Mission Report Tanzania

Scoping Mission Marine Fisheries Tanzania

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Contents

Summary

This report contains the findings of a scoping study into the marine fisheries sector of Tanzania which took place between October 17 and 21 2016. Wageningen Marine Research was asked to carry out this study by The Dutch Embassy and the Dutch Ministry of Economic Affairs. The study was to be directed at describing the Kenyan and Tanzanian fisheries sector and at sketching opportunities for cooperation. The main findings can be summarised as follows:

From a food security perspective the mission found that a number of potential (business case) developments can be identified. Improving the utilization of fish catches in Tanzania is seen as the most straightforward action to be undertaken. First, by addressing the problem of post-harvest loss and improved handling of fish. Second, having catches realised by the foreign fleet in the EEZ being landed (and processed) in Tanzania would potentially both increase local fish availability (by using the bycatch of those fisheries for the local market) as well as export earnings. Third, opening up the off-shore area for artisanal fisheries, provided the ecosystem can support this effort, could also result in more fish becoming available for export and the local market.

However any aspect of fisheries improvement, especially in terms of catches should be perceived against a backdrop of a better understanding of the current state of the stocks, preferably by a regional approach (especially for the migratory species), and where possible improve their state by reducing fishing effort, preventing the use of destructive fishing methods (dynamite and too small mesh sizes) as well as counter habitat destruction (including protecting mangroves).

To enable landings of tuna and tuna-like species and by-catches from the off-shore fleet requires the development of appropriate (harbour and processing) infrastructure. This infrastructure could have a spin off on local artisanal fisheries resulting in opening up other/new markets and supplying the market with other (quality) fish products.

Improvements made to either fisheries management or to the fish value chain should be considerate of the aspect of accessibility and affordability of fish. From a food security perspective it would for instance be important to monitor the effect of improvements on the price of fish. Experiences with Marine Protected Areas are perceived to be positive both from the perspective of the recovery of local fish stocks as from the perspective of the fishers. In connection to this it has been discussed whether some of the fisheries (through a Fisheries Improvement Scheme) would be in a position to acquire a Marine Stewardship Council certification for the sustainability of their fisheries. If this could be attained this could potentially open up new market options, such as in the local tourism sector.

Considering aquaculture and mari-culture there are quite some examples of marine aquaculture like the cultures of Milk Fish (*Chanos chanos*), Pearl Oysters (*Margaritifera*) and Tilapia (*Oreochromis niloticus*). Experiments are presently underway with integrated multispecies pond systems where milkfish, rabbit fish, and mullets (*Oedalechilus kesteveni*) are cultivated together with molluscs and seaweeds. Main challenges that need to be overcome are the production of feed, the production in hatcheries of fry and the development of an appropriate rearing system.

A special case stems from the prawn fisheries (*Ferropenaeus indicus, Metapenaeus monoceros, Paneus mono don, P. semisulcatus, P. japonicusis*). Since 2010 the industrial fishery has been closed. Noting the state of the stock it could be considered to study business opportunities in the development of shrimp mari-culture (*Macrobrachium rosenbergii, Metapenaeus monoceros, Penaeus indicus, Penaeus monodon, Penaeus semisulcatus*). There is clearly a market for the produce. There are already private sector operations with commercial farms for prawns at Bagamoyo and Mafia.

Considering Seaweed (*E. Cottonii* and *E. spinosum*) there is extensive experience with the culture. Main markets are the USA and Europe for the extraction of carrageenan polysaccharides as gelling, thickening and emulsifying agents in foods, cosmetics, and pharmaceuticals. Lately seaweed value-added products are produced locally including seaweed soaps (with or without spices), seaweed powder, massage oil, body cream, cakes, cookies, jam, puddings and salads. Of these products soaps, body creams and powder are marketed commercially. Noting the potential of seaweed production and developments on the international market it is worthwhile considering further developing this activity both on Zanzibar as in Tanzanians coastal zone.

As for the evaluation of the Tanzanian Fisheries Master Plan, although the issue was raised during the visit of the ministry, there did not appear to be an urgent need for additional input. However, still if required, methodological input and practical implementation can be considered.

At the policy level there are indeed a number of issues that can be considered. These range from the question whether fisheries policy is supporting fisheries development adequately and sufficiently enabling progress and whether the current Monitoring, Surveillance and Control system is adequate.

Maritime fisheries development potential in Tanzania: business opportunities and improving food security

Below the Development Potential of utilising Tanzania's marine (fish) resources are described. The opportunities identified centre on potential business cases. Yet these opportunities are embedded in a wider scope of improving food security be using the marine (fish) resources. This implies also an active role in this process of not only local and foreign B2B development but also of government and sustainable (marine and fisheries) policy development and implementation and identifying roles for local, national and international NGOs, funding agencies and banks.

The prime scope of opportunities identified lies in improving food security, linking up with the UN Sustainable Development Goals (SDG). By utilising in a sustainable way the potential of marine natural resources and creating a sustainable marine food chain a direct contribution can be provided to SDG 2 (Zero hunger) and 3 (Good Health and Well-being). Creating business opportunities in partnership can directly contribute to SDG 1 (No Poverty) and 17 (Partnerships for the Goals). By devising sustainable exploitation practices embedded in a sustainable management of natural marine resources contributes to SDG 14 (Life Below Water) and, via certification can contribute to SDG 12 (Responsible Consumption and Production).

The identified opportunities lie in the realm of:

- *Improving the utilization of fish catches: addressing post-harvest loss and improved handling of fish. Landing of catches realised by the foreign fleet in the EEZ: using the bycatch and export earnings. Requires the development of appropriate (harbour and processing) infrastructure. This infrastructure could have a spin off on local artisanal fisheries resulting in opening up other/new markets and supplying the market with other (quality) fish products.*
- *Off-shore artisanal fisheries, provided the ecosystem can support this effort.*
- *These developments require a better understanding of the current state of the stocks, preferably by a regional approach (especially for the migratory species), and where possible improve their state by reducing fishing effort, preventing the use of destructive fishing methods (dynamite and too small mesh sizes) as well as counter habitat destruction (including protecting mangroves).*
- *To enable landings of tuna and tuna-like species and by-catches from the off-shore fleet; requires development of infrastructure and processing facilities.*
- *Acquire (Marine Stewardship Council) certification: open up new market options, such as in the local tourism sector.*
- *Aquaculture and mariculture potential for Milk Fish, Pearl Oysters and Tilapia. Experiments with integrated multispecies pond systems where milkfish, rabbit fish, and mullets are cultivated together with molluscs and seaweeds. Main challenges that need to be overcome are the production of feed, the production in hatcheries of fry and the development of an appropriate rearing system.*
- *There is clearly a market for shrimp mariculture. There are already private sector operations with commercial farms for prawns.*
- *Noting the potential of seaweed production and developments on the international market it is worthwhile considering further developing this activity both on Zanzibar as in Tanzania's coastal zone.*

Part of these developments could be based on international cooperation in the region. For example in stock assessment and (international) fisheries management in the region cooperation could be extended. Also in the development of a local off-shore (tuna) fisheries cooperating with neighbouring countries could be beneficial. The latter for example in the development of harbour and processing facilities. Noting scale of production the development of aquaculture in the region, and especially investments in the production of feed and a feed mill could well benefit from international cooperation. Likewise the scale of seaweed production and the establishment of production and processing facilities could benefit from international cooperation.

1 Introduction

The Dutch Embassy and the Dutch Ministry of Economic Affairs, which have played a leading role in realising the Global Oceans Action Summit for Food Security and Blue Growth in 2014, have an interest in building on the potential of Kenya's and Tanzania's fisheries. In order to encourage the process, Wageningen Marine Research has been asked to implement a scoping study directed at describing the Kenyan and Tanzanian fisheries sector and at sketching opportunities for cooperation. In addition, the Embassy has discussed the idea with the Ministry of fisheries in both countries. Kenia expressed interest in two actions: a blue book of all stakeholders in Kenyan fisheries and advice on how to finalize the Masterplan Fisheries. Tanzania expressed interest in advice on how best to evaluate the current Masterplan Fisheries that will end in June 2016. Both countries thought a regional approach to fisheries was meaningful, so in this scoping study we will also see which opportunities exist for further cooperation between the two countries.

This report contains the findings of the first leg of this mission: the scoping study into the marine fisheries sector of Tanzania. Fisheries in Tanzania are of importance both in terms of providing food and valuable animal proteins, income and employment. Especially inland freshwater fisheries is of significant importance supplying up to 86% of total catches (Ministry Of Livestock and Fisheries Development Fisheries Development Division 2014) . The marine sector is divided in an artisanal subsector and industrial subsector fishing in territorial waters and even beyond Tanzania's Exclusive Economic Zone. Fishing is an important livelihood in coastal rural areas.

The overall Terms of Reference for the triplet of two scoping missions and one international workshop are as follows:

The overall aim is to perceive development potential in the fisheries sector in both countries in terms of business opportunities and improving food security. The scoping study will comprise of four activities:

1. A description of the marine fisheries sectors in both countries, describing the importance for the economy and for food security.
    a. A list of key stakeholders in marine fisheries (research institutes, private sector companies, NGO's and government institutions)
2. Advice on the Masterplan:
    a. Delivering expert knowledge to advice the Kenyan Government how to finalize the Masterplan Fisheries and how it can be implemented in a participatory way.
    b. Delivering expert knowledge to advice the Tanzanian Government how to evaluate the Masterplan Fisheries.
3. Describe opportunities for regional cooperation in managing fisheries.
4. Identify business opportunities for Dutch companies in the marine fishing sectors in both countries.

In this report for Tanzania we will address mainly items 1, 2b and 4. Item 3 will be focal point during the international workshop to be implemented in 2017.

The mission took place between October 17 and 21 2016. Prior to the mission a literature study was done (see annex 1). During the mission interviews were held with a variety of stakeholders (Government, NGO's, funding organisations, science, The Port and a diverse group of stakeholders from fish chain) as well as 2 workshops were held (see annex 2 for a list of people and organisations met); one on Zanzibar and one in Dar es Salam. A detailed programme can be found in annex 4, in annex 3 notes on meetings and workshops can be found. The mission was implemented by Dr Marloes Kraan and Dr Ir Luc van Hoof of Wageningen Marine Research.

The consultants wish to express their gratitude to all of the people involved in this mission. Especially all of the fishers, traders, officials, scholars, business men, NGOs and all others that took time and effort to meet with us and discuss Tanzanian Marine Fisheries in an open and constructive way. A special word of appreciation goes to the staff of the Dutch Embassy in Kenya and Tanzania, who not only enabled our visit but made it into a very smooth and enjoyable undertaking.

2 Main Findings

2.1 Tanzanian Fisheries Sector

Tanzania has a coastline of 850 km and numerous islands, including the three large ones: Pemba, Zanzibar and Mafia (Jiddawi and Öhman, 2002). Fisheries in Tanzania are of importance both in terms of providing food and valuable animal proteins, income and employment. Especially Lake Victoria is important with 63% of the main landings derived from the lake in 2013, but combined with fisheries on other lakes and rivers, inland fisheries dominate catches up to 86% (Ministry Of Livestock and Fisheries Development Fisheries Development Division 2014). The marine sector is divided in an artisanal subsector, with fishermen mainly fishing within the territorial waters (12 nautical miles) for fin fish and shrimps, and an industrial subsector fishing in territorial waters and even beyond Tanzania's Exclusive Economic Zone (see figure 1).

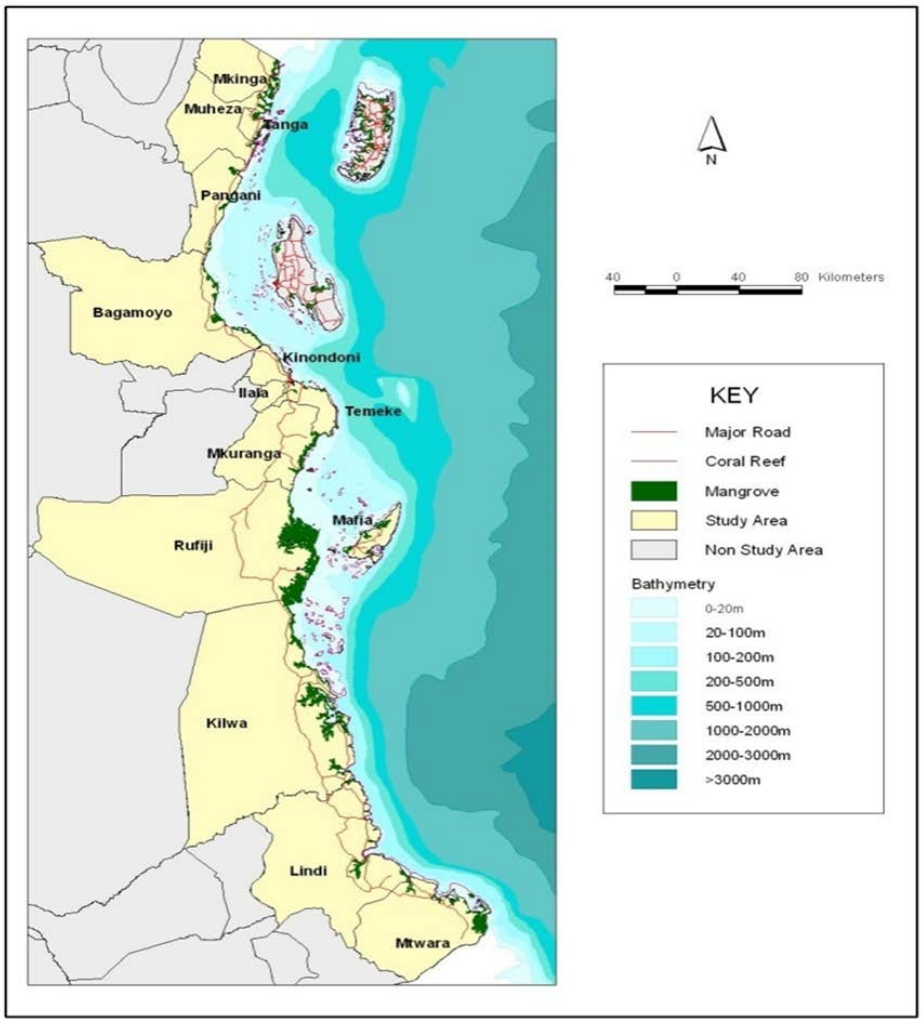

Figure 1. *Tanzanian coastal zone.*

Artisanal fisheries mainly take place in inshore shallow waters around coral reefs, mangrove creeks, sea grass beds and sand banks, fishing for the species linked to these habitats, but also for small pelagics. This (limitation to shallow waters) can be linked to the limited range of the traditional vessels (see table 1), with 90% propelled by sails, paddles and long poles (Jiddawi and Őhman 2002:521), and the limited range of the continental shelf (Jiddawi and Őhman 2002:519). It is only a limited number of fishermen that target large pelagics in slightly deeper waters as well as 12 licenced

industrial vessels (2002 data) fishing in the Tanzanian EEZ (Jiddawi and Őhman 2002:519). Artisanal fishing is done by local coastal communities and by migrant fishermen. Fishing seasons are influenced by the monsoon winds, which also has effect on the migration of fishermen (dago). The fishermen of Kojani from Pemba are most known as migrant fishermen and go as far as Mozambique and Kenya (Jiddawi and Őhman 2002: 520).

The fleet fishing far out fishes mainly for tuna (yellow fin tuna (*thunnus albacares*), skip jack tuna (*katsuwonus pelamis*), big eye tuna (*thunnus obesus*)), tuna-like species, marlin (*istiophoridae spp.*), swordfish (*xiphias gladius*) and sharks. This is mainly for the export. Within the EEZ fishermen fish for shellfish, cephalopods and crabs (FAO, 2007). Inland and marine fisheries combined, 183 223 people work as fisherman (Tanzanian Fisheries Statistics Section 2014) (Ministry Of Livestock and Fisheries Development Fisheries Development Division 2014). Fishing is an important livelihood in rural areas, with about 2 000 000 people working in ancillary activities in fishing communities (food vending, petty businesses). The FAO country profile describes many investment opportunities in Tanzania's fishing sector, such as in fishing for pelagics and processing fish (FAO 2007). The demand for fish products is high in Tanzania, the per capita consumption of fish was estimated at 7.7 kg in 2013 (Tanzanian Fisheries Statistics Section 2014) (Ministry Of Livestock and Fisheries Development Fisheries Development Division 2014).

The mission looked into both Tanzanian main land fisheries and Zanzibar fisheries. Zanzibar is a semi-autonomous part of Tanzania and has autonomy in non-union matters including the management of marine resources. Although natural resource management issues are not considered a union matter, there is communication and coordination with the mainland and a common agreement trying to reach harmonization on organizational structures and management approaches, mainly in terms of deep sea fishing affecting the Exclusive Economic Zone (EEZ) (de la Torre-Castro, 2006).

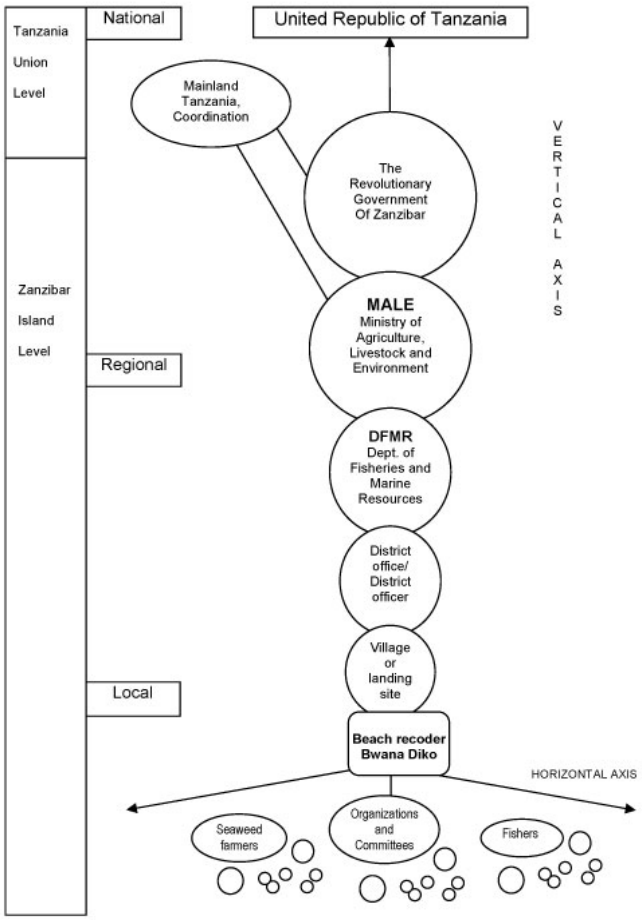

Figure 2. *Organisational structure fisheries management (de la Torre-Castro, 2006)*

Artisanal fishing methods in Zanzibar produce an estimated 14,000 t/yr. and are reported to provide a source of income to about 14% of the population (FAO, 1994 as quoted by (FAO, 2007; Jiddawi et al., 2002). These fisheries provide the major source of protein for most inhabitants, and virtually the only source of animal protein for low income groups (Jiddawi and Öhman, 2002).

In terms of food security, figures including fresh water fish catches, Tanzanian fish consumption stands at 700,000 tonnes (about 8 kg per person / year), and production is 370,000 tonnes. Part of the production is being exported and quite a large share for consumption is being imported (Ministry Of Livestock and Fisheries Development Fisheries Development Division 2014). In 2015 1,203,126 kg of *marine* fish was exported, mostly frozen fish (prawns, lobster, octopus, squid), but also dried (*dagaa*) and live crabs. And 16,743,964 kg was imported, mostly frozen pacific mackerel (12 million kg) (data received from the ministry).

2.2 Marine fisheries sector potential

A rough division of the fisheries sector can be made between inshore artisanal fisheries, shrimp trawling and the larger pelagic fisheries in the EEZ mainly for tuna and tuna-like species. More details can be found in the literature summary brief produced during the mission attached as annex 1 to this report.

The artisanal fisheries sector mainly operates in-shore and does not go out at sea very far: usually stays within the 2 nautical mile (nm) range. Fishers use many different techniques and fish on a typical tropical stock aggregate. Some 500 different species are fished commercially. Different vessels are used for catching different types of fish. For example the outrigger canoes mainly target nearshore species such as snappers, emperors, rabbitfish, and groupers whereas the dhows and bigger boats catch the offshore larger fish such as marlin, kingfish, sailfish, and tuna.

Middlemen and traders play an important role in the artisanal fishery in providing an opportunity for those fishermen who cannot afford to buy gear or vessels. A middleman usually owns the expensive gear and vessels, such as the seine or gill net and boats or *dhows*. He partners with the fishermen such that the money obtained from the catch is divided into three parts. One part goes to the middlemen, one is kept for the maintenance of the boat and gear and one part is for all the fishermen on the boat regardless of their number. The traders then distribute the fish inland (Jiddawi and Öhman, 2002).

After landing, fish is stored in a variety of ways, but the greatest proportion of fish catch is sold directly and not stored at all (58%). The primary methods for storing fish are smoking, frying, sun drying, and salting (Tobey and Torell, 2006). Most of the fishing by small-scale/artisanal fishers is largely market oriented, although it is still significant to household subsistence. Market linkages therefore form the most important part of mainland fishing livelihoods and contribute a significant percentage of local incomes. This is however limited by poor mechanisms for transportation including preservation for fresh produce (fish and other marine products). Fish and marine products are collected at landing sites by fishmongers, middle-persons or agents and sent to the market by sea or road to Kigamboni market which serves as the hub of fresh fish from as far as Lindi (Kilwa in the south) to Mafia island and Bagamoyo, or to processors in the various processing plants in mainland Tanzania (e.g. TANPESCA processing factory, Mafia). This pattern is restrictive or too expensive to be handled by many fishers, and has therefore created dependency on middle-persons some of whom maintain a patron-client relationship or bond, often exploitative and hence lowering local incomes. Only a few fishers had been able to take advantage of MACEMP support to establish their own marketing links. The increasing availability of micro-credit facilities (SACCOS, VICOBA) and money transfer facilities may provide opportunities for improving people's access to more efficient production equipment to enhance their livelihoods but this is yet to become evident for the larger population (Nordic Development Fund, 2014).

Table 1. *Fishing vessels used by artisanal fishermen in Tanzania. Source: Jiddawi and Őhman 2002: 521).*

Vessel	**Details**
Canoe (*Mtumbwi*)	Made up from a single log. The bottom is usually flattened for stability. No outriggers.
Outrigger canoe (*Ngalawa*)	Made up from a single log. Have outriggers which provide additional stability to these vessels.
Dhow (*Dau*)	Constructed out of timber planks. Bow is more pointed than the *Mashua* and the stem is rounded or pointed.
Boat (*Mashua*)	Constructed out of timber planks. The stem is square.
Dinghy (*Hori*)	Very small boat which accompanies bigger boats in the light attracting fishery. Constructed from plywood and planks.

Table 2. *Types of fishing gear used by artisanal fishermen in Tanzania. Source: Jiddawi and Őhman 2002: 520.*

Type of gear	Associated gears	Comments
Gill nets *Jarife*	Drift gillnet Demersal gillnet (large mesh) or Shark nets, Demersal gill nets (small mesh)	Used in tidal, sub-tidal and reef areas to capture fish moving with the tides. Target species are tuna, billfish, kingfish and sharks. Have high incidental capture of turtles and dolphins.
Cast nets *Kimia*		Used in sheltered areas. A circular net that is thrown over a shoal of fish or allowed to sink to the bottom. Closed when retrieved. Catches small fish such as eels, catfish, mullet, silver biddy, and shrimps.
Seine nets *Nyavu*	Purse seine Ring nets Beach seine	Use light to attract pelagic fish on moonless nights. Catch rate is 500–3000 kg net^{-1}. Beach seine is illegal in Zanzibar and only permitted in unnhabited islets. Nets are 50–100 m with long warps. Usually it is dragged onto the beach.
Drag nets *Kavogo Kigumi*	Any seine net can be used as a drag net	This method is illegal. Nets may be assisted by divers to untangle chase and retain fish Can be 50–100 m with long warps. Runs on the bottom Nets are set from a boat or from the beach. May use two vessels.
Scoop nets Senga		Used in catching small pelagic fish in the light attracting fishery. Mean catch rate is 60 kg boat^{-1} day^{-1}.
Basket traps *Dema, towe*	Large ones (*dema*), small ones (*towe*)	Hexagonal in shape with a single opening. Traps are usually set in seagrass beds, among wild or cultured seaweed, or coral reefs. The *dema* mean catch rate is 1–2 kg trap^{-1}.
Fixed traps (weir, fence) (*uzio, wando*)		Usually made up of mangrove stick or palm frond midrib. They are semi-permanent stake traps that are set in intertidal areas especially in sheltered areas. Catch rate varies from 12–100 kg trap^{-1}.
Handline *Mshipi*		Common fishery, probably found in every fishing vessel. Can be used from a vessel or from the shore. Currently important as a sport fishery in the tourist industry at several sites.
Longlines *Dhulumati*	Surface long line Bottom longline	Mostly for catching tuna especially by industrial vessels in the offshore waters. Used by artisanal fishermen for catching demersal fish.
Troll lines *Kurambaza*		Usually use artificial lures in catching fish such as tuna.
Octopus spearing *Mkuki/kijiti*	Spear, stick	A spear is made up of a stick with a sharp end or a piece of iron is inserted at the tip. *Kijiti* is a stick. Collection is done by diving or on exposed reefs. 4–7 kg person^{-1} day^{-1}.
Harpoons *Bunduki, mshare*	Spear gun. By skin diving using locally made masks	Illegal fishing technique which is banned in Tanzania but is still in use. Used for catching lobster and reef fish.
Mosquito net *Utazi wa juu* *Utazi wa chini*	Sheets of fine netting (mosquito nets) or a big piece of cloth 2 to 10 m long	One is used during neap tides and one during spring tides. Used by women in intertidal areas. Nets are held by several women. Others approach this sheet over a decreasing circle, splashing and making noise to chase fish into the net. Catch rate is 2–17 kg of fish net $^{-1}$ set, 5–20 kg *Acetes* net $^{-1}$.
Machete (*panga*) *Mwenge* (torch)	Machete Torch	Use a torch made of burning coconut leaves to attract fish- also use a machete to slash at fish. Average catch is of 7 kg day^{-1}.
Trawl net		Used in small to medium sized vessels. Have specialized prawn trawling nets with an average length of 38 m and 5 cm mesh. Operate in waters 5–15 m deep. Fish by-catch accounts for part of the catch.

The EEZ fisheries are conducted by a foreign fleet operating under licence from the Tanzanian government. Currently a Sustainable Fisheries Partnership Agreement (SFPA) is being negotiated with the EU. Catches of the tuna fleet are not landed in Tanzania. Partly because there is no proper infrastructure available for docking and processing, partly because the foreign fleet does have their own routine in landing catches in the region; mainly in the Seychelles. In 2015 EU vessels caught

8243 tons of fish in the Tanzanian EEZ (mostly skipjack, yellow fin and big eye tuna) (data provided by the EU Delegation in Dar es Salam).

As for the artisanal inshore fisheries, there are signs of overfishing. Fisheries landing statistics show with an increase in effort (doubling of the number of fishermen) a reduction in the catch per unit effort (see Jiddawi and Őhman 2002 for some CPUE estimates). In addition individual fish size is being reduced. Both are clear signs of overfishing.

In general any analysis is based on landing statistics. A comprehensive survey has not been undertaken in the region for many decades. Hence there is no proper assessment of stocks and the carrying capacity of the ecosystem.

A lot of work has been conducted in Tanzania on monitoring the artisanal fisheries resources. Most of the data collected are from short-term projects with specific goals. Government sponsored projects cover a range of subjects but due to resource constraints the information in most cases is not synthesized. The Fisheries Development Division, apart from dealing with all matters related to fisheries sector, is also the custodian of fisheries statistics and has obligation to collect, analyse, manage, and disseminate fisheries statistics to various stakeholders. The fishery resources of Tanzania have been monitored (via landings data) since before 1960 and the estimated yearly fish productions have been used in planning and management of fishery resources (Sobo, 2012). The artisanal fishery in Tanzania is mainly monitored through two main types of surveys namely the frame survey, which monitors the fishing effort, and the catch assessment survey, for monitoring catch landings (Hamidu and Singh, 2012).

Experiencers with MPAs, such as Mafia Island, show that with limitations in local fishing effort the stocks and stock assembly do recover. One of the main contributors to overfishing was identified by many people as the open access nature of the fisheries. In Tanzania, entry into the marine artisanal fishery is open access in nature, leading to increased fishing effort which is subject to inefficient management control thus, leading to potential problems of over exploitation (Hamidu and Singh, 2012). Although government uses a licence system to regulate entrance to the fisheries, the enforcement system is hardly equipped to implement effective Monitoring, Surveillance and Control (MCS).

In its own fisheries management plan (2011) the ministry identified the following key issues in fisheries development:

1. Fundamentally open access nature of fishery hampers any effective MCS , no database of fishers and fishing vessels exists
2. Beach Management Units (see 2.9) not achieving objectives
3. No effective national data strategy for monitoring of fishery sectors
4. Lack of buy in at senior political level for importance of fisheries in Tanzania
5. Policy and legislation require updating.
6. Lack of specific MCS strategic plans in fisheries management plans
7. Lack of economic and social information on the different fishery sectors to guide and inform MCS strategy
8. Judiciary and MCS officers often not trained in dealing with fisheries offences

During discussions and during the two workshops implemented the following issues were mentioned as to be addressed in marine fisheries development:

- EEZ fisheries
    - Development of Tanzanian Tuna Fleet
    - Harbour development
    - Processing facilities
- Artisanal fisheries
    - Over-fishing, bycatch and environmental degradation
    - Post-harvest losses
    - Internal market (food security) or exports/tourism?
    - Competition between modes of fishing
- Opening up off shore fisheries
- Developing the artisanal fish chain
- Mariculture and Seaweed farming
    - Prawn fisheries and culture

- Seaweed farming
- Fisheries management issues

These topics will be discussed in the following sections in this chapter. The final chapter will discuss fisheries development in relation to food security.

2.3 Fishing in the EEZ

The tuna fisheries in Tanzanian EEZ is exclusively exploited by foreign fishing vessels (Mngulwi 2003 in (Hamidu and Singh, 2012). It comprises purse seiners and long-liners that are licensed by the Deep Sea Fishing Authority. In 2007 there were around 70-80 vessels licensed. These vessels usually operate beyond the Territorial Sea (12 nm), mostly in the wider EEZ. There may also be 4-5 deep-water trawlers licensed to trawl at depths of 300-500 m (Muhando, C. and Rumisha, C.K. (2008).

Next to the licence fee the Tanzanian government collects, the licence in principal obliges the tuna vessels to land all by-catches in Tanzanian ports. This could be a valuable addition of available fish on the local market, although of course the effect on prices and availability of other fish products from the artisanal fleet should be taken into account to assess whether a net overall societal benefit can be achieved. However, since currently there are no proper port and processing facilities available these vessels never dock in Tanzania and hence never land by-catches.

During our mission week, several ideas were generated to address the tuna fisheries development.

2.3.1 Development of Tanzanian Tuna Fleet

One of the ideas mentioned was to develop a Tanzanian based tuna fleet. This fleet could replace the current foreign vessels operating in the Tanzanian EEZ and ensure landings of valuable fish for export earnings and for supply of the local market.

However, this would require a major investment in a fleet and in fleet development. This could entail developing an own tuna fishing fleet from scratch or trying to persuade vessels to relocate from current harbours to Tanzania. But what counts for the current fleet would also count for this newly to develop fleet: there is a lack of landing and processing facilities.

In addition, if we look at the current negotiations between Tanzanian Government and the EU concerning a SFPA, the catches realised by the EU vessels in Tanzanian waters account for approximately 2% of total catches realised by this fleet in the Indian Ocean. Turning this around, if a Tanzanian based fleet would be developed, this fleet would have to negotiate with the other countries in the region access rights in these EEZs.

2.3.2 Harbour development

Currently there is a lack of infrastructure for trawlers to dock and land catches in Tanzania. There are apparently plans to upgrade the harbour infrastructure to enable landings of the trawler fleet. This indeed could enable the development of a fish industry with focus on the EEZ resources.

2.3.3 Processing facilities

Next to harbour facilities there would be need for the development of proper processing facilities. In fact it is worth looking into the possibilities to attract fishing companies that are interested in developing a full fish marketing chain, from EEZ catches via landings and processing to supplying local markets and exporting fish and fish products. This kind of development has already taken place on Africa's West Coast.

When processing facilities and a market channel are developed this could also become an attractive alternative channel for other fisheries such as the artisanal fisheries located in the proximity of harbour and facilities.

Possible spin off of this development could be an increase in available fish on the market, an increase in quality of the fish and fish products and potentially an increase in export earnings. However, as mentioned above, this development requires quite an extensive investment. And a main question is whether indeed existing fishing and landing patterns of the international fleet can be altered. Also an important question to address is where to base this harbour: in Dar es Salaam (with limited space for expansion), another location along the Tanzanian coast or on Zanzibar.

2.4 Artisanal Fisheries

First it should be noted that below some general ideas about the artisanal fishing sector are being formulated. The consultants are very much aware of the fact that there is no ONE artisanal fishing sector and that regional differences can be very extensive both in terms of available fishing grounds and stocks, fishing conditions, landing and processing conditions and marketing conditions. The landing sites visited during the mission were located near urban centres and hence are not representative for the longer coast and fishing communities further away from urban centres.

2.4.1 Over-fishing, bycatch and environmental degradation

In general there is agreement on the problem of overfishing. Over the past years with a growing population and an even more rapidly expanding population in the coastal zone the number of fishers and hence fishing effort has increased dramatically resulting in dwindling catches. Also illegal fishing practices, such as using too small meshes, or beach seines and dynamite fishing, have an impact on the ecosystem, especially on the coral reefs, yet remain largely unmanaged.

Apart from fisheries, there is also the problem of turtle meat consumption, egg poaching and bycatches of dugong (*dugong dugon*), sharks and dolphins (Interview with WWF and workshop Zanzibar).

Signs of environmental degradation, as well as a decline in natural resources and biodiversity, are beginning to become more obvious. This is evidenced by declining yields of fish, deteriorating conditions of coral reefs, and continuing reduction in the area of mangroves and coastal forests. Seagrass beds have been negatively impacted by prawn fisheries. And there is a general problem of waste management, marine debris. This degradation is attributed to unsustainable use of coastal resources as well as pressures from the growing coastal population (Bryceson and Francis, 2000).

2.4.2 Post-harvest losses

Post-harvest losses are perceived to be an issue to be addressed. Fishers and traders claim post-harvest losses to range from 25-50% of catches, mainly due to ill-treating catches on board, poor processing facilities and practices and losses further up the marketing chain in transport and trade.

If post-harvest losses go as far as 50% on average, then this is really remarkably high. If on average post-harvest losses range around 25%, this although still a substantial loss, is in line with reports world wide of post-harvest losses in artisanal fisheries. However, from the discussions quite a bit more nuance in this picture appears. For example in some occasions, for instance in the rainy season, fishers land and try to sell catches but reach a market in which prices are very low and buyers are not available. Some fish species are primarily processed by sun drying, in the rainy season this is not possible, so prices are then extremely low. Indeed this constitutes a loss of harvest of 100%, but appears to be incidental.

In addition, many people referred to post-harvest losses as a loss in quality of the product. Hence not the entire product being spoiled but being of a lower quality, yet still available for consumption. Post-harvest loss thus is also associated with discussions around fish quality, supplying a market with preferred fresh fish or supplying a market with a processed product with a longer shelf life.

It is clear that in the artisanal fish marketing chain a gain in available produce at the market could be achieved by addressing the issue of post-harvest loss. This ranges from addressing stowing and storing conditions on board vessels (or in most cases the lack thereof), handling of fish on board and during first sales, method and practices of processing the fish and method and practices in storage and trade.

Especially for the more remote rural fishing communities it is worthwhile to undertake a separate scoping mission to investigate local conditions. We visited two market places in urban or nearby urban centres (see box 1). In many rural landing sites there are often hardly any landing and market facilities with fish being landed at the beach. In relation to this it may be considered to organise inter-fisheries visits, for example across fishing communities along the Tanzanian and Zanzibar coast but also exchange visits with fishers from example the West African coast, operating in an entire different setting.

For the more urban oriented fishers cold storage facilities could be a main factor in addressing post-harvest losses. Proper storage facilities can reduce losses and at the same time provide the fishers with the capacity to store produce for a period of time which may allow them to better respond to developments in the market and for example clearly reduce losses when a glut in the market appears. Whether this technical solution is feasible or not, depends on more aspects than technical and logistical elements (i.e. availability of electricity) alone. Aspects like the financial space in the market and the financial capabilities of the fishers; often delayed sales, or additional storage costs are unaffordable for local fishers and consumers. The delayed sales problem can be solved by having a trader buying the fish from the fishermen for a stable price, who then will store the fish. The question - will it be economically viable - remains.

Box 1 – Markets

Ferry Fish Market

We visited the Ferry Fish Market in Dar es Salam. The day we visited the market the management of the market would be transferred from the Ilala Municipal Council to a new management board. The market was set up at this location in the 1950ies and the new structure that we visited was built in 2002. The market was divided in 8 zones:

1.Auction hall

2.Fish preparation area

3.Fresh fish retail

4.Cafeteria

5.Sea shells, vegetable, fruits and groceries

6.Fish fry building

7.Mixed product shops

8.Fish landing site

The market appeared to be very well organised (for instance with appointed ward managers), was kept clean and appeared to be well used. At the auction space (ward 1) we could see that not only artisanal marine fish species were landed and auctioned, but also fish from the lakes (Nile perch heads) and deep frozen imports (from China in boxes; mackerel). It was mentioned that fish was also imported from India and Mozambique. We saw many different species being auctioned, processed and sold (tuna, many sardine like species, blue fish, cuttle fish, nile perch, mackerel, etc). Fisheries officers are active at the market checking the registration of the fishing vessels coming in, collecting revenues (5% of the total sale of the catch), checking and noting the species landed and controlling whether the fish was caught legally (if fish is caught by using dynamite, this is often visible – broken back or bloody gills). After the fish is bought at the auction space, the fish can be further processed in the fish preparation area (ward 2). Fish were there seen to be cleaned, scaled and cut into smaller pieces. Further processing could be done at the fish frying area (ward 6). Or the fish could be resold further in the fresh fish retail area (ward 3). The cafeteria area was quite large, with many women preparing food (all wearing white chef hats and white aprons), and fishermen, traders and customers coming to eat. When we visited on Tuesday morning (around 9.00) the auction area was not busy anymore, when we revisited Friday morning at 6.00 o'clock the auction was packed with many traders, auctioneers and fishermen landing their fish.

Mazizini (Zanzibar)

At Mazizini we visited the market place. This more rural fishing village (compared to Dar es Salam) had a relatively new market building where the fish was auctioned and prepared after it was bought. There were 6 stone counters where fish was prepared (gutted, cleaned of the scales and chopped into smaller pieces). Cats were eating whatever fell on the floor. There was a small podium in one corner where the auctioneers stood showing the bundles of fish to the crowd of traders / customers. The men standing in front of the podium, the women sitting at the side of the podium. Three men were simultaneously auctioning the catch of the day, surrounded by traders. It was a lively auction, with a continuous stream of fish being brought in, nicely ordered in bundles of fish of different species and sizes. Sometimes larger 2 fish in a bundle, sometimes 40 smaller fish. The auctioneers would start with a price and then they would go up with steps of 1000, until someone would shout to buy. Bundles of money would be thrown over to the auctioneers after which the fish was sold. In a discussion we had later with some representatives of the village and market, we heard that managing the market place posed some challenges. Electricity was not arranged yet, and keeping the market place clean was difficult.

2.4.3 Internal market (food security) or exports/tourism?

A crucial question that needs to be addressed is the competition over marine resources and their use. The competition between fishers and modes of fishing will be addressed below. Here we will briefly dwell on the question of which markets to supply.

In Tanzania increasingly fishers supply a market aimed at the tourism sector and the export market. Whereas directly and indirectly these are export earners, they are in competition with the supply of the local market. Although more research into the actual situation and its ramifications is required, several respondents reported that today the price of fish in Tanzania has developed to a level that it is no longer a relatively cheap source of protein. There is claim of fish no longer being available and affordable for the poorer segments of society that in the past used these as main protein source.

However, with an increased production for the export / tourist market fishers could in principal earn a larger income. This would enable them to further invest in development of the fisheries. This is a very complex issue to consider: the balance between local supply and for foreign markets, rural versus urban supply and development of a fishing fleet in light of the current state of the stocks.

In addition, with a growing tourism sector there are reports of conflicts between the two sectors: tourism and fisheries. This ranges from tourists and tourist activities disturbing fishing grounds and fishing gear to the tourism industry taking over local beach sites rendering them no longer accessible for local fishers.

2.4.4 Competition between modes of fishing

This entails three distinct forms of competition: competition between different fisheries, competition between sedentary and migrating fishers (see box 2) and competition between fishers due to growth in the number of fishermen. The first, competition between fisheries, was most distinct between the prawn and shrimp trawlers and artisanal fishers. However, this problem was addressed by allowing trawling during the day time and artisanal fisheries during the night. And in addition, due to the state of the stocks, the industrial prawn fishery has folded. Others can be gear conflicts between trap fishermen and mobile net fishers. The traps are set in the evening and then hauled in the following morning, but in some cases their traps get scooped up by mobile net fishermen (Mazizini visit).

The second competition, between sedentary and migrant fishers, is mentioned quite often as problematic. It entails competition over fishing grounds and hence access to the resource. But it also alludes to perceived social problems with migrating fishers. This is a phenomenon that needs further analysis before appropriate actions can be considered.

Box 2 *Dago* – migrant fishers

"This movement locally known as *dago* is an important characteristic of many fisheries in Tanzania. It has resulted in a localized increase of fishing effort in some areas during certain periods of the year and has been the cause of fishery conflicts with local communities. (…)The fishermen of Kojani from Pemba who are famous migrating fishermen are known to travel long distances as far south as Mozambique and up to the northern border of Kenya" (Jiddawi and Öhman, 2002).

The third competition, between fishers in general (thus for instance also between fishers using the same gears) is also playing a role. Due to rising number of fishers, in combination with catches levelling off or declining, competition between fishers is growing. The prevalent use of illegal gears is an indicator of increased competition.

2.5 Opening up off shore fisheries

A suggestion made many times by different types of stakeholders was facilitating a new fishery in the off shore area. The rationale behind the suggestion was that in the in-shore area there is overfishing and a very high fishing pressure from a large number of fishers. Yet the zone between 4 -50 nm is currently not being used by the artisanal fleet due to lack of appropriate equipment and fishing practices. The artisanal fisheries perceive the investments needed (boat, engine, fishing gear, storage facilities on board) as too large for them to fund without outside assistance.

In principle the idea of opening up new fishing grounds sounds promising. Especially when it concerns areas as yet not fished or not heavily fished and with fish stocks that can accommodate an increase in fishing pressure. In fact, noting the fishing pressure in the in-shore area (0-4 nm), which is the nursery and spawning area for many species, and the damage done to the coral reefs, reducing fishing pressure in this zone makes sense. However, just reducing fishing effort without providing alternative sources of income for the displaced fishers, although from an ecosystem perspective direly needed, seems unfeasible from a social context. Thus displacing this effort to the more off-shore area can be considered. However, as there is currently no stock assessment being done, there is no information available on the state of stocks and fishing opportunities. In fact it might well be that the stocks fished in the in-shore waters and the more off-shore areas are the one and same. Hence geographically spreading fishing pressure will not resolve the pressure on any single stock. On the contrary with a de facto open access situation, fishing pressure is likely to only increase.

In addition, there are currently fishers operating in this off-shore are. Usually doing multiple-day trips storing fish on board in ice boxes. Apparently this fishery does not attract a huge number of followers. Partly this might be because of the quite extensive investments in boat and equipment needed and partly because of the unfamiliarity of the in-shore fishers with off-shore conditions. Yet if this fishery would be highly profitable one would expect to see more fishing operations in this area.

For a more conclusive analysis additional research is required. It would be important to understand why this narrative is so widely shared, understand what is meant by inshore and off-shore (some also include fishing in the EEZ), and get a better picture of the current fishing zones and fisheries operating in them, and of the fish stocks fished and their habitats.

2.6 Developing the artisanal fish chain

Although at this moment not a full picture of the artisanal fisheries chain can be generated, this would need more visits to fishing communities, landing sites and fish markets, still some recommendations can be made for the further development of the chain.

From the post-harvest losses discussion it becomes clear that reducing losses and improving quality of produce are valuable investments in the chain. As mentioned there are quite some notable differences between rural and urban markets. This may call for specific tailor made solutions depending on local circumstances.

Yet if artisanal landings can be aligned with a system of fish processing at a larger scale this may well open up new ways of processing and new markets. One should keep in mind however that currently the information we have on the state of the stocks do not allow for an expansion of the fisheries. However, using the current catches in a more effective and efficient way could result in a net increase in fish supply. In addition it can be considered to expand fish production by way of marine aquaculture.

Box 3: An example of an artisanal fish chain: sardine fisheries

Sardine fishing is done at night from Zanzibar and mafia islands. After fishing the catch is kept in ice boxes for 2-8 days depending on the period of fishing. After fishing they come back to land the fish at the Ferry Fish Market in Dar es Salam. There the catch is sorted out, in buckets, and then the auction takes place. The catch is not stored as there are no facilities for that. All catch is being sold whilst fresh. About 75% of the catch is bought by traders who fry and resell, 15% is bought by consumers, 10% by traders and sold in Dar es Salam up to Morogord. For those who sell and fry, they buy in a bucket. When sold to consumers this is done in portions, a unit is a hand full. Price for small units like that range between 200 shillings up to 1000 shillings. Prices for buckets range between 1000-80.000 a bucket. Sometimes the fish is not sold but given for free! Fish losses between fishing and selling per year average at about 30% but this ranges from 0-100%. They can have 1kg and sell all, or all of the catch gets destroyed. This mainly happens in the rainy season, when buyers cannot process the fish in time. But also when there is a lot of catch, the price goes down. As fishers cannot store the catch to sell later after the glut, they have to accept these low prices. A solution would be to incentivise an investor to invest in storage, packaging and distribution. The investor can offer a more stable price at all seasons, assuming that the business can expand to a market beyond the local market. This would need to be investigated. The investor can offer a stable price to the fishers. Fishers often can't afford to do the storage themselves as they need a cash flow during fishing; they need money to pay fuel, and their crew. A major question is however, is it economically viable? And does the state of the fish stock justify investment in this fish value chain? And an issue to investigate is also what impact will this change in the value chain have on poor local consumers? If a bucket will have a stable higher price, the small traders can't participate anymore which further down the line will impact on poor consumers as well.

Source: one of the cases developed and presented at the stakeholder meeting at the Embassy.

2.7 Mariculture

There are examples of marine aquaculture (Mariculture) in Tanzania. Milk Fish, Pearl Oysters and Tilapia are cultured. This system and also for other species could be extended. This is a development that we see all along Africa's East Coast (Rönnbäck et al., 2002).

Integrated farming systems where several species are co-cultivated in order to improve resource-use efficiency, and reduce waste outputs and environmental impacts are of special interest. Experiments are presently underway with integrated multispecies pond systems at the Institute of Marine Sciences in Zanzibar, where milkfish, rabbit fish, and mullets are cultivated together with molluscs and seaweeds.

Main challenges that need to be overcome are the production of feed, the production in hatcheries of fry and the development of an appropriate rearing system. In this set up the mariculturist usually is specialised in fattening the fish. Fry and feed are purchased from specialised suppliers. The specific equipment, whether for example on land based recirculation systems or cages in the sea, need to be further developed.

Developing a feed factory is a much specialised endeavour for which investments from abroad can be sourced. The study into effective hatcheries for relevant species can be taken up in concert between for example the Ministry, Universities and Wageningen University & Research. In time a specialised company can then be developed/sourced, perhaps in concert with the feed production company and market parties.

2.7.1 Prawn fisheries and culture

A special case stems from the prawn fisheries. Since 2010 the industrial fishery has been closed, through a self-imposed moratorium by the fleet of 20-30 vessels due to reduced catches. In contrast, the artisanal fishery for prawns is un-regulated. It has been mentioned that to a certain extent the industrial prawn companies now involve the artisanal fleet in obtaining product.

However, noting the state of the stock it could be considered to study business opportunities in the development of shrimp mariculture. There is clearly a market for the produce. And worldwide there is ample experience in prawn and shrimp culture. There are private sector operations with commercial farms for prawns at Bagamoyo and Mafia, where several hundred employment opportunities are being realised (Nordic Development Fund, 2014).

2.8 Seaweed farming

As for Seaweed farming on Zanzibar there is extensive experience with the culture. Two species of seaweeds have been farmed since 1989: Eucheuma denticulatum (formerly E. spinosum) and Kappaphycus alvarezii (formerly E. cottonii). These species are found naturally in East Africa although the farmed strains are mainly imported from the Philippines.

The method of farming is the tie-tie system whereby fronds of seaweeds are tied to strings stretched between wooden pegs. These are situated in shallow intertidal lagoons inside the fringing reefs. They grow rapidly (up to 12% per day) and are harvested at spring low tides each fortnight. The seaweeds are then dried by the villagers, sold to agents and exported to USA and Europe for the extraction of carrageenan polysaccharides as gelling, thickening and emulsifying agents in foods, cosmetics, and pharmaceuticals.

Recently there have been problems of slow growth and disease susceptibility has been experienced with Kappaphycus alvarezii (Matern Mtolera, pers. comm.). This may be a monoculture-related syndrome. Despite increasing demand and prices on the world market, prices paid to seaweed farmers in Tanzania have gone down.

Lately working under the Innovation Systems and Cluster Programme (ISCP-Tz), seaweed value-added products are produced with the aim of adding value to the low-priced spinosum. Products that have been produced so far are seaweed soaps (with or without spices), seaweed powder, massage oil, body cream, cakes, cookies, jam, puddings and salads. Of these products soaps, body creams and powder are marketed commercially.

Noting the potential of seaweed production and developments on the international market it is worthwhile considering further developing this activity both on Zanzibar as in Tanzanians coastal zone.

2.9 Fisheries management issues

Tanzania uses a system of Beach Management Units, similar and perceived to be effective in Lake Victoria fisheries management, and similar to the practice in Uganda and Kenya (personal comm.). A Beach Management Unit means a group of devoted stakeholders in a fishing community whose main function is management, conservation and protection of fish in their locality in collaboration with the government (Sobo, 2012). The mission did not provide enough time to visit a relevant sample of BMUs and analyse operations at different parts of the coast (different fisheries, different location vis a vis landing sites and markets). However, as the BMUs are perceived crucial in fisheries management and development it is useful to gain more insight and on a wider scale in its operations. Especially when a

number of BMUs together form an area management entity there is a local based platform for the further development of fisheries management.

Together with the BMUs the local conditions on landing sites, landing, trading and processing practices can be discussed and perhaps result in locally specific plans for fisheries development. This is also the level at which discussions on improvement of the landing sites should be started.

Overall the BMUs we spoke to indicated that illegal fishing practices still are a major problem. Related to that is the observation that the lack of MCS capacity hinders enforcement of rules and controlling of fishing practices. Both on Zanzibar and in Dar es Salam we heard from BMU managers that one of the problems they face is that when fishermen are apprehended using illegal gear, they either get a really low fine or they get to walk away with it. At both landing sites that we visited we could observe illegal fishing gear lying at the beach (traps with too small mesh sizes) or being used (beach seining). The dilemma of illegality was explained well by a group of fishermen we spoke to. Using too small mesh results in catches of smaller fish which is less valuable at the market, but as catches are bigger, the end result is better than using the right mesh (Mazizini visit and Dar es Salam fish market visit).

Experiences with MPAs are perceived to be positive both from the perspective of the recovery of local fish stocks as form the perspective of the fishers. In connection to this, it has been discussed during the mission whether some of the fisheries would be in a position to acquire a Marine Stewardship Council certification for the sustainability of their fisheries. If this could be attained this could potentially open up new market options, such as in the local tourism sector.

3 Food security and fisheries development

From a food security perspective the mission found that a number of potential (business case) developments can be identified. Food security is related to four aspects: availability, accessibility and affordability, and utilization and stability (see box 4).

Box 4: Fish and food security

- Availability:
  - Improve productivity aquaculture (quantity)
  - Improve management of fisheries, resulting in more fish availability over time
  - Reduce loss of fish (discards, post harvest)
- Accessibility, affordability
  - Improve how fish can reach the poor consumers
  - Make sure that fish is affordable to (poor) consumers
- Utilization
  - Improve post harvest treatment (quality)
  - Improvements in the value chain (quality)
- Stability
  - Management of fisheries
  - Management of aquaculture
  - Value chain improvements

Source: Feeding 9 billion by 2050 – Putting fish back at the menu. (Béné et al., 2015)

Improving the utilization of fish in Tanzania is seen as the most straightforward action to be undertaken. First by addressing the problem of post-harvest loss and improved handling of fish. This issue was also mentioned often by different stakeholders both in Tanzania as on Zanzibar. It can result in relatively more fish and higher quality fish coming available through improved handling and processing practices throughout the entire chain.

Second by having catches of the EEZ being landed in Tanzania. This would potentially both increase local fish availability (by using the bycatch of those fisheries for the local market) as well as export earnings. Necessary infrastructure could have a spin off on local artisanal fisheries resulting in opening up other/new markets and supplying the market with other (quality) fish products.

The issue of availability of fish and stability is however also important and should also be considered when assessing fisheries management with a food security lens. It would be important to get a better understanding of the state of the stocks, preferably by a regional approach (especially for the migratory species), and where possible improve their state by reducing fishing effort, preventing the use of destructive fishing methods (dynamite and too small mesh sizes) as well as counter habitat destruction (including protecting mangroves).

Improvements made to either fisheries management or to the fish value chain should be considerate of the aspect of accessibility and affordability. From a food security perspective it would for instance be important to monitor the effect of improvements on the price of fish.

Opening up the off-shore area for artisanal fisheries, provided the ecosystem can support this effort, could also result in more fish becoming available for export and the local market.

However, the back drop to these developments is the state of the stocks and the fact that since the 1980s no stock assessment has been implemented. Yet with a diminished threat of piracy the chance that in concert with neighbouring countries Tanzania can implement a stock assessment is increasing.

It should be noted that quite an array of actions and activities in the field of fisheries development are taking place. Coordination between efforts is of course highly recommended.

As for the evaluation of the Tanzanian Fisheries Master Plan, although the issue was raised during the visit of the ministry, there did not appear to be an urgent need for additional input. However, still if required methodological input and practical implementation can be considered.

At the policy level there are indeed a number of issues that can be considered. These range from the question whether fisheries policy is supporting fisheries development adequately and sufficiently enabling progress and whether the current MCS system is sufficient.

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Quality Assurance

Wageningen Marine Research utilises an ISO 9001:2008 certified quality management system (certificate number: 187378-2015-AQ-NLD-RvA). This certificate is valid until 15 September 2018. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V.

Furthermore, the chemical laboratory at IJmuiden has NEN-EN-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 1th of April 2017 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation. The chemical laboratory at IJmuiden has thus demonstrated its ability to provide valid results according a technically competent manner and to work according to the ISO 17025 standard. The scope (L097) of de accredited analytical methods can be found at the website of the Council for Accreditation (www.rva.nl).

On the basis of this accreditation, the quality characteristic Q is awarded to the results of those components which are incorporated in the scope, provided they comply with all quality requirements. The quality characteristic Q is stated in the tables with the results. If, the quality characteristic Q is not mentioned, the reason why is explained.

The quality of the test methods is ensured in various ways. The accuracy of the analysis is regularly assessed by participation in inter-laboratory performance studies including those organized by QUASIMEME. If no inter-laboratory study is available, a second-level control is performed. In addition, a first-level control is performed for each series of measurements.
In addition to the line controls the following general quality controls are carried out:

- Blank research.
- Recovery.
- Internal standard
- Injection standard.
- Sensitivity.

The above controls are described in Wageningen Marine Research working instruction ISW 2.10.2.105. If desired, information regarding the performance characteristics of the analytical methods is available at the chemical laboratory at IJmuiden.

If the quality cannot be guaranteed, appropriate measures are taken.

Justification

Report C004/17
Project Number: 4311100029

The scientific quality of this report has been peer reviewed by a colleague scientist and a member of the Management Team of Wageningen Marine Research

Approved:	Dr.ir. Nathalie Steins Researcher
Signature:	
Date:	25-1-2017

Approved:	Drs. Jakob Asjes Manager integration
Signature:	
Date:	31-01-2017

Annex 1 Literature reviewed

The following literature resources have been used as background material for preparation of the mission and for the writing of the report. Below is a list of reviewed literature and a summary of the highlights from the most important articles and reports.

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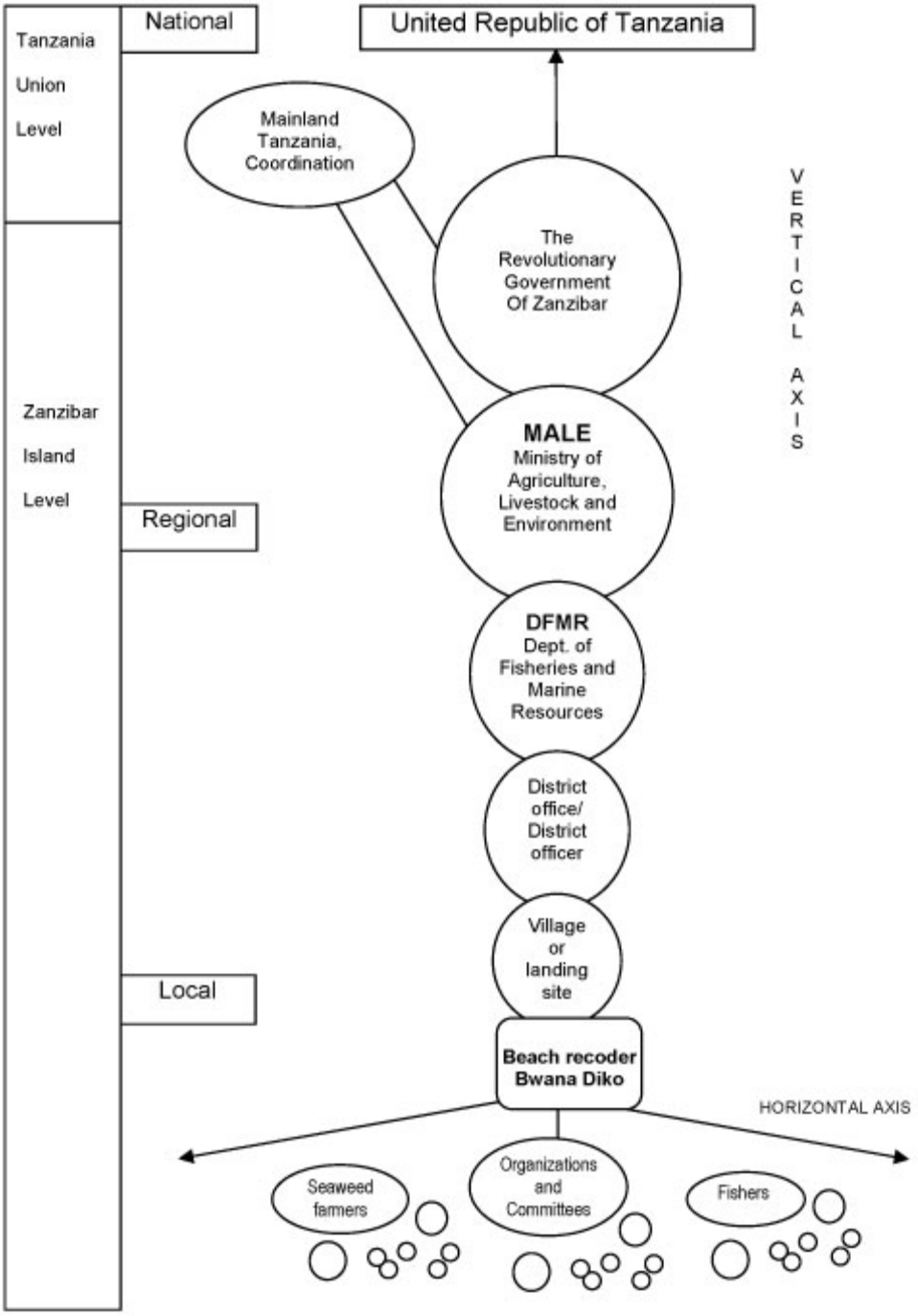
Below for selected reports and articles the main issues and points are provided. The synthesised literature has been used to produce the main mission report and is reflected there.

Bwana Dicos – Beach recorders (de la Torre-Castro, 2006)

Fieldwork done at Unguja, the largest island in the Zanzibar archipelago.

- Zanzibar has autonomy in non-union matters including the management of marine resources. Although natural resource management issues are not considered a union matter, there is communication and coordination with the mainland and a common agreement trying to reach harmonization on organizational structures and management approaches, mainly in terms of deep sea fishing affecting the Exclusive Economic Zone (EEZ).
- The nested organizational design in Zanzibar The Revolutionary Government of Zanzibar with its different ministries governs the Islands. The Ministry of Agriculture, Livestock, and Environment (MALE) is situated at the highest level of organization in Zanzibar, followed by the Department of Fisheries and Marine Resources (Swahili: "Idara ya uvuvi na mazao ya baharini"), which deals with the management of all marine resources.
- At the district council level, the district fisheries office collaborates with the constituencies, wards, and "Shehias." The Shehia is the lowest local governance level, and is appointed by and accountable only to the Revolutionary Government and the respective villages and landing sites under its jurisdiction. At the next level, i.e., the local scale of a village and/ or a fish landing site, the *Bwana Diko* is the responsible institution (Fig. 1).
- In Zanzibar, the most important are the *Fisheries Act* of 1988, the *Fisheries Law* of 1993, the newly revised *Fisheries Act* of 2005, not yet passed, and a policy document providing guidelines for fisheries.
- In general, fisheries in Zanzibar are diverse, e.g., type of gears, fishing techniques, and habitat use, and mainly artisanal, i.e., performed close to the shore and with relatively low technology.
- In the organizational structure (Fig. 1), *Bwana Dikos* are the link between the formal administrative units and the local resource users.
- The main duties of the *Bwana Dikos* are to monitor artisanal fishing and seaweed farming activities and to enforce the respective laws. They record basic information on fishermen, e.g., age, boats owned, licenses, and the like. They check the seaworthiness of the boats and the legality of gears. *Bwana Dikos* also report accidents in the sea. They communicate changes in laws or policies, coming projects, planning issues, etc. from the Department of Fisheries and Marine Resources (DFMR) to the locals, and from the locals to higher organizational levels. Other issues such as the behaviour of users, unusual events, or changes in attitudes and opinions of the local population are also reported (DFMR 2005, *Bwana Dikos* and Fishermen interviews).
- In the selected locations for fish landing monitoring, *Bwana Dikos* record statistics of the local fishery every second day, each month. These records include number of fishermen, vessel type, time of landing, main species caught, weight of the catch, local market prices, i.e., mainly through auction, and tidal and weather conditions, as well as unusual events (DFMR 2005, *Bwana Dikos (BD),* interviews, Jiddawi and Stanley 1999). They are formally in charge of monitoring, controlling, and reporting seaweed farming activities. However, the beach recorders are mainly focused on the monitoring of fisheries activities, the seaworthiness of fishing vessels, and the legality of gears (DFMR 2005, Seaweed farmers and *Bwana Dikos* interviews, *personal observation*).
- Four dilemmas that were identified during the fieldwork:
    - Kinship dilemma - BD are from same village; makes sense but also leads to difficulties: how report on people you know? The kinship dilemma was handled by favouring kinship relationships and giving priority to the short term benefits rather than long term consideration of maintaining productive ecosystems.
    - Loyalty dilemma – to whom to be loyal – the village or the employer? The common situation is to solve the dilemma playing a double role. In the village they side with the villagers, whereas in the DFMR they side with their superiors. The loyalty dilemma leads to confusion and unclear communication.
    - Poverty dilemma – the poverty of the *Bwana Dikos* themselves, with a salary that cannot fulfil their and their family needs, and the poverty that most fishing villagers experience. Salary of BD is often lower compared to that of fishermen. They need additional income sources. But also they understand the poverty situation, making them less prone to report illegal activities.
    - Control dilemma – how a single human can keep control over all the factors involved in monitoring the fisheries dynamics and to keep records at the same time. They do not have a boat. And at the market, one person is not enough to all the work at the same time.
- *Bwana Dikos*, public officials placed in villages or landing sites, constitute a key intersection point in the social-ecological system of the fisheries of Zanzibar. They also constitute links between formal and informal spheres, they are key structures in the vertical and horizontal axes, they represent the possibility to learn from the system through constant and good quality data acquisition, and they can be an invaluable source of information on the actual situation and legitimate bottom-up issues of the local population. The existence of the four dilemmas: kinship, loyalty, poverty, and control seriously jeopardizes the flow of the extensive knowledge that the *Bwana Dikos* actually have, and reduces the effectiveness of the formal governance systems for coastal fisheries management.

- Addressing these aspects with a combined focus on poverty reduction strategies and the possibility to increase the number of beach recorders/landing site is fundamental for the improvement of institutional performance and the monitoring of marine resources in Zanzibar and in similar settings.



Coastal Aquaculture Development in Eastern Africa and the Western Indian Ocean: Prospects and Problems for Food Security and Local Economies (Rönnbäck et al., 2002)

- The potential of coastal aquaculture to improve the income and assure the availability of affordable protein to the poor in developing countries has been impeded by the emphasis on the industrial-scale cultivation of high-valued carnivorous species destined for export markets in Europe, USA and Japan.
- The culture of red seaweeds in eastern Africa is quite recent, and the development has mainly taken place in Zanzibar, Tanzania until now, but it is also spreading to mainland Tanzania and neighbouring Mozambique and Kenya. Tanzania's production has been increasing steadily and reached 7000 t in 1999 (Fig. 1). Keto Mshigeni and Adelaida Semesi of the University of Dar

es Salaam introduced the idea of farming seaweeds into Tanzania during the 1970s (12, 13). Adelaida Semesi pioneered the introduction of farming techniques especially among women in villages in eastern Zanzibar Island (Unguja).

- Two species of seaweeds have been farmed since 1989: *Eucheuma denticulatum* (formerly *E. spinosum*) and *Kappaphycus alvarezii* (formerly *E. cottonii*). These species are found naturally in East Africa (14), and used to be collected from the wild for export to France and Denmark. Although these species are found locally, the farmed strains are mainly imported from the Philippines, and the consequences of this introduction should be studied further.

- The method of farming is the *tie-tie* system whereby fronds of seaweeds are tied to strings stretched between wooden pegs. These are situated in shallow intertidal lagoons inside the fringing reefs. They grow rapidly (up to 12% per day) and are harvested at spring low tides each fortnight. The seaweeds are then dried by the villagers, sold to agents and exported to USA and Europe for the extraction of carrageenan polysaccharides as gelling, thickening and emulsifying agents in foods, cosmetics, and pharmaceuticals.

- Commercial interests from the Philippines and Denmark played an important role in developing production and markets, and recently a large corporation from USA has engaged itself in purchasing farmed seaweeds from Tanzania. Growth and survival of these seaweeds have generally been good in eastern Africa, but recent problems of slow growth and disease susceptibility have been experienced with *Kappaphycus alvarezii* (Matern Mtolera, pers. comm.). This may be a monoculture-related syndrome. But despite increasing demand and prices on the world market, they have lowered the prices paid to seaweed farmers in Tanzania down to USD 0.09 per kg. The exploitative attitude of the multinational corporations is starkly shown in a quotation from FMC-Biolpolymer (21):

"As a potential seaweed supplier trying to find the best village to work in, you should be delighted to find a village populated by consumers with no or little livelihood options. In this case we call cottonii and spinosum farming the livelihood of last resort. Today we find the most productive and consistent farmers from villages like these … In these places it is too arid to farm or the soil is unsuitable and the reefs have been destroyed and fish stocks decimated … Your ultimate goal is to make seaweed farming become a way of life for the villagers. This happens after five or so years. At this stage people don't think too much about price, they just farm because they have always farmed. Their children will follow them into that career."

Edible oyster (*Saccostrea cucullata*) culture has been tried in mangrove areas in Gazi Bay, Kenya (29) and may have a potential along the east African coast (30). At Praslin Island, Seychelles, a small farm successfully grows black-lipped pearl oysters (*Pinctada margaritifera*) that produce highly valuable black pearls and giant clams (*Tridacna* spp.). During the mass death of corals and giant clams in the extreme warm conditions of the central Indian Ocean during the El Niño event in March 1998, the only giant clams to survive in Seychelles were those in the aquarium tanks of this small farm. The subsequent voluntary re-stocking of *Tridacna* clams back to the reef from the farm is an interesting positive contribution by aquaculture to the environment (Kari Nilsen, pers. comm.).Integrated farming systems where several species are co-cultivated in order to improve resource-use efficiency, and reduce waste outputs and environmental impacts are of special interest. Experiments are presently underway with integrated multispecies pond systems at the Institute of Marine Sciences in Zanzibar, where milkfish, rabbit fish, and mullets are cultivated together with mollusks and seaweeds (32).

- In line with Naylor et al. (37) the authors recommend the adoption of 4 priority goals for aquaculture in Africa:
    - Encourage farming of species lower on the food web—that is, fish with herbivorous diets, filter feeders such as oysters or plants such as seaweeds
    - Improve feed efficiency in industrial aquaculture systems and develop substitutes for fish-derived feed ingredients
    - Develop integrated fish farming systems that use multiple species to reduce costs and wastes while increasing productivity
    - Promote environmentally sound aquaculture practices and resource management.

Fishing Folk and their Fields, a study on village life and small-scale tourism on the East Coast of Zanzibar Cisca Zwiers

- Zanzibar is name of Pemba and Unguja (island most commonly known as Zanzibar). Meaning = zanj (black) island (Greek sailor named it that in 11th century). Known to early seafaring people from all over.
- Typical coral island; flat with almost any landscape features, poor soil quality, rising steeply from ocean bottom. Between Zanzibar and Pemba Indian Ocean as channel is deep and good fishing grounds, between Zanzibar and mainland less deep
- 1804 Omani Arabs took power. Brought the clove tree. Slaves were main industry. Abandoned in 1874. Became British mandatory protectorate. 1963 independence. 1964 Revolution & became part of Tanzania. Since 1964 ruled by Chama Cha Mapinduzi – Revolutionary Government of Zanzibar. Followed a socialistic course. Tourism allowed since 1980ies. Late in

20th century Madagascar and Indonesia took over cloves market. Huge impact on Zanzibar' economy.

- Tourism new economic activity (main) -> high pressure on a diversity of natural resources like coastal land, mangrove forests, clean water, fish stocks, landing sites, agricultural lands, coconut trees, and reefs.
- Good soil of agriculture mainly in the west. 2 types of soil: *maweni* soil (thin layer of fertile soil in little pockets in the rocks) and *uwanda* (bushes – for goats and cattle).
- Fishermen also farm. The changing seasons, with the rainy season offering bad fishing opportunities necessitates a diversification of livelihoods.
- Best fishing + best farming places (combi!) is sometimes also good for tourism – clash of space. When fishing is bad, farming is at its most important stage -> 'maritimity of a culture'.
- *Mzee*: old person – leader of family group: man with max 4 wives and offspring: cluster = *ukoo*. All *wazee* are the elders, one leader = *shehaa* of village. Official leader. Represents the government in village and vice versa. The representative of the CCM can be the same, or someone else.
- Growing of seaweed (*mwani*) – relatively new (in 2001). Has to be under water at all times, even at low tide. The women tie up the weed in small bundles, and attach these to a long string. This long string is then tied between two sticks, jammed into the coral seabed. The bundles float. Combi of warm water and sunlight -> grow 7% a day. Requires a sandy seabed with rocks and stones. Literature says it is a seasonal activity. In Kigomani this is not the case. Women do not have the luxury to stop growing seaweed. Literature says that it has rendered the women with more self-esteem, improved their position. In Kigomani, Zwiers finds, not the case. Could only be developed as it can be done alongside 'men's' world – divide in space: in different zone econ and socially. Done only when men are away. Women do not have full control over the money they earn. [Tourism different kind of work – individual – changes the way women take care of each other's kids and households. Strong division in worlds between village life and tourism places).
- Fishing. Larger boats run by *ushirka* (co-operations). Formed along family lines. The past few years, more fish had to be sold instead of taking it home, to provide cash. This is more needed because of higher prices in life. Though the fish sells at higher prices (tourism) – prices are now also too high to buy the fish for the fishermen's own family. Family gets the fish of less quality and less nutritious then the fish sold. Higher price for fish does not match up higher prices also for other goods. Fishermen have to also go out in bad season. Take risks. More new people move temp in fishing in good season and more people come to buy fish. Due to government subsidies (engines): more people ventured in waters – crowded.

Estimating Fishery Statistics in the Artisanal Fishery of Zanzibar, Tanzania: How big a sample size is required? (Jiddawi et al., 2002)

Artisanal fishing methods in Zanzibar produce an estimated 14,000 t/yr. and are reported to provide a source of income to about 14% of the population (FAO, 1994). These fisheries provide the major source of protein for most inhabitants, and virtually the only source of animal protein for low income groups.

As with many small-scale fisheries, current fishery monitoring programmes provide summary data that are sufficient to broadly characterise the fishery, but are not adequate for stock assessment and resource management since they are too imprecise to rigorously characterise trends in landings, let alone other status indicators like catch rate or species composition.

All participants in the fishery are Muslim so fishing activity is lower on Fridays, the day of prayer. The local fishermen generally land their catches close to home, but sometimes leave their villages to travel and camp on beaches elsewhere on Unguja and Pemba Islands, or as far as the coasts of Mozambique and Kenya.

The study focused on the diurnal fishing in both villages. These fisheries account for virtually the entire catch delivered to the auction site. Other market pathways are summarised in Jiddawi & Stanley (1999b). The dominant gear types are those typical of reef and near-reef fisheries: portable traps, small seines, drive-nets, spear without scuba, and handlines (Ruddle, 1996). Octopus are usually collected with a hooked stick by fishermen walking on or near the reef crest; some are caught using spears (Mhitu & Jiddawi 1999).

The fishing day starts near dawn as the fishermen use the early morning high tide to sail over the fringing reef without grounding the vessel. Most fishermen in Matemwe travel to their grounds in crews of 2–4 in double outrigger canoes (*ngalawas*) that are 5–7 m in length. Travelling time to the grounds varies from 0.5–1.5 hours, depending on winds and fishing ground. Most fishing takes place

on or outside the fringing reef or the reef surrounding the nearby atoll of Mnemba (Fig. 1). They fish late during the ebb, the low water slack, and the early part of the rising tide, then return and cross the reef on the rising tide in the afternoon. As the auction site is reached, one or two fishermen disembark with the catch and carry it to the auction near the high water mark. The remainder of the crew continues southwards along the beachfront to anchor the vessel near their homes. In Matemwe, the auction takes place around a one forked stick embedded in the sand, just above the high tide line. Strings of fish are hung on the stick for display as bidding takes place under the supervision of an auctioneer.

Mkokotoni fishermen do not have to contend with a fringing reef, thus the fishing activity is more constant within a lunar period. Dhows (*daus*) are the more common vessel in Mkokotoni. These are double-ended, planked vessels about 6–12 m long with a raked stem, wide beam and low freeboard. They have a deeper draft than the *ngalawas* of Matemwe as they do not have to go over the reef. Both vessel types are usually powered by lateen sails. Trips which employ the drive-net technique were more common in Mkokotoni and are conducted from the dhows with crews of up to 42 men and boys. Most Mkokotoni trips are day trips only. Fishing grounds are generally less than 4 hours sailing time and are usually less than 2 hours. Fishing grounds for Mkokotoni are more varied. They range from the large sand/mud flats and mangrove forests of the adjacent enclosed bay, to fishing grounds 2 hours sailing west of Tumbatu Island (Fig. 2). The nearest coral reefs to Mkokotoni are 4–6.5 km away. The range of depths fished by Mkokotoni fishermen, as reported in interviews, range from the exposed flats and reef crest to over 120 m during trap fishing. The auction process is similar in Mkokotoni but takes place at the seaward end of an open building. The catches are displayed on a concrete table and, as with Matemwe, auctioned in order of arrival.

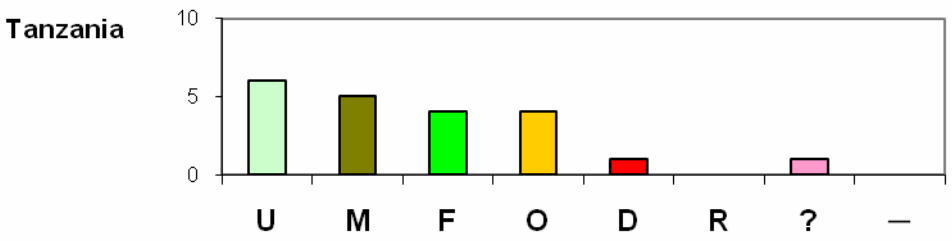
“Attempts have been made to establish statistical systems to monitor the artisanal fisheries in many tropical countries but we know of no example of sustained successful implementation. The problems of dispersed landings, the multitude of species, variations in fish prices and of unrecorded subsistence catches normally combine to make the systems inaccurate and inordinately expensive in terms of manpower. Additionally, the fact that most tropical fisheries are also multigear fisheries makes the derivation of any but the crudest expressions of fishing effort almost impossible. The result has been that few meaningful or beneficial results have ever been perceived to emerge from statistical systems in multispecies, multigear fisheries, and there has been strong tendency to scale down the work to meaningless levels or abandon it altogether.” Fakahau (1993)

One sampling team could study a number of ‘index’ sites. While the long-term commitment of a 3- to 4-member team and vehicle would seem costly, so are the resources needed to maintain samplers in every village. The sampling costs are small relative to the return in improved stock assessment from better quality data.

SWIOFC Stock information 2011 – meeting document (South West Indian Ocean Fisheries Commission, 2011)

There was no updated status report of Tanzania. The status of fisheries resources by countries is presented in **Appendix 4.**

- Tanzania from underexploited to depleted. -> Depleted resources were reported from: Tanzania (shallow water penaeid shrimp).
- Underexploited resources were reported from: Tanzania (yellowfin, big-eye, albacore and skipjack tunas; swordfish; marlin).
- *Caution should be exercised in interpreting this national assessment* as it is not necessarily an indication of the status of the stock (for which IOTC makes definitive assessments). Since many of the species of this group form straddling stocks, the evaluation should relate to the stock across its extent of distribution. Rather it would seem that countries were indicating the possibility of a national increase in participation within these fisheries.



In the SWIOFC region the percentage of: underexploited stocks decreased (from 24% to 18%); moderately exploited stocks decreased (from 21% to 13%); fully-exploited stocks increased (from 29% to 36%); overexploited stocks remained about the same (19%); depleted stocks increased (from 5% to 11%); and recovering stocks increased (from 1% to 4 %). The situation changed noticeably each year largely depending on the numbers of countries providing updated results.

The comparison - of the SWIOFC with global status report indicates that the SWIOFC region is improving in the recovery of some of its depleted stocks but that more stocks have become depleted, and that there is still a significant proportion of stocks that are over-exploited and need to be better managed. On the other hand, the region also has a larger proportion of its fisheries resources that are considered as underexploited in comparison with the global situation and these should be better utilized.

Report of the Performance Review of the South West Indian Ocean Fisheries Commission (FAO, 2011)

SWIOFC has played a crucial role in promoting and facilitating collaboration and cooperation in the region with regard to fisheries issues, serving as a platform for the development of several regional projects, such as SWIOFP, ASCLME and EAF-Nansen Project.

An important aspect of SWIOFC Statutes, stemming from its advisory nature as an Article VI (1) FAO statutory body, is the fact that the Commission cannot impose any obligation on its members. Both during the interviews with representatives of SWIOFC countries, as well as in the responses to the questionnaire, several members expressed their view that one of the main limitations faced by the Commission was its lack of enforcement powers, and advocated to change that condition by amending the SWIOFC statutes. Although some basic obligations on members could, and probably should, be incorporated into the SWIOFC texts (such as a financial contribution to the Commission by members), because the area of competence of the Commission is restricted to the EEZ of member States and, in many instances, to discrete coastal stocks, the adoption of mandatory conservation measures by the Commission is not possible under the scope of the present statutes. That is to say, a new agreement would have to be prepared and agreed upon in order to achieve this objective. Such an agreement may be within or outside the scope of FAO depending on the structure and nature of the mandatory powers sought by the member countries.

The attendance of the 12 members of SWIOFC in the Scientific Meetings ranged between 10 and 11 (85% on average), fluctuating between 9 and 11 (83.3%, on average) in the Commission Meetings, a rate of presence extremely positive and which reflects a high degree of interest of members in the meetings of the organization and a clear sense of ownership.

Although an increased participation of SWIOFC members in financing the work of the Commission is desirable, this will have to be achieved in a very pragmatic, gradual and well planned manner, and taking full account of the diverse socio-economic realities faced by different SWIOFC members. The majority of members and stakeholders who responded the questionnaire advocated for a “middle-ground” alternative, with SWIOFC remaining as a FAO (semi-autonomous) body, but also making use of funding coming from both member countries as well as donors.

The Statutes and the Rules of Procedure of SWIOFC are relatively recent and, although rather succinct, relatively up to date and consistent with modern principles of fisheries management and governance as expressed in international legal instruments (including both soft and hard law), since the United Nations Convention on the Law of the Sea (the 1982 UN Convention).

SWIOFC has not done much in terms of data collection, analysis and sharing by itself. Most of the work done by SWIOFC has been related to the provision of advice and coordination on institutional and organizational matters, needs and processes, including methods and protocols, for data collection, analyses and reporting, by member States, at country level. During the interviews done in Male, some members suggested that SWIOFC could undertake the responsibility of gathering, compiling and validating the “official” FAO fisheries statistical information coming from the region.

In spite of its relatively short history SWIOFC, has already played a very important role in the region in the promotion and coordination of fisheries research. The identification of data gaps and research priorities to be conducted by members has been one of the main tasks of the Scientific Committee. The establishment of an *ad hoc* Steering Committee for the South West Indian Ocean Fisheries Project (SWIOFP), during the Third Session of the Commission, and of an *ad hoc* EAF- Nansen Project Steering Committee and an *ad hoc* EAF Working Group, under the Scientific Committee, demonstrate the prominent role the Commission has played in the promotion and coordination of fisheries research in the region.

Unlike other Regional Fisheries Bodies, SWIOFC has not usually done any assessment of the stocks covered by its mandate. This has been commonly undertaken nationally, with the support of regional

Projects. The data available, however, indicate an appreciable deterioration of the condition of the stocks in SWIOFC region, from 2005 to 2009, a trend which is not dissimilar to the rest of the world. The region, however, still has a larger proportion of fisheries resources that are considered to be underexploited, in comparison with the global situation.

When compared to other regions, the "assessment of shared stocks" may be of lower relevance in the Southwest Indian Ocean than the "shared assessment of stocks". SWIOFC has served much more as a forum for the scientists, managers and policymakers of the region to share information on the management of fisheries than to provide comprehensive advice on the actual management of the exploited stocks. Although such a limitation is understandable, particularly in light of the significant amount of financial and human resources required for such a task, there is very little follow-up between meetings on how the condition of the examined stocks has evolved, a deficiency that should be rectified. Without a follow-up mechanism, it is difficult to assess how the stocks have evolved in time and to evaluate the efficiency and improvement needs of the management strategies adopted.

Although the Precautionary Approach (PA) has also been included in SWIOFC Statutes as one of its basic principles, the activities of both the SC and the Commission in regard to promoting the PA to fisheries management have been rather limited to date. This is clearly an area where SWIOFC can and should do much more, in order to fulfil its role in the regional coordination on fisheries.

It should be noted, however, that coordination on this matter is hampered by the different MCS capabilities of the various countries in the region.

There is a great need to improve transparency within the Commission in terms of availability of, and accessibility to, documentation. Although the reports of the Commission Meetings and the Meetings of the Scientific Committee are available on the FAO website, the background documents used during those meetings and referred to in the reports are not readily available.

Management Plan for the Tanzanian Artisanal Fishery for Small and Medium Pelagic Fish Species. (Ministry Of Livestock and Fisheries Development, 2011)

The following key issues were identified:

1. Fundamentally open access nature of fishery hampers any effective MCS , no database of fishers and fishing vessels exists
2. BMU's not achieving objectives
3. No effective national data strategy for monitoring of fishery sectors
4. Lack of buy in at senior political level for importance of fisheries in Tanzania
5. Policy and legislation require updating.
6. Lack of specific MCS strategic plans in fisheries management plans
7. Lack of economic and social information on the different fishery sectors to guide and inform MCS strategy
8. Judiciary and MCS officers often not trained in dealing with fisheries offences

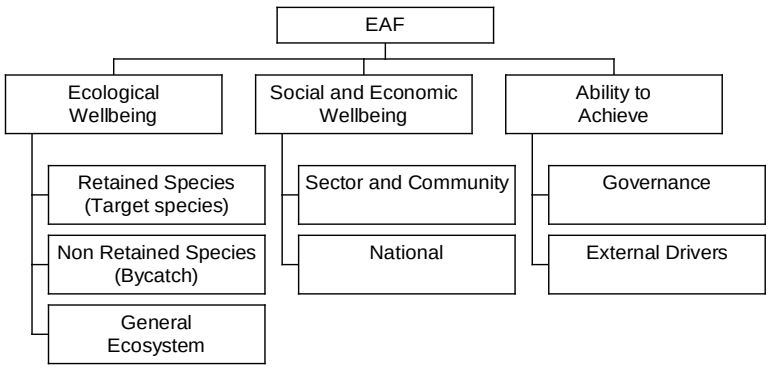


Figure*: General component tree used in the ERA process*

1. Ecological wellbeing:

1.1. Largely open access system for capture of pelagic fish species, and concomitant lack of adequate management measures.
1.2. Patchiness of information to understand both anthropogenic and fisher effects on the ecosystem.
1.3. Gear restrictions need to be addressed
1.4. Ineffective assessment of general ecology of the region
1.5. Climate-related changes, such as increase in water temperature and coral bleaching
1.6. Bycatch of marine mammals and turtles
1.7. Pollution
1.8. Habitat destruction, e.g. dynamite fishing

2. Social and economic wellbeing:
2.1. Lack of training and economic and social information on the all aspects of the fishery.
2.2. Inadequate communication amongst fisheries stakeholders
2.3. Lack of understanding of fisheries management by the fishing sector, including fishers, processors, and the broader community.
2.4. Reduction in catch causing economic hardships
2.5. Safety at sea
2.6. Inadequate catching, processing and market skills
2.7. Lack of alternative livelihoods

3. Ability to achieve:
3.1. Review the specifics of policy and regulations under the various policy instruments in place
3.2. Legal framework around current legislation requires attention, training of judiciary and police force in the importance of marine matters
3.3. Inadequate specific management measures, lack of coordination between national and regional/local management authorities, lack of staff.
3.4. MCS strategies and implementation require assessment and revision
3.5. Lack of registration for all fishers, rights allocation needs to be assessed.
3.6. Funding

Marine fisheries in Tanzania (Jiddawi and Öhman, 2002)

"(...) number of migrating fishermen who travel from their homes to camp and fish in other areas. This movement locally known as dago is an important characteristic of many fisheries in Tanzania. It has resulted in a localized increase of fishing effort in some areas during certain periods of the year and has been the cause of fishery conflicts with local communities." The fishermen of Kojani from Pemba who are famous migrating fishermen are known to travel long distances as far south as Mozambique and up to the northern border of Kenya.

Table 3. Fishing vessels used by artisanal fishermen in Tanzania.

Vessel	Details
Canoe (*Mtumbwi*)	Made up from a single log. The bottom is usually flattened for stability. No outriggers.
Outrigger canoe (*Ngalawa*)	Made up from a single log. Have outriggers which provide additional stability to these vessels.
Dhow (*Dau*)	Constructed out of timber planks. Bow is more pointed than the *Mashua* and the stern is rounded or pointed.
Boat (*Mashua*)	Constructed out of timber planks. The stern is square.
Dinghy (*Hori*)	Very small boat which accompanies bigger boats in the light attracting fishery. Constructed from plywood and planks.

Different vessels are used for catching different types of fish. For example the outrigger canoes mainly target nearshore species such as snappers, emperors, rabbitfish, and groupers whereas the dhows and bigger boats catch the offshore larger fish such as marlin, kingfish, sailfish, and tuna.

Table 2. Types of fishing gear used by artisanal fishermen in Tanzania.

Type of gear	Associated gears	Comments
Gill nets *Jarife*	Drift gillnet Demersal gillnet (large mesh) or Shark nets, Demersal gill nets (small mesh)	Used in tidal, sub-tidal and reef areas to capture fish moving with the tides. Target species are tuna, billfish, kingfish and sharks. Have high incidental capture of turtles and dolphins.
Cast nets *Kimia*		Used in sheltered areas. A circular net that is thrown over a shoal of fish or allowed to sink to the bottom. Closed when retrieved. Catches small fish such as eels, catfish, mullet, silver biddy, and shrimps.
Seine nets *Nyavu*	Purse seine Ring nets Beach seine	Use light to attract pelagic fish on moonless nights. Catch rate is 500–3000 kg net^{-1}. Beach seine is illegal in Zanzibar and only permitted in unnhabited islets. Nets are 50–100 m with long warps. Usually it is dragged onto the beach.
Drag nets *Kavogo Kigumi*	Any seine net can be used as a drag net	This method is illegal. Nets may be assisted by divers to untangle chase and retain fish Can be 50–100 m with long warps. Runs on the bottom Nets are set from a boat or from the beach. May use two vessels.
Scoop nets Senga		Used in catching small pelagic fish in the light attracting fishery. Mean catch rate is 60 kg boat^{-1} day^{-1}.
Basket traps *Dema, towe*	Large ones (*dema*), small ones (*towe*)	Hexagonal in shape with a single opening. Traps are usually set in seagrass beds, among wild or cultured seaweed, or coral reefs. The *dema* mean catch rate is 1–2 kg trap^{-1}.
Fixed traps (weir, fence) (*uzio, wando*)		Usually made up of mangrove stick or palm frond midrib. They are semi-permanent stake traps that are set in intertidal areas especially in sheltered areas. Catch rate varies from 12–100 kg trap^{-1}.
Handline *Mshipi*		Common fishery, probably found in every fishing vessel. Can be used from a vessel or from the shore. Currently important as a sport fishery in the tourist industry at several sites.
Longlines *Dhuumati*	Surface long line Bottom longline	Mostly for catching tuna especially by industrial vessels in the offshore waters. Used by artisanal fishermen for catching demersal fish.
Troll lines *Kurambaza*		Usually use artificial lures in catching fish such as tuna.
Octopus spearing *Mkuki/kijiti*	Spear, stick	A spear is made up of a stick with a sharp end or a piece of iron is inserted at the tip. *Kijiti* is a stick. Collection is done by diving or on exposed reefs. 4–7 kg person^{-1} day^{-1}.
Harpoons *Bunduki, mshare*	Spear gun. By skin diving using locally made masks	Illegal fishing technique which is banned in Tanzania but is still in use. Used for catching lobster and reef fish.
Mosquito net *Utazi we juu* *Utazi we chini*	Sheets of fine netting (mosquito nets) or a big piece of cloth 2 to 10 m long	One is used during neap tides and one during spring tides. Used by women in intertidal areas. Nets are held by several women. Others approach this sheet over a decreasing circle, splashing and making noise to chase fish into the net. Catch rate is 2–17 kg of fish net^{-1} set, 5–20 kg *Acetes* net^{-1}.
Machete (*panga*) *Mwenge* (torch)	Machete Torch	Use a torch made of burning coconut leaves to attract fish- also use a machete to slash at fish. Average catch is of 7 kg day^{-1}.
Trawl net		Used in small to medium sized vessels. Have specialized prawn trawling nets with an average length of 38 m and 5 cm mesh. Operate in waters 5–15 m deep. Fish by-catch accounts for part of the catch.

The middlemen and traders play an important role in the artisanal fishery in providing an opportunity for those fishermen who cannot afford to buy gear or vessels. A middleman usually owns the expensive gear and vessels, such as the seine or gill net and boats or dhows. He partners with the fishermen such that the money obtained from the catch is divided into three parts. One part goes to the middlemen, one is kept for the maintenance of the boat and gear and one part is for all the fishermen on the boat regardless of their number. The traders then distribute the fish inland. Consequently, the fishermen themselves receive the smallest return.

The demand for fishery resources has been gradually increasing following the increase in population and tourism development. This has caused an increase in fishing pressure.

In Tanzania, fish is brought by the boat to a landing site and auctioned on the spot. Beach recorders are used to record the catches in various sites usually about 16 times a month forming the basis of data for the artisanal fisheries production for the country.
During the period between 1984 and 1995, the annual fish catch recorded ranged between 45 000 and 54 000 t for mainland Tanzania (Fig. 2a). However, the inshore fishery is showing signs of overexploitation. The total annual catch in Zanzibar was about 20 000 t in 1988, but it has now dropped to less than 15 000 t yr. –1 (Fig. 2b). This trend is confirmed by detailed long-term studies in some localized areas such as Chwaka Bay, Zanzibar (Fig. 3a–3d) (32). In addition to data from

landing sites and other quantitative investigations interviews with older fishermen confirm this trend. However, sufficient data for full resource assessments are not available.

Coastal and marine resource use conflicts and sustainable development in Tanzania (Masalu, 2000)

The fastest growing population in the coastal area of Tanzania has led to an increasing competition over the allocation and use of coastal and marine resources, including land. The coastal zone is extensively and increasingly used for a large number of activities, such as: human settlement, agriculture, fishing, industry, trade, tourism, national/marine parks/conservation areas, etc., by many different groups or sectors. These multiple uses/activities are not usually mutually compatible and may result in conflicts.

- *Cheju-Chwaka Bay*: *rice farming versus fisheries:*
- *Marine transport of oil versus the coastal and marine environment*
- *Chwaka Bay: Seaweed farming versus tourism and fishery*
- *Mnemba Island: tourism versus fisheries*
- *Chumbe Island: conservation versus tourism and fisheries*
- *Tanzania: destructive fishing practices versus coral reefs and fish habitat*
- *Bagamoyo: commercial fishing versus artisanal fishing*

- sectoral coastal management approach
- the local community feels robbed of its resources and/or rights
- improperly planned and/or improper implementation of policies
- ignorance about the resources, their importance and the inter-dependency of the various coastal and marine resources.
- poor institutional framework

National Fishery Sector Overview (FAO, 2007)

Main areas for opportunities

Marine fishery
Within the marine fisheries of Tanzania investment opportunities exist in the Exclusive Economic Zone (EEZ). Possibilities exist for the exploitation of pelagic species like Tuna, tuna-like and other species.

Land based facilities
a) Fishing craft Tanzania's fishery is dominated by wooden fishing boats, which are made from hard wood. Investment could be in the manufacture of fibre glass boats, ferro-cement boats or any other alternative cheap material. The market for boats exists in the artisanal fishing sub sector.

b) Fishing gear manufacturing There is a big domestic demand for fishing nets and other fishing gear. Opportunities exist for further investment in the production of nets and other fishing gears like hooks, lines, and ropes of different sizes.

Fish processing facilities
There is room for fish processing investment in the following areas:
a) Fish canning industry
This activity is not developed. The sardines locally known as the "Dagaa" of the species *Stolothrissa tanganicae* from Lake Tanganyika and *Rastrineobola argentea* from Lake Victoria could be canned for human consumption. At present, sun drying is the main technology used for processing of "Dagaa". The resulting product is of poor quality. There is a possibility of improving the methods of processing for this species for other markets than those that buy the sun-dried fish. Investment opportunities also exist in the exploitation of marine pelagic stocks in the EEZ especially the tuna, and other tuna-like species, mackerel and swordfish, which can be utilized for canning.
b) Value-Added products
Fish and other fishery products in Tanzania are mainly exported in fresh/chilled or frozen state. Some sun dried and smoked fish are also exported to neighbouring countries. There is an opportunity for investment in value-added fish products such as: ready to eat fish, fish fingers, fish balls, salt-spiced marinated fish, fish sausages etc. Unexploited fish products from the EEZ can be utilized for this purpose.

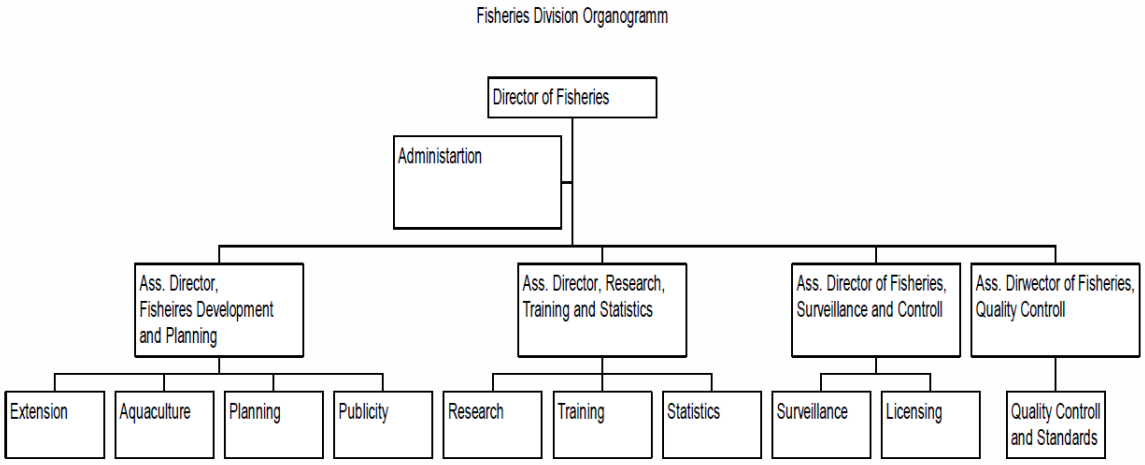
c) Fish meal
By-products from Nile perch fish processing plants and sardines can be used for fishmeal production.

d) Cold and hot smoking

Modified Atmosphere Packaging (MAP) increases the shelf-life of fish products; therefore fish processed in this way can be transported to long distances to reach the interior areas as well as for export. These processing alternatives could be another opportunity.

Fish support services
Although trade liberalization has offered opportunities for traders to invest in various inputs supply to industrial and agricultural activities, there are only a few investors serving the fishing industry. Ship chandling is absent in this country. Fisher folk require equipment like engines, spares, pulleys, swivels, waterproofing materials, containers for fish handling and filleting knives and boards. The government encourages investment in such services for sustainable fishing.
Fishing harbours
The fish landing sites in the coastal and lake areas lack appropriate facilities for receiving and handling fish. Investment in construction of proper fish receiving stations providing ice, freezing and cold storage facilities could be a profitable venture. Possible ports for investment include Tanga, Kigoma, Mtwara and the Lake Victoria region. Mtwara is particularly attractive due to the current effort to develop it under the program known as Mtwara – Mbamba bay corridor to provide Port services for Malawi and Tanzania.

7.4 Main constraints to development
Despite past efforts to develop fisheries in Tanzania, the following constraints still remain:
(i) Inadequate knowledge of the fisheries resource base;
(ii) Inadequate quality of fish seeds to use in the promotion of aquaculture;
(iii) Inadequate extension services;
(iv) Inadequate funds for research;
(v) Inadequate credit facilities for fisher community;
(vi) Inadequate information on markets;
(vii) Poor infrastructure in some parts of fish production areas which lead to a high percentage of post-harvest losses;
(viii) Lack of fishing harbours;



Fishing licence and registration
Licensing is the major regulatory measure imposed by the government to ensure sustainable utilization of the fisheries resources. All fishing vessels are subjected to registration in which the owners pay fees when vessels are commissioned for the first time, and, pays vessel and fishing licence fees annually.

For marine water fisheries:
(i) Restriction of mesh size of gill nets and trawl nets;
(ii) Restricted fishing in marine parks and reserves;

Evaluating a marine protected area in a developing country: Mafia Island Marine Park, Tanzania (Kamukuru et al., 2004)

Mafia Island Marine Park (MIMP) is situated south-east of Dar es Salaam in Tanzania, It is a large, multiple-use area being operated on the principles of integrated coastal management [46]. This ensures the need to balance the protection of the natural resource base while maintaining the local communities' right to the resources. Although the fishery at Mafia Island is multi-specific, snappers (Lutjanidae) along with emperors (Lethrinidae) are preferred groups that contribute to about 42% of the total marine catch.

The impact of seaweed farming on the socioeconomic status of coastal communities in Zanzibar, Tanzania (Msuya, 2011)

The first experiments on farming seaweed were conducted during the mid-1980s and later. In 1989, commercial cultivation of *Kappaphycus alvarezii* (commercially known as cottonii, Figure 1a) and *Eucheuma denticulatum* (commercially known as spinosum, Figure 1b) started. Seaweed farming is now an important industry contributing significantly to the economy of the Zanzibar Islands. Its contribution on the mainland economy is still minimal, thus there is potential to increase production. The industry employs about 15,000-20,000 farmers, most of whom are women. The current production is about 11,000 t of dry seaweed annually. The seaweed is exported to the U.S., France, Denmark, Spain, China and Chile.

Activities that bring most of the foreign money in Zanzibar, in order of significance, they are tourism, seaweed farming and the clove trade. Apart from being the second most important foreign money earner, seaweed farming contributes above 90 percent of Zanzibar's marine export products.

The income from seaweed farming has empowered farmers to improve their standard of living by paying for school needs for their children, including fees and uniforms; buy household items, such as furniture; improve their houses and even build new ones; as well as get food for the families (Pettersson-Löfquist 1995, Msuya 2006b). This has given the women recognition and power within the family and the society by joining the men in becoming bread winners. While the husbands were sceptical of the idea of their wives farming seaweed, they became more supportive when they saw the results of their wives efforts. Although most men do not farm seaweed, they help their wives in such activities as harvesting when there are large amounts of seaweed to be harvested, carrying wet seaweed from the farms to the drying places and carrying dry seaweed to the points of sale. Children help in such activities as tying branches to lines at home or harvesting during weekends and school holidays. Thus, seaweed farming is more of a family activity than the work of an individual. This gives the women more courage to continue with the seaweed farming business.

In Pemba, many men still farm seaweed. This is most probably because of lack of alternatives on that island compared with Zanzibar Island, where the more developed tourism industry provides increased alternatives to the people. There is also the aspect of Pemba people having been described as more hard-working than those in Zanzibar.

The farming process is based on agreements that involve the farmers being given farming inputs (mainly ropes) by the seaweed exporting companies and farmers are required to sell the seaweed to the provider of inputs. This way, farmers have no negotiating power over seaweed prices. This had been the only way of gaining income from seaweed farming until 2008 when the first seaweed value-added product was produced under the ZaSCI initiative. Working under the Innovation Systems and Cluster Programme (ISCP-Tz), seaweed value-added products are produced with the aim of adding value to the low-priced spinosum. Products that have been produced so far are seaweed soaps (with or without spices), seaweed powder, massage oil, body cream, cakes, cookies, jam, puddings and salads. Of these products soaps, body creams and powder are marketed commercially.

- The economic importance of seaweed farming in Tanzania began in the 1930s when seaweed was harvested from the wild and exported to European and U.S. markets.
- This trade, however, collapsed during the late 1970s when the wild stocks were depleted. It was then that Tanzania started looking at possibilities of farming seaweed.
- The commercial cultivation started on the Zanzibar Islands in 1989 and then spread to mainland Tanzania around 1994.
- Seaweed farming is now an important industry contributing significantly to the economy of the Zanzibar Islands. Its contribution on the mainland economy is still minimal, thus there is potential to increase production. The industry employs about 15,000-20,000 farmers, most of whom are women. The current production is about 11,000 t of dry seaweed annually. The seaweed is exported to the U.S., France, Denmark, Spain, China and Chile.
- Seaweed farming contributes greatly to the economy of the Zanzibar Islands of Tanzania. There are three main industries that bring most of the foreign money in Zanzibar. In order of significance, they are tourism, seaweed farming and the clove trade. Apart from being the second most important foreign money earner, seaweed farming contributes above 90 percent of Zanzibar's marine export products.
- The world market currently prefers cottonii over spinosum. This preference is based on the fact that when exported, seaweeds are processed to extract carrageenan, which is used as an emulsifier, stabilizer and gelling substance in the food, pharmaceutical and cosmetics industries. The gel extracted from cottonii, kappa carrageenan, is stronger than that extracted from spinosum, iota carrageenan. As a result, the price of cottonii in Tanzania is 300-500 Tanzanian shillings (Tsh., approximately US$0.2-0.3) while that of spinosum is 200 Tsh. (approximately US$0.1). Coupled with the seaweed prices is the problem of failure of cottonii to grow in areas where it used to because of changes in environmental conditions including rise in seawater temperatures, epiphytism and fouling.
- This way, farmers have no negotiating power over seaweed prices. This had been the only way of gaining income from seaweed farming until 2008 when the first seaweed value-added product was produced under the ZaSCI initiative. Working under the Innovation Systems and

Cluster Programme (ISCP-Tz), seaweed value-added products are produced with the aim of adding value to the low-priced spinosum. Products that have been produced so far are seaweed soaps (with or without spices), seaweed powder, massage oil, body cream, cakes, cookies, jam, puddings and salads. Of these products soaps, body creams and powder are marketed commercially.

Coastal poverty and MPA management in mainland Tanzania and Zanzibar (Tobey and Torell, 2006)

To what extent should poverty reduction, development and other social issues be linked to protected area management?
The diversity, abundance and accessibility of marine resources provide a complement to subsistence agriculture for coastal communities and this may be a key reason for their relatively higher material wellbeing. All of the sites studied are on the coastline where there are concentrations of coral reefs that serve as breeding, nursery and feeding grounds for many marine animals. Fish caught by small-scale fishers provide a high percent of the animal protein consumed in coastal communities. These easily accessible resources as well as opportunities for seaweed farming appear to be related to improved food security and material standards of living. Study results show that marine resource exploitation is a critical part of household survival strategies and food security on the coast.

In most of the villages in our study people complained of increasing resource competition due to a rising number of both local and visiting fishers. Focus group interviews found that from the fishers' point of view, fish catch is low because fishermen lack suitable vessels and gear to fish offshore, and hence they are forced to overexploit the inshore reefs. Reducing fishing pressure and destructive practices, and increasing income from fishing are program elements of MPA efforts in all the study sties. Conservation efforts in both Tanga and Mafia have promoted offshore fishing through use of fish aggregating devices and alternative or more sustainable fishing techniques, such as large mesh gill nets, deep-sea line fishing with lights, and purse seine fishing for pelagics like sardines.

Fish abundance in most locations has declined significantly in the last decade, while fishing effort has increased. Inshore fishing effort has roughly doubled in less than 20 years and overfishing and destructive fishing are problems everywhere [19]. Nationally, the industrial trawling fleet has increased from 12 vessels in 1988 to 25 in 2005 [20].

Although destructive fishing methods are illegal, they continue to be used due to inadequate enforcement and competition for marine harvests. In Menai Bay, policing seems to have had a positive impact, but the MPA area is large. There is one powerboat for patrolling the Bay and local fishermen help to patrol their areas using hand-held radios. In Tanga, some villages have been equipped with radio equipment and patrol boats for enforcement and monitoring, and fishermen have established patrol units to monitor and report incidences of illegal fishing. The Mafia Island Marine Park has the strongest policing capabilities with three boats on the water monitoring the park's boundaries all day. Also, two tourist lodges have agreements to monitor illegal seine net fishing. An inability to stop dynamite fishing, the use of poison, and nets with small-mesh sizes

Fish marketing
The authors found that fish is stored in a variety of ways, but the greatest proportion of fish catch is not stored at all (58%). The primary methods for storing fish are smoking, frying, sun drying, and salting. One strategy to increase income to fishing families is to improve marketing and the value of the fish sold. From focus group and key informant interviews the authors heard that poor marketing infrastructure is one of the reasons that it is difficult for the poor to escape subsistence fishing and improve income. Lack of storage facilities, refrigeration or iceboxes, and poor roads result in lower quality of fish and lower price. Fisheries key informants noted that villages closer to markets and with better road infrastructure have greater turnover and higher prices. In a meeting with representatives of the SEAPROD seafood exporting company in Tanga, the authors were told that fishermen lose about 50% of their product because it spoils before it gets to the market. Company officials added that lack of storage facilities is a large obstacle that if overcome could substantially increase the income of fishermen. One of the poverty alleviation and sustainable fishery elements of the Mafia MPA project is to improve local fish marketing capacity. At present, the fish traders provide seine nets, even boats and engines on no-cost loan on agreement that fish is sold to them at a fraction of the fish's wholesale price. A fishing group is being developed that will focus on organizing fishers to directly sell their catch in Kilindoni (the main centre of Mafia Island) and Dar es Salaam.

It has been found in other studies that promoting income-generating businesses as part of community-based coastal management improves community interest and participation, and therefore the likelihood of success. A study by Sievanen et al. [22] found that in some cases seaweed farming has reduced some fishing activities, but that it should not be assumed that alternative livelihood activities alone will result in reduced fishing effort.

Building enabling conditions for integrated coastal management at the national scale in Tanzania (Torell et al., 2004)

The economic and ecological pressures on Tanzania's coastline are already great and yet continue to increase as a result of population growth and continued demands for economic development. Destructive practices, such as dynamite fishing, coral mining, and mangrove clearing, have led to coral reef destruction, mangrove depletion, and declining fish stocks. This in turn has caused other environmental disturbances such as soil and beach erosion. Between 1990 and 1994, fish catches have dropped by 32%—even though the effort remained the same—a clear signal of overfishing [6]. Another concern is that during the past two decades, coastal forests have declined from 59,300 to 1050km2.

Six factors shaped the TCMP (Tanzanian Coastal Management Plan) design.

1. There was no national level policy to guide the accelerating transformation of coastal Tanzania. In Tanzania, management of coastal resources was performed locally prior to colonization, and moved toward a national and even international scale during colonization and early independence. By the time the TCMP was taking shape, there was a closing of the loop, as local governments and communities gained more opportunities to manage their own resources. The design team saw the usefulness of creating a national policy for coastal management in Tanzania, to support and guide districts and communities as they embarked on planning and managing their coastal resources.
2. Top-down power structures impeded effective participation in environmental management initiatives. When the TCMP started, environmental governance was sector-driven and top-down. Collaboration between local and national-level administrations was weak or not present. The design team found it essential to build the TCMP as an integrated project that depended on inter-sectoral collaboration.
3. There was insufficient human capacity to deal with environmental management issues. The number of skilled scientists was growing thanks to the Swedish-funded marine science program. However, capabilities in the natural sciences provided only some of the knowledge and skills required to be an effective coastal manager. Also, there were few skilled program managers. Those who did exist were already employed by the government. Asking these skilled managers to leave their jobs to work for the TCMP would only lead to discontinuity in the very agencies that needed to be strengthened. As a result, a decision was made to hire a small team supported by inter-disciplinary working groups. This ensured maximum competence while keeping especially talented individuals in their existing jobs.
4. Poverty was a major issue along the coast. It was acknowledged as impossible, if not irresponsible, to focus the TCMP's efforts exclusively on resource conservation. One of the key goals for the TCMP was to create mechanisms for addressing emerging economic opportunities. In response, the TCMP committed to developing investment guidelines for mari-culture and tourism.
5. The TCMP built upon and made links to the extensive regional collaboration and capacity-building efforts for coastal management. Contributing to the regional and global ICM efforts became another of the partnership's goals.
6. When the TCMP began, there were a substantial number of local ICM initiatives in Tanzania, from which the partnership drew experience. Linking with local programs was critical, and an essential element of the project design. This meant including activities to assist and facilitate learning between ongoing local programs. In response, the TCMP has become a service centre for the local programs, by establishing an information centre and by hosting semi-annual learning retreats.

The goal of the National Integrated Coastal Environment Management Strategy is ''to preserve, protect and develop the resources of Tanzania's coast for use by the people of today and succeeding generations to ensure food security and to support economic growth.'' In order to achieve this goal, the strategy calls for seven actions to be completed by the year 2025

1. Support planning and integrated management of coastal resources and activities at the local level and provide mechanisms to balance national and local interests.
2. Promote integrated and sustainable approaches to the development of major economic uses of the coast to optimize benefits and minimize negative impacts.
3. Conserve and restore critical habitats and areas of high biodiversity while ensuring that coastal people continue to benefit from the sustainable use of these resources.
4. Establish an integrated planning and management mechanism for coastal areas of high economic interest or with substantial vulnerability to natural hazards.
5. Develop and use an effective (includes factors such as cost, practicality, appropriateness and efficacy) coastal ecosystem research, monitoring and assessment system that will allow already available—as well as new—scientific and technical information to inform ICM decisions.
6. Build both human and institutional capacity for inter-disciplinary and inter-sectoral management of coastal resources.
7. Provide meaningful opportunities for stakeholder involvement in the coastal development process and the implementation of coastal management policies.

Governance in a beach seine fishery: a case study from Lake Victoria, Tanzania (Medard et al., 2016)

Conclusion
This paper has argued that there is little relationship between Tanzania's fisheries regulations and the activities that characterise the LV fishery. Management and governance of this fishery is driven by financial interests. In the absence of devolution of powers and responsibilities to the communities, local level institutions are neither endorsed nor empowered. Corruption emerges from imbalances in power, and not from the absence of strong law. Corruption has become fundamental to the fabric Tanzanian fisheries management and governance. It represents the penetration of non-state relations of power into the state, as well as the community. At a lower level, communities and BMUs have been deputized to oversee the actions of corrupt officials by imposing upon them the responsibility of implementing state law. In this way, the law itself has become corrupting. It has created new community-level institutions that employ it in their pursuit of graft. Such community reform efforts are predicated on a traditional conception of corruption and a lack of legitimate state power. It is the markets and livelihood needs that coordinate activities at the local level and, in turn, they shape the organization of fishing (incl. which gear to use) and govern the resource use. This is driven by actors' interests to meet their livelihood and income needs (money) through markets (local and global) and not necessarily fisheries management objectives. The point to understand here is that the markets represent a staggering power that shapes governance system at national, intermediate and local scale, and transforms the way in which resources are exploited and managed. These markets are both internal (local) and external to LV. The local and global markets are interconnected to form one reality: 'complex fisheries governance' because the ability of the state to discipline people is weak and the power of market agencies is stronger. If conservation objectives are to be addressed in the management of this fishery, the TFD must now consider market based instruments to shape the fishery's governance and management. The beach seine is likely to remain a permanent characteristic of the fishery because of the opposing forces (counter- tendencies) between compliance and non-compliance is built into the social systems and networks of this fishery. These problems have led to related difficulties in implementing fisheries laws and regulations, state-community dichotomies, lack of trust between local communities and government, an underestimation of the abilities of fishing communities and, finally, government failure to govern the users of this resource base.

Fisheries (Anonymous, nn)

Alternative livelihoods – As the population of Zanzibar rises, people are seeking sustainable ways to earn a living without overexploiting declining fish stocks. Increasing options are becoming available.
*Seaweed farming: W*idespread throughout Zanzibar, seaweed farmers – usually women – grow seaweed on ropes (off-bottom culture techniques) in intertidal areas for export. It is an important livelihood activity, producing over 7000 tonnes a year.
Crab fattening: Some communities collect juvenile crabs and place them in net enclosures in mangroves where they are protected from predators. The crabs are fed a diet rich in carbohydrates so they reach marketable size quickly.
Pearl farming: Local communities in the Fumba peninsula farm oysters for pearls. The market for sustainably produced pearls in Zanzibar has great potential, through the thousands of tourist visitors annually, but it is essential that wild oyster populations are not depleted (this is currently done by ensuring all those with pearl farms have no-take zones in their areas).
Sustainable tourism: The most important way MPAs improve household income is by creating new jobs: for wildlife guides, boat captains, park rangers, snorkel guides, hotel staff and fishing guides. Indirectly, tourists provide a market for local crafts made from local materials.
Sport fishing: This is sustainable game fishing: after being photographed, fish caught are released – still alive – back into the sea.

Assessment of the Marine Artisanal Fisheries in Tanzania Mainland. (Hamidu and Singh, 2012)

Tanzanian fisheries are categorized into artisanal and commercial fisheries. The artisanal fishery exploits the freshwater bodies and the demarcated territorial waters in the Indian Ocean. The catch comprises a variety of finfish and invertebrates. The commercial fishery is mainly comprised of prawns, octopuses, lobsters, and to a small extent sea cucumber fisheries in the territorial sea, while the Exclusive Economic Zone (EEZ) is exclusively exploited by foreign fishing vessels (Mngulwi 2003). Common fish species in the EEZ include tunas, marlins, sword fish, mackerels and sardines. Sharks are also caught mainly as by-catch. Fishing gears commonly used include gillnets, hook and line, trawling for prawns, and purse seining for sardines.

The fisheries sector falls within the agricultural sector (Francis *et al*., 2007). Fisheries provide substantial employment, income, livelihood, recreation, foreign earnings and revenue to the country. The industry employs more than 177,000small scale full time fishers and about 4,000,000 people are engaged in other related fisheries activities like net mending, boat construction, fish vending and processing (MLFD2010).

The contribution of fishing in agricultural activities has remained fairly constant over the last decade ranging between 4.4% and 5.7%per annum and a period average of 4.6%.Starting from a low 2.9% annual growth in 2000, the sector's growth rate increased to around 6% between 2002 and 2005, and has since steadily dropped to 1.5%in 2010.The decrease in growth between 2009 and 2010 has been attributed to illegal fishing, and destruction of nursery grounds. Currently, the sector accounts for about 10% of the national exports

The artisanal fishery in Tanzania comprises catch from both inland and marine waters. It is considered to be the most important fishery as it lands most of the inland and the marine catches, contributing about 98% to the total landings. Historically, artisanal fisheries have provided the economic base for the considerable number of people in Tanzania(Mapunda, 1983).

Fishing is one of the major economic activities, which provide highly needed food source and income for majority of coastal communities. Fish contributes more than 30% to the total animal protein consumed in Tanzania(Ministry of Livestock and Fisheries Development,2011).

Most of the artisanal catch in Tanzania is consumed locally, either as processed or fresh, while catches of Nile perch, shrimps, lobsters, and octopuses are also exported. There is no effective central marketing agency in the villages. The fish traders visit different fish landing sites daily to buy fish and transport to markets in major towns. Price is set depending on the demand for fish and distances of villages from the major coastal towns. Hence, price of fish is influenced by the variable costs of transportation. Prices tend to be lower farther away from the major urban centres(Sobo,2012).

In Tanzania, entry into the marine artisanal fishery is open access in nature, leading to increased fishing effort which is subject to inefficient management control thus, leading to potential problems of over exploitation(Abdallah,2004).
The demand for fish in Tanzania is progressively increasing, particularly with the greater number of people living along the coast and with the expansion of tourism activities.

"Tanzania's fishery resources are believed to have reached the upper level of exploitation. This is believed to be so because fishermen have been fishing in the same areas since time immemorial"(Jiddawi and Ohman,2002). However, at the same time fishermen lack suitable vessels and gear to fish offshore, hence they are forced to overexploit the inshore waters. Interviews with fishermen show that they perceive that catches are declining and an increase in fishing effort will not result in increased catches. Fishermen are also concerned about the increasing resource competition due to a rising number of both local and visiting fishers (Tobey andTorell,2006). Fisheries resources are renewable; however, capture fisheries are subject to depletion if not sustainably exploited. High fishing pressure and illegal fishing practices contribute to resource depletion.

Currently, the management tools used include monitoring, control and surveillance, information gathering and processing, data analysis and dissemination, and collaborative resource management through stakeholder participation and empowerment. Despite ongoing fisheries resources management efforts, there has been a decline in fish stocks and degradation of the environmental (Harrison,2010).

A lot of work has been conducted in Tanzania on monitoring the artisanal fisheries resources. Most of the data collected are from short-term projects with specific goals. Government sponsored projects cover a range of subjects but due to resource constraints the information in most cases is not synthesized.

The Fisheries Development Division, apart from dealing with all matters related to fisheries sector, is also the custodian of fisheries statistics and has obligation to collect, analyse, manage, and disseminate fisheries statistics to various stakeholders. The fishery resources of Tanzania have been monitored since before 1960and the estimated yearly fish productions have been used in planning and management of fishery resources(Sobo and Mgaya,2005). The artisanal fishery in Tanzania is mainly monitored through two main types of surveys namely the frame survey, which monitors the fishing effort, and the catch assessment survey, for monitoring catch landings.

Frame survey is an inventory of fish producing factors such as number of landing sites, number of fishermen, number of fishing vessels and gears by type and size. It is also a description of fishing and landing activity patterns, processing and marketing patterns, as well as describing supply centres for goods and services. The frame survey is also referred to as fisheries census, which means the fishing effort is obtained by complete total enumeration(Cowx et al.,2003).

Catch Assessment Survey(CAS) are surveys of catch landings, which are conducted at selected landing sites. The collected information includes data on catch, species composition, associated effort, and other secondary data such as prices, weight of fish and number of fish caught for bigger fish.

While Tanzania coastal resources provide a wide range of services to support economic development, poverty is still one of the main issues faced by many of coastal communities. Challenges ranging from increasing population, widespread poverty, poorly planned economic development, under-resourced local government institutions and weak implementation of existing policies have made it difficult to manage and improve marine and coastal resources and the quality of life of communities along the coast (Harrison,2010). . Invariably, lack of income generating opportunities has been one of the main causes of over-exploitation of coastal resources. Majority of the people in the coastal area live below the poverty line (Mkenda et al.,2004). These people are therefore unable to afford bigger and motorized vessels that will enable them to explore newer fishing grounds further away from the shore. Lack of capital also leads to lack of formal education and skills thus, the link between decline of fish resources and the degradation of fishing habitats due to use of destructive fishing methods is not easily comprehended.
Competition among the fishermen in the near shore waters, and decreasing CPUE has led to fishermen resorting to fishing methods such as beach seining, small meshed gillnets and other unsustainable methods like dynamite. These methods usually catch smaller and juvenile fish, which makes the fishery unsustainable (Berachi,2003).

Coastal Profile for Tanzania Mainland 2014 - Thematic Volume I Including Threats Prioritisation (Nordic Development Fund, 2014a)

Destructive fisheries and illegal fisheries scores highest as the impact has been considered irreversible and action needs to be taken in order not to permanently lose habitats and resources that local communities rely on to sustain livelihood. Deforestation in upstream catchments is of major concern related to fisheries at the coast as it leads to changes in river flows which again causes flooding, sedimentation and erosion and poor mangrove management is outspread increasing erosion and estuarine siltation.

Widespread and of important concern to local communities are poverty, lack of education and lack of alternative livelihoods contributing to unsustainable practises of fishermen and poor fisheries resource management allowing open access and leading to conflicts between different stakeholders (tourism, fisheries, sea weed farmers).
Scattered but of major concern are conflicts arising over use of fishing gears some of which may be illegal.

Management Framework for Coastal Zone Management (CZM) theme
Widespread and of major concern to local communities are the inability to stop dynamite (and other illegal) fishing, which threaten coastal habitats and their productivity, the lack of financial capacity to address management issues, the low capacity and motivation at local government (district) level to implement and enforce existing legislation and poor coordination between different sectors leading to ineffective governance and failures in enforcement.
Widespread and of important concern is the corruption at diverse management levels associated with extractive activities, particularly within fisheries.

Widespread and of major concern to local communities is the illegal fisheries damaging seaweed, sea grass beds and coral reefs (shallow water trawling, beach seining and dynamite fishing).
Widespread and of important concern is the poor management of shores and lack of understanding of coastal erosion processes.

Widespread and of some concern is pollution into catchments which may impact on marine productivity by degrading nursery areas in the coastal zone.

Widespread and of some concern is coral bleaching caused by increasing temperatures in sea surface waters.

Scattered and of some concern is poor upstream agriculture practises leading to increased sediment loads in coastal waters.
Locally and of some concern are changed sediment loads to estuaries due to upstream damming and agriculture practises and unsustainable mining of sand, coral lime, and salt.

Locally and of some concern are anarchistic tourism development threatening cultural heritage sites, loss of employment opportunities for locals due to competition from other areas of Tanzania and Kenya, destruction of marine environments from unsustainable and illegal fishing practises and alteration of the shoreline.

Locally and of some concern to coastal communities are social conflicts over access to fisheries resources.

Locally and of some concern to coastal communities are gill netting imposing threats to dugongs, turtles and whales; shrimp trawling threatening turtles; introduction of invasive species; pollution of local watersheds; nutrient enrichment leading to overgrowth of coral reefs; sedimentation of coral reefs from river discharges, sewerage discharges and dredging; and tourism activities destroying sea grass beds and coral reefs.

The coastal regions of mainland Tanzania encompass about 15% of the country's land area, and are home to approximately 25 percent of the country's population (about 8 million people)5. The population density for mainland coastal Tanzania has been relatively stable for the past 10 years. However, the rapid rate of population growth in mainland Tanzania and especially the coastal urban areas poses a big threat to coastal livelihoods.

Studies on the prevalence and persistence of dynamite fishing indicate that it is driven by the demand for quick returns [even more than poverty], in the absence of more profitable alternatives. This has eroded many people's willingness to comply with sustainable fishing, and the ready availability of dynamite or material to make the desired explosives locally has made it persist. The consequent habitat destruction and overexploitation of resources has in turn affected the well-being of the same communities. This has led to the continued destruction of the marine environment. Innovative fishers have capitalised on new technologies – crudely designed 'FADS' (Fish Aggregating Devices) (Bagamoyo) to enhance their profit margins at least a few times of the seasons.

Most of the fishing by small-scale/artisanal fishers is largely market oriented, although it is still significant to household subsistence. Market linkages therefore form the most important part of mainland fishing livelihoods and contribute a significant percentage of local incomes. This is however limited by poor mechanisms for transportation including preservation for fresh produce (fish and other marine products). Fish and marine products are collected at landing sites by fishmongers, middle-persons or agents and sent to the market by sea or road to Kigamboni market which serves as the hub of fresh fish from as far as Lindi (Kilwa in the south) to Mafia island and Bagamoyo, or to processors in the various processing plants in mainland Tanzania (e.g. TANPESCA processing factory, Mafia). This pattern is restrictive or too expensive to be handled by many fishers, and has therefore created dependency on middle-persons some of whom maintain a patron-client relationship or bond, often exploitative and hence lowering local incomes. Only a few fishers had been able to take advantage of MACEMP support to establish their own marketing links. The increasing availability of micro-credit facilities (SACCOS, VICOBA) and money transfer facilities may provide opportunities for improving people's access to more efficient production equipment to enhance their livelihoods but this is yet to become evident for the larger population. The fishing is largely targeted for the market and the Kigamboni market.

Mari-culture: Mari-culture in mainland Tanzania is steadily growing. There is an increasing engagement in fish farming (milk fish, mullet, tilapia, and prawn) in the coastal districts and the potential is there to expand, contributing to food security, income generation and employment in coastal communities. The development of mari-culture is also regarded as an ideal measure to lessen pressure on capture fisheries and its association to resource and habitat degradation.
The potential for the development of mari-culture however high faces a number of challenges which include uncertain legal ownership for sites suitable for aquaculture, damage to the mangrove ecosystem, and infrastructural inadequacies at local level to establish viable and affordable mari-culture establishments and limited extension services.

Seaweed farming: Seaweed production plays an important role in the sustenance of coastal households particularly in Bagamoyo, Tanga, Kilwa and Pangani. Commercial cultivation of seaweed in mainland Tanzania began in 1994 spreading from Zanzibar whose people had started production in 1989. Strategies for value-addition to enhance producers' livelihoods have allowed small-scale production of seaweed soap [Mlingotini, Bagamoyo] which is sold locally to residents or tourists (Msuya et al, 2013:5). This has been possible through the Innovation Systems and Cluster Programme (ISCP-Tz) and Seaweed Cluster Initiative (Msuya, 2011). Value addition has raised the economic benefits of the farmers and particularly for women who are the main producers. The significance of seaweed production as a potential income earner has however, suffered from extensive die-offs [linked to environmental changes]; and low prices for the crop, which are between TSH 300-500

(=USD 0.2 - 0.35) per kg for cottonii species and TSH 200 (=USD 0.18) for spinosum, and which are grossly not commensurate to the intensive labour input.

Because of the lack of viable alternatives, female-headed households are in many coastal communities the poorest and most dependent on near shore resources as an important source of food and income. Ascription to gender roles has influenced what women do. In those communities largely dependent on the fisheries, women are mainly involved in agriculture, gleaning, collection of shellfish, sea cucumber, and octopus, and catching small shrimp or sardines in the near shore using nets or pieces of cloth. Only a few women have been able to transcend traditional norms defined by patriarchy to become engaged in small-scale fishing using small canoes around the shore waters unlike their male counterparts who go to the deep waters (Chando, 2002). A number also are engaged in fish-farming.

The bulk of the women in fishing communities are involved in the processing and marketing of fish. Long-distance retail trade of dried or fried fish is prominent by female traders and includes trade in sardines. But this is competitive and often restrictive due to family responsibilities.

Seaweed farming along coastal Tanzania is an important income generation activity dominated by women, but as mentioned above, it is labour intensive and the prices are very low because of the value-chain inequities.

The TCZCDP – introduced the Collaborative Management Areas CMAs which are based on resource use, specifically on shared fishing grounds, and therefore involve several villages in each CMA. This has helped reduce conflicts and address the difficulties of managing common pool resources.

Community-based management structures such as the Village Environmental Committees (VEC) and Beach Management Units (BMU) promote collaborative resources management and enforcement, which are crucial for livelihood sustenance. Other livelihood opportunities can be garnered through larger-scale management systems such as Mafia Island Marine Park (1995), which include regulation of the fisheries. These are supported through the enactment of village and district by-laws for enforcement or general management (Silva, 2006). Women's representation is currently a key requirement in these governance structures and coastal and marine management institutions, including the Beach Management Units (BMU).

Lack of political will to address and confront the factors leading to destructive resource use/extraction (e.g.: dynamite fisheries, mangrove depletion) is however limiting management efficiency, hence affecting livelihood enhancement opportunities. Fishing: the open-access/common property marine resource base has provided both opportunities for livelihood enhancement to coastal fishing households, but also challenges due to weak governance systems, low motivation and corruption among stakeholders which have facilitated the use of destructive fishing methods including dynamite fishing and the use of beach seine.

Management of the Fishery Sector

The Ministry of Livestock and Fisheries Development (MLFD) has overall management of fisheries policies and regulatory frameworks, assisted by the Fisheries Development Division (FDD) responsible for coordinating fisheries through several zonal/offices. The Prime Minister's Office for Regional and Local Government (PMO-RALG), coordinate devolved management by districts under the Fisheries Act (2003). The Deep Sea Fishing Authority (DSFA) under the Deep Sea Fishing Authority Act (2007) regulates international fishing vessels using the 223,000 km2 Exclusive Economic Zone (EEZ) in a 60:40 fee sharing structure with Zanzibar.

National policies and legislation governing fisheries, include the National Fisheries Policy and Strategy Statement (1997) and supportive Fisheries Act No. 22 (2003) and Fisheries Regulations (2009) of which a key sector policy given the artisanal nature of the fishery is the emphasis on Community Based Natural Resource Management (CBNRM) which establishes user rights to fisheries through Beach Management Units (BMU) and Collaborative Fisheries Management Units (CFMU) (WWF, 2010; MLDF, 2013). There are over 700 BMUs, mostly in Lake Victoria and 200 coastal BMUs. Of the latter 63 have Fishery Management Plans (FMPs), 36 have by-laws and 65% have been trained in CFM (MACEMP, 2012 b). While most marine fisheries are open access, or regulated by local institutions (such as BMUs), the industrial prawn fishery is managed by the FDD, through a rotating monthly access per vessel to the three prawn fishing zones, with a six month closed season, as of 1st September each year. Since 2010 the industrial fishery has been closed, through a self-imposed moratorium by the fleet of 20-30 vessels due to reduced catches. In contrast, the artisanal fishery for prawns is un-regulated.

The main shallow demersal fishing grounds of mainland Tanzania and associated islands lie within the 20 meter contour, an area that includes mangroves, rocky tidal zones, coral reefs, sea grass beds, estuaries and intermediate habitats (Muhando, C. and Rumisha, C.K., 2008). More than two-thirds of the 1,340 km mainland coastline has barrier coral reefs (i.e. Mafia, Mkinga, Tanga, Mafia, Kilwa and Mtwara) interrupted only near major rivers, a total area of 3,580 km2. Some deeper waters are also fished, to 100 meter contour, though little data is available on this fishery.

Multiple fishing gears are used in the demersal fishery, both traditional as well as modern (e.g. basket fish-trap, stakes tidal fish-trap, hand-lines, gillnets, and seine net (Muhando, C. and Rumisha, C.K., 2008). The artisanal vessels include ngalawa (outrigger dug-out boat), mtumbwi (dug-out canoe), dau and mashua (planked boats), and motorisation (only 12%).
The principal small pelagic fishing grounds are fished by large semi-industrial scale purse seine netting vessels, involving light attraction at night (Muhando, C. and Rumisha, C.K., 2008). This activity is concentrated over sheltered, moderately deep waters, mostly along the shores of Tanga region, off Dar es Salaam, in the Songo Archipelago and around Mtwara.
The large pelagic species (mainly inshore tuna), are fished within 5-10 km of the coast, are targeted by a local fleet of 9-12 m boats, with large meshed gill nets. Weather conditions are the major constraint to covering that distance, usually operating from Tanga, Dar es Salaam, Kilwa and Mtwara, where a total of 200-300 boats are distributed. The fishing usually only takes place on darker nights, for 12-15 days consecutive, followed by 5-8 days off.

Prawns are associated with muddy environments, and their fishing grounds are associated with shallow, brackish and mangrove ecosystems, adjacent to major rivers and estuaries (namely Rufiji delta, Wami, Ruvu, Pangani and Ruvuma estuaries). Prawns migrate to breed in deeper waters and the juveniles undergo several stages before moving back into the deltas, estuaries and creeks where they feed and grow to maturity. The fishery is predominately for export, trawling in less than 20m, with catches of the white shrimp comprising almost 66% of landings, the bulk of white originates from the Rufiji Delta area.

Muhando, C. and Rumisha, C.K. (2008) note prawn catches have remained relatively static between 1988 to to-day, ranging from 1,000 to 2,000 t/year, from 13 trawlers in 1998 to 23 in 2008, suggesting over-fishing.
The industrial fishery for tuna and other large pelagic species comprises purse seiners and long-liners that are licensed by the Deep Sea Fishing Authority to fish within the Tanzania EEZ. Currently there are around 70-80 vessels licensed. These vessels usually operate beyond the Territorial Sea (12 nm), mostly in the wider EEZ. There may also be 4-5 deep-water trawlers licensed to trawl at depths of 300-500 m.

With five major rivers draining into the coast, notably Pangani, Wami, Ruvu, Rufiji and Ruvuma, together with associated freshwater/brackish interfaces at the respective deltas and associated wetlands, there is a minor freshwater fishery in some coastal districts, but species sizes and catch are not reported.

Seaweed farming was first introduced in Zanzibar in 1984 where commercial production started in 1990. It was encouraged at numerous mainland Tanzania locations and became established in Mafia, Mtwara and Tanga in 2005, locations where the suitable clear-water, shallow sheltered lagoons exist. The species cultured are Eucheuma cotonii and E. Spinosium, attached to lines anchored in shallow sandy lagoons.

About 50% of landings are from the artisanal demersal fisheries sector, with the artisanal and semi-industrial small pelagic fishery contributing 25% of total landings (Muhando, C. and Rumisha, C.K., 2008). The remainder is comprised of miscellaneous invertebrate fisheries, such as lobsters, octopus, prawns and molluscs, including small-scale exploitation of pelagic species offshore (deep-sea waters), producing about 1,300 t/year. Muhando, C. and Rumisha, C.K. (2008) report lobster catches averaging 80 t/year from artisanal fishers (in Tanga, Dar es Salaam, Kilwa and Mafia) and sold to tourist hotels and for export purposes.

Seaweed is farmed in 11 coastal districts on the mainland, employing 5,579 people. Kilwa District engages the largest number (2,649 seaweed farmers), while 1,001 farmers are based in Lindi Rural, 971 in Lindi Urban, and the other seaweed farming districts engaging between 15 and 210 farmers (MLFD, 2010). It is sold as a food source, medicine and for the production of agar and carrageenan, to export markets in Asia, Europe and United States of America at a price in 2004 of 350-450 USD/t of dried Eucheuma cottonii and 180-220 USD/t for E. spinosum, but prices fluctuate, mostly going down (MACEMP, 2009).

Mari-culture has to date been limited to pilot trials but thanks to private sector operations with commercial farms for prawns at Bagamoyo and Mafia, several hundred employment opportunities are being realised. A tilapia farm is under development in Mafia. At present, employment and socio-economic significance remains low.

The following list summarises specific threats to livelihoods related to fisheries and aquaculture, and the natural environment, many of which are human-induced (see MNRT, 2013):

- Social conflicts over fishing gears - where local fishers use gears or methods (some of which are illegal) that are not acceptable by neighbouring villages.

- Social conflicts over access to resource – where cultural and historical rivalry over “traditional” fishing grounds increases as pressure on the resource increases; also includes increasing

resentment of migratory fishing groups of “dago” fishers during seasonal visits, using gears considered destructive or conflict with local traditions.

- Destructive and illegal fishing - causing decline in productivity due to habitat destruction through beach seine, spear guns and dragnets, and dynamite, adversely affecting the fisher community livelihoods.

- Poor fishery resource management – allowing open access fishery, thus increasing fishing pressure and stock depletion is difficult to manage; leading to conflicts with tourists over coral reefs to dive and to snorkel, fish landing sites and tourist hotels; to seaweed farming conflict with boat users and tourists;

- Poverty and lack of education – combine with absence of alternatives or investment, are all attributed as the causes for the current behaviour of fishers.

- Pollution into catchments and coastal zone - by dumping or leaching of domestic, urban, mining and industrial wastes, sewage, solids, agricultural pesticides into catchments or direct disposal in wetlands, draining to estuaries and coastal zone, affecting marine productivity.

- Drainage changes - re-claiming areas for agriculture, to build roads, houses and cities or mosquito control, or diversion or in-efficient use of water for irrigation, mining, industry, livestock or domestic and urban needs alters flows, changes estuarine sediment loads.

- Unsustainable mining - salt, sand, coral lime, fossil coral limestone, etc. mined with damage to physical properties of shorelines and river basins.

- River damming - for reservoirs for domestic water, irrigation and/or hydro-electric power (HEP) changing sediment loads, affecting estuaries.

- Poor mangrove resource management – allowing over harvesting of mangrove and wetland or riverine trees leading to erosion and estuarine siltation.

- Catchment deforestation in major basins – causing changes in river flows, leading to excessive run-off, flooding, erosion and siltation.

The pragmatic outlook on the fisheries sector along mainland Tanzania’s coast is that there is little room for expansion and the current pressure is damaging the productivity and catches are unlikely to increase with more fishing effort. NEMC (2009) considers that over-fishing pressure and destructive fishing methods have contributed greatly in undermining the marine ecology changing species compositions in the same localities. Distance travelled for search of good fishing ground averages half to one hour except for three Tanga districts, where fishers tend to cover longer distances, implies a local decline the inshore fishery quality, again signs of overexploitation. Some potential increase may be gained from deeper water operations, improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture.

There are over thirty national legislation documents with particular relevance to coastal and marine resources and environment management. As described in the preceding thematic overviews, these, relate to natural resources, maritime transport, waste management and pollution, water resources, forestry and agriculture, urbanisation, infrastructure, industry and others. An additional twenty to thirty international conventions to which Tanzania is signatory are also relevant to the coastal zone. Although financial and human resources have constrained the effective implementation of the diverse legislative mechanisms from operating at their full capacity, they do generally complement each other.

Coastal Profile for Zanzibar 2014 Thematic Volume I (Nordic Development Fund, 2014b)

The economy of Zanzibar is dominated by fisheries and tourism, and to a smaller extent agriculture and trade. Tourism in Zanzibar continues to be a major contributor to the National GDP and indications are that the contribution from the sector will continue to increase as the industry grows further. Its share of GDP increased to 51% in 2007 exceeding 43.5% recorded in 2006. The next largest sectors contributing to GDP are agriculture at 27.3%, and industry at 15.4 % (Zanzibar Economic Bulletin, March 2009, in Steck 2010).

The artisanal/small-scale fishery sector in Zanzibar supports a significant proportion of local livelihoods. In 2000, it was estimated that the activity provided full time employment for over 24,000 people with thousand more part time fishermen (UNEP/FAO/PAP/CDA, 2000). By 2007, this figure was estimated to be 34,268 (Joint Frame Survey, 2007). Enhanced market demand for fish and other marine products, including prawns, lobster and sea shells for export, has increased access to capital for investment and allowed some Zanzibari fishermen to advance into offshore fisheries increasing incomes for a certain percentage of fish-dependent households. Nungwi village, at the northern tip of Unguja Island is the primary landing site for large pelagic fish.

Fishing targeting the export market is significant in Zanzibar particularly related to prawns, lobsters, sea cucumbers (including seashells and seashell opercula). Bivalves such as cockles and oysters are collected mainly for domestic consumption. The most common fishing vessels are dug-out canoes, outrigger canoes, planked motorised boats and planked sailing boats. In 1997 there were 5,149 of such fishing vessels in Zanzibar, 2,933 of which were found in Unguja Island (UNEP/FAO/PA/CDA, 2000).
Increased effort in fishing has not resulted in increases in fish catches per unit, and reports indicate that the export of lobster and prawns has dropped drastically due to depleted stocks. This is attributed to the use of destructive fishing methods. Due to depletion of resources such as lobster, deeper waters are exploited using SCUBA gear.

Institutionally, the Ministry of Agriculture, Natural Resources, Environment and Cooperatives (MANREC) oversees an agricultural sector policy, which includes fisheries, while a long-term plan has yet to be developed for the sector. The Department of Fisheries and Marine Products (DFMP), enforces the law, while the Marine Conservation Unit (MCU) manages the Marine Protected Areas (MPA). The Marine Resources Department is responsible for all non-fisheries marine resources, and the Vice President's Office (VPO) and the Department of Environment look after environmental impacts and ICZM. The Marine Control and Surveillance Unit (MCS) is the enforcement part of the Fisheries Department.

The Fishery Policy (1985) objective is to increase the supply of fish, create employment and conserve the marine resources, regulated by the Fisheries Act, 1988 and its Fisheries Regulations (1993). While sustainable management of the marine environment falls under the Environmental Management for Sustainable Management Act ("Environment Act"), 1996, conservation of key breeding and feeding sites is done through the Nature Conservation Areas Management Unit Act, 1999.
The Deep Sea Fishing Authority (DSFA) under the Deep Sea Fishing Authority Act (2007) regulates international fishing vessels using the 223,000 km2 Exclusive Economic Zone (EEZ) a 40:60 fee sharing structure with the mainland.

Zanzibar has started community-based approaches in fisheries through Community Fishermen Committees (similar to Beach management Units, or BMUs, as seen on the mainland) in all fishing villages. Whereas the sea is publicly owned and every individual has a user right, marine environments adjacent to any village are traditionally under the use interest and monitoring of that village (World Bank, 2003).

Seaweed farming on Zanzibar has been divided into zones around the two islands, with allocated areas to the various seaweed companies (RGV 2014). The result has kept prices down but enables growers to have guarantee purchase from companies, in exchange for support to farmers to set-up farms. Recently, some deregulation has allowed farmers to sell product on the open market, but with reduction in materials and extension services from companies and local declines in production (RGV 2014).

The main shallow demersal (bottom-living) fishing grounds for Zanzibar artisanal fishermen lie within the 10 meter contour, calculated at about 6,720 km2 of which 4,000 km2 (59.5%) are around Unguja and 2,720 km2 (40.5%) are around Pemba (BoT, 2006). Some deeper waters are also fished, of which around 90 km2 is living coral (VPO, 2012).

The principal small pelagic fishing grounds are fished by large semi-industrial scale purse seine netting vessels, involving light attraction at night (Muhando, C. and Rumisha, C.K., 2008). This activity is concentrated over sheltered, moderately deep waters, mostly on the western shores of Pemba and Unguja.

The large pelagic species (mainly inshore tuna), are fished within 5-10 km of the coast, are targeted by a local fleet of 9-12 m boats, with large meshed gill nets. Weather conditions are the major constraint to covering that distance, usually operating from Nungwi where 100-150 boats are based. The fishing usually only takes place on darker nights, for 12-15 days consecutive, followed by 5-8 days off.

MACEMP (2009) estimated of fishers that, 82.6 % use gillnets, 15.6% use drift net, 76.5% use hand line, 20.6% use trolling and 2.9% use long lining. Overall landings are dominated by reef fishes (35%), small pelagic (24%) such anchovies and sardines; and large pelagic (13%) including tuna, billfish and Spanish mackerel. The remaining 28% is contributed by shellfishes, invertebrates and other mid water fishes like sharks (Jiddawi, 1998).

The industrial fishery for tuna and other large pelagic species comprises purse seiners and long-liners that are licenced by the Deep Sea Fishing Authority to fish within the Tanzania EEZ. Currently there are around 70-80 vessel licenced. These vessels usually operate beyond the Territorial Sea (12 nm), mostly in the wider EEZ. There may also be 4-5 deep-water trawlers licenced to trawl at depths of 300-500 m.

Seaweed farming was first introduced in 1984 and commercial production started in 1990. Jambiani and Paje were two pilot villages in 1989 producing 261 t/yr. The species cultured are Eucheuma cotonii and E. Spinosium (citing De La Torre-Castro and Jiddawi 2005, Eklöf, J.F et al, 2005, Jiddawi and Ngazy, 2000), attached to lines anchored in shallow sandy lagoons. Leading districts are Central, South and North 'A' in Unguja and in Pemba main seaweed farming districts are Wete and Micheweni.

The Zanzibar Fisheries Frame Survey (2010) summarises the number of fishers, with just fewer than 15,437 in 1985 and to 34,571 in 2010. Due to variations from year to year and seasons, the total number of full-time fishers on the islands of Zanzibar is likely to be between 28,000 and 37,000 individuals. Fish are landed at 33 and 123 official fish landing beaches on Pemba and Unguja, usually associated with the home villages of fishers. A number of temporary fishing camps exists that house dago, or migrant fishermen, seasonally moving up and down the Zanzibar and mainland coasts (notably from Kojani Island, off the NE Pemba).

The Frame Survey data further reveals that there are 8,639 vessels operating, with outrigger canoes and dug-out canoes together accounting for over 6,000 units. Dhows and planked boats are dominant in Unguja while in Pemba the outrigger canoes are more common. For 2010, only 15.6% of fishing vessels in Zanzibar were propelled by motor, the remainder using sails, poles and/or paddles.

Seaweed is now farmed in over 56 villages, employing 21,969 people in 2009 (2010 Frame Survey) and production has reached more than 9-10,000 t/year (MACEMP, 2009). It is sold as a food source, medicine and for the production of agar and carrageenan, to export markets in Asia, Europe and United States of America at a price in 2004 of 350-450 USD/t of dried Eucheuma cottonii and 180-220 USD/t for E. spinosum, but prices fluctuate, mostly going down (MACEMP, 2009).

Various segments of the inshore fishery sector have recently been showing signs of over-exploitation (Muhando and Rumisha 2008). The estimated potential for Zanzibar is between 25,000 and 30,000 t/year (Mkenda and Folmer 2001, quoting FAO 1991), thus current landings of around 25,000t annually reflect a fully exploited resource. Considering the significant increasing in number of fishers over the years, the catch per unit effort (CPUE) has clearly declined.

Mkenda and Folmer (2001) stress that the lack of information on the situation of fish biomass in Zanzibar remains a major management problem. Fish biomass surveys (and thus maximum sustainable yield (MSY) estimates), have not covered the inshore fishery, the mainstay of the artisanal sector.

The growing demand for fish has increased with population growth and the expansion of tourism, causing increases in fish prices, increased fishing pressure and increased use of gears that are destructive (i.e. beach seine, spears, and juya la kigumi - a dragged purse-seine net used around reefs). The latter is one of the more difficult to control because the net used is not illegal but the way it is used (involving smashing corals to force fish out) is destructive and illegal.

Damage to habitats cause loss of spawning and nursery grounds, loss of biodiversity and diminished habitat resilience.

Exports of marine fishery products are valued at USD 598,203 from Zanzibar and include fish, sea cucumber, shells, lobster, crabs, squids, octopus, sardines and aquarium fish (DFMR, 2006). However, the local market for seafood's, especially from the tourism sector, creates a strong demand for fish and shellfish, with little surplus for export. As a result, Zanzibar exports on average only a few tonnes of fresh fish, which provides a small percentage of revenue (Table 9).
Seaweed accounts for 1% of total agricultural production, but 23% of cash crop production in 2007 (SMOLE, 2010, quoting OCGS, 2008) and is a significant source of foreign exchange earnings, averaging 13% of merchandise trade exports. Zanzibar exports on average 7,128 t/year, which is considerably more valuable than the total sum of all the other export products.

According to MACEMP (2009), livelihood studies on Zanzibar showed that fishing is the most dominant livelihood source, with 28.7% occupation on average over all districts, followed by crop farming (24.2%) and seaweed farming (14.4%), while tourism and other activities jointly accounted for 32.6%. The fishing industry also supports a significant number of individuals working in associated sectors such as boat building and repair, gear selling and repair, and marketing of fishery products, involving a total of 34,268 individuals were directly employed in fisheries related sectors (Jiddawi & Khatib, 2007; Jiddawi & Yahya, 2002). SMOLE (2010) reports that despite the tendency of a lower fish CPUE, fishermen have a higher than average income, USD 765/year compared to average incomes of USD 415/year.

Seaweed is now farmed in over 56 villages, employs 18,000 people and has become an alternative source of income for coastal communities, a supplement to fishing, livestock and agriculture activities especially for women who account for 88% of the seaweed growers. They are supported by six seaweed companies who supply farming input, techniques and purchase the dry product.

Incomes and production have however changed over time. In 1991, farmers produced an average of 1.5t annually, earning farmers nearly US$200 a year at 2007 prices. Production has dropped to an

average of 0.5t per farmer in 2009, with only 6% of farmers earning $148 or more annually (SMOLE, 2010). The price has increased over time, but not enough to keep pace with inflation, despite the 2006 government increase in the minimum price. Growers, however, still continue to farm as they have no livelihood alternatives and despite DFMR efforts to encourage divergence from the on-foot, lagoon-based E. spinosum culture to the deep water growing of the more profitable E. cottonii. The main difficulty, especially among women, has been that most are not competent swimmers.

Other emerging mari-culture activities described by MACEMP (2009) are finfish culture, culture of pearls, oysters and crab fattening (citing Jiddawi et al, 2007, Dubi et al, 2006). All are very small scale and some still in their experimental phases, hence employment and socio-economic significance remains low.

The summarised specific threats to livelihoods related to fisheries and aquaculture, and the natural environment, are as follows:

- Social conflicts over fishing gears - where local fishers use gears or methods (some of which are illegal) that are not acceptable by neighbouring villages.
- Social conflicts over access to resource – where cultural and historical rivalry over “traditional” fishing grounds increases as pressure on the resource increases; also
- Includes increasing resentment of migratory fishing groups of “dago” fishers during seasonal visits, using gears considered destructive or conflict with local traditions.
- Destructive and illegal fishing - causing decline in productivity due to habitat destruction through beach seine, spear guns and dragnets, adversely affecting the fisher community livelihoods.
- Lack of resource management – leading to conflicts with tourists over coral reefs to dive and to snorkel, fish landing sites and tourist hotels; to seaweed farming conflict with boat users and tourists; allowing open access fishery, thus increasing fishing pressure and stock depletion is difficult to manage.
- Poverty and lack of education – combine with absence of alternatives or investment, are all attributed as the causes for the current behaviour of fishers.

The pragmatic outlook on the fisheries sector on Zanzibar is that there is little room for expansion and the current pressure is damaging the productivity. Catches are unlikely to increase with more fishing effort. Some potential increase may be gained from deeper water operations, improvements in efficiency and/or value-added in the small pelagic fishery and from coastal aquaculture. The current policy of “open access” (confirmed by World Bank, 2003) raises concern that, together with the findings that there is over-fishing (Mkenda and Folmer, 2001), the current policy goal is not feasible and regulation is needed so that the catch realised is the MSY.

Community Participation in Fisheries Management in Tanzania (Sobo, 2012)

Increased pressure on the fishery resources use and destruction of the aquatic environment led to the introduction of the establishment of participatory management which was implemented by formation of Beach Management Units. The government, through the Fisheries Act Number 22 of 2003 (section 18) and its principal Regulations of 2009 (Regulation 133 - 136), provides for establishment of participatory resource management approach by involving local fishing communities, a system commonly known as co-management through Beach Management Units.

The government decided to involve local communities in fisheries management through Beach Management Units as they are the beneficiaries, they have vast experience and indigenous knowledge on the behaviour of the fishery resources and they are the first to suffer when the resource is completed. This brings advantage to them (BMU) to be involved in managing the resources, protect, conserve, utilize in a sustainable manner and involved in decision making. A Beach Management Unit means a group of devoted stakeholders in a fishing community whose main function is management, conservation and protection of fish in their locality in collaboration with the government.

According to BMU guidelines, in every BMU, there is data and information committee of six members who are supposed to be trained on collection of Catch Assessment Survey (CAS) data.

Their success is due to the following reasons: Support by the village government which gave the BMU the mandate to collect revenue on behalf of the village government, Seriousness in revenue collection – ensuring all possible revenue collection are met and transparency among the BMU leaders, village

government and their activities implementation. These are the basis of their sustainability and their existence.

The lesson learnt from these BMU's including the following:

- ☐ A lot of trainings have been provided to these BMU members
- ☐ The majority of BMU members are less exposed to community project management therefore their basic idea is that community projects means simply benefiting from it financially and not to use their efforts energy and resources to make project a success. Thus such attitude calls for a lot of follow-up and monitoring and support for success.
- ☐ Low level of education to the BMU members makes execution of the training they get a bit difficult.
- ☐ Lack of commitment to community development activities makes it difficult for the BMU members to commit to BMU activities.
- ☐ The BMU leaders with exposure to other activities, with better income are more serious and committed to the BMU activities; also they are able to put to use the training they get. I.e. So manga BMU leaders have their own income earning activities that keep them busy most of the time but they still work closely together in managing the BMU and all activities are properly documented as compared to other BMUs in RUMAKI.

Tanzanian Coastal and Marine Resources: Some Examples Illustrating Questions of Sustainable Use (Bryceson and Francis, 2000)

Amongst these the authors emphasise:

- Dialogue and linkage between traditional and scientific knowledge systems.
- Mechanisms for interaction between scientists, managers and decision-makers.
- Continued human and technical capacity building of research institutions.
- Essentiality of addressing land and sea tenure and common property rights.
- Genuine involvement and empowerment of local communities and civil society including community based organisations (CBOs), and local non-governmental organisations (NGOs).
- Credible and equitable arrangements for benefit-sharing with communities.
- Open availability of information for overall transparency and accountability.
- Integration of socio-economic opportunities into conservation programmes.
- Recognition of and respect for local and traditional institutions.
- Openness in collaboration between traditional and government institutions.
- Strengthening of relevant institutions providing entry to decision-making.
- Management agreements between institutions for cross-sectoral co-ordination.
- Long-term and broad-based visions in policy thinking.
- Democratic process of public involvement in policy-making and implementation.

Signs of environmental degradation, as well as a decline in natural resources and biodiversity, are beginning to become more obvious. This is evidenced by declining yields of fish, deteriorating conditions of coral reefs, and continuing reduction in the area of mangroves and coastal forests. This degradation is attributed to unsustainable use of coastal resources as well as pressures from the growing coastal population.

Various management responses have been (or are being) undertaken at different governance levels in the attempt to manage coastal and marine resources sustainably. These responses include traditional management systems, collaborative management arrangements, and enforcement of policies and laws through regulatory mechanisms. Despite all these efforts, problems of biodiversity loss, pollution, and habitat destruction and degradation continue to increase. This clearly indicates deficiencies in the existing management frameworks.

Traditional management systems and many customs and traditions associated with fishing in Tanzania have broken down because of pressures from commercialisation, population growth, technological innovations and deterioration of the authority of elders as guardians of management systems (Tobisson et al. 1998). While in several places colonialism is regarded as one of the main contributing factors to the collapse of traditional management systems, in Tanzania that was less directly the case. During the German and British rules and even after independence, fishing was not considered a priority activity by the authorities, and therefore there were fewer interventions by the Governments than, for instance, in cash-crop agriculture.

Table 3: Some of the main policies, legislation and plans relevant to management of coastal and marine environments.

Resource	Policy	Legislation	Plans
Coral reefs.	• National Fisheries Sector Policy and Strategy Statement, 1997.	• Fisheries Act, 1970. • Marine Parks and Reserves Act, 1994.	
Mangrove forests.	• National Forest Policy.	• Forest Ordinance.	• National Forest Action Plan 1990/91–2007/08. • Management Plan for the Mangrove Ecosystem in Tanzania, 1991.
Fish stocks.	• National Fisheries Sector Policy and Strategy Statement, 1997.	• Fisheries Act, 1970. • Marine Parks and Reserves Act, 1994. • Deep Sea Fishing Authority Act, 1997. • Territorial Sea and Exclusive Economic Zone Act, 1989.	
Seagrass beds.	• National Fisheries Sector Policy and Strategy Statement, 1997.	• Fisheries Act, 1970. • Marine Parks and Reserves Act, 1994.	
Beaches.	• National Land Policy, 1995.	• Town and Country Planning Ordinance, 1956 Cap 378.	• Town/City Plans.
		• The Town and Country (Public Beaches Planning Area) Order, 1991.	
Endangered species.	• National Fisheries Sector Policy and Strategy Statement, 1997.	• Fisheries Act, 1970 • Marine Parks and Reserves Act, 1994.	
Cross-cutting.	• National Environmental Policy		
	• Water Policy, 1991.	• Water Utilisation (Control and Regulation) (Amendment No. 10), 1980.	
	• National Land Policy, 1995.	• Land Act, 1998 • Village Land Act, 1998.	
	• Local Government Reforms.	• Local Government (District and Urban Authorities) Acts, 1982. • Regional Administration Act, 1997. • District and Village bylaws.	
	• Public Health.	• Public Health (Sewerage and Drainage) Ordinance.	
	• Mining Policy.	• Mining (Environmental Management and Protection) Regulation, 1999.	

The assessment of Tanzania's co-management experience with respect to coastal and marine resources has demonstrated the following:

- In co-management systems, the degree of power sharing and the amount of responsibility between the government authorities/programme (or project) management team and local communities range from full control by the former to shared control by the authorities in charge and local communities. In all the co-management practices reviewed, the government remains legally responsible for the overall management of resources, while the resource users' needs are included in the planning and implementation processes.
- Different mechanisms have been used to actively involve various stakeholders in decision-making processes. District environmental committees were established that draw members from villages and other stakeholders. These committees provide a link between the Project and the communities as well as with the government agencies. At the village level, Village Conservation Committees have been established. These committees have been instrumental in surveillance and law enforcement systems, educating villagers on environmental conservation and monitoring project activities. In addition, there is a Steering Committee composed of representatives from the World Wide Fund for Nature Conservation (WWF), the Commission of Natural Resources, the Department of Environment, the Ministry for Regional Administration and Special Departments, local committees, and district commissioners. Tanga Programme is guided by a Regional Steering Committee with the following membership: Regional Administrative Secretary, District Executive Directors of Muheza and Pangani, Tanga Municipal Director, and representatives of Irish Aid and IUCN's East Africa Regional Office (EARO). This Committee approves annual work plans, reports and budgets, and makes policy decisions.
- Participatory processes have been widely used in the designing, planning and implementation of different programmes. These processes involve both primary and secondary stakeholders in socio-economic and resource assessments, issue identification and analysis, and evaluation and monitoring (Tanga Coastal Zone Conservation and Development Programme); in development of a General Management Plan (Mafia Island Marine Park); and in demarcation of boundaries (Menai Bay Conservation Area) (van Ingen and Makoloweka 1998, Ngaga et al. 1999, Kelleher 1999).
- As highlighted in the previous section, supportive policies and legislation for co-management practices currently exist in Tanzania. However, making co-management approaches work

effectively on the ground will require a change in the attitudes of government authorities as well as local communities:

- Despite the approval of the Local Government Reforms, which give more powers to the district authorities, there is still too much dependence on directives and guidance from central government.
- The Tanga Programme has not succeeded in establishing bottom-up planning. The Programme planning cycle (village action planning Ý district planning Ý programme planning) is not followed, as district work plans are based on the Programme work plan instead of on the village action plans (Kelleher 1999).
- Local communities are not satisfied with the kind of support they receive from district staff. The district staff has been having difficulties responding to villagers' concerns punctually, providing convincing explanations for their own actions, and solving the villagers' problems (Kelleher 1999).

· Formal management agreements are used to define roles and responsibilities of collaborating partners as well as improve relations among institutions. These agreements have been developed through participatory and transparent processes. In Tanga, village-based collaborative fisheries management regimes cover about 70% of the entire coast (Kelleher 1999).

· Local communities are involved in enforcement of regulations and village bylaws. In Tanga and Menai Bay, the local communities are currently participating in regular patrols (Kelleher 1999, Ngaga et al. 1999). More importantly, part of the costs of patrols is borne by the district authorities. Tanga and Muheza districts are paying for the fuel of Mwambani and Kigombe patrol units, respectively.

· MBCA has developed regulations and procedures governing fishing and the establishment of fishing camps, or 'dago'. Through these regulations, the local community in the area excludes outsiders from fishing in the Bay. For instance, the fisher folk from Dar es Salaam are prohibited from fishing in the Bay (Ngaga et al. 1999). This creates a sense of ownership and responsibility in the local communities in the Bay.

· There are indications that some communities have started receiving economic benefits that the communities attribute to these management initiatives. Between January 1998 and June 1999, the fish catch at Bweleo and Unguja Ukuu in the Menai Bay increased by 35% and 8%, respectively (Ngaga et al. 1999).

Table 5: Major factors affecting the sustainable use of coastal resources in Tanzania.

COASTAL RESOURCES	VALUES / USES		ISSUES THREATENING SUSTAINABILITY	MANAGEMENT RESPONSES	EXAMPLES IN COASTAL TANZANIA
	ECOLOGICAL	ECONOMICAL			
Coral reefs	• Habitat shelter. • Food chain support. • Wave barrier. • Sand production. • Carbon sink.	• Fishing. • Tourism and recreation. • Pharmaceutical products. • Coral mining.	• Physical damage. • Over-exploitation. • Pollution. • Coral bleaching.	• Traditional systems. • Legislation. • Protected areas. • Community projects.	• Mafia, Tanga, Kojani, Uroa/Pongwe.
Mangrove forests	• Habitat shelter. • Food chain support. • Wave barrier. • Detrital breakdown. • Sediment/pollutant trap/filter.	• Fishing. • Timber, firewood. • Eco-tourism. • Additional products. • Aquaculture sites.	• Over-exploitation. • Clearing. • Pollution.	• Traditional systems. • Legislation. • Protected areas. • Community projects.	• Rufiji, Menai, Bagamoyo, Mtwara.
Fish stocks	• Food chain support.	• Fishing.	• Over-exploitation. • Conflicts between subsistence, artisanal and industrial trawlers. • Inappropriate fishing methods. • Habitat destruction. • By-catch. • Pollution.	• Traditional systems. • Legislation. • Community projects.	• Mkokotoni, Matemwe, Lindi, Mtwara, Chwaka/Marumbi.
Seagrass beds	• Habitat shelter. • Food chain support. • Detrital breakdown. • Sediment/pollutant trap/filter.	• Fishing.	• Inappropriate fishing methods. • Pollution.	• Traditional systems. • Legislation.	• Bagamoyo.
Beaches	• Wave energy absorption. • Habitat shelter. • Turtle nesting sites. • Sediment/pollutant trap/filter.	• Working place, landing site. • Building sites. • Sand mining. • Tourism and recreation.	• Accessibility. • Erosion. • Cultural conflicts. • Pollution. • Inappropriate erosion mitigation measures.	• Traditional tenure and access systems. • Legislation. • Mitigation measures.	• Kunduchi
Endangered species (e.g., turtles, dolphins, dugong, red colobus monkeys, holothuria)	• Biodiversity values.	• Eco-tourism.	• Over-exploitation. • Accidental catches. • Habitat disturbance and destruction.	• Legislation. • Protected areas.	• Nungwi, Kizimkazi, Jozani.

Annex 2 List of people and organisations met in workshops or interviews

Meeting at the Ministry of Agriculture, Livestock and Fisheries
Monday 17 October 2016

Name:	Organisation:
Dr. Yohana L. Budeba	Permanent Secretary, Fisheries, Ministry of Agriculture, Livestock and Fisheries
Mrs Mlolwa	Acting director fisheries
Merisia Sebastian	Principal fisheries officer (PFso)
Magese Bulayi	Acting Assistant Director Fisheries
William M. Ndagile	PFso
Upendo Hamidu	Senior Fisheries officer (SFso)
Tumaini Chambua	SFso
Melkizedeck Koddy	PFso
Pudensiana C. Panga	SFso
Zuhura I. Kimera	SFT
Magrett Dominic	PFso
Dr. Tinuga DK	PVO
Ritha Maly	Assistant Director Aquaculture (ADAQ)
Abdi Hussein	SFso

Meeting Dar es Salam Fish Market
Tuesday 18 October 2016

Name:	Organisation:
Henry Sato Massaba	Dar Int. Fish Market
Juma Issa Msangi	Ilala Municipal Council
Ali Kibwana	Dar Int. Fish Market
Nassor Ismailly	Body member Dar Int. Fish Market
Chepi O.Mitole	Market User Committee
Said M. Iddy	Market User Committee

Mustafa Mchachu	Chairman Zone 5
Novath A. Mwogeya	Chairman Zone 1
Waziri B. Kasagi	Chairman Zone 2
Asha Zewe	Ilala Mc – fisheries officer Ferry int. market
Hadija Misango	Food vendor ferry fish mkt
Seleman Mthuna	Treasurer
Chande Dadi Ally	
Godwin E. Bagandanshwa	Workers general supplies
Zakia S. Abdala	Committee member Zone 4
Charles S. Mussa	Deputy secretary Zone 4
Omari Makungu	Chairman Zone 3
Eliakunda Godyfrey	ASKARI/security officer
Athumani Iddy	Chairman Zone
Cyril Nyange	Chairman Zone 6
Rajabu R. Mngoi	
Mbaraka Kilima	Secretary, market committee
Suleiman Mluge	Secretary Zone 3
Saleh Mseand	Chairman UWAWADA
Seif Said Seif	Treasurer UWAWADA
Dorah Minja	Health officer

Focus group with MBU members at the Ferry Fish Market
Tuesday 18 October 2016

Name:	Organisation:
Upendo Hamidu	Ministry of Agriculture, Livestock and Fisheries (acting as translator)
Abdallah (M)	BMU Chairperson – Temeke (former fisher)
Saidi (M)	BMU Chairperson – Pemba Mnazi (fisher)
Nick (M)	Secretary for 4 BMU's that have formed a network to have

	collaborative management of the fishing areas
Sulemani (M)	BMU Chairperson – Mbwa Maji (and fisher)
Constance (M)	MCS committee in a BMU
Selemani (M)	Member of the data collection committee of a BMU - Mbwa Maji (and former fisher)
Mariam (F)	Deputy secretary of BMU – Mbwa Maji
Fatuma (F)	Secretary for statistics group

Zanzibar workshop
Wednesday 19 October 2016

Name:	Organisation:
Sheha Idrissa Hamdan	Director of Planning &Research Ministry of Agriculture, Natural resources, Livestock and Fisheries, Zanzibar
Mohamed Chum Juma	Chief Fisheries Officer- DFD
HashimChandeMoumin	Chief Marine Resources- DFD.
Bishara Ali Juma	Artisanal Fishery Officer- DFD
Mchanga Said	Planning Officer Department of Fisheries Development-DFD
Dr. NarrimanJiddawi	Senior Lecturer Institute of Marine sciences IMS - Zanzibar
Dr. Saleh Yahya	Lecturer Institute of Marine sciences IMS - Zanzibar
Omar Hakim Foum	Fisheries Officer & Smart Fish Focal point Zanzibar – Department of Fisheries.
Jaala Simba	Coordinator Marine Conservation Unit
Dr. Ali MakameUssi.	Researcher & lecturer State University of Zanzibar.(SUZA)
Mr. Hosea Gonza Mbilinyi.	Director General DSFA
Dr. Yohana Shagude	Director IMS
Haji Shomari Haji	Head of MCS
Mohamed Suleiman	FEC- MBCA
Anas Masoud Othman	Manager MBCA
Sharif Mohamed Faki	PECCA

Workshop Embassy
Friday 21 October 2016

Name:	Organisation:
Samuel Chiwingi	Alphakrust
Bulongo Farah	MALF
Asha Zewe	Ilala Municipal council (IMC)
Mohammed Said Mohidin	Ferry Fish Market
Zahir Ashur	Ferry Fish Market
Mohamed Ally Juma	Ferry Fish Market
Onesmo Sulle	TIFPA
Gratian Bamwenda	ESRF
Innocent Ngao Wanyonyi	WIOMSA – Western Indian Ocean Marine Science Association
Piero Benedetti	FAO
Daniel Mira Salama	Worldbank
Jason Rubens	Worldbank
Eugene Gies	NL Embassy
Ambukisye Simfoe	FETA-Bagamoyo
Bakari	B.M.U. Kinondoni
Charles Lugomela	University of Dar Es Salaam
Yohana Shaghude	University of Dar Es Salaam
Paul Onyango	University of Dar Es Salaam
Catherine Msina	Marine Parks
Erika Pasquini	EU
Winfried V. Haule	TAFAYO
Melkizedeck Koddy	Ministry of Agriculture Livestock and Fisheries (MALF)
Henry S. Massaba	Feri Market
Onesmo Sulle	TIFPA
Komba Kakoa	Nipashe newspaper
Anne Robi	Daily News

Daniel Semberya	The Guardian

Interviews held with (during the week of 17-21 October 2016)

Fred Kafeero	FAO representative in Tanzania
Erika pasquini	EU
Mathayo Mpanda Mathew	Project manager, external relations, cooperation, EU Delegation
Mathias Migulu	WWF
Lindsey West	Director, Sea Sense
Winfried Haule	TAFAYO
Charles Lugomela	University Dar es Salam - Department of Aquatic Sciences and fisheries Technology
Benaiah Benno	University Dar es Salam - Department of Aquatic Sciences and fisheries Technology
Paul Onyango	University Dar es Salam - Department of Aquatic Sciences and fisheries Technology
Daniel Mira Salama	Senior Environmental Specialist, Worldbank
Joseph Msaki	On behalf of Director of Operations, Port of Dar es Salam
Nelson C. Mlali	Acting Port manager, Port of Dar es Salam
Gladson N. Urioh	Acting Planning Director, Port of Dar es Salam

Annex 3 Brief notes of meetings and workshops

Stakeholder Workshops on Zanzibar and in Dar es Salam

On Zanzibar and in Dar es Salam we held workshops with a group of experts from fisheries, government, research and civil society (see annex 2 for participants and annex 4 for the programme). The main method we used in both workshops was to ask the participants, divided in small groups, to discuss important marine (fish) value chains amongst themselves in two rounds. In the first round we would ask them to describe the main characteristics of the value chain and the problems the actors in the chain faced. In the second round we would ask the participants to think about solutions to these problems. In Zanzibar the stakeholders would create a list of main problems derived out of the first round (in which quite some chains had been identified) and discuss the top three problems of that list in more detail. In Dar es Salam the groups would discuss the problems identified in their chain.

Zanzibar

The chains that had been discussed on Zanzibar were: small pelagic fishery (sardines, anchovy), artisanal fisheries (reef fisheries and large pelagic), sea cucumber fisheries and sea weed farming and the aquaculture chain. The main problems that were discussed in more detail were:

1. Going further
2. Aquaculture
3. Post-harvest losses

Going further: fishermen in Tanzania and Zanzibar all fish in nearshore waters, it would be good to have some fishermen fish further out. However there is a lack of seaworthy vessels, lack of offshore fishing skills, lack of modern fishing gears, it will have high investment costs, and there is a lack of processing industry. What is needed? Promote investment, PPP, training, change mind sets of local fishers. Who should do that? Government, private sectors, development partners e.g. the NL.

Aquaculture: There is a lack of seeds, feeds, lack of knowledge farmers, lack of policy and technology. We need to develop breeding and hatchery, use of local food stuff, enabling policy, review our curriculum in schools and private sector. Who should do that? Private sector should drive it. For seed we need investors, but also universities, research institutions and government. Species that are thought of: octopus (small group in Pemba is doing it), snapper, grouper (high value species) and milkfish (can take fingerlings from the mangrove).

Post-harvest losses:

	Problem	Solution
1	Lack of ice freezers, lack of electricity at most of the landing sites	Electricity company should make these improvements
2	Lack of water	Zanzibar water authority
3	Lack of space and poor hygiene in the boats. Most of the vessels when they go, they keep the fish (anchovy, daga) at the bottom of boat without any modification. Most is spoilt already before come back.	Make use of trays to put the fish in. Modify vessels with boat owners.
4	Drying techniques; they dry fish on the sand. When it is the raining season, there is no sun.	Provide shelters. [One place provided by UNIDO; but then there are some leakages on top of the roof, so they fail to maintain it.]
6	Use of wood for boiling.	Solar technique.
7	Dry without sun technique needed	
8	Education about processing -> needed!	Training – PPP. Donors? In anchovy area we did it. Other sites needed. Fishers complain, need to work with them to make them change.
9	Discuss bycatch in deep sea waters. No landing facility for deep sea vessels.	Try to modify landing site, land here bycatch and sell to local fishers.

Dar es Salam

In the Dar es Salam workshop 1 group discussed a fishery in detail, namely the sardine fishery (see box 3); the other groups discussed the different challenges throughout a number of chains.

Challenges that were recognised were:

1) poor handling
2) lack of capital
3) poor infrastructure
4) Market competition in price between local fish and imported fish (Kamongo).
5) Lack of modern fishing equipment.
6) Lack of knowledge of stocks
7) Illegal practices
8) Safety
9) Bycatch
10) Post-harvest losses
11) Market knowledge (if a market is saturated, where can I take my fish?)
12) Consumers sometimes get low quality fish

The groups were then asked to select one problem and solve it.

Poor handling and quality management: Fishers don't have the capacity needed; they need to understand the state of the stock better as well as how to handle the catch. It would be good to take fish to test it on quality, from the three stages between sorting to distribution and test it for ecoli, salmonella etc. To show what the problem is. If there would be more ice available to keep the fish cold that would be a major improvement. Investments in the technical infrastructure for production of ice are needed. As well as training and awareness. This requires input from government and investors.

Stock assessments: the basic problem is that we do not know how much fish is available to catch. This is the basis of all further investments. Stock assessments are needed, government and investors can contribute.

See box 3 for the solution for the main problem in the sardine fishery.

Survey - debate

In the Dar es Salam workshop we planned to have a kahoot survey (see www.kahoot.it). Due to technological challenges (internet connection dropped) we held it by projecting a proposition (meant to provoke debate!) via the beamer and participants could stand up if they agreed or sit down (remain seated) if they disagreed. This then resulted in a moderated debate when opinions differed. By doing this we gathered some extra information about some of the main topics linked to developing marine fisheries in Tanzania and possible improvements in the value chain.

The propositions (including some joke propositions) were:

1. Tanzania is the most beautiful place in the world.
2. There is potential for fisheries development in Tanzania.
3. There is potential for fisheries in Tanzania, and you can send the bill to me.
4. If fishers can fish further out, fishing pressure in the coastal zone will be relieved.
5. Helping fishers to fish further out, will solve the problem of declining fish resources.
6. We can't help fishermen to fish further, if we do not know the state of the stocks.
7. Developing aquaculture in the coastal zone is a good idea.
8. It's a waste of resources; Tanzania exports seaweed as raw product and imports the end product.
9. Bringing down post-harvest losses is key to improving food security.
10. Improving infrastructure at fish landing sites will be key to reducing post-harvest losses.
11. Improving quality of fish will have negative effect on food security of poor Tanzanians.
12. If Tanzania wants to profit more from EEZ fisheries, a fishing harbour is top priority.
13. If you want a license to fish tuna in our waters, you need to land your catch in our harbour.
14. Tanzania should stop licensing other nations to fish, we will fish for it ourselves.
15. Conservation of marine resources and securing fisher livelihoods go hand in hand.
16. We should have a gender sensitive approach to developing sea weed culture.
17. Migratory species can only be managed by a regional approach.
18. We actually know nothing about our fish stocks, as we do not have data.
19. Fiber glass boats sounds like a nice idea, but it is not sustainable.
20. It is important to understand why fishermen do what they do.
21. It is important to understand why some things never change.
22. BMUs can play an important role in sensitizing the fishermen.
23. The government needs to create a conducive environment in order for businesses to invest.
24. We are going to make a group picture.
25. Instead of more MCS, we need sharing of knowledge about sustainable fisheries.
26. Instead of more MCS, we need sharing of norms about sustainable fisheries.
27. With declining fish stocks, competition between fisheries is likely to increase.
28. Dynamite fishing should be bombed.
29. It is important to understand the rationale of fishermen to use illegal fishing methods.
30. As long as you get away with using illegal fishing methods, it is not likely to change.
31. Marine protected areas are thé solution to over-fishing.

Annex 4: Programme of the mission

	Monday	Tuesday	Wednesday	Thursday	Friday
Morning	**10.00-11.00** Meeting Ministry (Permanent Secretary, TAFIRI, MPRU en FETA (Fisheries Education and Training Agency)	**08.00-09.00** Ferry Fish Market (interview(s) with processing & trade companies) **10.30-11.30** Visit to harbour/Port Dar es Salaam	**09.00-12.30** Workshop at Zanzibar Grand Hotel	**07.00-09.00** Ferry back to mainland **10.30-11.30** Meeting University Dar Es Salam (Aquatic Sciences and fisheries) Dr. Lugomela and Dr. Benno	**09.00-13.00** Workshop at the Embassy
Afternoon	**13.00-13.45** Meeting Embassy staff and researchers **14.00-15.00** World Bank Daniel Mira-Salama **15.00-16.00** EU Erika Pasquini	**11.30-14.30** Visit to Kigamboni, BMU, further visits Mbwa Maji and Pemba Mnazi **15.45-17.45** Ferry to Zanzibar, Azam Marine	**14.00-18.00** Mazizini Landing site and market during catch landing and auctioning	**13.00-14.00** Meeting with SeaSense, WWF and TAFAYO (NGO's) **14.00-17.00** Preparation workshop at the Embassy	**14.00-15.00** Debriefing
Evening	Dinner with FAO Res Rep Report writing	Report writing + preparation workshop	Report writing	Reporting writing + preparation workshop	

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Wageningen Marine Research is the Netherlands research institute established to provide the scientific support that is essential for developing policies and innovation in respect of the marine environment, fishery activities, aquaculture and the maritime sector.

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The Wageningen Marine Research vision
'To explore the potential of marine nature to improve the quality of life'

The Wageningen Marine Research mission
- To conduct research with the aim of acquiring knowledge and offering advice on the sustainable management and use of marine and coastal areas.
- Wageningen Marine Research is an independent, leading scientific research institute

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