast to the unprotected areas where fishing was done with less enforcement. The fact that fishermen in the reserves claimed not to fish from the MNP's confirmed awareness of these no-fishing zones. However, it should be mentioned that some fishers contravened regulations and poached in parks.

Half the fishermen observed certain taboos. The taboos did not focus directly on the marine environment, but dealt with personal safety at work, cleanliness and hygiene, and good fish handling practices (See Appendix 8.14). There was no sign of indigenous marine environmental conservation being practised with one exception, the *sadaka*.

Sadaka is a traditional ceremony where fishermen offer sacrifices and say prayers in a 'holy' place (*mzimu*) next to the sea. Among the Digo fishing community in the Diani-Kinondo region of Kwale District, fishing grounds designated as *mzimu* were not fished but conserved (McClanahan *et al.* 1996, 1997). Fishermen on the Malindi/Kilifi coast have lost respect for this practice and fish regularly in areas adjacent to 'holy' places.

The absence and/or disappearance of fishing-related taboos may be explained by the following

reasons:

- *The combination of a small fishers population and abundant fish stocks* in the past never stressed the existing resources. As a result there was no need for traditional conservation of the fishery resources and the marine environment in general.
- *Fishing as a multi-ethnic activity.* Fishing, unlike in the past when it was a Swahili and Bajuni-dominated activity, presently includes members of tribes that do not come from fishing backgrounds, such as the Giriama. Most taboos do not fit with the faiths of other fishermen, many of whom are Christians.
- *The fishing youths.* Youth tend to regard taboos as the 'hobby' of older fishermen and are not inclined to follow what the older fishermen tell them when it comes to observing certain rules.
- *Education.* Formal education has also contributed. Unlike in the past, fishing as an economic activity today is also done by some young men who are primary-school dropouts. These drop-outs look down upon such taboos.
- *Role confusion.* In the past, it was a taboo for a woman to go to landing beaches and be present near fishing vessels. But, today, women are a common sight at landing beaches as fish mongers, particularly those visited by the Wapemba.

The regulations on the exploitation of fishery resources in the Fisheries Act (Kenya 1991) had little influence on the fishermen's choice of fishing gear, though fishermen were generally aware of the regulations. This may be explained by the following reasons:

- Poor small-scale fishermen are willing to use any fishing gear, legal or illegal, to exploit targeted fish;
- Many fishers did not realise the importance of these regulations on the long-term effect of fishery resources. The government has not explained its policies and did not educate the fishermen;
- Fishermen saw the fishery resources as common property with unregulated access.

Fishers complained that they had not received financial benefits from the parks despite the large sums of money that parks generated. Fishers suggested various ways to receive benefit from the parks notably,

- Loans to be given fishers from gate collections;
- Dissolution of the parks;
- Opening of parks for fishing during the *kusi* season.

Fishermen were prepared to participate in projects aimed at conserving their fishery resources

if they were promised incentives for improving their incomes. Fishermen were also willing to reduce their fishing frequency and to diversify to other income generating activities. Fishermen's attitudes towards environmental conservation and the protection of fishery resources may change positively, provided this resulted in improved incomes.

Conclusion

Fishermen used mainly the gear with which they had experience and which brought them high catches. Fishermen paid little attention to environmental impacts of the gear and there were few signs of indigenous marine conservation. Poverty and the need to maximise catches affected gear choice. Half the fishermen followed certain taboos relating to personal safety at work, good hygiene and fish handling. Fishermen were willing to initiate and participate in programmes of marine environmental conservation if it enabled them to improve their incomes.

Fishermen who operated adjacent to the MNP's, specifically in the reserves, were aware of the fishing prohibitions in the parks. This was because they faced more enforcement from the KWS officials. Also, fishermen in reserves were more environmental sensitive than those in unprotected areas. Observance of fisheries regulations was higher among fishermen in the reserves, and this potentially made them to be more concerned about the impacts of their fishing activities on the resource compared to unprotected areas.

The majority of fishermen appreciated the importance of marine environmental conservation. These fishermen were prepared to reduce their fishing frequency If provided improved incomes as a way of contributing to the conservation of the resource. With higher and reliable income, fishermen were willing to diversify to other non-fishing employment openings, and, therefore, contribute to the sustainability of the reef fishery resource.

Recommendations

It is important that proper and effective management strategies be implemented that will ensure sustainability of the marine resources and improve the livelihood of fishermen. However, effective management of the fishery resource is difficult because the sector falls under two ministries; the Ministry of Agriculture and Livestock Development and the Ministry of Environment and Natural Resources. As a result, there is lack of a clear policy and implementation structure on environmental management (Daily Nation, 2000). The following recommendations will help achieve both environmental conservation and improved livelihood of the fishermen:

- Community participation and co-management. Fishermen should be involved in

decision making on conservation and management. The fishermen should also stand to benefit from such efforts;

- Improvement of fisher living standards. Possible tracks are (i) fee sharing of parks with fishermen; (ii) financial aid from NGOs, and other financial institutions; (iii) more efficient marketing of the fish; and (iv) providing funds for fishermen who are prepared to diversify;
- Occupational diversification. Fishermen should be encouraged to seek non-fishing employment so as to reduce pressure on the coral reef fishery resources;
- Promotion of environmental education to emphasise the protection and conservation of coral reef fishery and other marine resources;
- Fisheries board. A government board should be established in collaboration with KMFRI for fishery resources management and welfare of fishermen.

Appendix 8.10: RA 10

Bibliography on Marine Artisanal Fisheries in Africa

Nicole Versleijen[1]

References and publications on marine artisanal fisheries were collected with special attention for East Africa and Kenya. The material was collected through examination of electronic and printed sources. Keywords used for search purposes were fish, artisan and Africa. Further keywords occasionally used to reduce the number of 'hits' were livelihood, Kenya, Tanzania, Somalia, Mozambique, South Africa, coast, resource, management, coral reef, (indigenous) conservation, Indian Ocean, marine and environment.

The following on-line sources were examined:

Worldwide Web	Google Search Engine (www.Google.com).
Electronic/	www.sciencedirect.com;
Online jrnls	www.jstor.org;
	www.esajournals.org;
	www.nbii.gov/datainfo/onlineref/ejournals/alpha.html.
International &	FAO (www.fao.org);
National	UNEP (www.unep.org);
Organizations	Kenya Fisheries Dept. (www.kenyafish.org).
Newspapers	The Daily Nation: www.nationaudio.com;
(2001&2002)	The East African Standard: www.eastandard.net;
	The East African:www.nationaudio.com/News/EastAfrican.

In addition, the collections of two libraries in the Netherlands were examined namely the African Studies Centre (Leiden) and the Agricultural University (Wageningen), more specifically:

AGRALIN	Catalogue of the Agricultural University (Wageningen) and other Agricultural Libraries in the Netherlands.
SilverPlatter	ASFA; AGRIS; Zoological Record, EconLit; Tropag & Rural
IAC	Internal database (International Agricultural Centre).
ASC	Library Catalogue.

1 Versleijen N. ed. (2002). *Bibliography on marine artisanal fisheries in Africa.* Leiden: African Studies Centre (CD-Rom).

PICA	Library Catalogues in the Netherlands (PICA).
NISC	African Studies and South African Studies Database.

References were selected according to their relevance for the research project and this means that the 'net' was caught wider for Kenya and East Africa than for the other parts of Sub-Sahara Africa. As part of the search process (print) copies of documents were collected. Available publications were reviewed as to their relevance for the bibliography. Publications that could not be examined in integral form were judged by title, type of document and any other information available. The list of references was revised regularly and publications removed that were less relevant on second sight or insufficiently documented. Each reference was categorised according to subject category and country-region.

In total, 304 publications/references have been compiled. The earliest publication is from 1965 while the most recent one is from 2002. Of the publications, 157 are available to the editor and the research team, 137 have not been collected so far while 10 references are located at other Dutch libraries. The bibliography is presented in a digital version (CD) and print version. The digital version has been compiled under Reference Manager.

Appendix 8.11

The Wapemba Fishermen

These seasonal fishermen from Pemba and Tanzania visit some fishing villages such as Mtwapa, Mayungu and Bofa along the Kilifi/Malindi coastline during the high fishing season from the month of September to April each year. Often they manage to become legitimate fishermen in the Kenyan waters because they acquire national identity cards and fishing licences from the government authorities. They also interact freely with the local people to an extent of marrying with local women so that they can be fully accepted by the host communities.

The traditional fishing gear of the Wapemba is the small-mesh size seine *(juya)* net, which is responsible for the overexploitation of their fishing grounds in Pemba (Reubens 1996), and which compelled them to come to Kenya. According to the Chairman of the Mayungu fishing village, fishing in this area is highly threatened by these Wapemba, who use unlawful fishing gear within the reefs, destroying fish larvae, the juveniles fish and corals. These fishermen throw away the small immature fish already dead, sometimes measuring 3cm, which are unsuitable for sale. Sometimes they throw back up to 100kgs of small immature dead fish. Sometimes this 'trash-fish' is buried at the beach, causing more marine environmental degradation (Daily Nation, 1998).

Local fishermen at the study sites believe that it is the Wapemba fishermen who are to blame for the decline in fish catch and degradation of the fishery resources. To protect and conserve their resources these fishermen have once or twice staged a physical confrontation with these foreigners. This is the reason why they are not allowed (Wapemba) in some landing beaches such as Uyombo (Watamu) and Takaungu, while in other landing sites they are free to operate. In Lamu, conflicts exist between the beach-seiners from Pate and those from Kiunga. Each group blames the other for resource degradation. However, these confrontations are not as severe as those in Kilifi/Malindi as beach-seining is the order of the day in Lamu. It is worth noting that beach-seiners also see others as threat and degraders of the resource.

There is need to end the use of this net in the in-shore waters in the massive way practised by the Wapemba. An area which has been fished using this type of net takes approximately 90 days for it to start showing signs of recovery. This means that when an area of the sea has been seriously drag-seined, no fish catches will be recorded from such places for a period of 3

months, throwing the lives of the locals who use the fishing ground in disarray. However, the Wapemba must be credited for their economic importance to the host communities. Firstly, since they are superior fishermen and have all the necessary facilities, they facilitate the transfer of fishing technology to the local fishermen. Secondly, they create employment opportunities for local youths who lack fishing equipment and opt to fish with these foreigners. Thirdly, some women act as fish traders during this season because fish is plentiful and find a temporary source of livelihood. Lastly, Wapemba fishermen can be generous to the local fishermen who receive some free fish for family consumption (sometimes even for sale) when the locals fail to go fishing for some reason or they fail to catch fish.

Source: Tunje (2000: 68)

Appendix 8.12

Regulations in Marine Parks and Marine Reserves

Within the Marine National Parks and Reserves some regulations are in force. There regulations are not only concerned with conservation but also with the access and the use of the area.

It is not allowed to:

- Engage in any of the following marine activities without paying the prescribed fees:
  - Goggling
  - Water skiing
  - Diving
  - Site viewing in Mida Creek
  - Operate or use a glass-bottom boat or any other marine vessel in the park area;
- Reside in the Marine National Park and Reserve;
- Clear any vegetation in the Marine National Park and Reserve;
- Posses any weapons, explosives or poison in the Marine National Park;
- Collect shells, aquarium fish and corals in Marine National Reserve;
- Kill or capture any mammal or turtle;
- Harass any mammal or turtle so as to disturb its behaviour or breeding grounds;
- Chase any marine mammal or turtle with intent to kill;
- Take any marine mammal or turtle, alive or dead, including any marine mammal or turtle stranded on land;
- Remove any marine animal or vegetation or alter existing forms of prehistoric, archaeological, historical or other scientific interest in the Park area;
- Use the following prohibited methods while fishing in the Reserves:
  - Trawling within five nautical miles within the Marine National Reserve
  - Use of spears for fishing
  - Use of any explosives, poisonous or noxious substances or electric shocks for the purpose of rendering fish more easy to catch;
- Fish in the Marine Park.

An exception to these regulations may be obtained through a special permit from the director of the KWS or an Officer authorised by him (Hof 1999).

Source: Versleijen (2001:26)

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Appendix 8.13

Takaungu and Uyombo Site Histories

Takaungu

I was born during colonial times, here at Takaungu. But that was not the Takaungu there is right now. There were not that many buildings, the primary school was situated at the creek and for the rest there were only houses of people. But even those were not that many. And the places where most of the houses are right now, there were bushes. Most of the people who were staying here were Muslim. These Muslims were mostly Bajuni, Arabs and Waswahili. Mijikenda were there but they were very few as well as the Wayahoo from Tanzania. The Swahili and Bajuni are still living there but a lot of Mijikenda have moved in. The shamba's were used to build houses on, that is why you see so many coconut trees in between houses. The bushes outside Takaungu were cleared and became shamba's. Nowadays you have to go up to Vuma to find the nearest bushes to Takaungu. The Mijikenda were farmers when they came here, the Bajuni were the fishermen. However since the Mijikenda saw that it was such a good job to make money with, they started fishing as well. Most of them were taught by the Bajuni. Right now, there are more Mijikenda fishermen than Bajuni, and still there are moving Mijikenda into Takaungu! (*Bajuni Fisherman at Takaungu*).

Uyombo

My father was one of the first fishermen at Bandarini around 1918. Later, around 1960, he moved to live there. We were the only family living there. All the fishermen at Uyombo in those days were Bajuni. I did not join my father since I was married by that time and lived in Malindi, however I was fishing at Uyombo. When my father started fishing here and when he moved here things were different. First of all there was no Marine National Park, the fish catch was high, all the fishermen were Bajuni, there were not that many shamba's and so on. My father had a huge shamba on which about 50 labourers were working. Those were all Giriama. The Giriama were not fishermen these days but they were good farmers. The Giriama started fishing around 1970, they were taught by the Bajuni. Now they are more in number than the Bajuni, but that does not matter . (*Bajuni Fisherman at Uyombo*).

Source: Versleijen (2001:58, 77)

xx

Appendix 8.14

Three Types of Fisher Taboos

Taboos Dealing with Fisher's Personal Safety

1. Whistling or making noise in the course of fishing is not allowed traditionally. This is because fishing is a risky venture and requires maximum concentration and seriousness to avoid any misfortunes.
2. Fishing activity should not be done when the fisher is annoyed or in bad moods. This is to make the fisher pay maximum attention to his activity and avoid any misfortunes.
3. Entering the fishing vessel with one leg while the other leg is hanging down is a taboo as this can lead to serious accident which can be harmful to the fisher.
4. It is a taboo to go out fishing while the fisher is drunk. This is to make the fisher pay attention to his work and avoid misfortunes such as *dau* capsizing and drowning.
5. The container (locally known as *upo*) which is used to remove water out of the fishing vessel should not be put upside-down. This is to make it ready and available for it to be used in case of any emergency use. This is also to avoid much water entering the vessel that could lead to capsizing.
5. Traditionally, woman is not supposed to move nearer or enter a fishing vessel. This is because she can easily talk or behave in a seductive manner, making the fishermen loose concentration in their work. This can easily cause accidents.

Taboos Dealing with Fisher's Personal Hygiene

1. Entering the fishing vessel while in shoes (slippers) is not allowed as the dirty shoes may contaminate the fish and cause serious health problem to the consumer.
2. Going fishing after having a sexual interaction with a woman and without taking bath is prohibited culturally as the fisher is unclean, and therefore he is likely to contaminate the fish.
3. Urinating while standing in the fishing vessel is not allowed as the last drops of urine are likely to fall in the vessel, thereby contaminating the fish catch.
4. A pregnant woman or one who is menstruating is not supposed to enter a fishing vessel or hold the basket containing fresh fish. This is because such a woman is 'unclean' and can easily contaminate he fish.

Taboos Dealing with Proper Fish Handling

1. Green raffia is not used in tying fresh fish. This is because such green vegetative material may have a sour taste and could contaminate the fish.
2. Removing the fish scales using a stick is not allowed as the cleanliness of the stick is not guaranteed. The fish can be easily contaminated, especially if a green stick is used, from the sap.
3. A soot-coated *sufuria* is not supposed to be used for putting fresh fish from the fishing vessel; this is likely to contaminate the fish.

Source: Tunje (2000:77-78)

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APPENDIX A. CHARACTERISTICS OF FLT-ADMISSIONS IN CENTRAL PROVINCE DURING 1978 AND OF THE CASES STUDIED AT ADMISSION[x]

			All admissions during 1978[xx] N=273	Cases, studied at admission N=85
Characteristics mother	Education:	none	62%	58%
		standard 1-4	17%	25%
		standard 5-7(8)	21%	17%
		secondary	0	0
	Gravidity:	pregnant	17%	20%
		not-pregnant	83%	80%
	Marital status:	single	9%	5%
		married	62%	72%
		separated/ divorced/ widowed	29%	23%
	Income from labour:	none	33%	29%
		casual labour	59%	64%
		regular employment	9%	7%
Characteristics family/household	Household size:	Average number of:		
		adults	2.4	2.6
		children	4.4	4.7
		total	6.8	7.3
	Size, small-holding:	no land	43%	40%
		1 acre or less	19%	21%
		more than 1 acre	16%	12%
		more than 3 acres	22%	27%
Characteristics children	Average no. of children admitted with one mother		2.5	2.6
	Age index child:	xx-12 months	29%	40%
		13-24 months	37%	39%
		25-36 months	16%	13%
		37-60 months	10%	4%
		60-xx months	9%	4%
	Weight-for-age (index children below 60 months of age only)			
		xx-59%	28%	25%
		60-79%	46%	39%
		80-xx	26%	36%

x All data as recorded in the clinic records
xx Source: Hoorweg & Niemeyer, 1979

APPENDIX B. SOCIO-ECONOMIC CHARACTERISTICS OF FLT-CASES AND CONTROL GROUP

			FLT cases N=85	CONTROL group[x] N=100
Characteristics mother	Age:	19yrs and younger	2%	5%
		20-29yrs	46%	36%
		30-49yrs	50%	57%
		50yrs and older	1%	2%
	Education:	none	59%	34%
		standard 1-4	26%	34%
		standard 5-7(8)	15%	25%
		secondary	0	8%
	Marital status :	single	8%	1%
		married,monog.	62%	90%
		married,polyg.	11%	2%
		sep./divorced	15%	2%
		widowed	4%	5%
Characteristics family/household	Domestic stage :	young fam.	26%	24%
		middle-age fam.	65%	55%
		elder fam.	9%	21%
	Average number of children:			
	pre-school children (0- 5yrs)		2.4	2.2
	school-age children (6-16yrs)		2.0	2.3
	grown-up children (17yrs & older)		0.1	0.3
	Average household size		6.7	6.9
	Social class :	poor households	67%	42%
		intermediate h.holds	28%	35%
		affluent h.holds	5%	23%
	Size, small-holding:	no land	36%	0
		0.1-0.9 acres	13%	31%
		1.0-2.9 acres	24%	52%
		3.0 acres and more	27%	16%
	Percent women who report that they are able to grow enough food to feed their families		25%	46%
	Percent women who report that they have milk at their disposal (home production)		12%	61%
	Percentage of women who report that they have eggs at their disposal (home production)		21%	68%

x Weighted results

Differences between the two groups as regards age mother, domestic stage, number of children and household size are not significant. The two groups differ significantly on all other variables (chi-square test).

flt

APPENDIX C. FARMSIZE AND THE INCIDENCE OF CASH-CROP CULTIVATION AND SALE OF FOOD CROPS

		N	CULTIVATE cash-crops		SELL food crops[xx]	
			yes	no	yes	no
FLT-CASES	no land	30	-	-	-	-
	0.1-0.9 acres	11	0%	100%	9%	91%
	1.0-2.9 acres	20	30%	70%	40%	60%
	3.0-xxx acres	22	41%	59%	39%	61%
CONTROL GROUP[x]	no land	0	-	-	-	-
	0.1-0.9 acres	31	30%	70%	19%	81%
	1.0-2.9 acres	53	48%	52%	36%	64%
	3.0-xxx acres	16	79%	21%	57%	43%

x Weighted results

xx Sell food crops, either occasionally or regularly

APPENDIX D1.
KNOWLEDGE QUESTIONNAIRE: RESULTS FOR FLT-CASES AND CONTROL GROUP

			FLT cases N=85	CONTROL group[a] N=100
1. When a child has a swollen body, red or grey hair and is miserable; what disease does it suffer from?		kwashiorkor/higo[x]	92%	98%
		other answers	4%	2%
		don't know	5%	0
2. What causes higo?		food: poor quality	49%	42%
		food: insufficient quantity	18%	18%
		other answers	27%	39%
		don't know	6%	1%
3. What causes kuhoma?[xx]		food: poor quality	33%	16%
		food: insufficient quantity	22%	27%
		other answers	27%	48%
		don't know	18%	9%
4. At what age can a child start to eat the following dishes?	(a) ucuru[xxx]	0 - 4 months	80%	35%
		5 - 9 months	15%	52%
		10+ months	5%	13%
	(b) gitoero	0 - 4 months	58%	40%
		5 - 9 months	35%	56%
		10+ months	7%	4%
	(c) mboco	0 - 4 months	38%	18%
		5 - 9 months	45%	53%
		10+ months	18%	29%
	(d) ngima na mboga	0 - 4 months	38%	8%
		5 - 9 months	37%	50%
		10+ months	25%	42%
	(e) githeri	0 -20 months	19%	13%
		21 -29 months	36%	40%
		30+ months	45%	48%
5a. When a child of 2 years eats three meals a day (breakfast, lunch, dinner); is that enough or does it need anything else?		enough	31%	57%
		needs extra's	60%	41%
		don't know	10%	2%

a Weighted results
x The Kikuyu word higo literally means kidneys but also stands for kwashiorkor.
xx kuhoma = the Kikuyu concept closest to marasmus: a condition in which a child does not grow well and has thin arms and legs.
xxx ucuru = maize gruel; gitoero = mashed bananas and Irish potatoes; mboco = beans; ngima na mboga = maize porridge with vegetables; githeri = whole maize and beans.

APPENDIX D1, KNOWLEDGE QUESTIONNAIRE; CONTINUED

		FLT cases N=85	CONTROL group N=100
5b. If answer: needs extra's. What is needed? (more than one answer allowed)	mention milk/ucuru	38%	22%
	mention eggs	13%	11%
	mention fruits	8%	21%
	mention other foods	12%	7%
6. When a child suffers from kuharuo (=diarrhoea) what foods or drinks should you give?	water, plain	39%	40%
	water, with sugar and/or salt	12%	42%
	other answers	49%	19%
7. What is the best age at which to stop breastfeeding a child?	0 - 9 months	7%	12%
	10 -14 months	26%	33%
	15 -20 months	32%	41%
	21+ months	35%	14%

APPENDIX D2, FOOD PREFERENCES: IDEM

Average number of choices for beans, peas, eggs and meat when compared with the four foods mentioned in parentheses:		
BEANS - (rice/f.millet/banana/cabbage)	3.2	3.5
PEAS - (maize fl./kale/I.potato/orange)	2.5	1.6
EGGS - (rice/f. millet/banana/cabbage)	3.5	3.3
MEAT - (maize fl./kale/I.potato/orange)	3.1	1.9
Total score: number of choices for the high-protein/high-calorie foods above.	12.3	10.4
(standard deviation in parentheses)	(2.3)	(2.6)

APPENDIX E.
KNOWLEDGE QUESTIONNAIRE: RESULTS FOR FLT-CASES INTERVIEWED ON DIFFERENT OCCASIONS (N=61)

		ADMIS-SION	DIS-CHARGE	HOME-VISIT
1. When a child has a swollen body, red or grey hair and is miserable; what disease does it suffer from?	kwashiorkor/higo[x]	92%	95%	85%
	other answers	2%	2%	10%
	don't know	7%	3%	5%
2. What causes higo?	food: poor quality	49%	53%	49%
	food: insufficient quantity	16%	18%	20%
	other answers	28%	25%	21%
	don't know	7%	5%	10%
3. What causes kuhoma?[x]	food: poor quality	34%	39%	33%
	food: insufficient quantity	25%	28%	26%
	other answers	25%	18%	23%
	don't know	16%	15%	18%
4. At what age can a child start to eat the following dishes? (a) ucuru[x]	0 - 4 months	82%	73%	75%
	5 - 9 months	15%	20%	20%
	10+ months	3%	7%	5%
(b) gitoero	0 - 4 months	57%	57%	47%
	5 - 9 months	36%	23%	38%
	10+ months	7%	20%	15%
(c) mboco	0 - 4 months	41%	37%	33%
	5 - 9 months	41%	37%	38%
	10+ months	18%	27%	28%
(d) ngima na mboga	0 - 4 months	44%	35%	30%
	5 - 9 months	34%	35%	30%
	10+ months	21%	30%	40%
(e) githeri	0 -20 months	20%	12%	20%
	21 -29 months	38%	25%	29%
	30+ months	43%	63%	51%
5a. When a child of 2 years eats three meals a day (breakfast, lunch, dinner); is that enough or does it need anything else?	enough	26%	39%	43%
	needs extra's	67%	61%	53%
	don't know	7%	-	3%

x See legend with appendix D.

APPENDIX E. KNOWLEDGE QUESTIONNAIRE; CONTINUED

		ADMIS-SION	DIS-CHARGE	HOME VISI
5b. If answer: needs extra's What is needed? (more than one answer allowed)	mention milk/ucuru	44%	43%	46%
	mention eggs	13%	8%	3%
	mention other foods	20%	18%	8%
6. When a child suffers from kuharuo (=diarrhoea) what foods or drinks should you give?	water, plain	39%	54%	43%
	water, with sugar and/or salt	15%	13%	10%
	other answers	46%	33%	48%
7. What is the best age at which to stop breastfeeding a child?	0 - 9 months	10%	12%	8%
	10 -14 months	25%	28%	30%
	15 -20 months	33%	22%	20%
	21+ months	33%	38%	42%
8. Have you ever heard of the three food groups: body-building foods (gwaka miri) protective foods (kugitira mwiri) and energy foods (kuhe hinya)?	yes	-	100%	97%
	no	-	-	3%
8 b. Is maize flour a body-building or energy fd?		-	78%	81%
c. cabbage, body-building or protective fd?		-	75%	83%
d. milk, protective or body-building fd?		-	83%	80%
e. fruits, body-building or protective fd?		-	68%	58%
f. Irish potatoes, energy or protective fd?		-	83%	73%
g. beans, energy or body-building fd?		-	82%	78%
h. green leaves, protective or body-building fd?		-	62%	64%

(The answer percentages given are the percentage of women choosing the correct, underlined alternative)

flt

APPENDIX F.
PREFERENCE SCALE: RESULTS FOR FLT-CASES INTERVIEWED ON DIFFERENT OCCASIONS (N=61) (Listed are the proportions of respondents choosing the first of the two foods mentioned; for example, at the time of admission 97% of the women preferred beans over rice)

	ADMISSION	DISCHARGE	HOME-VISIT
Beans-Rice	.97	.98	.97
Beans-Finger millet	.64	.77	.82
Beans-Green banana	.92	.92	.90
Beans-Cabbage	.67	.80	.88
Peas-Maize flour	.84	.92	.83
Peas-Kale	.46	.39	.55
Peas-Irish potato	.80	.85	.78
Peas-Orange	.49	.57	.60
Eggs-Rice	.97	.95	.92
Eggs-Finger millet	.89	.93	.88
Eggs-Green banana	.75	.89	.93
Eggs-Cabbage	.92	.89	.82
Meat-Maize flour	.87	.95	.92
Meat-Kale	.69	.64	.67
Meat-Irish potato	.87	.92	.92
Meat-Orange	.77	.69	.80

APPENDIX G. DIETARY RECALL: AVERAGE FOOD CONSUMPTION IN GRAMS OF FLT-CASES AND CONTROL GROUP BY AGE (STANDARD DEVIATIONS IN PARENTHESES)

	FLT-CASES					CONTROL GROUP[x]			
	BF[xx] N=14	06-23 N=20	24-35 N=22	36-59 N=5	Age (months)	BF N=15	06-23 N=17	24-35 N=31	36-59 N=29
Cereals	81	122	174	250		63	116	135	176
Roots & tubers	87	90	42	0		240	160	256	164
Grain legumes	8	37	47	19		5	14	39	40
Vegetables	57	99	115	176		36	50	56	63
Fruits	0	1	14	0		0	1	0	0
Eggs & meats	4	13	4	6		0	18	0	5
Fat	2	5	7	7		4	5	4	7
Sugar	1	2	6	8		0	9	15	20
Miscell. solid foods	0	0	0	0		0	0	0	0
Subtotal: Solid foods	239	367	424	466		348	373	505	474
()	(149)	(225)	(189)	(90)		(180)	(128)	(214)	(172)
Milk:	150	373	250	190		416	717	362	223
()	(175)	(231)	(212)	(143)		(268)	(505)	(250)	(148)
Subtotal: Raw matter	389	740	685	656		764	1091	867	698
()	(271)	(322)	(316)	(122)		(333)	(452)	(310)	(232)
Cooking water	349	607	826	774		253	425	716	752
Total consumed (grs.)	738	1347	1511	1430		1016	1515	1583	1450
()	(343)	(534)	(496)	(568)		(409)	(347)	(312)	(316)
Energy intake (Kcal.)	547	1004	1177	1249		839	1231	1271	1283
()	(266)	(377)	(416)	(423)		(367)	(360)	(329)	(342)
Protein consumption (grs.)	18	40	43	42		23	43	38	37
()	(10)	(19)	(22)	(14)		(13)	(18)	(12)	(13)

x Weighted results

xx BF= children breastfed; see note 23.

flt

APPENDIX H. DISTRIBUTIONS OF ANTHROPOMETRY OF FLT-CASES AT ADMISSION AND OF CHILDREN IN THE CONTROL GROUP ON OCCASION OF THE FIRST SURVEY

		FLT-cases N=94	CONTROL Group[x] N=147
Weight-for-age	-59	14%	-
	60-69	22%	2%
	70-79	34%	31%
	80-89	18%	35%
	90-99	10%	23%
	100-109	2%	6%
	110+	-	3%
Height-for-age	-79	9%	-
	80-84	20%	4%
	85-89	30%	17%
	90-94	24%	44%
	95-99	13%	27%
	100-104	4%	8%
	105+	-	-
Weight-for-height	-69	1%	-
	70-79	13%	1%
	(80-84)	9%)	3%)
	85-89	23%	13%
	90-99	43%	51%
	100-109	11%	26%
	110+	1%	5%

x Weighted results

flt

APPENDIX J. ANTHROPOMETRIC RESULTS OF FLT-CASES AND CONTROL GROUP BY AGE: CONDITION AT ADMISSION, GAINS AT THE FLT-CENTRES & LONG-TERM GAINS (STANDARD DEVIATIONS IN PARENTHESES)

	FLT-CASES				Age (months)	CONTROL GROUP[x]				
	6-11	12-23	24-35	36-59		6-11	12-23	24-35	36-59	
Average age at admission (months)	8.5	16.9	28.5	45.4		9.0	17.7	28.2	47.8	Average age at first examination
Average number of days between the two examinations at the centre.	15.4	15.4	17.2	15.6		-	-	-	-	
Average number of days between admission and home-visit	177	183	189	176		190	210	208	208	Number of days between first and second examinatic
Average W-A at admission	73.0	70.0	71.5	76.2		91.5	86.2	86.8	84.8	W-A at first examination
Average H-A at admission	93.0	89.0	85.2	87.6		96.4	93.3	92.2	93.0	H-A at first examination
Average W-H at admission	86.6	85.7	90.5	91.0		99.4	95.9	97.5	95.8	W-H at first examination
Grams/day gained during stay at the centre	4.7	10.2	12.3	22.1		-	-	-	-	
Grams/day gained between admission and home-visit	7.0 (3.2)	7.8 (3.6)	3.9 (4.9)	4.9 (5.3)		7.6 (1.5)	6.7 (3.4)	6.0 (2.9)	4.2 (3.1)	Grams/day gained between first and second examinatic
Rate of growth (cm/year) between admission and home-visit	10.6 (5.0)	8.8 (3.8)	7.3 (3.1)	7.9 (3.8)		10.4 (1.1)	8.2 (3.1)	8.1 (3.3)	6.2 (1.7)	Rate of growth (cm/year) between first and third examination[xx]
Number of children	N=18	N=24	N=21	N=31		N=11	N=33	N=33	N=69	

x Weighted results

xx The children in the control group were re-examined after half a year, and a third time, after a full year. Height was re-measured on the latter occasion only (see table 6).

APPENDIX K. SUMMARY OF KNOWLEDGE AND PREFERENCES OF FLT-CASES BY AREA, BY SOCIAL CLASS AND BY DOMESTIC STAGE (RESULTS AT ADMISSION AND HOME-VISIT)

	RESULTS BY AREA						RESULTS BY SOCIAL CLASS				RESULTS BY DOMESTIC STAGE			
	LOWER AREA		MIDDLE A.		UPPER AREA		POOR H.H.		INTERM. HH[xx]		YOUNG FAMS		M-AGE FS.[xxx]	
	Adm[x]	H-V[x]	Adm	H-V	Adm	H-V	Adm	H-V	Adm	H-V	Adm	H-V	Adm	H-V
Q4. Women mentioning an early age of introduction (0-4 months) for two or more of the following dishes: ucuru; gitoero; mboco; ngima na mboga	61%	55%	68%	47%	84%	79%	73%	67%	67%	48%	75%	55%	69%	61%
Q7. Women mentioning a weaning age of 14 months or younger.	17%	27%	32%	42%	58%	47%	38%	36%	29%	43%	17%	36%	39%	39%
Q8. Average percentage of mothers correctly classifying (7) foods into different food groups.	-	73%	-	71%	-	77%	-	73%	-	75%	-	77%	-	73%
Preferences: Average number of choices for high-protein/high calorie foods (out of 16 comparisons)	12.5	13.6	12.1	11.7	12.9	14.1	12.4	13.0	12.8	13.6	12.8	13.4	12.5	13.1
Number of women	N=23		N=19		N=19		N=40		N=21		N=12		N=49	

(x) Adm=Admissions; H-V=Home-Visit

(xx) Includes 4 'affluent' HouseHolds

(xxx) Includes 7 'elder' Families

flt

APPENDIX L. SUMMARY OF ANTHROPOMETRIC RESULTS OF FLT-CASES BY AREA, BY SOCIAL CLASS AND BY DOMESTIC STAGE (STANDARD DEVIATIONS IN PARENTHESES)

	RESULTS BY AREA			RESULTS BY SOCIAL CLASS		RESULTS BY DOMESTIC STAGE	
	Lower	Middle	Upper	Poor	Interm[x]	Young	M-Age[xx]
1. Children falling below critical value of H-A(90)	65%	63%	50%	60%	56%	47%	61%
2. Children falling below critical value of W-H(85)[xxx]	16%	41%	14%	21%	25%	26%	21%
3. Grams/day gained at the centre	12.6	12.6	15.1	-	-	-	-
4. Grams/day gained between admission and home-visit	5.3 (4.3)	6.9 (4.9)	5.5 (4.8)	6.0 (4.4)	5.5 (5.2)	7.5 (4.3)	5.4 (4.7)
5. Cm/year gained between admission and home-visit	9.1 (4.4)	7.9 (4.0)	8.4 (3.8)	8.9 (4.2)	7.8 (3.7)	7.4 (3.1)	8.8 (4.2)
Number of children	N=31	N=27	N=36	N=62	N=32	N=19	N=75

x Includes 4 children from 'affluent' households

xx Includes 10 children from 'elder' families

xxx Differences by area : $X^2=6.96$; df=2; $p < .05$.

APPENDIX M. CHARACTERISTICS OF CASES NOT LOCATED AFTER DISCHARGE

A. Socio-Economic characteristics of the mothers (N=19)

1. Women aged 29 or younger	58%
2. Women without formal education	63%
3. Women who are not married (single, separated, divorced, widowed)	21%
4. Women from 'young' families	47%
5. Average number of children in household (pre-school; school-age & grown-up children)	3.9
6. Women from 'poor' households	74%
7. Women without land	21%
8. Women who report that they are able to grow enough food to feed their families	17%

B. Anthropometric characteristics of the children (N=29)

Age:	6-23 months	24-59 months
1. Number of children	14	15
2. Average weight-for-height	85.8	91.1
3. Average height-for-age	88.5	85.8
4. Children falling below		
value: W-H(85)	54%	13%
5. idem : H-A(90)	39%	80%
6. Grams/day gained at the centre	6.6	19.4

flt