

**Livelihood Assets required  
for an East Africa FADs Programme**

FINAL TECHNICAL REPORT

Project FMSP R8249

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Richmond, M.D., De Villiers, A, and Mkenda, A.F.

Samaki Consultants Ltd.  
Dar es Salaam  
Tanzania

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## **GLOSSARY OF ACRONYMS AND TERMS**

### **ACRONYMS**

CEDS	Chole Economic Development Society
DANIDA	Danish International Development Agency
FAD	Fish Aggregation Device
IMS	Institute of Marine Sciences (UDSM postgraduate training institute on Zanzibar)
IUCN	World Conservation Union
MIMP	Mafia Island Marine Park
STP	Sustainable Tanga Programme (DANIDA funded)
TCZCDP	Tanga Coastal Zone Conservation and Development Programme
Tsh	Tanzania shilling (February 2003 - 1,000 Tsh = US\$ 1.00)
UDSM	University of Dar es Salaam
WIOMSA	Western Indian Ocean Marine Science Association
WWF	World Wide Fund for Nature

### **TERMS**

Dau	5-10m wooden vessel with pointed transom
Mashua	8-12m wooden vessel with square transom
Ngalawa	Kiswahili term for an outrigger dugout canoe

## EXECUTIVE SUMMARY

A number of studies on the status of Tanzania and Zanzibar's inshore fisheries have described threats to the sustainability of marine resources and therefore threats to the livelihoods of coastal fisheries communities. This research aims to improve the understanding of the potential for Fish Aggregation Device (FAD) programmes to contribute to the livelihoods of poor coastal fishers by providing opportunities to increase fish catches in offshore waters. In addition to a national perspective, three case study areas were selected for fieldwork to profile livelihood assets and to assess threats and vulnerabilities of a FAD programme

The case study sites were selected according to the following criteria:

- The existence of pelagic fisheries;
- Market opportunities for pelagic fish;
- Institutional support operative in the village and/or district.

Frame surveys, secondary literature and local knowledge of the areas led to the choice of northern Unguja (Nungwi and Kigomani villages), Tanga Region (Kigombe and Sahare) and Mafia Island (Chole and Juani Islands) as sites for the field investigation.

In five study sites visited fishers and other stakeholders were generally supportive of the idea to test FADs in their fishing grounds. In most of the sites there are private sector businesses or donor projects that expressed a willingness to invest capital in the deployment of trial FADs. In Tanga and Mafia Island there are development projects already working with fishers to explore the potential of offshore fishing and FADs are complementary to existing activities.

Of the three areas visited, Nungwi is potentially the most suitable for trial deployment of a FAD with many of the required local livelihood assets well-established. Fishers are already harvesting the pelagic resources, and hence have the physical and human capital to respond to a FAD programme. Their fishery is the most profitable (certainly compared to more traditional reef-based fisheries) and they are able to obtain finances locally, without donor assistance. Many of the buyers are locally based so market profits are reinvested into fishing in Nungwi, and market knowledge is entrenched in the fishing community. The markets for high value fish are well established and the social organisation around the fish auction provides the opportunity to levy funds for FAD replacement. Similarly, the experience and social organisation amongst fishers would support management of a FAD in their fishing grounds. Access to the fishing grounds in Nungwi is generally good all year.

The Tanga sites have many of the factors in place that would be required for fishers to benefit from a FAD programme. The fishers are already fishing pelagic fish species and the markets are paying a premium for large pelagic fish. They are nevertheless currently experiencing a negative investment in fishing due to loss and damage to gillnets and an inability to refinance. A FAD may be able to reverse this trend with the use of alternative fishing gears. The Tanga fishers are however not well organised socially and they would require assistance in developing procedures for ownership and management of a FAD in their fishing grounds.

Mafia has the least developed offshore fishery of the study sites and therefore potentially has the most to gain in terms of poverty reduction from a FAD programme. Fishers have only recently (in the last 5-10 years) responded to market demands for fresh fish and market outlets are developing rapidly. They have poor access to the deep-sea fishing grounds, at least during the southeast monsoon and consequently have relatively little experience of offshore fishing. Fishers are however responding to the gear exchange programmes promoted by the Mafia Island Marine Park in an effort to encourage them to fish offshore. A FAD could provide fishers with important additional income generating opportunities and, with support, could significantly improve their livelihoods in what is one of the poorest districts of Tanzania.

The national policy environment is supportive of FADs as a potential tool for diversifying fishing opportunities for artisanal fishers, especially offshore. The legislative framework also encourages local management of natural resources and development of by-laws that could embrace FADs.

However, there is currently no legislation that specifically incorporates FADs or FAD ownership/management. This issue would have to be addressed to provide a strong legal basis for a FAD programme. Generally speaking local communities have limited experience in cooperative management of marine resources and would require support to develop management mechanisms for fishing FADs that would minimise costs (including those associated with conflict) and maximise benefits.

The market demand for high value pelagic species has increased in all the study sites, reflected by the number of buyers trading in these products and the decline of the dried fish market in favour of fresh fish. The market network has developed to transport fresh and frozen fish around the country to tourist destinations and urban centres. The tourist market in Zanzibar provides fishers with a valuable market that coincides with their peak fishing period. Export from Zanzibar to foreign markets has contributed to demand for large marine fish species in the past, though currently there is no foreign trade. On Tanzania mainland, the export of marine finfish is not approved due to concerns over food security for coastal communities. Further studies are recommended to resolve this concern which may lead to the establishment of export potential should an increase in the landing pelagic fish species not be profitably marketed locally.

The post harvest chain is improving with ice reaching most of the landing sites mainly through fish buyers. Only in Mafia had fishers adopted icebox technology for use on their boats in the fishing grounds.

Technical and financial support would be required in a number of different aspects in order to implement a FAD trial programme. These include:

- Physical assessment of trial sites both in terms of the bathymetry, currents and accessibility by potential users.
- Expertise in FAD design and site surveys for local deployment of FADs.
- Skills training and the introduction of new gears for exploiting pelagic species.

The summary of the findings and recommendations from this investigation are presented in a draft policy brief aimed at decision-makers.

## 1. BACKGROUND

In Tanzania data on the status of the inshore fishery is scarce and there are many problems interpreting what historical and current data does exist. There is a common theme to the majority of investigations into the status of this fishery indicating that it is under stress. There have been a number of investigations undertaken and reports produced on the status of inshore fisheries resources over the last three decades (e.g. Tarbit, 1984; Iverson et. al., 1984; Jiddawi and Muhando, 1990; and review by Jiddawi and Ohman, 2002). The majority of these reports have concluded that the inshore resources are threatened by destructive fishing methods and over-fishing. For example, almost two decades ago, Tarbit (1984) concluded that 'the artisanal fishermen of Tanzania are approaching the upper limit of exploitation on their traditional fishing grounds'. Jiddawi (1997) observed that 'the fishery now shows signs of being over-exploited as the fishing pressure on the reef increases and destructive fishing techniques proliferate'. Benno (1992, cited in Wagner, 1997) examined beach seine landings in southern Zanzibar and reported that '51.3% of the catch was immature, 37.8% possessed developing gonads and only 7.8% were in a spawning state'.

In terms of the socio-economic context and whilst baseline data is limited, it is estimated that almost 50% of the population of Tanzania are poor (URT, 2000a). Poverty in the Tanzania context is characterised by low incomes and expenditure, high mortality and morbidity, poor nutritional status, low educational attainment, vulnerability to external shocks, and exclusion from economic, social and political processes. Within this there are localised perceptions of poverty (see Narayan, 1997) and regional variations (URT, 2000a). The majority of the poor are in rural areas and the most vulnerable groups are the young (where there is very high unemployment), the very old, women, those in large households and those involved in subsistence agriculture, livestock production and small-scale fisheries (URT/UN, 2001). Poverty in mainland Tanzania is most pronounced in the southern regions (Mtwara and Lindi) in terms of life expectancy and infant mortality; and in Coast and Tanga in terms of food security (cereal equivalent). In Zanzibar, where poverty (as well as political uncertainty) is also an important problem, fish is the principal source of animal protein for the low-income families.

Taking into account the above, poverty reduction and community empowerment are principle development aims within a relatively hard budget constraint (URT, 2000a). This will be achieved through improved market efficiency, increased productivity and pro-poor policy support, with particular emphasis on promoting export-oriented expansion and diversification of the pro-poor sectors (RFIS, 2002).

'A fish aggregation device (FAD) is any method, object or construction used for the purpose of facilitating the harvesting of fish by attracting and thus aggregating them' (Bergstrom, 1983). The rationale behind the deployment of FADs is to attract (aggregate) valuable pelagic species including skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*) and bigeye (*T. obesus*). FADs aggregate both small surface-swimming tunas (skipjack and immature yellowfin) and deep-swimming tunas (mature yellowfin and bigeye). Schools of tuna may take up residence around FADs for periods ranging from a few days to a few weeks, with some schools exceeding 1500 mt (see Anderson, 1994).

From the findings of DFID research project R4777 in Fiji, and from additional research undertaken in Vanuatu, a FAD Programme Development Handbook was produced in co-operation with the Secretariat of the Pacific Community (SPC), AUSAID and DfID (see Anderson and Gates, 1996). In Tanzania there currently exists a pelagic fishery targeting yellowfin tuna, kawakawa (*Euthynnus affinis*), little tuna (*Auxis thazard*) and billfish species (*Makaira* spp.; *Tetrapterus audax*; *Istiophorus gladius*) but is mainly prosecuted by fishers using traditional vessels, mashuas, and (expensive and inefficient) surface-set drift gillnets. It is proposed that the efficiency of this fishery can be significantly enhanced through the introduction of the Indian Ocean-design Fish Aggregation Device (FAD) fished with trolling gears, pelagic drop-line and pelagic handline gears (see Anderson, Baxter and Richmond 2001). New fishing opportunities will be evaluated in the Tanga and Mafia areas. Support for the development of deep sea resources in Tanzania has been identified numerous times, more recently by Jiddawi and Ohman (2002).

Seasonality of weather conditions are a distinctive feature of the coast of East Africa (see Table 1). The main wet season months of April-May are generally described as poor months for fishing offshore large pelagic species, due to the cold and wet conditions. The beginning of the southeast monsoon, from June through August witnesses an increase in wind speeds and wave height, and a general reduction in access to fishing grounds. From August to September, sea conditions are usually calmer, and vessels using sail may have problems accessing fishing grounds.

**Table 1** Details of main seasons of East Africa.

	<b>Season</b>	<b>Months</b>	<b>General conditions</b>
<i>Kusi</i>	SE monsoon	Jun-Sep	usually dry; strong southern winds
<i>Leleji</i>	Calm period	Sep-Oct	cool; mostly calm with intermittent winds; moderate rain.
<i>Kaskazi</i>	NE monsoon	Oct-Feb	hot; humid; usually dry; moderate NE winds; few squalls.
<i>Leleji</i>	Calm period	Feb-Mar	cool; mostly calm with intermittent winds; moderate rain.
<i>Masika</i>	Wet season	Mar-Jun	cool; very wet; squalls

## 2. PROJECT PURPOSE

There have been no recent deep water FAD programmes in Tanzania although their potential to contribute to poverty eradication is recognised in national fisheries policies. The purpose of this project is to provide a preliminary evaluation of the potential for a FAD programme to contribute to poverty eradication. Included in this evaluation is the need to describe the livelihood contexts of the coastal fishing communities.

## 3. RESEARCH ACTIVITIES

During the preparation of the Proposal, in September 2002, initial contact was made with various local institutions and government authorities in Tanzania. The following authorities supported the study (see Appendix 2):

- Western Indian Ocean Marine Science Association (based on Unguja Island, Zanzibar)
- Faculty of Aquatic Sciences and Technology, University of Dar es Salaam (UDSM)
- Institute of Marine Sciences (IMS) – (UDSM)
- Fisheries Division (mainland Tanzania)
- Department of Fisheries and Marine Resources (Zanzibar)
- Department of Commercial Crops, Fruits and Forestry (Zanzibar)
- Tanga Coastal Zone Conservation and Development Programme (TCZCDP)
- Mafia Island Marine Park (MIMP)

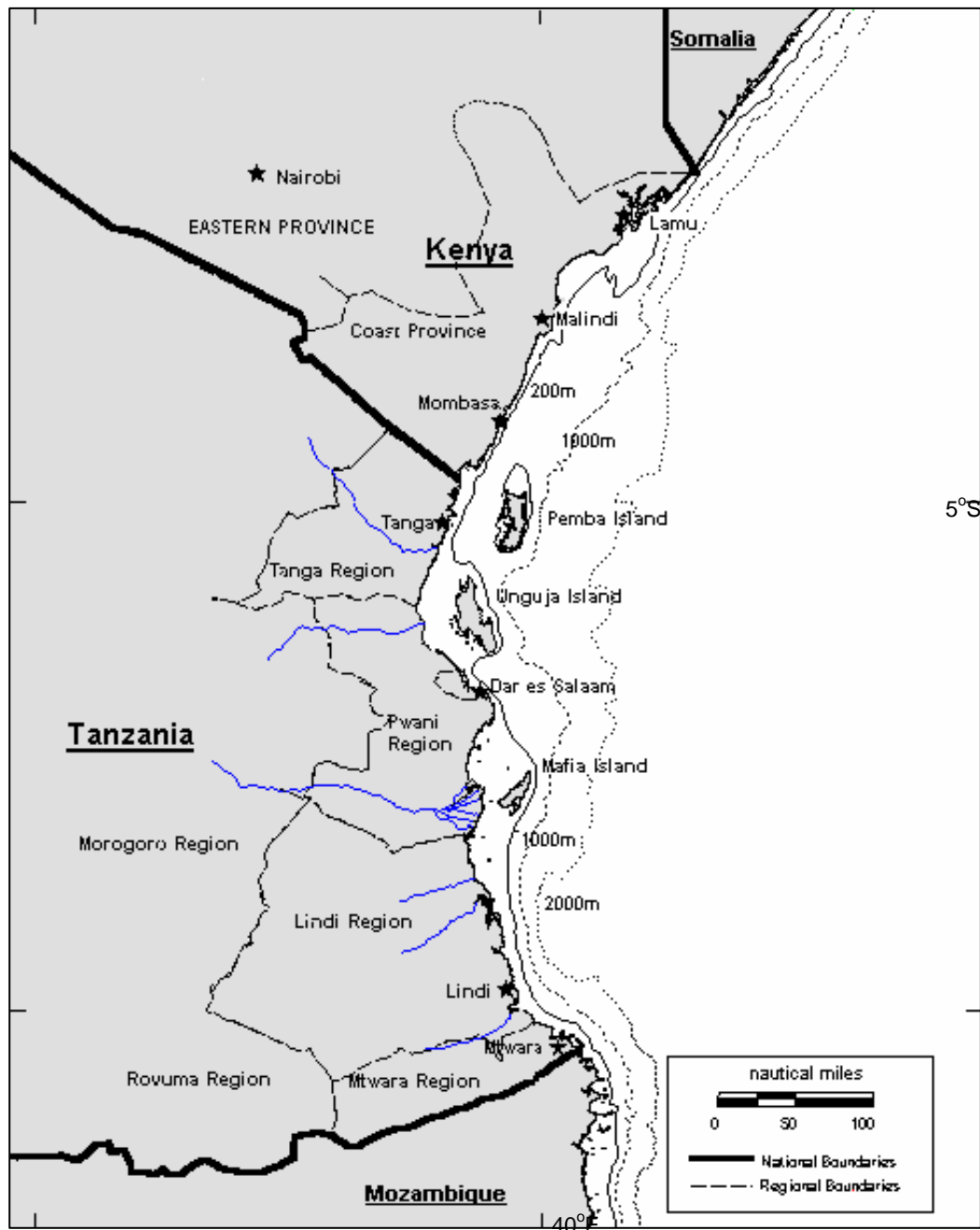
### 3.1. Site Selection

The criteria for selecting these areas as potential study sites for a FAD programme include:

- The existence of pelagic fisheries;
- Market opportunities for pelagic fish;
- Institutional support operative in the village and/or district.

Several coastal areas within Tanzania and Kenya satisfy these criteria. Potential sites exist along the coast of Kenya, Dar es Salaam, Pemba Island and southern Tanzania, particularly Mtwara Region (see Fig. 1). In this investigation, the Tanga Region, northern Unguja Island and Mafia Island were selected as the three study areas.





**Figure 1** The East Africa coastline and bathymetry.

### 3.2. Visits to Case Study Areas

Two days were spent in each of the three selected areas. In each area, preliminary meetings (and/or prior correspondence) with the relevant local authorities explored the potential of FADs and of the local capacity to support a FAD programme. Through these discussions, agreements were made as to specific study sites and possible villages that were most likely to benefit from FADs. At the selected villages, meetings with fishers and buyers were scheduled beginning with a general introduction, followed by separate focus groups interviews led by the consultants. All meetings were concluded with a final feedback to the entire group that allowed final discussions and verification of the team's conclusions.

## 4. OUTPUTS: LIVELIHOOD ASSET PROFILES

Over 150 fishers participated in interviews contributing to this study. Village authorities, institutional and marketing stakeholders and government officers were also interviewed. Details of the stakeholders meet are summarised in Table 2. Information and the perspective from these interviews are incorporated in the following sections detailing the livelihood assets for each case study site.

**Table 2** Profile and number of stakeholders participating in focused interviews.

Area and site	STAKEHOLDERS			
	Institutions	Government <sup>a</sup>	Fishers	Fish Buyers
Tanga Region (Kigombe)	2 (TCZCDP)	7	34	1 (Sea Products Ltd.)
Tanga Region (Sahare)	2 (STP)		20	14 (local buyers)
Mafia Island (Chole and Juani Islands)	4 (MIMP)	3	59	1 (ice boat) 2 (Tanpesca Ltd.) 4 (local buyers)
Unguja Island (Nungwi)	2 (IMS)	8	24 (buyers and fishers combined)	
Unguja Island (Kigomani)	1 (WIOMSA)		15 (buyers and fishers combined)	
<b>Total</b>	<b>11</b>	<b>18</b>	<b>152</b>	<b>+ 22</b>

a. Mostly Fisheries and Natural Resources Officers.

### 4.1. General Background to Tanzania

To avoid duplication in the following sections, aspects of assets common to all of the study sites are described below:

#### 4.1.1. Access to fishing grounds

In Tanzania there is no historical ownership of fishing grounds, for either inshore or offshore fishing grounds (Jiddawi and Ohman, 2002). However, a number of development projects, including the TCZCDP and the MIMP, are developing participatory marine resource management in specified areas. Most of these efforts have been focused on inshore waters, in particular coral reef areas.

There exists a 12-miles limit within which foreign industrial fishing vessels are not permitted to operate, although this is not applicable to the 20 or so prawn trawlers that fish the near-shore grounds off the major estuaries. Tanzania claims exclusive rights to its 200-mile Exclusive Economic Zone (EEZ), within which there are approximately 20 long-line fishing vessels licensed to target pelagic species.

#### 4.1.2. Fishery for large pelagic species

In Tanzania, the fishery for large pelagic species, tunas and billfish, relies on three types of vessel, the ngalawa, the dau and the larger mashua. All are rigged with lateen sails, although *mashua* have the option to carry an outboard engine (as do large ngalawas). The main gears used are surface rigged gillnets, although trolling lines, mid-water fishing with baited down-lines and occasionally purse-seine nets are also deployed for small surface tuna schools. By far the most common gear deployed in the large pelagic fishery are 6-8 inch mesh gillnets, comprised of several lengths of net (usually 8-12) forming a single net of 700-100 m length, and 7-10m drop. These are rigged for surface use, attached to the bow of the mashua or dau by a 50m line (see Plate 1). Fishing taking place for about 20 days per month, on the darker moon nights, with net setting in the late afternoon and hauling very early in the morning, often while still dark, followed by travel back to the landing site. Resting and preparation for the following afternoon's departure takes place on the beach of the landing site.



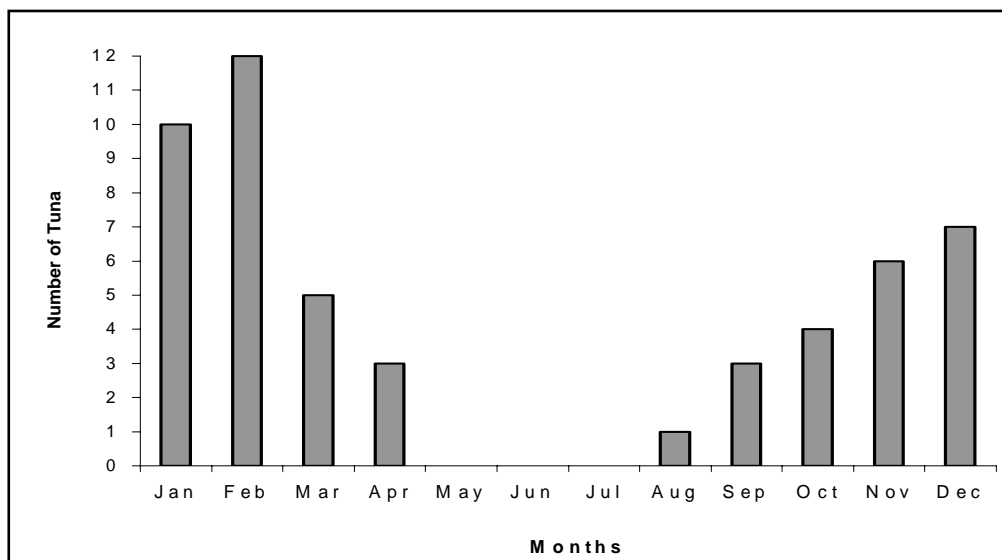
**Plate 1** Setting surface-set gillnets in the Pemba Channel from a mashua.

Night fishing with surface-set gillnets involves considerably more work than other methods of fishing, including absence from home often for three weeks each month and working at night. Bycatch from gillnets includes dolphins and whales. The whale and especially dolphin mortality from gillnets is of concern to mammalogists (Berggren, *pers. com.*). The use of trolling lines for capture of large pelagic species is conducted on an *ad hoc* basis by many vessels travelling across deep water. The few dedicated trolling fishers, operating from *ngalawas* may use this gear in the most favourable weather months of June-July, and Jan-Feb. However, for the gear to be effective, water conditions must be clear and sunlit, hence rainy periods not productive.

The principal resources targeted by a FAD fishery are the smaller surface tunas, skipjack, kawakawa, frigate mackerel, juvenile yellowfin and bigeye tuna. Billfish, jacks, sharks, rays, dolphinfish (*Coryphaena hippurus*) and rainbow runner (*Elagatis bipinnulatus*) are also likely to be taken in the catch. Physiological characteristics of smaller tunas make them vulnerable to surface gears. Without significantly developed gas-bladders they need significant oxygen resources to maintain the respiration rate required for constant swimming, surface waters provide these. Skipjack tuna does not develop a gas-bladder as it grows so that its obligatory swimming speed increases with its size (respiration rate is related as a cubic function of the swimming speed, (Sharp, 1983)). As yellowfin tuna mature they develop morphologically and physiologically decreasing their obligatory swimming speed and oxygen requirements and thus can tolerate the lower oxygen levels found at greater depths where competition and the risk of predation are reduced. The implication of this observation is that surface-set gill-nets exploit only one component of the tuna resources potentially available. A second consideration is thermal sensitivity. Tunas maintain higher body temperatures relative to the surrounding water. Sharp (1983) reported that the temperature range for skipjack and yellowfin was between 20°C and 32°C; he also observed skipjack and juvenile yellowfin 'have limited thermoregulator capabilities'. These small tunas are therefore sensitive to the depth of isotherms. When the water mass is isothermal to the main EACC/ASW thermocline (during the SE Monsoon) the habitat available to the smaller tunas is correspondingly larger and the abundance of these species at the surface will be lower than when the thermocline is shallow (during the NE Monsoon). Figure 3 presents the approximate location of the large yellowfin tuna resource of the east coast of Zanzibar (Sharp, 1981).

Seasonality of catches of tuna and other billfish has been described by Richmond and Mganwa (1994), and confirmed by fishers. Yellowfin tuna were caught in greatest numbers during the warmer months of the year (see Figure 2). The sizes of yellowfin tuna caught was also reported to vary throughout the year. The largest fish (70-85 kg) are regularly caught from March-April and August-October. The significant reduction in catches during the intervening period of the wet season precludes any size estimates being obtained, although some fishers indicated that during

this period a range of fish sizes were common. Smaller fish (5-50 kg) were reportedly common during the warmer months of November-February.



**Figure 2** Perceived seasonality in catches of tunas reported by Sahare fishers in Tanga.

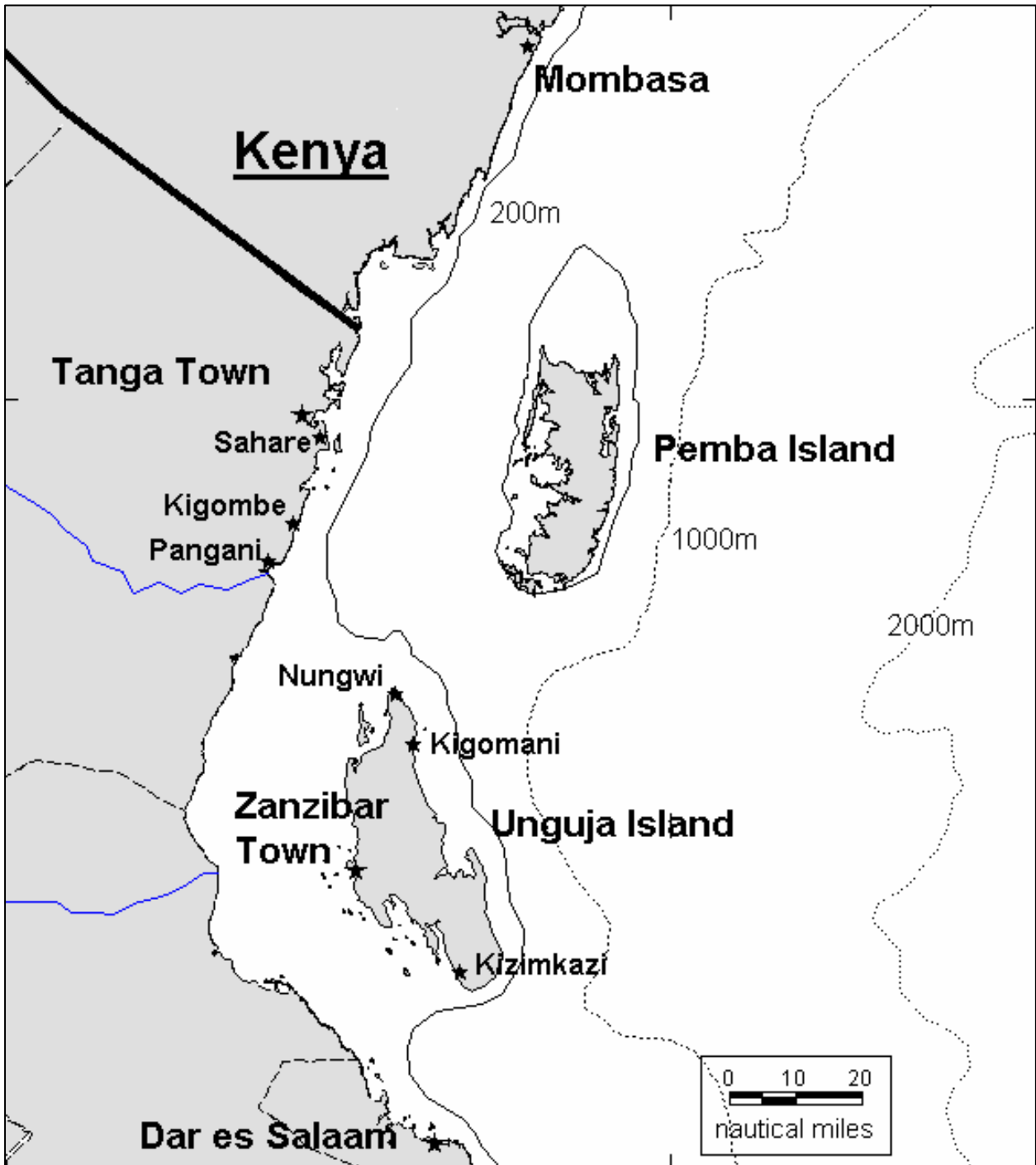
## 4.2. Livelihood Assets Profile - Tanga Region

### 4.2.1. Introduction

The Tanga Region comprises two districts (Pangani and Muheza) and the Tanga Municipality, with a resident population exceeding 150,000, in 42 coastal villages. The economy of most coastal households depends on a combination of activities, and families are rarely self-sufficient in food. Fishing is by far the most important economic activity, but agriculture and trade are also important. Commercial stakeholders include prawn trawlers, buyers and exporters of marine products, mangrove pole cutters, the sisal industry and solar salt producers. Tourism is limited, but growing. Tanga town is built around an important harbour that provides for the importation and export of containerised goods. This harbour is the second largest in Tanzania, with 183 vessels being serviced in 1995-6 with a cargo of 180,000 tonnes processed – a 33% increase on the previous year (see UNEP, 2001). The main inshore East Africa shipping channel runs alongside the coast of Tanga with boats visiting Tanga, Zanzibar or Dar es Salaam passing very close to the shores.

The Tanga coastline extends for approximately 180 km from the Kenyan border in the north to Saadani Game Reserve in the south. Along this shore are found 96 isolated coral reefs, seagrass beds, mangrove forests, and several estuaries and embayments. The unsustainable use of these coastal resources in the Tanga Region was identified in the early 1990's, evidenced by declining yields of fish, deteriorating conditions of the coral reefs, and continuing reduction of the area of mangroves and coastal forests. The Tanga Regional government authorities recognised these predicaments and, in collaboration with the Eastern African Regional Office of the World Conservation Union (IUCN-EARO) and Ireland Aid, developed a collaborative programme for the conservation and sustainable development of coastal resources (see Box 1).

From Tanga Region two fishing villages were selected for detailed case study. These were Kigombe, about 20 km from the city of Tanga, and the fish landing site of Sahare, about 5 km from the city. These were selected because of the alleged high prevalence of pelagic species landed compared with others sites in the area. This was based on local knowledge from District Fisheries Officers, the fish exporting company Sea Products Ltd., and the TCZCDP. Kigombe is also one of the pilot villages in the TCZCDP.



**Figure 3** Coastal features of the Tanga area, Unguja and Pemba Islands (Zanzibar).

#### 4.2.2. Natural Assets

The 200-metre depth contour lies within 3 miles of the shore. Beyond this the seabed slopes rapidly to depths of 500-800 metres in the central Pemba Channel. The presence of large pelagic fish species in the deeper waters of the Pemba Channel, within a few miles of the shores of the Tanga Region was confirmed during the field visits by fishers and fish buyers. The Tanga Yacht Club sport-fishing unit keeps detailed records of catches dating from the 1960's that similarly documents catches of tuna and billfish species. The Pemba Channel is well known for tuna and billfish catches, and a number of game-fishing clubs from southern Kenya have exploited these resources since the 1950's (see Hemphill, 1995). Despite the regular deep-sea sport fishing in the northern Pemba Channel, there exists very little documentation of this resource.

### **Box 1 – The Tanga Coastal Zone Conservation and Development Programme (TCZCDP)**

In July 1994, the TCZCDP was initiated, with implementation involving the three Districts in collaboration with the Tanga Regional Administrative Secretariat (RAS), the Ministry of Natural Resources and Tourism and the Vice-President's Office (Environment). Technical and managerial assistance was provided by IUCN-EARO who also manage the project on behalf of the donor, Ireland Aid. The Programme's overall goal was: "*Sustainable use of the coastal resources of the Tanga Region for the benefit of present and future generations of residents, through a series of integrated activities aimed at conservation and collaborative management of coastal resources*". The initial phase involved participatory socio-economic and resource assessments and annual stakeholder workshops to agree on priority issues, options for actions and means to overcome problems. Pilot studies were set up in one village in each district: Mwambani-Mchukuuni (Tanga Municipality), Kigombe (Muheza District) and Kipumbwi (Pangani District). Phase 2 took place between July 1997-December 2000, culminating with the establishment of four collaborative fishery management areas, and a further two developed, plus one collaborative mangrove management plan developed. Of the 40 main coastal villages in the three districts, at least 32 (80%) were implementing collaborative area management. An important focus of the second part of Phase 2 was the progressive decentralisation of the Programme according to the requirements of the Local Government Reform Programme (LGRP), and regional staff were relocated to the districts. Extensive training was conducted in a wide range of Programme related skills for district staff and village stakeholders in order to build capacity for maintaining programme activities to ensure sustainability. Phase 3 began in early 2001 and is expected to last for three years (until end of 2004). The stated goal is "*to ensure that the integrity of the Tanga coastal zone ecosystem is improved, and its resources supporting sustainable development*". The purpose of the phase is to improve coastal zone resources management by district administration, resource users and other stakeholders.

The abundance of tuna species is reported to be seasonal with the greatest catches landed during the northeast monsoon. During the wet season, very little offshore fishing is conducted in this area, due to heavy rain. In addition, the wet conditions make long journeys at sea unpleasant and many fishers turn their attention to agriculture during these months. At the beginning of the southeast monsoon, strong and changing winds and high seas prevent many fishers from Kigombe and Sahare reaching offshore grounds beyond the reefs. Conversely, during the calmer months that follow (September – October), the absence of reliable wind restricts sailing smaller vessels (ngalawas) from access waters beyond the reefs and return without risk of post harvest spoilage of catch, particularly from Kigombe village. It was noted that this period is the best season for trolling.

#### 4.2.3. Physical Assets

##### Fishing gears

The frame survey data (2001) reports 437 ngalawa, 108 dau and 78 mashua for the Tanga Region. A total of 85 outboard and 5 inboard engines are also reported. Both of these are vessels are suitable for deep-sea fishing, and are local constructed. Engines, spare parts, technicians, fuel and fishing gears are readily available in the area.

The financial returns from pelagic fishing have increased with the expanding market demand for higher value fish. This is reflected by a reported increase in the number of individuals (especially from the Tanga Municipality) that have invested in ngalawas and hand-lines for surface trolling. High unemployment amongst youth has led to an increase in their interest in fishing and the use of ngalawas and hand-lines offer a real opportunity to access the offshore fish resources. The decreased returns from inshore fishing have been a further incentive to invest in offshore gears. However, investment in gillnets has been thwarted by damage to nets from whales and ships. Thus, despite the perceived opportunity to fish large pelagic species, the number of fishers using mashuas has decreased from 11 to 4 in Kigombe village. The risk of loss from whales and shipping is so high it was said that it has become very difficult to raise credit to reinvest in nets.

Inshore, low-tech, experimental bamboo FADs were trialed in Kigombe through the TCZCDP following the recommendations of a fisheries consultancy (Beckley *et al*, 1997). These authors suggested that if the designs proved to be successful, deep-water FADs should be considered. However, made from local materials and located in inshore areas close to the villages in about 40-70m depth, the experience was disappointing. Over a period of about 8 months, the FADs had to

be replaced on a monthly basis and were eventually all lost. Losses were due to strong currents, dragging, damage from ships and local vessels, but also theft. The component parts (bamboo and rope) were of considerable value to individuals. Their potential was however noted and there was interest in future development of the concept. Future trials should use materials and designs that prevent theft and reduce the risk of damage from shipping or dragging.

#### Post harvest and transport to markets

No vessels carry ice aboard to preserve the catch. However, while Sahare is close to Tanga town and ice is readily available, Kigombe village is more distant, relying on buyers that visit with small pick-ups and ice to purchase produce. There are also 20 freezers reported in the village, owned by buyers. The fishers have no potential to store fish, and must sell immediately and thus have no control over the price. The ability of fishers to respond to market opportunities depends on the capital available and the gears supplied. It was noted that "*Fishermen are fishermen and middlemen middlemen*". Hence, it is the job of the middlemen (i.e. the buyers) to buy fish and engage in post harvest tasks. The buyers set the price and it is generally a buyer's market. Fishers do have the choice of landing site, and can choose to market their catch at more established sites with a greater number of buyers.

In general, the immediate vicinity of Tanga city has good road access to both Dar es Salaam and Arusha, two major cities with a high demand for fresh fish. Road quality deteriorates with distance from the city.

#### 4.2.4. Financial Assets

Access to capital to invest in vessels and appropriate fishing gears at the two sites visited was limited. Few fishers have money enough to bank and the local bank in Kigombe closed due to lack of customers. Gains from fishing are usually invested in housing or boats. In rural areas, there are currently no credit schemes for fishers. Reportedly, a Government loan scheme was abandoned due to the high administration costs of following up on loans to members of the fishing community, mainly due to the high mobility of many fishers.

Fishers considered that established municipal credit schemes were not suitable for them since the loan limits were too small to do anything with, the repayment period too short, and the requirement for a study period in town expensive considering the opportunity cost of lost fishing days. Most fishermen were buffered by the middlemen who provide loans for gear, or advanced payment when returns were low (such as in the wet season). Thus there exists an informal credit system.

It was noted that middlemen (e.g. fish buyers) and relatives no longer provide credit to fishers to invest in gillnets since the risk of loss (due to entanglement with ships and whales) was so high. Fisher's partners are mainly involved in agriculture and provided important support for households.

The potential for fishers to invest in their own FADs is limited due to their general lack of financial organisation and lack of disposable income. It was suggested that a levy could be raised at the point of fish sale but this would require that fishers commit to a particular market so that the levy could be routinely deducted. They would also require financial skills and to develop trustworthiness to operate their own levy system and bank accounts. In addition, fisher stated that they need proof that FADs worked before they would invest in them. Restricted access and management of the FADs with individual/or cooperative ownership was considered mandatory for private investment. An alternative revenue earning systems for deployment of FADs could be derived from a licensing system for those fishers fishing FADs. Informants suggested that the District Fisheries Department could then take the responsibility for establishing FADs.

Division of the fish catch depends on the proportion of capital invested by individuals into the boat. However, generally 50% of the value of catch is set aside for the boat and gear owner with 50% divided among the crew (who may also be an asset owner). For ngalawas the split may be different with 20% for the asset owners and 80% for the crew (who usually have their own handlines).

#### 4.2.5. Human Assets

The fishers from Tanga are already accessing the Pemba Channel and are familiar with deep sea conditions, although the majority of fishers are engaged in purse-seining for small pelagic species

(e.g. sardines, silversides, Indian mackerel and scads). The Sahare landing site is popular with visiting fishers, especially from Zanzibar and Pemba Islands - often regarded as some of the most experienced in the country - thus there is frequent exchange of information and skills with outside fishers. In general, skills related to post harvest activities are restricted to the sale of whole fresh fish, without any form of processing (e.g. gutting). However, unsold fish can be either sun-dried, smoked or salted.

#### 4.2.6. Social Assets

##### Cooperation among fishers

While cooperation among the crew of a single vessel is necessary, especially for large boats, cooperation between fishing crews is minimal. Fishing crews make a contribution of some kind to be part of the crew, by either investing in part of a net, providing their labour or working alongside each other for sales, profit sharing and boat maintenance. Boat crews tend to be loyal to their boat and abandoning a boat would lead to a potential loss of crewing opportunities. Cooperation between fishers (in fishing and marketing) is not common. Each fishing crew generally has their own established and individual relationship with middlemen.

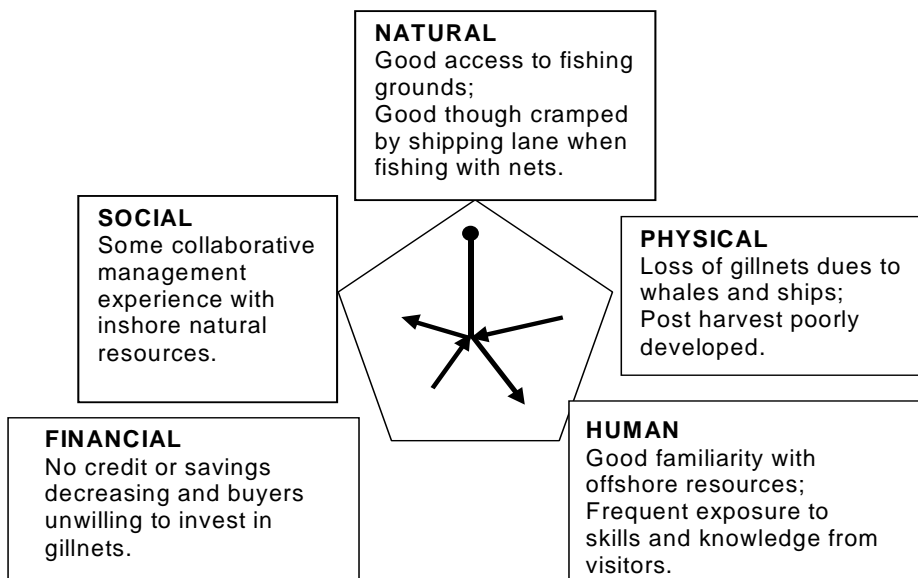
##### Local organisation

Committees responsible for defined 'management areas' have been established with facilitation by TCZCDP (see Box 1). The Kigombe community are actively involved in one of these community management area, known as the Mtangata management area. This management area covers fishing grounds for five villages, and has been defined since 1997. The committees are expected to meet monthly and comprise representation from the different villages, fishers, leaders, women, etc. They have to some extent been successful in managing use, and restricting the use of dynamite and fish poisons. However, they reported limited success in enforcing reef closures and restricting access of fishers. They consider that enforcement requires government support and legislation, plus training in the use of firearms.

By contrast, the fishers from Sahare are not involved in any form of community management or organisation partly because of the range of fishers encamped at that site. The site is very close to Tanga town and many opportunistic fishers pass through, from Pemba Island, Unguja Island and Mombasa (Kenya). In addition, the youth from Tanga town reportedly drift in and out of the fishing community in search of employment and thus community management would be difficult.

#### 4.2.7. Summary

Figure 4 presents a summary analysis for Chole and Juani Islands using the assets polygon.



**Figure 4** Assets polygon for Tanga.



### 4.3. Livelihood Assets Profile - Unguja Island (Zanzibar)

#### 4.3.1. Introduction

Zanzibar comprises two main islands, Pemba and Unguja, with the latter supporting the greater population and the administrative capital of Zanzibar Town. The population approaches one million, with more than half of this on Unguja Island. The economy is based on agricultural and fisheries production, with a well established artisanal fisheries industry. The bulk of fisheries activities takes place inshore on the continental shelf and it is considered that resources are now over exploited (Jiddawi & Ohman, 2002). From the mid 1990's a rapidly growing tourism industry has developed on Zanzibar, providing a demand for high quality fish products.

The market demand, intense fishing pressure in coastal waters and the increasing capital available to invest has promoted the fishermen in the north of Zanzibar to develop offshore fishery in the Pemba Channel. The primary fish landing site for large pelagic fish species is Nungwi village at the northern tip of the Island (see Fig. 3). Nungwi was an obvious case study site and the nearby village of Kigomani was chosen because of its well-documented trend in the exploitation of offshore fisheries resources (see Box 2).

#### **Box 2 Development of the Kigomani pelagic fishery fleet**

A major development of the offshore fisheries in Kigomani was initiated with a Netherlands Small Embassy Grant in May 1994. This was provided to two fishers cooperatives to build two mashuas, complete with gillnets and outboard engines in an attempt to encourage drift gillnet fishing for large pelagic species offshore. At this time, all fishing was conducted in inshore waters, based around coral reefs, with ngalawas powered by sail. The two mashuas were the first two fishing vessels of their type in the village equipped for deep-sea fishing. The two cooperatives have re-invested fishing profits into another three boats each, and other fishers in the village have observed their success and subsequently built another seven boats such that there are now about 14 mashua in Kigomani equipped for offshore fishing. Because of the presence of a fringing reef and a shallow lagoon along these shores, outer reef access during low tide requires that all the mashuas from Kigomani to be powered by a combination of sail and engines. The effectiveness of the grant was monitored through a data collection system involving the fishers, with monitoring facilitated by the Institute of Marine Sciences (UDSM) (see Richmond and Mganwa, 1995; 1997).

#### 4.3.2. Natural Assets

Fishing data collected by surface gillnet fishers from 1994-1997 confirm a consistent supply of tuna and other large pelagic species (Richmond and Mganwa, 1994, 1995). The first year of catch monitoring (May 1994-March 1995) confirmed that 65% of the average total catch was tuna species (Richmond, 1999). A short-term study during the wet season (Knox, 1999) showed that tuna accounted for 80% of the total catch. Of these the species composition was 52% frigate tuna (*Auxis thazard*), 21% kawakawa (*Euthynnus affinis*) and 8% yellowfin tuna (*Thunnus albacares*). The main fishing grounds for boats from Nungwi and Kigomani are waters north of Leven Bank, extending to the west as far as Maziwe Island. Kigomani vessels also fish grounds due east beyond Mnemba Island (see Fig. 3).

Nungwi is well placed for pelagic fishing with the fishing grounds of the southern Pemba Channel relatively close to shore (see Fig 3). The 200m depth contour is within a couple of miles of the main beach, and easily accessible from the shores of Nungwi. More importantly, these grounds can be accessed during most seasons of the year. During the strongest period of the northeast monsoon, the vessels can travel further west to set their nets. During the southeast monsoon, the seas directly to the north and west can be fished for most of the season.

Fishers from Kigomani reported that the decline in fish catch in coastal waters led to the increased fishing of pelagic fish in the deeper offshore waters. Fishing in these waters is seasonal primarily due to rough seas and difficulty in accessing the fishing grounds during the wet season. From Kigomani, access requires engines (see Box 2).

A few weeks of rough weather are experienced occasionally during the northeast monsoon season. At these times, fishers from Kigomani have developed a routine to travel to the southwest end of Unguja Island, becoming temporary visitors at the village of Kizimkazi, from where they can access large pelagic fishing grounds off southern Unguja. The current year was the first time Kizimkazi villagers denied these fishers permission to visit, much to the chagrin of the Kigomani fishers.

#### 4.3.3. Physical Assets

The frame survey data (1997) reports 234 ngalawas, 397 daus and 40 mashuas in Nungwi, with 42 outboard and seven inboard engines. The regular catch of high value fish combined with a regular high priced market has led to expansion of the fishing fleet from five vessels in 1975 to over 60 at present. In addition to the fleet of 14 fishing mashua in Kigomani (see Box 2), there are reportedly 80 ngalawas fishing from Kigomani mostly around the inshore reefs.

In Nungwi, few of the boats have outboard engines since the fishing grounds are easily accessed using sail. Boats and engines are maintained in the village, while engine maintenance for Kigomani is generally carried out in Zanzibar Town although local skills are developing. Nungwi has a reputable boat building business that supplied all the vessels used by Kigomani. Recently boat-building has started on the Kigomani beach, reflecting the greater capital available to invest in boats and the increase in skills in procuring boat building materials by the fishers themselves.

None of the boats carry post harvest facilities on board and fish was only put on ice when it was sold. It was noted that there are over 100 freezers in the village of Nungwi. Mobile phones are present on 20 of the Nungwi boats and are also used by 15 of the 22 fish buyers at the Nungwi auction supporting well-coordinated and timely sales of fish. Unlike Nungwi, Kigomani has no electricity and thus no ice making facilities. The nearest source of ice is Pwani Mchangani about 7 km south. In Kigomani fish are immediately auctioned on the landing beach and ferried out to retail markets, or traded on to the main market in Zanzibar Town. None of the fishing boats were equipped with mobile phones, though some of the buyers did use mobile phones to organise and hire transport. The Department of Fisheries has land in Nungwi and are reportedly planning to build a fish storage/processing plant, and the fishing association in Nungwi has started construction of a fish storage depot.

The nearby small island of Mnemba houses an exclusive tourism resort (Conservation Corporation Africa) donated US\$ 10,000 in 1999, specifically for the development of FADs for use by Kigomani fishers. This has not been followed through, but the funds are kept with the IMS awaiting an opportunity for dispersal.

#### 4.3.4. Financial Assets

There are no formal credit operations in Nungwi or Kigomani. Fishers may gradually save funds earned from crewing for purchase of boat-building materials leading to eventual ownership of an ngalawa, then possibly a mashua. This process is likely to take several years. Individuals may also contribute lengths of net to begin buying their way into a boat crew and earning better share of the profits. There were examples of individuals that owned 1-5 lengths of net on a boat. Fishers can access credit from individual boat builders such that repayments are made only after the boat has started realising profits. The boat builders are united so that if an individual defaults on repayments the builders will collectively refuse to repair the boat. Since all fish sales are channelled through the auction, the auctioneer can be asked to adjudicate loan repayment and deduct money owed at the point of sale.

The diversity in employment provided by tourism development in the economy, combined with high prices commanded for fish products has led to increased investment in the local fishing industry. The investment is significant since a boat (9-10m mashua) costs about 1,500,000 Tsh<sup>1</sup> to build, nets will cost about 2,000,000 Tsh and fishing lines up to 100,000 Tsh. With the smaller items (anchors, ropes, sails, etc.) an operational vessel will cost about 4,000,000 Tsh. The cost of an outboard engine adds another 1,500,000 – 2,500,000 Tsh. This investment is currently being met

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<sup>1</sup> the exchange rate at the time of the study was approximately 1,000 Tsh to US\$ 1.00, thus a new mashua costs about US\$ 1,500.

through internally-generated savings and there are no promotional programmes/donors investing in fishing at present. Many of the boat owners are operating bank accounts. In Kigomani, some fishers may borrow money from family, often salaried employees in the hotel industry. Fishing income was considered to provide the greatest contribution to disposable income and was driving re-investment in fishing. Informal credit is provided through fish buyers when fishing income drops. Income from fishing was split 50% to the asset owners and 50% to the crew. It was considered that after basic costs had been paid, fishers of an offshore fishing boat could depend on an income of about 50,000 Tsh per month. This is a higher monthly income than many other activities, including farming and teaching, and is thus highly attractive<sup>2</sup>.

The two fishing cooperatives in Kigomani have successfully managed these cooperatives and expanded to own three more boats and engines each (and thus each group has an asset value of more than 26,000,000 Tsh). They received basic training in book-keeping and monitoring methods as part of the Netherlands Embassy Small Grant and have succeeded in setting up payment systems that have persisted up until now. Both cooperatives have bank accounts and save money for boat maintenance and repair. About half the fleet in Kigomani is comprised of boats owned by the cooperatives. With present yields, it takes about four years of profit saving before there are sufficient funds to expand by investing in another boat.

The assistance provided to the fishing cooperatives was facilitated by managers of the Matemwe Bungalows hotel located in the village of Kigomani. This hotel is one of the oldest in the region, with a reputation and philosophy for community involvement and support for environmental conservation. They have also shown strong support for trials of FADs.

#### 4.3.5. Human Assets

From the villages of the Unguja Island fishers have been accessing the deep waters of the Pemba Channel from the mid 1970's. The experience of fishing this resource is thus considerable and well established. In Kigomani village before 1994, fishing relied only on ngalwas fishing off the reefs, with small inshore nets, hand-lines, traps and spearguns.

Nungwi fishers have developed a strong and well-managed marketing structure. About 22 buyers distribute fish from the auction site. At least four are dedicated buyers for the hotel trade. There are reported to be at least seven with experience in transporting fish to Dar es Salaam when landings exceed the capacity of the local market. Buyers and fishers have invested in mobile phones so that they can streamline their marketing operations, essential for fresh fish marketing. In addition, buyers have invested in fish storage with more than 100 freezers already in use in the village.

#### 4.3.6. Social Assets

The artisanal fisheries in Nungwi is well-organised and becoming more developed. The fishers association is functional with funds used to develop the industry. It was estimated that they banked about 1,700,000 Tsh per annum for use in the association. They have shown their ability to manage fish landings through strong marketing and an obligation to sell at the Nungwi landing site. It appears that they are able to manage individual ownership of fish traps in the inshore area and they were confident that this could be extended to the offshore fishing grounds.

There are seven villages that fish the waters off the northern tip of Zanzibar (Mkokotoni, Potoa, Fukocheni, Tumbatu, Nungwi, Pwani Mchangani, Matemwe), mostly selling catches through the Nungwi landing site. This has contributed to the development of a well-established market that attracts many buyers and is well organised. They already operate an internal levy system of 5% of all sales. This revenue is divided three ways: to the fisher's cooperative, the Nungwi community, and the village responsible for collection of the levy (rotating over a three month period). This level of organisation has allowed them to invest in a boat engine, three cars (no longer operational) and the building of a fish storage site that will be equipped with cold storage. They have confidence in

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<sup>2</sup> The average consumption expenditure per capita in Tanzania is about 10,000 Tsh (ca. US\$ 10) per month, and the food poverty line is 5,000 Tsh per month. It is estimated that 19% of Tanzanians fall below the food-poverty line. It is important however to note that in general Tanzania is a very poor country with a GDP per capita that is less than US\$ 500 (see NBS, 2002). The Gini Coefficient for Tanzania is 0.36, compared to most other African and Latin American countries that exceed 0.45, while European countries and Canada rate around 0.30.

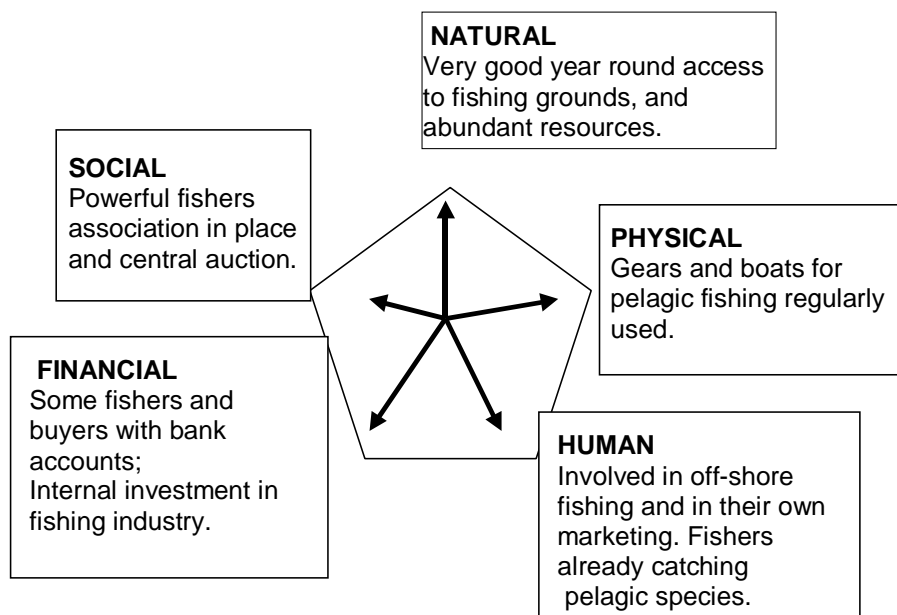
their own management skills, noting that “We already demarcate areas inshore for individual or group use and that kind of right is understood and managed, we could manage a FAD. If FADs work, we will invest in our own after we have seen how to do it”.

In Kigomani there is no inherent system for management considered applicable to FADs and restricting access would be difficult to enforce “even the ngalawas would go there to fish, towed by boats with engines”. Legislative powers at village level that are used to govern immigrant fishers would not be applicable to offshore FADs. The fishermen in Kigomani thought that they would need help to establish management systems in Kigomani since they themselves have no experience in setting up by-laws “We are not educated here, our job is to go fishing”. In Nungwi it was however considered possible to fish an experimental FAD on a rotating basis (between the villages in the fishing area) so that many fishers can experience fishing a FAD site.

Both Nungwi and Kigomani fishers noted that siting of a FAD should avoid gillnet fishing grounds where they could potentially interfere with nets and lead to conflicts. Suggestions were made of appropriate sites where such risk would be minimal.

#### 4.3.7. Summary

A summary analysis for northern Unguja Island using the assets polygon is presented in Figure 5.



**Figure 5** Assets polygon for northern Unguja Island (Zanzibar).

### 4.4. Livelihood Assets Profile - Mafia Island

#### 4.4.1. Introduction

The main island of Mafia is located about 120 km south of Dar es Salaam and 20 km from the western fringes of the Rufiji Delta across the shallow Mafia Channel. Mafia Island is approximately 50 km in length and the eastern shores are fringed by coral reefs. Mafia Island is recognised as a hotspot of marine biodiversity within the Eastern African region and efforts are currently being made by the MIMP to conserve the natural environment and guide development (see Box 3).

The Mafia District comprises the Mafia Island archipelago, which includes seven main islands plus numerous smaller reefs and sand banks (see Fig. 6). The administrative centre of Mafia Island and the district headquarters is located at the town of Kilindoni on the west. There is a population of

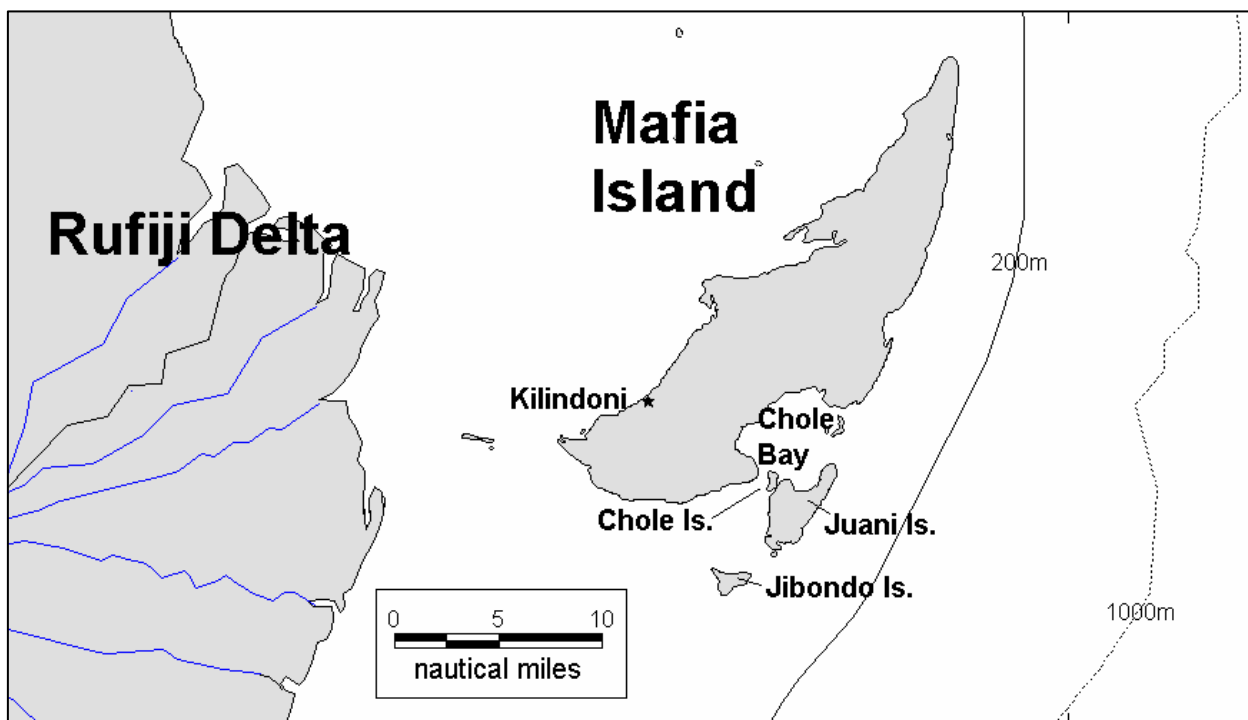
about 40,000 residing on the various islands of Mafia. Coconut production is the traditional source of wealth with fishing and other marine resources acquiring increasing importance over the past 20 years. Since 1995 a small tourism sector has developed centred mainly on SCUBA diving and snorkelling. Two of the main eastern villages engaged in fishing were selected as case study sites.

**Box 3 Mafia Island Marine Park (MIMP)**

The Mafia Island Marine Park (MIMP) was established in 1995 with the primary goal “to conserve the diversity, abundance and function of all physical and biological resources, in order that they may continue to be enjoyed and productively utilised by present and future generations”. The management of MIMP falls under the Board of Trustees, Marine Parks & Reserves which is a body created in 1996 under the Ministry of Natural Resources & Tourism, Tanzania. The park encompasses an area of 820 km<sup>2</sup> which at the time of establishment was the largest marine protected area in the Indian Ocean outside of Australia. MIMP is also one of the most highly and densely populated MPAs in the world with approximately 10,000 people residing within the boundary and another 8,000 or so residing nearby. Four villages are entirely enclosed within the park and a further eight villages straddle the perimeter. Because of this situation MIMP is founded on a principle of involving communities in decision-making and permitting sustainable resource-use within the provisions of a General Management Plan (Sept, 2000).

Two decades of dynamite fishing up to 1998, a longer history of coral mining for lime production, and extensive coral bleaching in 1998 has left a legacy of damage to the marine environment. The situation has been compounded by increasing fishing pressure and in particular the use of small-mesh seine nets which remove juvenile fish and damage seabed habitats. These are the main issues currently facing the MIMP and its communities. The Worldwide Fund for Nature’s Tanzania Programme Office (WWF-TPO) has been involved in supporting the development of MIMP since 1992. In 1999 a new 5-year programme of WWF support was initiated with joint funding support from WWF-UK and the UK Department for International Development (DfID). The project focuses mainly on artisanal fisheries management, sustainable livelihood development and environmental education, as well as strengthening park operations and infrastructure. WWF’s involvement in Mafia is governed by a Memorandum of Understanding between the WWF Tanzania Programme Office and the Board of Trustees, Marine Parks and Reserves, Tanzania.

These are the villages (and Islands) of Chole and Juani (see Fig. 6).



**Figure 6** Mafia Island.

#### 4.4.2. Natural Assets

Data on the pelagic fisheries of Mafia island are scarce. The few studies that have been done in Mafia focused on the ecology and fish species in the Chole Bay area (Jiddawi and Ohman, 2002). However, it was generally agreed by the MIMP staff and that of the Mafia District that the pelagic fisheries resources of Mafia are largely un-exploited. Recognition of this resource resulted in a deep sea fishing club established on Mafia Island during the 1960's, but abandoned at the end of the colonial period. In the meeting with fishers on Chole Island only 13 out of the 63 fishers fished offshore, and this seasonally. Of those fishing outside Chole Bay, only 6 had ever caught a yellow-fin tuna and only two had ever caught a dolphin fish. Most common gears used outside Chole Bay are the deep-set gillnet at 20-40m depth, for demersal fish species, and some handlining and trolling from ngalawas.

The 200 m depth contour lies within 4 km of the eastern coast, beyond which the sea descends to over 500 m within 6 km. Access to the deep water fishing sites is strongly influenced by the seasonally reversing monsoon winds. During the northeast monsoon, artisanal fishers can easily access offshore grounds. During the southeast monsoon high wave conditions are generated at the Kinasi Pass (at the mouth of Chole Bay) hampers passage, especially to vessels under sail. During this season the only alternative route to the deep-water grounds is south of Chole Bay, against the prevailing wind, a distance of about 13 miles. Thus there are about four months with reliably good access to offshore fishing areas (December to March) using existing vessels.

#### 4.4.3. Physical Assets

##### Fishing gears

The fisheries frame survey (2001) reports high number of mashuas and ngalawas concentrated in Mafia suitable for the fishery of pelagic species. Data reveals 266 ngalawas, 32 daus and 43 mashuas, however, most of these vessels are not fishing boats but are used to transport fish products to Dar es Salaam from the main town of Kilindoni. There are reported to be 58 outboard engines and a single inboard engine among the Mafia-registered fleet. Chole and Juani Island have 14 and 50 ngalawas respectively, of which a total of only 4-6 may fish in open waters. Also present are 10 mashuas between the two sites, with only 2 venturing into open waters.

Fishing boats are made locally on the islands of Chole and Jibondo, usually a wide-beamed design, ideally suited to the relatively calm waters of the inner bays. The most common vessel type used in Mafia Island is the ngalawa. All these are locally constructed and serviced. Boat builders on Chole Island agreed that it was possible to alter existing designs of mashuas for offshore conditions.

Fishing gears used in the inner bays include hand-lines, fish traps and seine nets (requiring large crews of young men to surround reef areas). Older men that have invested in their own ngalawas target the same fish using either hand-lines or fish-traps (madema). MIMP has recently introduced a gear exchange programme with the provision of large-meshed gillnets and long-lines in an effort to encourage fishing outside the management areas. The gillnets were intended for use as surface set gears, as practised in northern Unguja but the fishers prefer to bottom-set them to catch shark for which there is a lucrative fin market. The gear assistance also included loans-in-kind that included boat refurbishment and two 40 HP outboard engines. Repayments are made by monthly instalments.

Fishers are dependent on buyers and/or MIMP for fishing gears, with small-mesh nets used around reefs are supplied by Dar es Salaam buyers in return for fish. Deep sea fishing gear is not available (except for small hooks and light line) and must be sourced in Dar es Salaam. Similarly, most outboard engine spares must be obtained from Dar es Salaam although mechanics in Kilindoni are capable of minor repairs and maintenance.

More than 70% of the households on Chole Island rely on fishing income (De Villiers, *pers. com.*). There is an increasing entry into fishing by the youth after leaving school since land available for farming is limited. Young men often begin fishing by joining a net fishing crew. Those with the collateral (e.g. ownership of a mango tree or funds to pay a boat builder) may secure the capital to invest in their own ngalawa for inshore fishing.

## Post harvest and transport to markets

Fresh fish can be sold directly to visiting ice-boats anchored in Chole Bay. The fish is preserved on ice until transport to Dar es Salaam up to 15 days later. A significant recent trend is the hiring of ice-boxes from buyers in Kilindoni for use on fishing vessels.

There are minimal transport costs to deliver fish for sale to the ice-boats in Chole Bay. However, where fishers choose to sell fish in Kilindoni, either to the visiting buyers or the marine products export company Tanpesca Ltd. transport cost are incurred. Smaller fish can be transported by bicycle (for hire at 1,000 Tsh). Larger fish need to be transported by car (hired at 15,000 Tsh). The time taken to organise transport and to reach Kilindoni can result in poor quality or spoiled product. It was generally agreed that should there be regular landings of large pelagic fish species an effective transportation mechanism would develop.

### 4.4.4. Financial Assets

There are no national loan programmes operating on Mafia Island that are accessible to local fishers. A micro-financing scheme is operating through the local branch of the National Bank of Commerce but is only available to salaried employees that are paid through the bank.

On Chole Island the member-based village NGO, Chole Economic Development Society (CEDS) offers loans to the community. The ceiling for these loans is 300,000 Tsh and must be supported by tangible collateral (such as trees or housing). Though they have not invested directly into fishing, loans have been provided to individuals for boat repairs. Most young fishers have not yet inherited land and they have no assets against which they can borrow money. It was also argued that the 300,000 Tsh ceiling was not sufficient to investment in fishing. Funds for the CEDS are raised through tourist levies arranged through the Chole Mjini Hotel, on the same island. The CEDS has accrued significant funds (6,000,000 Tsh) such that they could invest in an ice-boat thereby allowing direct enter into marketing of fish products. This idea is currently being discussed with the members to seek consensus. The MIMP also offers loans to residents through a savings and credit scheme. This scheme has similar constraints as the CEDS since few members have enough collateral to be able to borrow sufficient funds to invest in fishing gears.

The Dar es Salaam buyers with ice-boats are considered the most dependable source of fishing gears with whom fishers have developed a good working relationship that extends beyond gear supply. The buyers provide inputs such as ice and petrol, and also advance cash loans when returns from fishing are poor. However, this arrangement ties the fishers to a very low-priced market.

### 4.4.5. Human Assets

Fishers have responded rapidly to the introduction of new fishing gears, such as the adoption of beach-seine nets in the 1990's with an accompanying shift from dried to fresh fish marketing. Similarly, their positive attitude towards the MIMP gear exchange programme provides further evidence that they are adaptable and ready to try out new gears and learn new techniques. However, some training would be required to improve seamanship skills (and vessel design) to allow them to explore offshore fishing grounds.

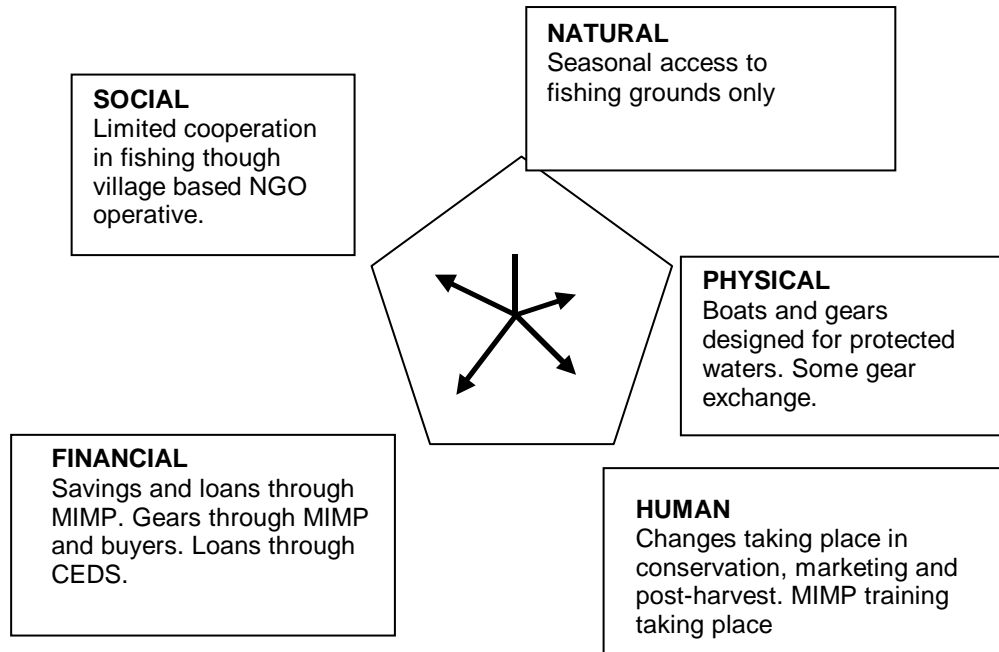
Experience in post harvest and marketing amongst the fishers and local community on Mafia Island is minimal due to lack of demand. However, the post harvest and market chain is changing rapidly. Experience with the fresh-fish market is being developed and youth from the islands have travelled with the ice-boats to Dar es Salaam to sell fish at the main city auction. In the meeting at Chole nine participants considered that they had experience of the fish market in Dar es Salaam and four were currently trading fish there.

### 4.4.6. Social Assets

There are no legally registered fishing cooperatives amongst the fishers interviewed. Some fishers cooperate informally to fish as members of a net team. Their links tend to be with each other and the buyer that has provided them with gear, rather than between fishing crews. Chole has a formally registered NGO (since 1994) with the mandate for supporting economic activities.

#### 4.4.7. Summary

The summary analysis for the villages of Chole and Juani Islands, using the assets polygon is presented in Figure 7.



**Figure 7** Assets polygon for Chole and Juani Islands (Mafia Island).

### 4.5. Policies, Institutions and Processes

Fisheries issues are a non-Union matter, with the governments of mainland Tanzania and of Zanzibar having separate and independent policies.

#### 4.5.1. National policy support

A progressive and supportive policy environment exists in Tanzania and Zanzibar explicitly favouring the exploration of the potential of FADs in an effort to increase fishers' income and to relieve pressure on the inshore fishing grounds. There is no legislation that embraces FADs or their ownership, but for local management of resources it is anticipated that supportive legislative framework for FADs could be locally developed. Highly relevant to this is the fact that fishing gears are exempt from import duty. Although there are differences between Zanzibar and mainland Tanzania with respect to the specific mention of FADs, examples of legislation that supports the development of offshore fisheries are listed below:

#### Draft Fisheries Legislation Zanzibar (MALNR,1998)

- To improve the economic conditions of fishers.
- Provide training and extension services in the use of different fishing techniques for offshore fishing grounds.
- Establish fish aggregating devices (FADs) and artificial reefs.
- Involve community groups and or fisher associations to enforce relevant laws and regulations and to promote establishment of by-laws to guide local fishing.



## National Fisheries Sector Policy (12) and Strategy Statement (MNRNT, 1997)

- To improve the involvement of the fisher communities in the planning, development and management of fisheries resources.
- Facilitate the formulation of village by-laws relevant to the fisheries sector to enhance sustainable exploitation and utilisation of the resources.
- Encourage the fisher community to form Fisheries Development Trust Funds, credit schemes as appropriate.
- Facilitate the development of fisheries and related infrastructure.
- Encourage private enterprise development in the fisheries sector by promoting commercial fishing.
- Facilitate all initiatives geared towards availability of fisheries inputs (i.e. spares, gears, equipment, etc.).
- Facilitate the promotion of fish marketing and distribution in collaboration with the private, industry and trade sectors.

### 4.5.2. Legal context for marketing pelagic fish resources

In Zanzibar, the Department of Fisheries and Marine Resources is located in the Ministry of Agriculture, Natural Resources, Environment and Cooperatives. The Director of Fisheries is required to authorise licenses governing fisheries product business and export. Various partnerships between local and foreign ventures have successfully exported fish products from Zanzibar in the past. On the mainland, within the Fisheries Division of the Ministry of Natural Resources and Tourism, the Director is responsible for issuing licences regarding foreign ventures and export of marine products. However, the national food security programme (President's Office) has a governing policy that requires that the export of all food products should be approved at Ministerial level thereby beyond the powers of the Director of Fisheries. To date licences for the export of marine finfish have not been approved due to concern that it will negatively affect the availability of protein in coastal communities. Export of freshwater finfish has been conducted for Nile Perch for many years. Contrary to this, business and export licences have been issued to industrial fishing fleets fishing in national waters beyond the 12-mile zone. The Tanpesca Ltd. marine products export business has applied for a license to export marine finfish which to date has taken 15 months to process, and has not yet been approved.

On the mainland there exists a fish levy of 5-10% on sales (depending on district) at designated landing sites at which fishers are obliged to sell catches. On Zanzibar, while there appears to be no equivalent levy, an auction fee is imposed and independent levies exist at certain landing sites (e.g. Nungwi).

### 4.5.3. Legal context of potential cooperative ventures

Cooperative law is well established in Tanzania and has recently been updated (Act 29, 1991) to reflect the liberalisation policies supporting business development in Tanzania. Local cooperatives (with not less than 10 members) are encouraged and can be easily registered at district level at the District Cooperative Department under the Ministry of Cooperatives and Marketing. The apex organisation at national level is known as the Cooperative Union of Tanzania (CUT).

FADs that are not easily stolen and can resist the current of the East African coast are by design expensive. The cost of a FAD is in the same order as an offshore fishing vessel and its gear, however it is not a fixed asset, it cannot be resold in times of need and thus essentially becomes an operating expense that may be beyond the financial capacity of artisanal fishers. Various communities offered suggestions of how they might apply levies to sustain a FAD programme and this would need to be explored and facilitated.

### 4.5.4. Institutional support

In Tanga and Mafia Island case study sites there are current management projects that are directly supportive of FAD development (TCZCDP and STP in Tanga, and the MIMP in Mafia). The projects are working closely with the local communities and strengthen the enabling environment for local communities to develop the capacity to manage their own natural resources. At the case study sites on Zanzibar there are however currently no development organisations directly supporting the fishing communities. Nevertheless, the Nungwi fishers expressed their own

confidence at being able to manage a FAD in their fishing grounds based on their positive experience of cooperation between the villages that currently fish the area and sell fish through the Nungwi auction. The southern Unguja WWF-supported Menai Bay Conservation Area and the CARE-supported Misali Island Conservation Area on Pemba Island are local examples of initiatives to support local resource management.

The IMS and the WIOMSA both based in Unguja and are primarily focused on research in marine sciences. Both expressed interest and support for a FAD programme and have the technical capacity to support aspects of monitoring.

#### 4.5.5. Markets and stakeholders in marketing

Many recent developments in Tanzania contribute to improving the options for marketing of seafood products. Across much of mainland Tanzania the growth of infrastructure coverage and quality over the last ten years reflects the general growth of the economy (estimated at 4% per annum). In particular, the expansion of road networks, including new bridges (e.g. across the Rufiji River), has considerably improved access to and from the main industrial and commercial centre of Dar es Salaam. Similarly, road transport on the main Zanzibar island of Unguja has witnessed significant improvement over the last ten years. Between the eight private domestic air charter companies and the national carrier Air Tanzania Corporation, daily air transport to most coastal towns in Tanzania is now reliable. Over a period of several years the fish market in Dar es Salaam was completely redesigned and built with funding by Japanese International Cooperation Agency and opened in late 2002. The specifics attributed of the case study sites are described below.

### **Tanga**

There is an increase in demand for pelagic fish that are traded to an increasingly sophisticated domestic market. Where fishers in the past would have to smoke or dry these large fish these are now routinely moved down the market chain as fresh produce. Fish marketing is dominated by auctions at fish landing sites in the main fishing villages. The vast majority of the buyers are middlemen that move fish from auction sites to urban areas such as Arusha, Mbeya, Dodoma, Morogoro, Dar es Salaam. Marine products from Tanga are also officially and unofficially exported to Mombasa, Kenya. The Tanga-based Sea Products Ltd., operating since 1995, is trading in marine products, primarily octopus and cuttlefish, for export. Their market chain is the most sophisticated operation in the area with ice-boxes routinely used at the point of purchase. A premium is paid for large pelagic fish species over 10 kg. It was estimated that of the 40-50 buyers operating in Sahare, about 40% were buying "samaki kubwa", i.e. the large pelagic species.

### **Mafia Island**

Fish marketing in Chole Bay, relies on fresh fish being exclusively shipped to Dar es Salaam markets. The local market comprises four small hotels and the local population is considered insignificant by the local fishers. Shipment to the Dar es Salaam market is achieved through three channels: dedicated buyers/ice boats, the Kilindoni buyers, and Tanpesca Ltd.. The Dar es Salaam buyers own ice-boats and set up floating markets in Chole Bay, whereas Kilindoni buyers have ice-boxes that are filled and then shipped to Dar es Salaam. Tanpesca Ltd. is a commercial company trading in marine products (prawns, crabs, octopus, cuttlefish, etc.), but not finfish. This company and the Kilindoni buyers are located at the District headquarters across the island from Chole Bay. In order to sell to these buyers in Kilindoni fish must be transported by bicycle or by car. All these markets have developed over the last ten years and replace the traditional trade in n'gonda (dried fish) that was sold to buyers trading with Lindi, Kilwa and Dar es Salaam.

### **Nungwi (Unguja Island)**

Large pelagic species are regularly landed at Nungwi and sold through the auction. Presently about 60-80 gill-net mashua contribute to this business. All the fishers based in Nungwi either as residents or visitors usually sell through the fishers association auction. This organisation ensures that the auction is well supplied with fish, thereby attracting buyers which in turn encourages the growth of the market. The self-imposed levy allows the community and the fishers to accrue funds that have been used to improve their industry. Fortuitously, one of the peak fishing seasons coincides with one of the main tourism seasons. This reliable market has led individuals to invest in

deep freezers, mobile phones (on shore and on the boats) and vehicles. The development of tourism in Nungwi has also provided jobs and together with the increased returns to fishing has encouraged local people to invest in more boats and fishing gears. There are purported to be 22 permanent fish buyers in Nungwi, four of which supply the hotels (Kiwengwa, Matemwe, Pwani Mchangani and Nungwi). Others market their produce in Zanzibar town at the main market and/or sell on to middlemen, hotels in town, the hospital and army etc. Seven of the buyers were said to have experience in trading fish in Dar es Salaam and to which they are able to trade should local demand and/or prices be unfavourable.

### **Kigomani (Unguja Island)**

Most of the year the Kigomani boats fish north of Nungwi and sell their catches at the Nungwi auction. Marketing in Kigomani itself is less developed than that in Nungwi. The auction generally takes place when the fish are landed, and includes a small fee to the auctioneer. Direct purchases are also made from individual boats, some when boats arrive before dawn. There is no capacity to freeze fish in the village and all fish must be exported out of the village. The road access to the village is good, only 45 minutes from Zanzibar town and more than 60 local buyers buy fish in Kigomani. Of these, 15 are local residents, ten of which have mobile phones which are used to call in hire vehicles when needed. Others come from neighbouring villages and Zanzibar Town to disperse the catch around local village markets and to the main town market. In general the fishers recognise an increase in the demand for pelagic fish and can always sell fresh fish.

#### **4.5.6. National and local stakeholders in fisheries development**

National organisations for fisheries training and research within the Fisheries Division (mainland Tanzania) include the Tanzania Fisheries Research Institute (TAFIRI), the Mbegani Fisheries Training Institute and the Pangani Fisherman Training Centre. Aquatic research, which includes fisheries and aquaculture undergraduate and postgraduate training is undertaken by the Faculty of Aquatic Sciences and Technology of the UDSM. On Zanzibar, the IMS (also of the UDSM), undertakes research in all aspects of marine science focusing on postgraduate training. IMS also has an advisory role to the Zanzibar Government on coastal and marine affairs.

## **4.6. The Vulnerability Context**

### **4.6.1. Seasonal access to fishing grounds**

For most of the offshore fishing grounds, access with current vessels (mainly mashua and daus) results in an optimum fishing season limited to 3-4 months per year (e.g. Mafia Island). During the remaining months, strong winds and rough seas in some locations, prevent access to offshore fishing grounds, particularly during southeast monsoon. Nungwi in northern Unguja is especially well-situated with respect to offshore fishing grounds with only brief periods during the northeast monsoon preventing access. To increase access in most localities significant improvements in boats and seamanship skills will be needed thus increasing the length of the fishing season.

The fact that fishers cannot fish throughout the year has profound implications in terms of poverty and vulnerability. Data on the flow of income was not obtained during the brief visits made during the study which is unfortunate as this might have allowed the cost of idle labour during the low season to be calculated and compared to the benefit of fishing throughout the year. Nevertheless, it is obvious that poor fishers are affected the most by seasonality. Wealthier fishers can afford stronger vessels capable of reaching offshore fishing grounds and sites further along the coast where they camp and fish. Poorer fishers by contrast are not able to leave their inshore home grounds and are thus forced to engage in the few options of limited economic activity available to them during the low fishing season. Seasonality therefore exacerbates poverty and increases vulnerability. Consequently, the introduction of FADs is more likely to be of benefit to the poor of the fishing villages.

### **4.6.2. Implications of national and sectoral policy changes**

There is currently no legislation that encompasses FADs deployment or use in Tanzania. If a FAD program were to be initiated the legal context of FADs would need to be developed. The lack of a legislative context for ownership of FADs will result in a many different deliberations at the point of

use. This may contribute to conflicts arising over the fishing in FAD areas. Thus considerable effort should be dedicated to describing the legal context of FADs.

The process of decentralisation gives management responsibility for artisanal fisheries resources to district authorities. Annex 1 of the National Fisheries Sector Policy and Strategy Statement (1991) details local government responsibilities. In many districts this process is challenging the capacity of local district staff to generate sufficient revenues to meet operational demands. As a result, support for a potentially risky investment such as the deployment and management of FADs is not likely to be forthcoming.

Fishing has traditionally been open access in Tanzania and thus there is limited experience in management of this resource. Recent efforts in marine management areas (Menai Bay, Unguja, Mtangata coastal management area Tanga, and Chole Bay, MIMP) are beginning to strengthen local management of marine resources. Although at present most of these initiatives are project led, the trend suggests an increasing in local resource management, with others sites soon expected to follow these leads (e.g. Mnazi Bay-Ruvuma Estuary Marine Park). An often unforeseen result of the development of stronger ownership of marine resources is the partial or total exclusion of visiting fishers that rely on fishing grounds away from their home villages (e.g. Kigomani fishers, see section 4.3.2).

In Kigombe and Sahare (Tanga), Kigomani (Unguja), Chole and Juani Islands (Mafia), fishers considered that controlling access to FADs would be difficult. Restricted access could however be achieved by careful placement of a FAD that was only reachable by those with the appropriate craft and from villages that were least likely to be in conflict over its use. Alternatively, another approach would be to deploy many FADs so that competition over one FAD would be limited and hence the potential for conflict reduced. Despite progressive legislation supporting local control of natural resources many people living in remote fishing villages will need advocacy support and capacity development to allow them to embrace the policy and develop their own by-laws for FAD management that can be enforced.

#### 4.6.3. Development of markets

In Tanzania, there is a positive trend in the increasing demand for pelagic fish species. This is derived from a population growth of about 3% per annum, combined with the increasing development of infrastructure, industry and investments. However, some site-specific problem exist, for example on Mafia island where the marketing system through the ice-boats does not easily accommodate larger fish; and in Kigombe, Tanga, the number of buyers in the larger fish have decreased with the decrease in catch as a result of net losses. Nevertheless, the consensus was that market and transport problems for large, good quality fish would be overcome should landings become consistent. The lack of electricity in many remote coastal areas close to offshore fishing grounds provides an ideal opportunity to test the effectiveness of solar-powered ice machines to support local fishing and marketing efforts.

In Unguja the peak of supply coincides with the peak demand due to the tourist season in the northeast monsoon period when it is easier to access the pelagic resource. Should tourism collapse due to world events, or should FAD fishing extend the fishing peak then the bouyant market in Zanzibar may be strained. Through most of the 1990's tourist numbers for Zanzibar and mainland Tanzania have increased to 450,000 (UNEP, 2001). However, over the last five years, the tourism industry on Zanzibar has been subjected to a series of setbacks caused by political instability and more recently by the potential threat of terrorist attacks. In 1995 many of the donors terminated support for the islands following political unrest, in particular between the two main parties and between the two main islands of Pemba and Unguja. The recent peace accord (MOU) between the two political parties has provided a much needed positive development.

#### 4.6.4. HIV/AIDS

Sexually transmitted diseases including HIV/AIDS are spreading throughout many areas of Tanzania, including Zanzibar. National campaigns on the control of HIV/AIDS are carried out under the Ministry of Health, and, with the support of numerous donor organisations, some progress is being made to abate its spread. Any development activity that will contribute to improvements to livelihoods of coastal people, for example, through the generating of fish that can be sold, has the

potential to attract increased prostitution that could lead to an increase in more sexually transmitted diseases such as HIV/AIDS.

## **5. CONTRIBUTION OF OUTPUTS: FAD PROGRAMME POLICY BRIEF**

The research undertaken during this project, through visits to case study sites and involvement of relevant stakeholders, has described the livelihood assets for the coastal communities of the three study areas. The subsequent analysis of the findings and review of the relevant literature has resulted in a draft policy brief that will serve to disseminate the factors in favour of developing a FAD programme for Tanzania (see Appendix 3).

## 6. APPENDIX