



Mission Report Kenya

Scoping Mission Marine Fisheries Kenya

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Summary

This report contains the findings of a scoping study into the marine fisheries sector of Kenya which took place between 30 January and 3 February 2017. Wageningen Marine Research was asked to carry out this study by the Embassy of the Kingdom of the Netherlands and the Dutch Ministry of Economic Affairs. The study was aimed at describing the Kenyan fisheries sector and at sketching opportunities for (business) 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 utilisation of fish catches in Kenya is seen as the most straightforward action to be undertaken to address food security and increase revenue and marketing opportunities. Addressing the challenge of post-harvest losses of fish through improved handling and processing practices throughout the entire chain will result in the availability of relatively more fish and higher quality fish. The availability of good storage facilities may, however, incentivize fishers to increase fishing activity as landings can now be stored, irrespective of whether there is a market. Therefore, it is important that an effective management system is in place.

In the context of developing business opportunities, the issue of availability of fish and stability is important and is an essential consideration when assessing fisheries management with a food security lens. Fisheries management in Kenya is currently facing many challenges including dwindling fish stocks in the coastal waters and signs of overfishing of high value species in the territorial waters and possibly the EEZ, an increasing number of entrants to the artisanal fisheries, limits to the available scientific information to inform management, lack of institutional capacity and poor enforcement.

An effective management system of the artisanal inshore fisheries in line with achieving the maximum sustainable yield and with a strict licencing policy and enforcement, would contribute to a transition towards a sustainable fishery. This would directly contribute to national food security by protecting the resource base and ensure livelihoods in the longer run. As some species from the artisanal fisheries are interesting for a more high-end market in Kenya and for export, setting up public-private partnerships in relation to achieving sustainability certification may act as a driver for improving fisheries management.

Opening up the offshore area for artisanal fisheries could result in a reduction in localised fishing pressure in the inshore waters and more fish becoming available for export and the local market. This should, however, be done in the context of a sustainable fisheries management system. Also here, public-private partnerships towards sustainability certification may play a role. As currently fishing licenses in Kenya are only given on an annual basis, this will be a barrier for any investments by (foreign) companies in the fishing industry. In addition, developing a more offshore oriented small-scale fleet goes hand in hand with safety challenges. Establishing a life guard service may in this context be helpful for all fishers.

Currently Kenya cannot uphold any regulations to land (a proportion of) the catches from the EEZ by licensed distant water vessels, largely due to the lack of adequate infrastructure. Such economic linkage provisions would potentially both increase local fish availability (by using the bycatch of those fisheries for the local market) and increase 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.

Diversification with respect to marine produce is another option. The development of seaweed mariculture seems to be the best candidate as return upon investments is high, production is environmentally-friendly, the demand for seaweed is growing, Kenya's coastline hosts many suitable

areas and production will generate direct and indirect employment opportunities for relatively many people.

A special case is found in the production of Artemia (brine shrimp) by the Kenya Marine and Fisheries Research. The principle of harvesting Artemia from salt ponds has been proven and is now ready to be developed from the proof of concept state to the full production phase. This could be established by seeking investors in the already established production markets of Artemia. Also the Artemia could be used in the local development of the aquaculture section.

The current marine fisheries management policies do provide a foundation for sustainable fisheries. It depends, however, on the effective implementation of the management plans and Monitoring, Control and Surveillance whether or not these management efforts do in practice will pan out.

Quite an array of national and international actions and activities in the field of marine fisheries development, for example under the Kenyan Coastal Development Project and SWIOFish umbrella, are already taking place in Kenya. Coordination between efforts is highly recommended.

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. Kenya 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 explore which opportunities exist for further cooperation between the two countries.

The first leg of the mission was a scoping study into the marine fisheries sector of Tanzania (Van Hoof and Kraan, 2017). This report contains the findings of the second leg of this mission: the scoping study into the marine fisheries sector of Kenya. Kenya has a relatively small coastline with a narrow continental shelf. While fisheries are a major activity in the country, the marine sector is outshone by the freshwater sector – primarily the fishery on Lake Victoria targeting Nile perch. Only about 5%, or 9 000 t was reported as “marine” produce in 2013 (Food and Agriculture Organization of the United Nations, 2016). The marine sector is divided in an artisanal subsector and industrial subsector fishing in territorial waters and even beyond Kenya's Exclusive Economic Zone. Fisheries are an important source of livelihood to fishing communities in the country. They also contribute to food security and provide raw materials for production of animal feeds as well as fish oil and bioactive molecules for the pharmaceutical industry. Fisheries support auxiliary industries such as net making, packaging material industries, boat building and repair, transport, sports and recreation.

The overall Terms of Reference for the triplet of two scoping missions and one international workshop were 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 advise the Kenyan Government how to finalize the Masterplan Fisheries and how it can be implemented in a participatory way.*
 - b. *Delivering expert knowledge to advise 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 Kenya we will address mainly items 1 and 4. Item 2a was in the end not requested by the Kenyan government. Item 3 will be focal point during an international workshop planned in 2017 (the third leg of the mission).

The mission took place between January 31st and February 4th 2017. Prior to the mission a literature study was undertaken (for an overview of extracts from important literature, see annex 1). During the mission interviews and group meetings were held with a variety of stakeholders (government, NGOs, funding organisations, the scientific community and a diverse group of stakeholders from the seafood value chain). In addition, one joint stakeholder workshop was organised in Mombasa at the end of the mission (see annex 2 for an overview of meetings and participants). A detailed programme can be

found in annex 4, in annex 3 notes on meetings and the workshop can be found. The mission was carried out by Dr Ir Nathalie Steins and Dr Ir Luc van Hoof of Wageningen Marine Research.

The consultants wish to express their gratitude to all the people involved in this mission. Especially the fishers, traders, officials, scholars, businessmen, NGOs and all others that took time and effort to meet with us and discuss Kenyan Marine Fisheries in an open and constructive way. The consultants also want to thank Local Ocean Trust for facilitating the meetings in the Watamu area, and in particular staff member Sammy Safari Elijah for providing Swahili-English translation during three group meetings. A special word of appreciation goes to the staff of the Dutch Embassy in Kenya, who not only enabled our visit but made it into a very smooth and enjoyable undertaking.

2 Main Findings

Kenya has a relatively small coastline, compared to the size of the country. The coast stretches over 600 km (Figure 1) with a narrow continental shelf. Distinctive is the almost continuous fringing coral reef which stretches parallel to the coast (FAO, 2016). While fisheries contribute less than one percent to the country's GDP, they are of and recognised for their strategic value. The marine sector is outshone by the freshwater sector (Smart Fish, 2011; FAO, 2016). Total fishery and aquaculture production in Kenya amounted to 186,700 tonnes in 2013, with 83 percent coming from inland capture fisheries (of which Lake Victoria contributed about 90 percent). Marine capture fisheries produce less than 9,000 tonnes per year, which compared to neighbouring countries is low (FAO, 2016). Whereas the marine fishery is largely artisanal, the fresh water sector is both industrial and artisanal (Smart Fish, 2011).



Figure 1: Kenya Coastline (Google Maps, 2017)

In the new millennium, freshwater aquaculture development in Kenya has witnessed a remarkable development, especially in 2009-2010. Kenya is now one of the fast growing major producers in Sub-Saharan Africa (FAO, 2016). From an annual production of about 1,000 tonnes in 2001–2006, the harvest of farmed fish leaped to over 4,000 tonnes in 2007–2009. A nationwide government-led fish farming campaign resulted in an increase in the total area of fish ponds from 220 ha to 468 ha. Together with the improved seed supply and supports covering other aspects, farmed fish production rocketed to 23,501 tonnes in 2013. This is more than four times the production in 2009. The main species produced in 2013 was Nile tilapia (75 percent), followed by African catfish, common carp and rainbow trout. Mariculture is not yet practiced commercially, despite its potential demonstrated by trials (*ibid.*).

Kenya's fisheries and aquaculture sector contributes approximately 0.54 percent to the country's GDP (2013). Fish consumption has been declining from a modest 6.0 kg/caput in 2000 to 4.5 kg/caput in 2011. The value of fish exports was about USD 62.9 million in 2012, about 5 times greater than the USD 12.3 million in fish imports. The fisheries sector generates direct and indirect employment for about 2.3 million Kenyans. In 2013, around 129,300 people derived their livelihood directly from fishing and fish farming activities (including 48,300 in inland waters, 13,100 in coastal waters fishing and around 67,900 in fish farming) (FAO, 2016).

2.1 Kenyan Marine Fisheries Sector

Kenya's marine fisheries are mainly artisanal and subsistence in nature. They are undertaken mostly from small, non-motorized boats such as outriggers, *dhow*s and planked pirogues. As a result of the limitation in fishing craft technology, fishing effort is mainly constrained to "within the reef" as fishers call it (0-5 nautical miles) and is hardly undertaken outside the territorial waters (FAO, 2016).

Some 13,000 fishers operated almost 3,000 artisanal fishing crafts in Kenya's marine and coastal waters in 2013. Annual artisanal catches are approximately 9,000 tonnes, representing about 5% of the documented total national fish catch (State Dept. of Fisheries and the Blue Economy, 2014a). Figure 2 gives an overview of documented marine capture production. While the inshore fishery is operated by local artisanal fishers, the offshore distant waters are targeted by Distant Water Fishing Nations (DWFN) with a major focus on the tunas (skipjack, yellowfin and bigeye). Foreign fishing vessels are authorized to operate in Kenya's EEZ in accordance with the Regional and International Agreement and Cooperation provision of the National Oceans and Fisheries Policy. This policy states, *inter alia*, "The Government will continue to grant fishing rights to other distant Water Fishing Nations to fish in its Exclusive Economic Zone (EEZ) taking into account the state of the stock and economic returns" (FAO, 2016).

Table 1: Marine fish landings by sector, weight and value in 2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

Marine capture production*	Tonnes	000 Kshs.	Number of fishers	Number of craft
Demersal	4,433	523,153		
Pelagic	2,362	309,893		
Crustaceans	762	250,851		
Other marine (sharks, rays, sardine)	908	110,752		
Molluscs	669	103,523		
Total	9,134	1,298,172	12,915	2,913

*Landings registered in Kenya; these are mostly from registration at local landing sites and exclude catches from distant water vessels operating in the Kenyan waters

Kenyan waters can be divided into three zones. The first extends five nautical miles seawards. Fishing in this zone is for artisanal and sport fishers only, and off limits for (semi-) industrial fisheries and certain gear types. Artisanal fishers may venture further out – "beyond the reef" - but most of their activities occur within the five nautical miles. Sport fishers often set out further seawards (Hoorweg *et al.*, 2009).

The second zone is between five and twelve nautical miles seawards. Together with the first zone, it constitutes the territorial waters. This is the zone where semi-industrial prawn trawlers are allowed to operate against payment of an annual licence fee (Hoorweg *et al.*, 2009).

The third zone delineates the 12 to 200 nautical miles offshore area and is the Exclusive Economic Zone (EEZ). Commercial fisheries are permitted here, but fishers are requested to respect a 15 nautical mile zone. The potential yield of the EEZ has been estimated to be as high as 150,000 tons. Vessels have to be licensed. The fleet consists of long-liners and purse-seiners', and are mostly foreign vessels with a Kenyan license.

2.2 Artisanal and inshore marine fisheries

2.2.1 General overview

In the artisanal marine fisheries, different types of gear and craft are deployed. Vessels include dugout canoes, motorized boats, sailboats (*dhow*), outrigger canoe (*ngalawa*), and open fishing boat (*mashuwa*). Built to withstand rough seas and open fishing voyages, *dhow*s and *ngalawa*s are equipped with shark nets, driftnets and gillnets. Canoe fisheries employ beach seines, cast-nets, drift long-lines, set gillnets, fish pots and barricade traps. Major gears used by the artisanal fishers include: gillnets, seine nets, cast-nets, long-lines, hand-lines, spears, *lema* (basket traps), *uzio* (barricades) and *tata* (weir traps). *Chachacha*, which is a traditional gear used to catch half beaks, is utilized in Vanga (FAO, 2016).

Because of limitations in terms of craft and equipment, fishing effort of artisanal fisheries tends to be limited to the narrow continental shelf. Lobsters, crabs and octopus are increasingly targeted because of their high market prices. Lobsters are mostly caught between October and March at the North East Monsoon period. The fishery is attractive to local entrepreneurs who engage the services of skilled diver-fishers for this purpose. In addition to local fishers from around the Kenyan coastline, many migrant fishers from Pemba Island (Zanzibar, part of Tanzania) fish lobsters. The crab fishery thrives mainly in Mombasa, Malindi, Kilifi and Watamu. This fishery is also very active in the Ngomeni-Marerereni area, especially during the peak tourist season when the product fetches much higher prices (FAO, 2016).

Prawns are harvested by around 900 small-scale fishers along the entire Kenyan coastline in the inshore areas and by semi-industrial bottom trawlers within the Malindi-Ungwana Bay 3 – 5 nautical miles off the shoreline. The target prawn species include the Indian white prawn (*Penaeus indicus*), speckled shrimp (*Metapenaeus monoceros*), giant tiger prawn (*P.monodon*), green tiger prawn (*P.semisulcatus*) and peregrine shrimp (*Metapeneus stebbingi*) (FAO, 2016; KMFR, 2015b).

The overall national marine small scale prawn production is estimated at 363.5 metric tons/year. The Malindi-Ungwana bay sites of Kilifi and Tana River Counties produce up to 41% of the total prawn production followed by Kwale (39%), and Mombasa with 19%. The Malindi-Ungwana Bay artisanal prawn fisheries resources play an important role to the national and local economy through food production, employment creation and revenue generation (KCDP, 2015).

The (semi-)industrial prawn fishery is one of East Africa's largest, and is mainly taking place in the Ungwa Bay at the mouth of River Tana (FAO, 2016). This fishery has been associated with conflicts among stakeholders, primarily due to poorly defined fishing zones, alleged destruction of breeding grounds and high amounts of fish and non-fish by-catch. Measures to address some of these challenges were put in place in the Prawn Fishery Management Plan (PFMP) of 2010. This plan was, however, largely designed by relying on information from the semi-industrial trawl fishery only, thereby missing out the equally important small-scale prawn fishery that occurs within the shallow areas of the bay, estuaries, mangrove creeks and beach ridges (KMFRI, 2015b). As a consequence, a comprehensive management for the prawn stocks as a whole is lacking. ...

The small and medium pelagic fishery in Kenya is multi-species, multi-gear and multi-fleet. Target species belong to the families *Scombridae* (trevallies), *Sphyraenidae* (barracudas) and *Hemiramphidae* (halfbeaks). Fishing gear used include cast nets, gill nets, beach and reef seines, hook and line, vertical line, long line and trolling line, and more recently the use of ring nets. Although the ring net and reef seine fishing gears are the most suitable gears for targeting the small and medium pelagic fisheries resources, their use resulted in mixed responses. Issues tabled by stakeholders include allegations of the use "inside the reef" and of by-catches of under-sized fish. This led to the development of a Ring Net Fishery Management Plan. The plan was, however, formulated without adequate scientific data and information (KMFRI, 2015a). In the meetings during the mission, fishers reiterated the aforementioned concerns over the ring net fishery. Enforcement of regulations and the management plan were perceived to be poor.

The only domestic tuna-catching is carried out by an artisanal fleet of around 800 small-scale vessels, all of which are typically confined to within 3-5 nm of the coast. They have an annual catch of around 300 tonnes from the regional stocks of skipjack, yellowfin and bigeye tuna. None of these stocks is assessed as being overfished or subject to overfishing by the Indian Ocean Tuna Commission (IOTC) (POSEIDON *et al.*, 2014).

Landings of the artisanal and semi-industrial fleet are registered at the 197 landing sites in Kenya. Either a Fisheries Assistant or a member of a Beach Management Unit (BMU) collects daily landings data at each landing site and compiles monthly catch totals. The County Director of Fisheries then compiles monthly statistical report at county level and submits these to the National Office of the State Department for Fisheries and the Blue Economy (State Dept. for Fisheries and the Blue Economy, 2014a).

From the meetings with fishers and traders during the mission, the consultants got the impression that most Kenyan artisanal and semi-industrial fishermen are not boat-owners themselves but hire boats from traders. Only a few fishermen (also) operated their own boat, which in most cases was a dugout canoe. The resulting dependency relation may negatively affect economic revenue from the fishery and may have implications for expected stewardship roles in fisheries management (see section 2.4.2).

The professional sport fishers in Kenya have formed the Kenya Association of Sea Anglers (KASA) with about 35 charter boats. In addition, there are, perhaps, another 35 charter and private boats. KASA members are required to submit records of their catches, which is not the case with the non-member boats, although the catches of the latter are likely to be much lower than those of the professional charter boats (Hoorweg *et al.*, 2009).

2.2.2 Challenges in the artisanal and inshore fisheries

From the literature review and the information from interviews and meetings during the mission, 3 key challenges in the artisanal fisheries were identified. These include stock decline and overfishing, influx of new fishermen and post-harvest losses. The first two challenges bear close relationship to governance issues, which will be discussed in a separate section 2.7

2.2.2.1 Stock decline and over-fishing

While artisanal fisheries are often considered to be 'eco-friendly' by their nature, it is well-documented that intensive artisanal fishing can contribute to the degradation of marine resources by affecting the ecological balance and losses of local biodiversity (McClanahan *et al.*, 1990; 2001). This seems also to be the case in Kenya. One of the major changes in the state of the coral reefs in Kenya is the dramatic decline in the number and individual size of finfish. Fishing activities have reduced fish populations in studied reefs causing a severe decline in the species richness of the fished areas (Mangi *et al.*, 2007). Unrestricted access into the marine fishery in Kenya's south coast and the increased use of improper fishing technology (such as ...) are considered to be a major cause of this decline (Ochiewo, 2004; Oluoch *et al.*, 2009). Increased poverty is driving people into fisheries, thereby increasing fishing pressure (see 2.2.22). Compliance levels to most of the fisheries regulations has been low, which has been linked to poor enforcement. In some cases the rules are unknown and unclear to fishers (Mangi *et al.*, 2007). In a study on Kenyan coastal fisheries carried out by Hoorweg *et al.* (2009), nearly all fishers interviewed were concerned with the degradation of marine resources and mentioned declining catches. Reasons for reduction in marine resources given by Kenyan coastal fishers included the growing number of fishers, official establishment of no-take areas, rough weather (notably the heavy El-Niño rains of 1997/98) and competing fisheries such as commercial trawling (Hoorweg *et al.*, 2006).

A recent report by POSEIDON *et al.* (2014) also concluded that while the domestic prawn/shrimp and demersal fisheries are exploited by small-scale vessels and industrial activity is lacking, stocks are probably overfished and subject to overfishing due to poor fisheries management.

The Kenya Marine and Fisheries Research Institute (KMFRI), under the auspices of the Kenya Coastal Development Project, has recently undertaken a series of stock assessments for a number of relevant fisheries. Technical reports and online factsheets are available: small and medium pelagic fisheries with ring nets and reef nets, small scale prawn fisheries in Malindi-Ungwana and rabbitfish (*Siganus suto*) (KMFRI, 2015a; 2015b; 2015c). The current observations on stock status are mostly based on landings records and lack a structured survey time series.

The pelagics stock assessment suggest that for all species investigated only one species (*Hemiramphus far*) is above safe biological stock levels and with a fishing mortality that is lower than the maximum sustainable yield (KMFRI, 2015a). For all five prawn target species, current fishing mortality is higher than the fishing mortality that generates the maximum sustainable yield, indicating that overfishing is occurring in the fishery. Stock status for most prawn species indicates that the fishery is operating beyond the maximum sustainable yield (MSY) estimated reference rates. The spawning stock biomass per recruitment (SSB/R) estimate for prawns of 0.06 is below that required for the MSY of 0.2 thus indicating the stocks are currently overfished. The current exploitation rate (F/Z) of between 0.59 and 0.76 for the prawn species is above 0.5 indicating that the fishery is overfished (KMFRI, 2015b). For rabbit fish, the stock assessment suggests that the stock is below and the fishing mortality above MSY levels (KMFRI, 2015c).

In addition to recent stock assessment work, researchers have recently surveyed the off shore area with acoustic fish finders. Reports are not yet available, but during a meeting at the KMFRI researchers said to have witnessed abundance of fish. These observations seems to be in line with the observations made in the literature that the maximum sustainable yield of Kenya's marine and coastal waters is between 150 000 and 300 000 metric tonnes, while the current (reported) production level is only about 9 000 metric tonnes per annum (FAO, 2016). It should, however, be noted that the last comprehensive stock assessment including an extensive survey, has taken place in the 1980s.

Discussions with fishers and traders confirmed scientific findings and also pointed to clear signs that Kenyan's marine coastal waters face overfishing. This included species for which no stock assessments are available at all. Fishers reported reduced catches and overall a declining average size of fish. While this has been known and documented for the inshore area, it also became clear that artisanal off shore or semi-industrial fishers are confronted with signs of overfishing of fish stocks. Independently, fishers at the fish market in Mombasa and at the Beach Management Units in Watamu and Uyombo reported that compared to 10 years ago catches of tuna, merlin, kingfish and red snapper declined with about 50% and, moreover, that sizes of fish caught are observed as being reduced compared to 10 and 20 years back. Declining catches and sizes were confirmed in interviews with traders. Also government representatives mentioned that catches of artisanal and coastal fisheries were going down. During the discussions a number of possible causes were identified, including increasing number of artisanal fishermen entering the semi-industrial fishery beyond the reef, the lack of limitations on licenses, increasing activity of large foreign vessels and seismic research. While the information on declining catches and fish size is qualitative information from a small group, these perceptions are indicative of increased pressure on these fish stocks.

2.2.2.2 Influx of fishers

High population increase, influx of immigrants, poverty, unemployment and lack of livelihood options are causing additional pressure on coastal resources (Mangi *et al.*, 2007). Often livelihood options are limited in fishing communities due to lack of alternatives outside of the fisheries sector, or because fisheries overexploitation limits their income potential (USAID, 2015). As barriers to new entrants are minimal, those with limited financial resources perceive the fishery as offering opportunities. As a result, the number of fishers has greatly increased and both traditional and non-traditional fishing gears (such as beach seines) have been adopted (Mangi *et al.*, 2007). According to USAID (2015), part of the overfishing of Kenya's inshore waters, can be attributed to this large and largely uncontrolled influx of new fishing operations.

Interviews held during the mission confirmed this. With a declining level of tourists travelling to Kenya as a result of political unrest in the country, the tourism industry over the past decade has been less of a local employer than before. As a result, workers from the tourism industry seek for alternative

sources of income, such as fishing. Workers in the tourist industry are also known to engage in seasonal fishing activities in the low season of tourism. In addition, opportunities to engage in farming are limited and the persistent draughts not only hamper agricultural production but also result in farmers to seek alternative income opportunities. Fishing, with a relative easy entrance, offers such an opportunity. In poverty stricken conditions this results in a large influx of people engaging in fisheries and also an increase in the deployment of illegal fishing and use of illegal gear.

With respect to the influx of new fishers, it appears that we can distinguish three distinct groups: (i) those fishers that have been engaged in fishing for generations, (ii) new entrants to the fisheries who perceive fishing as a temporary (windfall) activity necessary to generate income in the short term, and (iii) migrant fishermen from elsewhere (for example Pemba fishermen from Zanzibar, part of Tanzania). These three groups may well have different perceptions and interests in the state and development of the fisheries in the long term.

2.2.2.3 Post-harvest losses

A detailed analysis of the fish value chain and marketing of the fish produce follows in section 2.4. However, as post-harvest losses were considered to be a major challenge for the artisanal and inshore fisheries in meetings during the mission, the issue is included in this section as well.

Upon landing of the catch, usually directly at the beach or at a small landings site or facility, fish is usually sold directly to traders. Most of the fish is sold fresh. A few landing facilities have small freezers, but this is an exception. Fish are usually sold directly to traders and intermediaries, and hardly ever directly to consumers. The traders sell the fish on to (usually female) fish mongers for sales and local hotels and restaurants. Catch that does not remain in the locality, usually finds its way to Mombasa and sometimes to Nairobi. In many cases, catch from the artisanal fisheries is transported in baskets without ice; this is not only the case for local, short distance transport but can also be the case for longer distances to Mombasa.

As fresh fishery products have a relatively short shelf-life, and rapidly lose quality and economic value if not handled properly, it is necessary to comply with sanitary and phyto-sanitary measures in order to assure fish quality and safety for human consumption and minimize post-harvest losses (Ministry of Fisheries Development, 2008). Post-harvest losses, which were defined as either entire losses of produce or a reduction in quality, were reported to go as high as 60-80% of landed catches. Part of this can be attributed to inadequate handling of the catch on board or after landing.

Another post-harvest loss is wastage in terms of unwanted by-catch. This seems to be particularly an issue in the prawn trawl fishery where the amount of fish discards, and low value and or under-utilized fish was estimated to be 1,800 tonnes per annum at the start of the millennium (KMFRI, 2002). While effort in the prawn fishery has been strongly reduced, by-catch still is a significant portion of the fishery. By-catches are often not utilized for human consumption due to the lack of technology, handling, or process methods to transform the fish into stable and acceptable products. In addition, such fish are not utilized, or available for human consumption because they are either small, bony, devoid of taste, un-economical to process, or may not be landed by trawlers due to storage limitations (Oduor-Odote & Kazungu, 2008). Post-harvest losses originating from by-catch are not only waste in terms of food security, but may also have negative effects on stocks and the wider ecosystem through food-web interactions.

In order to increase food security and realise full benefits of catches, it is important to reduce any post-harvest losses to a bare minimum.

2.2.3 Development of the artisanal and inshore fisheries

In view of the existing challenges in the artisanal and inshore fisheries – stock decline and overfishing, influx of a growing number of fishers and post-harvest losses - the short term perspective of realising increased catches from the inshore area is one of (more) overfishing. In order to arrive at a more sustainable fisheries and increase food security it is prerogative that the number of fishers, and hence the fishing effort exerted in the coastal zone, is strictly managed. This would entail using the current

licencing system as a stricter tool to regulate access to the fisheries and strengthening the co-management system of the Beach Management Units (see section 2.7).

In addition developing capacity to inform fishers about the rules and to more strictly enforce rules and regulations would result in fishing practices more in line with the perspective of the fisheries law and fisheries management plans. An example is the much contested use of the ring net. If this gear would indeed only be deployed in waters of over 30 meters of depth and not, as is at times the case now, in fishing on the reef, these nets would cause less environmental damage.

All in all, a reduction of fishing effort in the inshore fisheries is required. One option of achieving this is a displacement of effort to the near offshore area, which is discussed in more detail in section 2.2.4. Another option is the overall reduction of people entering and staying in the fisheries. This would require the strict management of licences and the creation of alternative sources of employment and income. If the marine resources would be used for creating alternative livelihoods, options of developing mariculture, for example seaweed cultivation, should be seriously considered. Also the establishment and further development of a Kenyan offshore fleet and landing and processing facilities could generate alternative sources of income.

Finally, it is a prerogative that all catch is utilised to its fullest. This will require adaptations in handling, processing and storage. This is further elaborated in section 2.4.

2.2.4 Development of an offshore artisanal fisheries

Due to the limitations in fishing craft technology, fishing effort of the artisanal fleet is mainly concentrated within the reef and is hardly undertaken outside the territorial waters (FAO, 2016). With increasing fishing pressure in the coastal areas and documented and perceived signs of overfishing, a general suggestion made during interviews and discussions is to move effort beyond the reef by assisting artisanal fishers to develop an offshore artisanal fishery. The provision of other fishing craft and training is perceived to be a solution to the fishing pressure in the inshore area.

The question is whether or not this is really a solution to the problem of overfishing in the coastal fisheries or will just result in displacement of the effort to other areas, not solving the problem. The full potential of small and medium pelagic fisheries along the Kenyan coast is not yet known (KCDP, 2015) and the potential maximum sustainable yield biomass is estimated to be at least 15 times higher than current *documented* marine catches (FAO, 2016). This suggest that there are untapped exploitation opportunities to serve a displacement of the fleet. At the same time, there are signs from the limited stock assessments available (KMFRI 2015a; 2015b; 2015c) as well as information from fishers and traders that overfishing of individual stocks beyond the reef is already taking place. Observed catches have been declining and the overall size of fish caught has been diminishing; by lack of a full stock assessment, this is a clear indication of overfishing. This would argue against displacing the fleet. This means that any decision on displacing the fleet should be based on a sound assessment of the exploitation potential in line with achieving the long term maximum sustainable yield and should be accompanied by an effective management system.

Another consideration it that the fishing pressure on many of the stocks is the sum of the total fishing pressure exerted by the artisanal and semi-industrial inshore fleet and the high-seas international fleet. For some stocks (for instance pelagic species) fishing pressure is exerted both in the inshore and offshore fisheries; moving fishing effort beyond the reef would hence not result in a reduction of overall fishing mortality on those stocks, and may (with poor management of new entrants) even lead to a further increase.

From discussions with fishers, it also became clear that even when supplied with alternative vessels and mode of propulsion (fiberglass boat and out board engine) fishers were not able to engage successfully in these fisheries. Reasons included perceived dangers in fishing beyond the reef (safety and navigation), lack of specific fishing skills needed, and lack of access to markets. In addition the question should be raised if profitable fisheries beyond the reef are possible at all, why do not more fishers and investors develop this opportunity?

If an artisanal offshore fishery could be developed without merely displacing fishing pressure on stocks or even increasing it to beyond sustainable levels, this development would have to go hand in hand with the establishment of proper handling, processing and storage facilities at landing sites. This may well call for the establishment of a limited number of well-equipped landing sites operating out of designated ports.

2.3 Fishing in the EEZ¹

Kenya's EEZ lies within the richest tuna belt of the South West Indian Ocean, due to its geographical location and proximity within the upwelling region of this part of the Indian Ocean. Exploitation of this rich resource by the Kenyans has, however, been hindered by infrastructural limitations and appropriate fishing equipment and vessels (AFIPEK, 2016). Kenya's marine fisheries are mainly exploited by foreign vessels which rarely land or declare their catches in the country. As a result, Kenya gains little economic revenue and on-land jobs from these valuable marine resources. With improved management, there seems great potential for increasing the contributions of marine fisheries to Kenya's economic development (USAID, 2015).

In terms of stock status, the stocks of skipjack, albacore and swordfish outside the South Western Indian Ocean appear moderately exploited. There is some room for increasing harvests for these stocks while maintaining biomass at or above Maximum Sustainable Yield (MSY). The stocks of swordfish in the South Western Indian Ocean and of bigeye tuna throughout the Indian Ocean appear to be at least fully exploited and fishing pressure is near MSY. High levels of juvenile bigeye tuna and yellowfin tuna harvest have reduced the long-term maximum sustainable catch and associated optimal fishing effort for these stocks. For yellowfin tuna, conservation measures adopted by the Commission have not prevented the stock from being classified as overfished in 2009 with stock biomass possibly being below MSY. For the remaining stocks of concern to the Commission, there is little quantitative information on stock status available and their status is uncertain. (Panjarat, 2009). The 2016 report of the Indian Ocean Tuna Commission confirms that yellowfin tuna is still overfished. Other overfished species include black marlin, blue marlin, striped marlin, Indo-Pacific sailfish, longtail tuna and narrow-barred Spanish mackerel (IOTC, 2016).

In 2013, 36 foreign purse seine vessels purchased vessel authorisations in Kenya: Republic of Korea (2), Spain (14), Seychelles (7), France (8), Mayotte (5) (POSEIDON *et al.*, 2014). Purse-seiners use a large net to encircle a school of fish which is then closed at the bottom after which the catch is hauled on-board. The annual fee for a purse seiner in 2013 was EUR 22.730. This fee was lower than the fee stated in legislation (EUR 37.880) for the past few years, because of the piracy situation in the western Indian Ocean and a desire by Kenya to encourage foreign vessels to purchase authorisations (*ibid.*). The fee for fishing access to Distant Water Fishing Nations is considered to be disproportionately low compared to the real value of the resource (WWF, 2014). Purse seine vessels from the European Union (EU) have been known to purchase authorisations in Kenyan waters even if vessel catches are low. They currently do so under private access agreements and not under an EU fisheries partnership agreement. Their access to Kenyan waters is part of a regional network of fishing opportunities. This is critical for the fleet because of the migratory nature of tuna (POSEIDON *et al.* 2014). Data on catches from the distant water fleet in Kenyan waters are hardly available. The only data available on purse seine catches in Kenya are for French and Spanish flagged vessels between January and October in 2013 and amounted to 236 tonnes, but this is an underestimate; as catches are likely to fluctuate strongly (per area) due to the migratory nature of tuna (*ibid.*).

There are three principal companies providing supplies to visiting foreign fishing (and non-fishing) vessels employing around 500 people. One of these companies also engages in tuna processing, operating on a 'fee for service' basis for major tuna traders. Raw material is landed directly by EU

¹ In this paragraph a limited overview of fishing in international waters is presented. More details can be found in annex 1 especially pages 82 and 83

purse seine vessels to the company's private berth. The tuna is then processed into loins to send to the EU for canning. The volume processed tuna fluctuates strongly. Processing activities are sporadic as it depends on good catches of yellowfin tuna in or near the Kenyan EEZ. In some years the company may process no tuna at all. (POSEIDON *et al.*, 2014). Kenya accounts for less than 5% of the Western Indian Ocean's processing capacity (WWF, 2014).

There have not been any foreign longline vessels authorised to fish in Kenya's EEZ since 2007, probably influenced by the threat of piracy (POSEIDON *et al.*, 2014). Long-liners fish with long lines and large hooks. The Fisheries Act allows for varying periods of fishing authorisation validity for longline vessels: EUR 7,575 for one month; EUR 15,151 for three months; and EUR 22,727 for 12 months (*ibid.*). Before 2007, the number of longlines during the year varied between 20 and 50, and were mostly from China and Taiwan (Hoorweg *et al.* 2009). Recently, there has been re-emerging interest from Asian longliners to fish in the Tanzanian waters due to the improved piracy situation. However, no company has yet applied for authorisations in Kenyan waters (POSEIDON *et al.*, 2014).

Recently, through funding of the World Bank's Kenya Coastal Development Programme (KCDP), initiatives have been taken to enable the implementation of a Vessel Monitoring by Satellite (VMS) system,

2.3.1 Development of a Kenyan tuna fleet

In 2013, Kenya has launched its first Tuna Fisheries Development and Management Strategy, thereby upping its stake in the USD 4 billion global tuna fisheries industry. The Strategy runs from 2013 to 2018 and is aimed at building an effective governance system for the marine fisheries sector. This includes the provision of an institutional framework to ensure compliance with relevant national laws and international standards and agreements. The objective is to develop the country's tuna supply chain including enabling the current rudimentary tuna fishing fleet to fish beyond 20 nautical miles (FAO, 2016). According to FAO (2016), if the strategy were to be successful, Kenya's tuna fishery would be transformed into a productive and sustainable modern, commercially-oriented coastal and offshore fishery with direct positive impacts on employment, wealth creation and foreign exchange earnings.

During the interviews it was indeed suggested that a dedicated industrial tuna fleet should be developed in order to tap into the potential the Kenyan EEZ has to offer. Interestingly, none of the people the consultants spoke to mentioned the government's Tuna Fisheries Development and Management Strategy, which leads to question to what extent the strategy has already been disseminated to the operational level. In any case, the endeavour of developing a (semi-) industrial tuna fleet would require (private) investment. In order for this development to be successful, adequate landing sites or (fishing) ports with adequate handling, processing, storage and transportation facilities will be required.

If such facilities were to be developed this could in principle also attract landings and processing of other fleets and species. In addition, it would create the opportunity for the Kenyan government (for example as part of a formal EU fishing agreement) to include a clause in the licences to foreign vessels to land part of the catch on Kenyan soil of catches by foreign vessels operating². This in its turn could increase the supply of fish and fish produce to the local market and increase the earnings from marine fish produce exports. Currently frozen by-catches of foreign fleets (mainly Chinese) have to be imported into Kenya to supply the local market.

As fleets would dock in Kenya this would also facilitate the management of the fleet. It would allow for observers to board vessels and be present during fishing trips. This could result in catches being more accurately registered and documented which would contribute to a better management of the EEZ resources.

² That said, if Kenya would develop its own tuna fleet and associated port facilities the question is whether granting access rights to Distant Water Vessels should still be on the agenda.

In this context, it should be investigated whether developing a Kenyan fleet or attracting a foreign fleet to land in Kenyan ports should be preferred. On the one hand, taking into account required investments, the development of an own fleet could be a rather steep undertaking. On the other hand, changing current fishing and landing practices of the licensed fleet could also prove to be rather difficult. These distant water fleets do not solely operate in Kenyan waters but have an established fishing pattern following the migrations of the tuna and tuna-like stocks and have already established landing practices in specific ports.

Investing in a dedicated fishing port or in developing fishing facilities for the industrial fleet at an existing port could not only be attractive for the industrial fleet, but could, as a spin-off, be attractive to the artisanal offshore fleet and the local artisanal fleet to land their catches. The port of Mombasa appears to provide sufficient space to service a fishing fleet. What would be required is the (further) development of handling and processing facilities.

Shaped as a public-private partnership, a joint investment of government in infrastructure and private investments in handling and processing facilities and public and/or private investments in fleet development could facilitate this development. If such investments would also reduce post-harvest losses in local catches (processing facilities) and increase the availability of fish and fish produce at affordable prices in the local market, this would directly contribute to an increase in food security.

2.4 The (artisanal) fish value chain

The above section illustrates that next to sustainable fisheries management development, including fleet development, attention should be given to the handling, processing, transportation and trade in fish. Mapping the value chain and the marketing possibilities of fish and fish products are fundamental when considering development of the marine fishing sector.

2.4.1 The value chain

In 2009 Hoorweg *et al.* carried out a study among Mijikenda and Cajun fishers. The consultants found that once the artisanal catch was landed, the fish was sold to various traders. Almost all marine fish landed in Malinda and Killifish Districts was sold on a local scale, either directly at landing sites, or in open markets or at fish shops. The sellers included both fishers and traders. Most of the sold fish was consumed locally, although some was taken to Mombasa, Nairobi and elsewhere. In nearly all cases, the fish was sold to traders and intermediaries and hardly ever directly to consumers.

Hoorweg *et al.* (2009) found that traders usually had a specialty such as small finfish (29%), medium finfish (35%), large finfish (18%) or shellfish (14%). They differed significantly in the average amount of fish they purchased daily; roughly a third bought less than 10 kg (small-scale buyers), a third between 10 and 50 kg (medium) and a third more than 50 kg (large-scale). Most traders frequented only one landing site; almost 40% of the traders bought at two, three or even more sites. Almost half the traders fried the fish before resales. And only a third of the traders had access to a cooler or freezer. The destination of the fish included the nearest village (29% of the traders), the nearest village on the tarmac road (27%) and urban destinations such as Malinda or Mombasa. Transport was either on foot (43%), bicycle (23%) or *mutate* (bus) (33%). Hoorweg's description of the artisanal fish supply chain is very similar to the situation eight years later during our mission. One of the biggest challenges faced by the seafood sector along the Kenyan coast is value addition. Adequate value addition facilities are lacking. Most of the seafood products are therefore sold fresh. Mirage *et al.* (2012) point out that since most of the products are sold raw, fishermen do not reap significantly from the supply chain. Inadequate information on market opportunities and ignorance on prices, trends and customer needs reinforces this situation. The chain is also significantly underdeveloped given that there is very little linkage between the different parts of the value chain and little value addition at various points within the chain.

An analysis by POSEIDON *et al.* (2014) concluded that with respect to imports and exports of fish, trade is primarily driven by the unit cost of the product and the best prices that can be fetched in

different markets. Certain Kenyan fish products are exported (mainly Nile Perch from Lake Victoria and some marine products such as lobster, octopus, shark and tuna) to higher income markets, where they get a better price. Fish protein imported to Kenya tends to be in the form of lower quality or the generally cheaper products such as small pelagic fish.

2.4.2 Market Analysis

Kenya's fish market structure classifies traders according to their target market: internal or international market. For the internal market, fish is largely sold fresh. The external market places additional demands in relation to quality and food safety regulations during handling, processing and storage of Nile perch fillets, prawns, octopus, cuttlefish and lobsters. Export markets are usually the EU countries of Italy, the Netherlands, Germany, Belgium, Portugal, Spain, Cyprus, Malta, France and Poland; the Far East countries of Japan, Hong Kong, Singapore, Malaysia and China; the Middle East countries of which Israel had a high demand for Nile perch (45% of the export of this species) and, to a much lesser extent, the United Arab Emirates (UAE). The United States of America (USA), Venezuela, Colombia and Cuba also import some quantities of Kenyan fish, just as some unverified but negligible amounts are exported to neighbouring African countries (FAO, 2016).

In 2009, Kenya exported 18.506 tonnes of fish and fish products. Exports included Nile perch fillets, fish maws, octopus, sharks, swordfish, crabs and fish skins. Export of Nile perch accounted for 87.4% of total fish exports in weight and 84.73% of the total fish export earnings. Export of fish maws comprised 5.6% of total export quantity and 11.3% of total monetary value, while octopus contributed to 2.4% in quantity and 3.2% of monetary value.

During interviews and meetings, it became clear that for the marine artisanal value chain, a proper market and marketing analysis is lacking. This implies that there is no clear picture of the overall demand in Kenya for marine fish and fish produce and the efficiency of the current marketing practices. For example, it was indicated that some important and promising markets like Nairobi and Eldoret are sparsely serviced with marine fish.

In addition, the parties in the market chain such as local and more long distance traders play a significant role in the marketing up country. Traders, and Kenya is not unique in this case, are easily accused of monopolising the market and setting prices at unfair levels, quite often by reducing competition through establishing (credit) relationships with fishers and making cartel-like agreements with fellow traders. Point in case is that it appears in Kenya that ownership of artisanal vessels and fishing gear is quite often in the hands of the traders. This reduces the role of individual fishers to become sort of a hired labour force in the fishing operation. Risk of low catches still remains with the crew as the catches are shared between vessel owner, gear owner and crew. As fuel costs are to be borne fully by the crew any catches that do not generate sufficient revenue, may have significant socio-economic implications for individual fishermen. This situation may possibly weaken resource stewardship by the fishers who in the end need to make ends meet.

It would be worthwhile to investigate further how this system of dependency has developed over the years and what the implications are on the supply chain and for fisheries management. This could be linked to the influx of new entrants in the fishing business. As we have witnessed elsewhere, in general fishers descending from traditional fishing families with a track record in fisheries and ownership of boats or other means of production, tend to be more easily inclined to acknowledge developments in fish stocks and the necessity to devise and act upon fishing management measures.

In addition it should be analysed how the credit relations in the market chain between producers and traders are influencing the efficiency and effectiveness of the system. Also the efficiency and effectivity of the market chain to get fish and fish produce to relevant markets should be looked into. Out of the monopolistic nature of a limited number of traders with a limited absorption capacity for fish, there is a tendency by traders to push down price levels. This said, traders do provide services to the fishers, for example credit, social support and transportation of fish that of course do come at a price as well. A competition analysis of these services would allow a more clear insight in the operations of the marketing chain.

2.4.3 Developing the artisanal fish chain

2.4.3.1 Post-harvest losses

As mentioned before, post-harvest losses are significant. Several options to reduce them could be considered. As mentioned above, the development of larger scale processing facilities could open up a new outlet for fish produce for local fishers. Obviously, port facilities in Mombasa for example would only be directly reachable for fishers operating in nearby areas. However, if indeed a (new) market would be successfully developed through a central processing plant, this may create a new value chain in which it would pay off for traders to become collecting and wholesale traders moving chilled fish from local fish landing sites to central processing facilities.

One consideration that should be taken into account is that improved cold storage facilities at local landings sides may entail a perverse market incentive, in that fishers would land more fish as it can now be stored. In cases of low market prices this may further reduce prices and in the worst case lead to post-harvest loss by fish not being able to find its way to the market. In cases of high market prices, increasing supply because of the possibility to store the fish may reduce the price, impacting on fishers' income. A negative incentive to continue fishing created by the possibility to store the fish may also lead to increased fishing pressure. While appropriate cold storage facilities are key to reducing post-harvest losses, it is evident that these have to go hand in hand with sound fisheries management and linking supply and demand.

With appropriate storage and processing of fish, including at small local landing sites, chilled transportation and / or the development of (novel) fish products the post-harvest losses could potentially be reduced, new markets serviced and food security be further improved. Experiments with novel fish snacks, for example reported by Oduor-Odote *et al.* (2008), could even open up processing of currently not used fish landings.

It should be noted that investing in local cold store facilities or cool boxes for transportation may be a considerate investment for artisanal fishers and small-scale traders. This may be a barrier for adaptation. Low interest loans or community group microcredits may be a way to open up opportunities. A second issue may be electricity supply which may not be available or not be continuously present. Use of solar energy may overcome this problem.

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

In better utilising fish landings, be it from the artisanal or the (semi) industrial fleet, aspects of food security play a significant role. Improving fish and fish produce availability for the consumers in Kenya may improve food security.

However, as witnessed in other countries (i.e. Senegal) with an improved supply-chain of fish and fish produce, especially with a further processing of landings, availability of fish for some groups in society may be reduced. Competition over available fish in the consumer market may lead to increased price levels, with consequently fish and fish produce becoming more of a luxury product.

In addition, considerations have to be made between different markets, e.g. local consumer market, the hotel/tourist market and the export market. Each of these markets will present specific conditions to the products supplied. And these markets, although to an extent perhaps competing over produce and in price, are not mutually exclusive.

In terms of direct food security, the more fish products are available at affordable prices in the local market the larger is the extent to which the local food security can be sustained. However, securing income through production for the export market and for the tourist market may generate additional income which in itself may increase the food security of the producers and the labourers involved in the particular sector.

Securing landings of by-catches from the industrial fleet may also to an extent improve availability of fish and hence food security. Here, however, there may be aspects of possible competition between artisanal landings and industrial landings and imports. Noting the amount of imports of fish in Kenya, it appears that there is enough space in the market to increase sustainable fish production and

availability in the local market. Yet, a more detailed analysis is necessary as there might be distinct separated markets for different products.

The latter is already at times experienced by the artisanal fishers. Upon landing they may encounter a market in which the operating fish traders favour specific species and/or specific sizes of fish³. Hence at times the landings are not being bought. Part of a dedicated market study should also look into this phenomenon and analyse the competitiveness of the markets at the landing sites.

2.4.3.3 Certification

When considering opening up markets, and especially in relation to an expansion of local production (processing) and exports, certification can play a major role. As already experienced in the fresh water fish trade, in order to export to for example the European market, landing sites, processing and handling facilities need to be certified in terms of handling and hygienic practices.

In addition, for a lot of export markets sustainable sourcing certification under the Marine Stewardship Council (MSC) or Aquaculture Stewardship Council (ASC) ecolabels is a prerequisite in order to gain market access. Increasingly retailers and restaurants in the north Western Europe and the USA resort to a strict policy of only dealing with MSC and ASC certified seafood produce.

In order to obtain the MSC ecolabel, fisheries must demonstrate to an independent certification body that they meet three criteria: (1) sustainable target fish stocks, (2) minimal environmental impact of fishing, and (3) effective management (MSC, 2014).

There are ample international examples where local fisheries and trade have been able to obtain MSC certification. An example where a Dutch seafood company has been working closely together with the government and fishers to successfully achieve certification is the Suriname seabob shrimp fishery (MSC, no date). Although there is interest in MSC certification in some fisheries (lobsters, octopus) and the consultants were informed that under the Kenya Coastal Development Project some initial work has been done on assessment and management of the lobster in preparation of a potential MSC certification initiative, there are currently no clear MSC certification processes under way in Kenya. With the assistance of outside investors it is well possible to strive for certification. This would require significant fisheries improvements to meet the MSC criteria. The MSC runs a developing world programme to assist small-scale fisheries in achieving these objectives (MSC, 2013).

Once MSC certification is obtained this could also have a positive impact on the Kenyan market. For example it may be an attractive feature for the tourist industry to offer hotels and restaurants that exclusively serve MSC (and ASC) certified products.

2.5 Mariculture

Whereas freshwater aquaculture development in Kenya in the new millennium has been remarkable, making Kenya one of the fast growing major producers in Sub-Saharan Africa (FAO, 2016), mariculture is not yet practiced commercially, despite its potential demonstrated by trials. Kenya's mariculture activity has for some time now consisted of the traditional brackish water ponds and artisanal shrimp and oyster culture, while some intensive shrimp culture is practiced along the coast. There is potential for oyster farming on most of the coastline, as well as possibility of exploiting marine algae as a crucial protein source (*ibid.*).

Today there are some examples of the culture of prawns, oysters and milkfish (*Chanos chanos*), all at land based facilities. Hence it appears that there is quite some potential to extend mariculture production. This could be for the local market, supplying on top of the artisanal fish landings and

³ In discussions it became clear that particular traders favour the smaller sizes of certain fish species. This allows for easier transport and sales. However, this does provide a stimulus to the fishers to target the more juvenile cohorts of the stock, which may render the fisheries less sustainable.

reducing the pressure on these resources. It could also be for the export market, especially for prawns, shrimp and oysters.

2.5.1 Developing mariculture

2.5.1.1 Land based versus sea based

In the discussions during the mission, it has been suggested to start with sea based cage ranging. Tuna caught in the West Indian Ocean could in the cages be fattened to marketable produce. This clearly is an option. However, these cages do require the necessary investment. And worldwide cage culture has received criticism regarding fish disease and pollution. In the case of tuna, fattening is still directly dependent of fisheries on the current tuna stocks. As there are indications that some tuna stocks are today under overfishing pressure (Panjarat, 2009; IOTC, 2016) basing a mariculture operation on catches does not contribute to increased sustainable fisheries and sustainable aquaculture, and may actually further negatively affect the reproductive capacity of tuna stocks.

However, these concerns are species dependent. For certain species cage culture may well present a viable and sustainable option.

2.5.1.2 The value chain

Compared to the fisheries value chain, there are two important additions. To a certain extent the fisheries and aquaculture value chains may overlap at the level of processing and the consumer market, although quite often they also service completely distinct markets. But for mariculture to take off there is a need to secure the production of brood (fingerlings) and the supply of appropriate feed(s). Currently in Kenya there are no operational hatchery facilities. For example the culture of milkfish is dependent on the catch of fingerlings in the wild. This has associated risks of no quality control over the fingerlings and also the chance of introducing other species into the culture.

The supply of feed is an additional challenge. In one of the discussions during the mission it was mentioned that currently there are developments on its way to establish a feed plant in Kenya. Usually one of the limiting factors in establishing an aquaculture feed plant is the size of the plant compared to the sector: usually the plant is far too large in production capacity in relation to the size of the aquaculture industry. In addition there is a challenge to source the ingredients for the feed production from sustainable sources.

A business opportunity can be seen in the development of a sustainable aquaculture (mariculture) chain in which the production of sustainable feed, based on sustainable agriculture and a minimal use of fish oil and fish meal in the feed, is linked to the sustainable, ASC certified, production of produce.

2.5.1.3 Artemia

A special case is found in the production of Artemia (brine shrimp) by the KMFRI. KMFRI has proven the principle of harvesting Artemia from salt ponds. The Artemia is said to be of excellent quality. The process now ready to be developed from the proof of concept state to the full production phase. This could be established by seeking investors in the already established production markets of Artemia. A world-wide market for Artemia exists which could be tapped into. Also the Artemia of could be used in the local development of the aquaculture section.

2.6 Seaweed farming

According to Mwakio (2015), Kenya's first ever seaweed farm has weathered the storm since its establishment more than a decade ago as the price offered by buyers begins to rise and with it farmers' profits. A farm in Kibuyuni village in Shimoni, Kwale County has also increased its produce, largely on account of training offered by the KMFRI. Production quota at Kibuyuni Seaweed Farmers Organisation rose and today the group boasts 50 members, most of them women, registered since 2012.

The East African Seaweed Company buys and exports the raw material to markets in South Africa and China. Experts estimate that seaweed farming could earn the country up to KSh40 million annually and help uplift thousands of lives of those who depend on fisheries. Two strains of seaweed known as *Kappaphycus alvarezii* (*cottonii*) and *Euchuma denticulatum* (*spinosum*) are grown, with *Cottonii* attracting a higher price (Mwakio, 2015).

Studies have uncovered a market potential that could place the country in the same league as its neighbour Tanzania. This country has been supplying the global seaweed market with a sizeable product for over 20 years. KMFRI first set up Kibuyuni, a seaside village of 2,500 people, as a model farm. Over the years, other farms have been developed at Mkwiro in Wasini Island with 1,000 people, Funzi with 1,000 inhabitants and Gazi with 15,000 residents (Mwakio, 2015). Morris Mukaraku, the officer in charge of the Corporate Affairs Department at KMFRI: "Seaweed farming has been identified as a good prospect for social and economic development of coastal areas. It is aimed at diversifying livelihood opportunities for poor fishing communities whose source of income has been seriously put at risk by diminished capture of fish." (*ibid.*).

Extracts of dried seaweed are used as food thickeners, in the global pharmaceutical and cosmetic industries and as an additive to soils, mainly in coastal areas where the partly dried seaweed is transported to areas that need to be fertilised (Mwakio, 2015). Seaweed extracts such as carrageenan and agar are used as thickeners and homogenizers in pharmaceutical, human and animal food and cosmetic industries (soap and shampoos) and as fertilizer (KCDP, 2013).

2.6.1 Impacts

A side effect of seaweed farming is that it locally provides a kind of Marine Protected Area in which fingerlings aggregate. The area is not fished and hence provides excellent shelter. Having said this, there are known cases of conflict between seaweed growers and fishers as the latter at times navigate through the farm, destroying the seaweed installation. If the area under seaweed farming expands considerably (without taking other users into account), these types of conflicts may well increase.

In addition, the locations suitable for coastal seaweed culture are dependent on several conditions. Salinity and PH values determine suitability, which for examples excludes areas close to river deltas, where especially during the rains the salinity is affected. Moving to more offshore areas may open up larger production potential. Yet this may require the development of suitable platforms for production and also may increase costs of production.

Currently there are reports of sea urchin infestation which affects the seaweed crop. Also from reports from Tanzania (see Van Hoof & Kraan 2017) we have learnt that at times disease can affect the crop.

2.6.2 Development of mariculture

2.6.2.1 Inshore or offshoring

The narrow continental shelf on much of the Kenyan coast limits the available habitat for seaweed growth and, as a result, limits natural populations with commercial potential. In addition, it results in less space for commercial seaweed aquaculture operations. The common occurrence of estuaries are another limiting factor as lowered salinity levels prevent successful cultivation. These factors, combined with potential multi-use conflicts (e.g. fishing, nature conservation, tourism), illustrate the importance of assessment studies to identify suitable areas for seaweed cultivation systems (Bolton *et al.*, 2007).

The development of constructions such as rafts that could be deployed in deeper waters could expand the potential of the seaweed culture.

2.6.2.2 Market Development

The current production of seaweed at the south coast falls below the 1,000 tonnes threshold which represents commercial farming. To get traders interested in marketing seaweeds, the commercial threshold has to be attained. According to KCDP (2013), the socio-economic factors in the farming

communities are favourable for seaweed farming; coupled with room for expansion of farms, there are good prospects for up-scaling seaweed farming in these areas to a level of a viable commercial venture. Community mobilization and capacity building through support from KCDP will give this venture the necessary impetus to raise production and consequently develop a viable industry with the involvement of other players (including traders, processors) and stakeholders along the value chain (*ibid.*).

In individual interviews with seaweed farmers and a seaweed buyer, the consultants learnt that the Kenya Coastal Development Project piloted seaweed farms have been quite successful in establishing a seaweed farming culture. The main issue has been linking the produce to a larger market. In addition, the *Cottonii* strain, which is commercially (from an export perspective) the most interesting strain, has proven to be more difficult to farm and process. According to an international buyer, this is a real issue as the company is only interested in the *Cottonii* strand. If the farming system for *Cottonii* could be improved, for example by offshore farming, and production increased, this would lead to a competitive price. According to this buyer, developing the seaweed farming business would “enable workers to send their kids to school, improve their houses, empower women and combat violent extremism in one of the poorest regions in the country”

Currently there are local buyers with connections to the world market that do purchase the dried produce. The main external demand is for *Cottonii*. Here lies a concrete business development opportunity with direct impacts on employment opportunities and food security: fulfilling the production potential of seaweed, and in particular *Cottonii*, along Kenya's coast, with the development of appropriate farming technology also for the more deeper water production. Based on this it can be assessed whether the development of a larger scale local processing plan for seaweed would be a viable investment opportunity.

It is clear that when established, even at a more artisanal basis, provided a market/buyer is available, the production of seaweed is a clear income generating activity. This could play a role in reducing the fishing pressure on the inshore area by providing alternative income generating activities. During the mission it was pointed out that in neighbouring country Tanzania, seaweed farming started already a long time ago and now involved 20.000 farmers. In Kenya, where seaweed farming is in its infancy, 100-200 farmers are employed in the pilot schemes. Training, capacity-building and the improvement of farming techniques to produce the demanded *Cottonii* strand were seen as important prerequisites for its further development in Kenya.

2.7 Fisheries management

Fisheries Management in Kenya has been restructured over the past years. In 2014, the Ministry of Agriculture, Livestock and Fisheries was responsible for fisheries policy, with the Ministry's State Department for Fisheries in charge of implementation of policy in relation to fisheries management and conservation. The designation of a specific department for marine and coastal fisheries was a new development with potential implications for the staff to be included in any negotiations over a possible FPA/Protocol with the EU (POSEIDON *et al.*, 2014). In late 2016, the State Department was renamed to State Department for Fisheries and the Blue Economy. This reflects the Kenyan government's ambition to utilise the potential provided by the marine resource base for sustainable development. The new name also included an organisational restructuring, which means that many of the government representatives the consultants spoke to during the mission were not in acting or between-jobs positions. In figure 3 below the structure of the State Department of Fisheries as per 2014 is presented. It should be noted that currently organisational changes are being implemented, which means that the figure does not fully reflect the current situation.

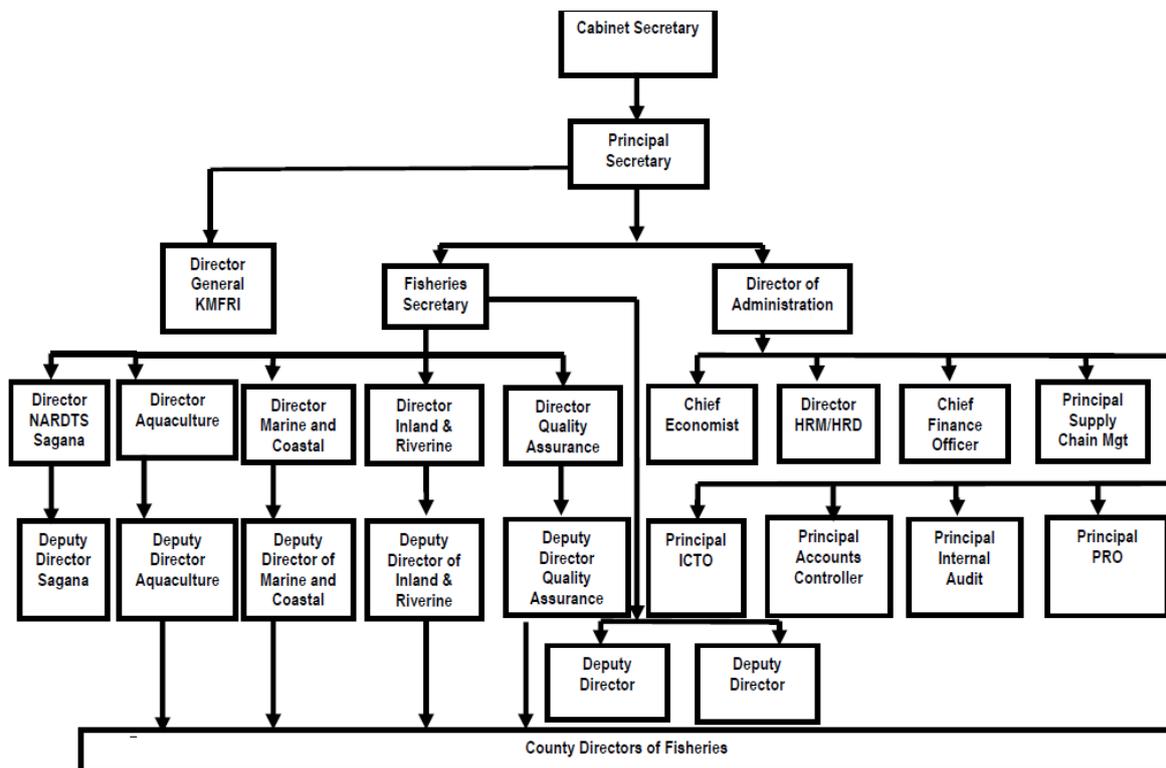


Figure 3: Organisational structure of the State Department of Fisheries as per 2014
 Source: POSEIDON *et al.* (2014)

The KMFRI is the principal research organisation in the country. Other departments and organisations relevant to the management of fisheries are the Kenya Maritime Authority (KMA), responsible for vessel registrations; the Kenya Ports Authority, the Kenya Navy and the Marine Police, which have a role in monitoring, control and surveillance (MCS); and the National Environmental Management Authority (NEMA) (POSEIDON *et al.*, 2014). Highlighting its goal to promote fisheries management best practices, Kenya in 2014 established the 'Agriculture, Fisheries and Food Authority' with objectives included preventing the collapse of the small-scale fishing subsector (FAO, 2016).

Kenya's development strategy is driven by its Vision 2030 document. The document sets out a series of pillars in the economic, social and political domain as well as pillars oriented at 'enabling' and macro strategies. Within each of these pillars there are a series of higher-level 'goals' per sector (POSEIDON *et al.*, 2014).

The Ministry of Agriculture, Fisheries and Livestock has a suite of management objectives and programmes, which include:

- development and review of fisheries management plans and harvest strategies;
- protection and rehabilitation of critical fish habitats;
- fish harvesting rights administration through fisheries licensing, permitting and partnership agreements;
- monitoring fishing performance through an elaborate fisheries statistics programme including a sample-based survey, a frame survey and administrative data sources;
- protection of endangered, threatened and protected marine species (such as turtles, marine mammals and vulnerable shark species) from fishing activities (FAO, 2016).

Fisheries governance in Kenya has historically focused on the inland sector. A report by Smart Fish (2011) found that governance of the marine sector is weak. Within the territorial waters a key governance structure has been the implementation of Beach Management Units (BMUs), which is essentially a co-management approach. The report concluded that although in principle the concept is good, there is little evidence to demonstrate the effectiveness of BMUs. Organising fisheries

management interactions of artisanal fisheries with the industrial fishing sectors targeting the same stocks, such as the shrimp fishery, remain a major governance challenge (*ibid.*).

The 2011 Smart Fish report was also very critical about the functioning of the governance system for the offshore sector. This was assessed as almost zero and limited to licensing fees with no culture of managing these licences. Poor governance in this sector has effectively led to “non-performance” of Kenya. This analysis was confirmed by the FAO. According to FAO (2016) Kenya lacks capacity to monitor the activities of the distant-water fishing fleet operating within its EEZ. Its nationally registered fishing fleet operating in its deep-waters is small, and as a result of this and other issues, including the lack of good landing facilities, the distant-water fishing fleet operating within its EEZ land more than 20.000 tonnes outside the country (*ibid.*).

For the EEZ, the SWIOFISH programme (2013-2028) could act as a key instrument to advance regional fisheries management. This World Bank funded programme is a follow up of the South West Indian Ocean Fisheries Project (SWIOFP), which closed in 2013. The SWIOFP project focussed on generating scientific knowledge and developing legal and institutional capacity for towards an action plan to manage fisheries within the EEZ's of the coastal states in the South West Indian Ocean (World Bank, 2013). As part of this action plan, the member countries of the South West Indian Ocean Fisheries Commission (SWIOFC) agreed to reform the Commission, promoting it from an advisory body to a Regional Fisheries Management Organization (RFMO) of the Coastal States – enabling it to take binding decisions on fisheries management, and to negotiate in bloc with Distant Water Fishing Nations, among others. The South West Indian Ocean Fisheries Governance and Shared Growth Programme (SWIOFish) is the follow-on of SWIOFP and will cover a 15 year period, with funding provided by the World Bank, other donors and trusts (IOC, 2015). The SWIOFish programme objective is “to increase the economic, social, and environmental benefits of SWIO countries from marine fisheries. It will target both growth and poverty reduction and the strengthening of institutional and private sector capacities of the fisheries sector” (*ibid.*).

Next to the SWIOFISH project and the Kenya Coastal Development Project (KCDP) the Kenyan government is implementing a series of fisheries and aquaculture projects. Details can be found in Annex 1: page 51-53.

2.7.1 Legislation and management plans

The current set of legislation, comprising of the fisheries bill and the suite of management plans for specific fisheries, does provide a solid ground for fisheries management and achieving sustainable fisheries. At the regional level the Kenyan Coastal Development project has been a key driver in the development of these management plans, while for the migratory stocks the SWIOFish programme will be instrumental in driving regional management cooperation. However, as mentioned above, whereas on paper the structures, rules and regulations are there, it is at the level of implementation and enforcement that these plans will materialise into a sustainable effect on the stocks and the fisheries.

The licensing system does provide a tool to more actively manage the number of legal fishers operating in any one fishery. This, however, would require active management and enforcement by the authorities. As mentioned in several publications the lack of capacity to patrol at sea and have observers on board vessels hampers the effectivity of the management system (FAO, 2016; POSEIDON *et al.*, 2015). Under the SWIOFish project, initiatives to set up an observer programme were taken (World Bank, 2013). Through the Kenyan Coastal Development Project investments have also been done in facilities for the implementation of a Vessel Monitoring by Satellite (VMS) system.

Licenses are only granted for a period of one year. This means that license holders face uncertainties about their fishing access rights. This in turn is a barrier for companies to invest in improved fishing techniques and other technical or management innovations aimed at improving fisheries. This is likely to be a major constraint in developing business opportunities in conjunction with foreign (Dutch) seafood companies.

In addition, fishers mentioned that at this moment there is no coastal service that can venture out for seafarers in distress. Fisheries accidents occur frequently; fisheries being one of the most dangerous professions world-wide. The establishment of a coastal rescue and distress service could contribute to more safe operations at sea. This in turn could well be an enabler to have the artisanal fleet more effectively operate beyond the reef area.

2.7.2 Beach Management Units

The establishment of BMUs is an important step in improving governance. Through a bottom-up process communities and stakeholders are involved in the decision making, implementation, and monitoring processes; the idea being that this process will result in improved stewardship at the operational level. While limited to the coastal zone, BMUs also provide a framework for managing fisheries that often are of a transboundary or shared nature (Smart Fish, 2011).

In the discussions held with a suite of BMU representatives during the mission, it appears that at the operational level, involvement, scope and impact of the BMUs may vary significantly between areas. A more in-depth analysis is needed, which would require more time in the field along the entire coast, to get a more detailed picture of the effectiveness and operational scope of a number of BMU's. Yet, for some of the BMUs visited it seems that in terms of co-management there was little of both. Local fishers did not feel that they shared a joint responsibility with government for the management of the fisheries. As one respondent put it: "we are responsible for organising the landing site, that's all". There appeared to be a discrepancy in the perceptions of the limited number of government representatives who had a very clear opinion about role attribution and the way this was understood by the BMUs, or as one of the government representatives put it: "Management is still open. There are no limitations on catch or the number of licenses. The idea was to bring this responsibility to the community; they need to watch. ... The ministry is not the one to set the fishing limits, this should be with the community. But the BMUs don't take it up, the awareness is not so good. ... Community education is needed".

While some BMU members were aware of their role and responsibilities, it was also pointed out by fishers, traders and researchers that family, tribe and friendship ties sometimes made it difficult for the board members, who are all volunteers, to enforce the rules. "As one BMU member put it "if the job was paid, they would struggle for their jobs; now they are volunteers and they just leave".

From the meetings with BMU members, the following main challenges for the BMUs emerged:

- Financial support: fishermen have to make a financial contribution to the BMU, but as they are struggling, board members find it difficult to enforce the rule.
- Voluntary nature of the job: this affects commitment and also may result in board members not taking responsibility or simply walking off as it is not their job that is on the line.
- Internal conflicts.
- Lack of ongoing capacity building: initially new board members received a training and develop experience while on the job. With changes of the board, new members do not always get the training and neither is there a good transfer of capacity and skills from departing board members to new board members;
- Marketing: how to find a market for the fish and provide high quality.
- Lack of good landing facilities including storage.
- Institutional support: lack of support from the fisheries department in capacity building, improving and maintaining landing facilities and enforcement.
- Dependency from traders: most fishers do not own their own boats. This gives them a feeling of powerlessness, as the traders determine the price. If a fisher protests he runs the risk of getting kicked off the boat.
- Competition from sports fishing: sports fishing is becoming more popular and fishermen perceive this activity generates substantial pressure on the stocks. While it is illegal for them to land the fish, this is not enforced.
- Lack of enforcement of rules: examples included the use of mosquito nets to fish in creeks, use of ringnets within the reef, use of traps with small mesh. This was also linked to the fishers' own willingness to abide with rules or use more selective fishing nets, often linked to

dilemmas such as the one sketched in the following quote: "They [fishers] say: 'We let the fish escape and then the next person uses small mesh traps to catch the fish we just let escape'. I cannot do this on my own. I need support."

- Lack of alternative fishing opportunities or income sources: this can best be illustrated by two quotes from BMU members: "Don't say to fishermen: 'Stop fishing with a speargun and then don't give them an alternative'" and "Once you have been capacity-built there is nothing. Capacity-building only works if in the end you also have a job".

In the current context of a high influx of new entrants to the fisheries and increasing poverty in general and its associated problems such as additional pressure on stock and allegedly increasing use of illegal fishing techniques, it can be questioned whether or not the social cohesion in the coastal areas today still allows for a well-functioning co-management structure. It seems apparent that a more strict enforcement of the fisheries law and management plans (the stick behind the door) would be an enabler for fishers taking more control over resource management (the carrot). Also it should be emphasised that the interests of the members of the BMUs (fishers, gear owners, fish mongers, traders) are not at all times synchronised. These are important considerations when improving fisheries and their management to foster sustainable resource use, generate income and socio-economic benefits and improve food security.

3 Food security and fisheries development

A significant proportion of Kenya's total fish catch caters to the protein needs of the local population (FAO, 2016). In 2007, 2008 and 2009, 86.6%, 86.7% and 92.2% of all reported fish caught from Kenyan waters were consumed domestically and thereby directly contributed to food and nutrition security. That said Kenya's per capita fish consumption is relatively low at 5kg in 2011 and 2014 (*ibid.*). For communities along Kenyan lakes and coastlines, small-scale fishing is essential to overall household well-being, providing both income and nutrient-rich food (USAID, 2015). Besides the contribution to livelihoods and nutritious food, fisheries also provide raw materials for production of animal feeds, fish oil and bioactive molecules for the pharmaceutical industry. Fisheries also support auxiliary industries such as net making, packaging material industries, boat building and repair, transport, sports and recreation (Smart Fish, 2011). Through the creation of employment opportunities these activities also indirectly contribute to food security.

Based on a study on artisanal fisheries in the Kenyan Coast, Hoorweg *et al.* (2009) propose that, in addition to improvements in fishing techniques and access to markets, fisher households must broaden their resource base in order to deal with challenges posed by declining stocks, competition from tourism and demographic changes. By securing additional resources, notably non-maritime employment, fisher households will strengthen their livelihood strategies in this way and improve household security (*ibid.*).

Food security is related to four aspects: availability, accessibility and affordability, and utilization and stability (see Box 1).

Box 1: 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)

From a food security perspective, the mission found that a number of potential (business case) developments can be identified for Kenya. These to a large extent align with the investment opportunities for the fisheries and aquaculture sectors identified by the State Department for Fisheries and the Blue Economy in 2016 (see Box 2).

Box 2: Investment opportunities for fisheries and aquaculture in Kenya

Aquaculture:

1. Fish Feed Production: Inadequate and good quality fish feed remain a challenge in aquaculture and so there are opportunities to invest in the feed production.

2. Fingerling Production: this is an area of investment by private hatcheries

Intensive Aquaculture Production: This includes investment in Recirculating Aquaculture Systems (RAS) and Aquaponics.

3. Integrated aquaculture: Aquaculture can easily be integrated with conventional crop and livestock farming. This provides opportunities for diversification on crop and livestock farming and can put to productive use otherwise idle land during certain seasons. In ASAL, fish could be stocked in water reservoirs meant for livestock watering. This will increase the benefits accrued from such water bodies by diversifying sources of income and increasing security for quality food for livestock farmers in such areas.

4. Cage culture: This can be done in rivers, water reservoirs, lakes and the ocean. The advantage here is that more benefits can be generated from such water bodies.

5. Aquaculture inputs and equipment: These include fish rearing tanks, pond liners, harvesting nets, containers

6. Bait culture: There exists a very big market for bait fish (juvenile *Clarias gariepinus* and *Chanos chanos*) for the Nile perch capture industry in Lake Victoria and Tuna fisheries of the Indian Ocean.

7. Ornamental fish culture: There are only a handful of ornamental fish producers in Kenya. Resources for culture of both marine and fresh water species are available in Kenya. Potential markets for the ornamental fishes include local cities, the Africa countries, Europe and Asia.

8. Capture-based Aquaculture: This can be done in the many water reservoirs in the country. These include domestic water reservoirs, irrigation reservoirs and the hydroelectricity reservoirs. It involves stocking of such reservoirs with appropriate fish species of commercial value which is later harvested when mature.

9. Training and aquaculture technology transfer: In emerging aquaculture technologies, innovations and procedures

Mariculture and coastal fisheries in inshore waters:

1. Industrial fishing port at Lamu with fish port infrastructure (including dry dock, quay and service provider needs)

2. Artisanal fishing infrastructures (cold storage and jetties) in riparian counties

3. Fish auction markets at the coast

4. Fisheries laboratory to support products development and testing

Fish Inspection and Quality Assurance:

1. Improvement of fish landing facilities

2. Development of cold chain facilities;

3. Establishment of accredited analytical laboratories for fish and fishery products;

4. Value addition for fish and fishery products and branding,

5. Development of fish auction centres

6. Technology adaptation for dry fish

7. Value chain development for selected fish species

8. Development of fish markets in major towns

9. Investment in refrigerated fish transport vehicles

10. Develop marketing infrastructure.

11. Establish aquaculture market outlets to promote entrepreneurship and branding

12. Promote market and product development through economic partnership and trade agreements

13. Promote per capita fish consumption. "Eat more fish campaigns" throughout the country

Source: State Department for Fisheries and the Blue Economy (2016)

In the context of developing business opportunities, the issue of availability of fish and stability is important and is an essential consideration when assessing fisheries management with a food security

lens. It is key 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 the status of the stocks by reducing fishing effort, preventing the use of fishing methods with a high negative impact (such as the illegal use of ringnets in inshore waters and or the use of too small mesh sizes) as well as counter habitat destruction (including protecting mangroves and reefs).

An effective management system of the artisanal inshore fisheries (number of fishers, vessels and gear type) in line with achieving the maximum sustainable yield (MSY), with a strict licencing policy and enforcement, would contribute to a transition towards a sustainable fishery. This would not only provide a considerable contribution to national food security by protecting the resource base, but would also safeguard the livelihoods of the coastal communities which is currently under threat. As some species from the artisanal fisheries are interesting for a more high-end market in Kenya (hotels and restaurants on the coast, Nairobi) and for export, setting up public-private partnerships in relation to achieving sustainability certification may act as a driver for improving fisheries management.

Opening up the offshore area for artisanal fisheries could result in more fish becoming available for export and the local market. However, there are indicators pointing to the fact that the stocks in this area are also already under sever fishing pressure. A transition to sustainable fisheries management is therefore important. Again, public-private partnerships towards sustainability certification may play a role here. In this context, it must be noted that currently fishing licenses in Kenya are only given on an annual basis. This will be a barrier for any investments by (foreign) companies in the fishing industry. In addition, moving fishers out to the more offshore waters goes hand in hand with challenges relating to safety. Establishing a life guard service may in this context be helpful for all fishermen; provisions such as life-vests would already improve the situation and are more easily to achieve .

Regardless of the source of production, addressing the challenge of post-harvest losses of fish will result in relatively more fish and higher quality fish becoming available through improved handling and processing practices throughout the entire chain. This is currently the most straightforward way of addressing food security issues and may also result in new market opportunities. Establishing fish processing facilities may be an enabler in this process. As there may be a risk of increased fishing effort when good storage facilities are available, it is important that an effective management system (first consideration) is in place.

If through regulations it would become compulsory to land (a proportion of) the catches from the EEZ by licensed vessels in Kenya, 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.

Diversification with respect to marine produce is another option for developing business opportunities and increase food security. Here, coastal seaweed culture seems to be the best candidate for further development as return upon investments is high, production is environmentally-friendly, the demand for seaweed is growing, Kenya's coastline hosts suitable areas for both 'on coast' as offshore production on platforms and production will generate direct and indirect employment opportunities for significant numbers of people.

In relation to the development of business opportunities in the artisanal and territorial waters fisheries, it must be emphasised that the backdrop is the state of the stocks. The current policies do provide the (paper) foundation for sustainable fisheries. It depends, however, on the effective implementation of the management plans, including a well-functioning co-management system with BMUs, and Monitoring, Control and Surveillance whether or not these management efforts do in practice will pan out.

It should be noted that quite an array of national and international actions and activities in the field of marine fisheries development, for example under the Kenyan Coastal Development Project and

SWIOFish umbrella, are already taking place in Kenya. Coordination between efforts is highly recommended.

As for the evaluation of the Kenyan Fisheries Master Plan, there did not appear to be an urgent need for additional input. However, if required assistance in methodological input and practical (participatory) implementation still can be considered.

In summary the *main directions for business opportunities* can be found in:

- Aquaculture development including feed and fingerling production and integrated production facility design and operation
- Mariculture development including processing design and marketing development and the development of off-shore (floating) production platforms
- Fisheries development through a management system development and sustainable off-shore stock exploitation and certification
- Value chain development including processing, diversification of production, market development and certification.

Further developing these opportunities and taking up chances is of course foremost dependent on local people and local initiatives to explore these opportunities. To assist in this process it is suggested to organise a Business to Business visit aimed at matchmaking and capacity building. Details for this proposal can be found in annex 5.

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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.

Justification

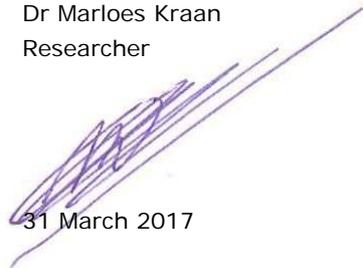
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The scientific quality of this report has been peer reviewed by a colleague scientist and a member of the Management Team of Wageningen Marine Research

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Date: 31 March 2017



Approved: Drs. J. Asjes
Manager Integration

Signature:

Date: 31 March 2017



Annex 1 Literature overview

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 comprised of copied extracts of the highlights from the most important articles and reports.

In order to guide usage of these sources below an indication of the topical content of the literature:

Topic	Pages
Introduction to Kenyan Fisheries	39-47, 74-79, 102-105, 109
Fisheries practices	39-47, 65-79, 74, 76-80
Fish Produce Value Chain	44-47, 48, 51, 80-82, 88
Kenyan Fisheries Management	47-53, 59-74, 80-102, 105-109, 135
Legislation	61-64, 86-88
KCDP Project	54-58
Aquaculture and Mariculture	40-41, 44, 49-50, 89-91, 98-99, 114-115
Statistics	40, 43, 82, 86, 88, 94-97, 99

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(FAO, 2016)

Kenya's fisheries and aquaculture sector contributes approximately 0.54 percent to the country's GDP (2013). Fish consumption has been declining from a modest 6.0 kg/caput in 2000 to 4.5 kg/caput in 2011. The value of fish exports was about USD 62.9 million in 2012, or about 5 times greater than the USD 12.3 million in fish imports. In 2013, around 129 300 people derived their livelihood from fishing and fish farming activities (including 48 300 in inland waters, 13 100 in coastal waters fishing and around 67 900 in fish farming).

Total fishery and aquaculture production in 2013 amounted to 186 700 tonnes, with 83 percent coming from inland capture fisheries (of which Lake Victoria contributed about 90 percent). Catches of Nile perch - the most sought and mainly exported fish species – seriously declined due to overfishing after the 2000 peak at 110 000 tonnes but since 2007 stabilized around an average of 45 000 tonnes per year. Marine capture fisheries produce less than 9 000 tonnes per year, comparatively much less than neighbouring countries.

	1980	1990	2000	2010	2012	2013	2014
PRODUCTION (thousand tonnes)	47.9	202.6	216.1	152.6	180.2	186.6	192.3
<i>Inland</i>	42.3	192.0	210.9	144.1	171.6	177.8	183.3
<i>Marine</i>	5.7	10.6	5.2	8.5	8.6	8.9	9.0
Aquaculture	0.2	1.2	0.5	12.2	21.5	23.5	24.1
<i>Inland</i>	0.2	1.0	0.5	12.2	21.5	23.5	24.1
<i>Marine</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Capture	47.8	201.3	215.5	140.4	158.7	163.1	168.2
<i>Inland</i>	42.1	191.0	210.3	131.9	150.1	154.3	159.2
<i>Marine</i>	5.7	10.4	5.2	8.5	8.6	8.9	9.0
TRADE (USD million)							
<i>Import</i>	2.7	0.7	4.6	7.8	12.3	15.5	0.0
<i>Export</i>	0.9	26.9	38.9	63.8	62.8	39.0	0.0
EMPLOYMENT (thousands)	5.9	6.0	20.0	20.0	20.0	20.0	20.0
Aquaculture			6.0	6.0	6.0	6.0	6.0
Capture	0.0	0.0	14.0	14.0	14.0	14.0	14.0
<i>Inland</i>			6.0	6.0	6.0	6.0	6.0
<i>Marine</i>			8.0	8.0	8.0	8.0	8.0
FLEET (thousands boats)	15.7	19.7	19.9	19.9	19.9
APPARENT FOOD CONSUMPTION							
<i>Fish food supply (thousand tonnes in live weight equivalent)</i>	48.7	175.4	188.8	140.1			
<i>Per Capita Supply (kilograms)</i>	3.0	7.5	6.0	3.4			
<i>Fish Proteins (grams per capita per day)</i>	0.9	2.2	1.8	1.0			
<i>Fish/Animal Proteins (%)</i>	5.7	11.8	11.6	5.7			
<i>Fish/Total Proteins (%)</i>	1.4	3.8	3.0	1.6			

Source: FAO Fishery and Aquaculture Statistics

Figure A: Kenya Fisheries Statistics (FAO, 2016)

Freshwater aquaculture development in Kenya in the new millennium is remarkable, especially in 2009-2010, making Kenya one of the fast growing major producers in Sub-Saharan Africa. From the annual production of about 1 000 tonnes in 2001–2006, the harvest of farmed fish leaped to over 4 000 tonnes in 2007–2009. In a nationwide fish farming mass campaign launched by government in 2009, the total area of fish ponds was increased from 220 ha to 468 ha by building 7 760 new fish ponds. Together with the improved seed supply and supports covering other aspects, it lead to a hike in farmed fish production reaching 23 501 tonnes in 2013, more than four times of the production in 2009. The main species produced in 2013 was Nile tilapia (75 percent), followed by African catfish, common carp and rainbow trout. Mariculture is not yet practiced commercially, despite its potential demonstrated by trials.

Figure 6 — Kenya—Aquaculture production

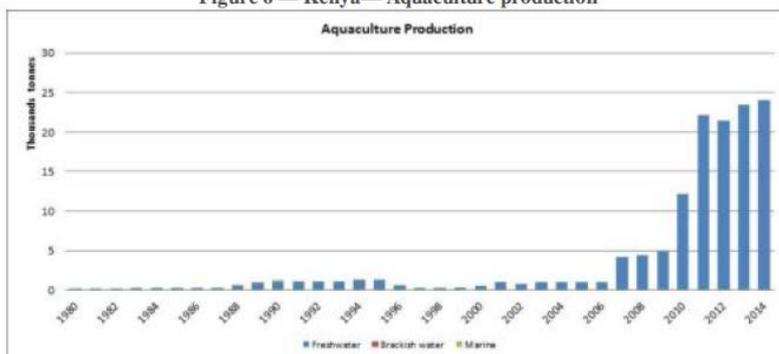


Figure 7 — Kenya—Major species groups in aquaculture production

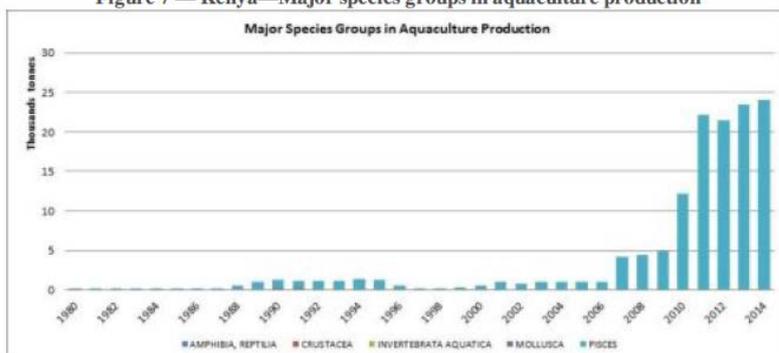


Figure B: Aquaculture production (FAO, 2016)

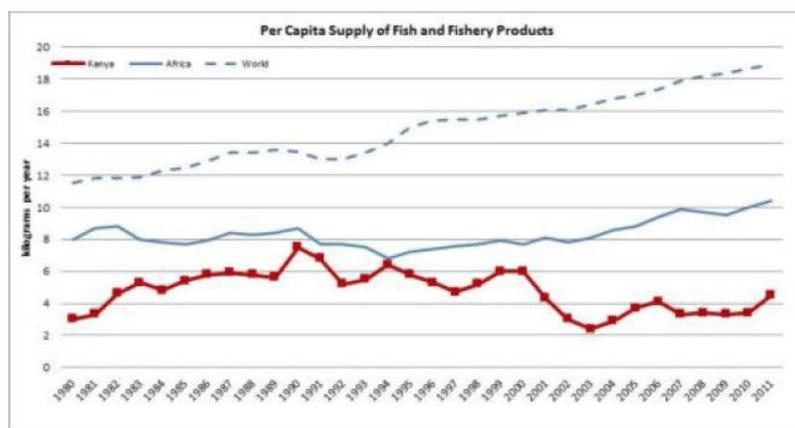


Figure C: Per capita Supply of fish and fish products 1980-2011 (FAO, 2016)

A prominent feature of Kenya’s rich heritage is its over 600 kilometers of coastline on the Indian Ocean, with productive ecosystems, which play a highly significant role in the economic and social wellbeing of the people. A distinctive seamark of the coastline is the almost continuous fringing coral reef which stretches parallel to the coast. This coastline comprises 12 nautical miles of territorial waters and a 200-nautical mile Exclusive Economic Zone (EEZ) with a total area of 142 400 km². Kenya has important, well-defined and well-developed marine and freshwater fisheries. The marine fisheries can be classified into two subsectors: the coastal artisanal fishery, and the Exclusive Economic Zone (EEZ) fishery. A basic feature of the coastal fishery is the largely subsistence and artisanal nature of the fishers who operate small craft propelled by wind sails and manual paddles. The EEZ fishery, on the other hand, is characterized by distant-water fishing vessels which exploit target species mainly with purse-seines and long-lines.

The maximum sustainable yield of Kenya's marine and coastal waters is between 150 000 and 300 000 metric tonnes, while the current production level is only about 9 000 metric tonnes per annum. Kenya's aquaculture potential stands at 1.14 million hectares of farming area with capacity to produce 11 million tonnes of fish worth well over 750 billion Kenyan shillings (about USD 7.3 billion) per annum. Kenya has a thriving recreational fishery, with a large variety of fish species close to shore. It is a preferred destination for sport-fishing tourists who angel, troll and scuba-dive in the country's coastal and deep waters.

In the marine sector, one issue is the control of foreign flag vessels that are fishing tuna in the Exclusive Economic Zone and where illegal, unreported and unregulated (IUU) fishing is known to occur.

The Kenyan coastline is rich in fish species. Species caught in Kenya's marine waters can be categorized as demersal, pelagic, sharks and rays, crustaceans, molluscs and deep sea/big-game fish. Fishing is mainly artisanal, subsistence and inshore. The Kenyan marine waters host a large variety of fish species, including finfishes: pelagics, such as kingfish, barracuda, mullets, queenfish, cavalla jacks, little mackerels, barracudas, milkfish, sailfish, bonitos, tunas, dolphins and mixed pelagics; demersal species, such as rabbitfish, snapper, rock cod, scavenger, parrotfish, sturgeon, unicorn fish, grunter, pouter, blackskin, goatfish, steaker and mixed demersals; crustaceans and invertebrates, such as prawns, lobsters, crabs, and sea-cucumbers, etc.; and molluscs, such as squids and octopus. Other fish species exploited in the waters are the parrotfish (*Leptoscarus vaigiensis*), the crown-of-thorns starfish (*Acanthaster planci*), moray eels (*Muraenidae*), damselfishes (*Abudefduf annulatus*, *A. xanthurus*), acanthurida (*A. triostegus*), cardinal fish, wrasses, angelfish, scorpion fish, etc. Other finfish species include emperors, and rock cods. Deeper waters support the pelagic species such as tuna, eels, and mullets.

Factors affecting marine fish landings in Kenya include tides, the monsoon weather pattern, fishing gear and craft, and social and economic considerations. Demersal fish species predominate over pelagics in the catches.

Kenya sits within the rich tuna belt of the West Indian Ocean where about 25% of the world's tuna is harvested. In cognizance of this, the Kenya Marine and Fisheries Research Institute (KMFRI) in 2012 perfected plans to use the e-satellite station to identify fishing zones in order to enable fishers increase fish catch.

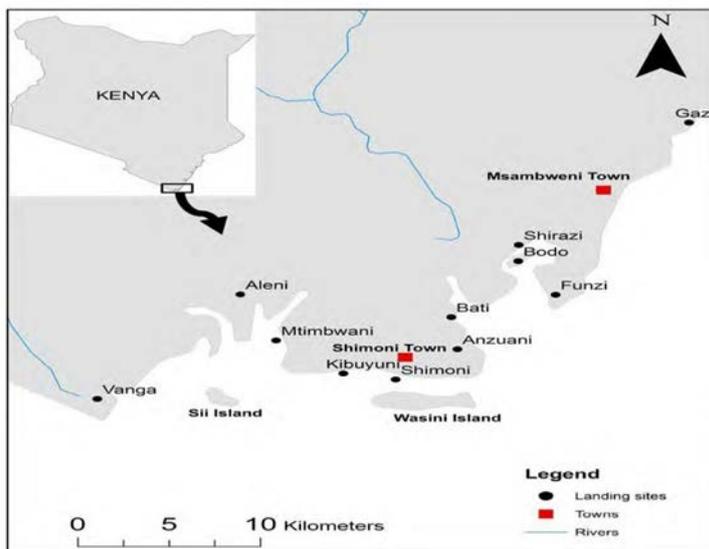


Figure D: Kenya Coastal Landing Sites (FAO, 2016)

There were a total of 197 landing sites in Kenya's marine and coastal waters in 2014. The major fishing areas are the length of Kiunga coastline and Lamu islands in the North, Tana River mouth, Ngwana Bay and Malindi area, including the offshore North Kenya Bank and Shimoni, Vanga, Funzi Island and coral reef areas on the Southern border. Thirteen major fishing grounds exist in Lamu,

including: Dodorori, Faza, Lagoon, Manda, Matondoni, Pate and Shela. Major fish landing sites including Kipini, Jetty, Mayungu, Mambrui, Malindi among others are located within the Malindi-Ungwana bay area, while landing sites within the Mombasa-Kilifi area include Nyali, Msanakani, Reef, Kenyatta, Marina, Mtwapa, Kanamai Bureni, Vipingo, Kijangwani, Kuruwitu, Kilifi and Watamu. Seven major sites (Chale, Mgwani, Mwanyaza, Mvuleni, Mwape, Tradewinds and Tiwi) fall within the Diani-Chale area while four major fish landing sites (Vanga, Shimoni Msambweni and Gazi) are situated within the Funzi-Shirazi bay area.

Different types of gear and craft are deployed by fishers towards the exploitation of the fish resources. The vessels include canoes, motorized boats, sailboat ('dhow'), outrigger canoe ('ngalawa'), and open fishing boat ('mashuwa'). Built to withstand rough seas and open fishing voyages, 'dhows' and 'ngalawas' are equipped with shark net, driftnet and gillnets. Fishing in canoes, on the other hand, employ beach seine, cast-nets, drift long-lines, set gillnets, fish pot and barricade traps. Major gear used by the artisanal fishers include: gillnets, seine nets, cast-nets, long-lines, hand-lines, spears, 'lema' (basket traps), 'uzio' (barricades) and 'tata' (weir). 'Chachacha', which is a traditional gear used to catch half beaks, is utilized in Vanga.

Kenya's marine fisheries, being mainly artisanal and subsistence, are undertaken mostly from small, non-motorized boats such as outriggers, dhows and planked pirogues. As a result of the obvious limitation in fishing craft technology, fishing effort is mainly constrained within the reef and is hardly undertaken outside the territorial waters.

Gillnets, artisanal seine, hand-lines, trolling lines, trammel net, harpoons, hooked- and pointed-sticks, fence- and basket traps, and bottom lines are used in the fishery, while pots are used to harvest lobsters in Lamu, Malindi and Kwale areas. Medium-sized trawlers and modern technological fishing equipment including prawn seine, are employed for industrial prawn fishing. Ring nets are also used to exploit offshore fish resources far into the EEZ.

Some 6 500 fishers operated 1 800 artisanal fishing craft in Kenya's marine and coastal waters in 2010. As a result of the nature of these craft, they lack access to offshore and deep-sea fisheries and thus land small catches, in the neighbourhood of 7 000 tonnes annually, representing about 4% of the total national fish catch. But while the inshore fishery was exploited by the local artisanal fishers, the offshore distant waters were targeted by Distant Water Fishing Nations (DWFN) with a major focus on the tunas (skipjack, yellowfin and bigeye). Foreign fishing fleet are authorized to operate in Kenya's EEZ in accordance with the Regional and International Agreement and Cooperation provision of the National Oceans and Fisheries Policy which states, inter alia, "The Government will continue to grant fishing rights to other distant Water Fishing Nations to fish in its Exclusive Economic Zone (EEZ) taking into account the state of the stock and economic returns".

A total of 2 913 fishing craft were actively used in the marine capture fishery in 2014. Of these, dugout canoes were the most prevalent, accounting for 47.9%; 'Dhow' with flat at one end ('Mashua') 22.1%; 'Hori' 10.8%; 'Dau' 9%; 'Ngalawa' (outrigger boats pointed at one end) 5.7%; 'Mtori' 3.1%; Surf and rafts 1.4%.

Kenya's coastal and marine environments show expansive resource diversity. The coast, encompassing both the intertidal and sub-tidal areas, provides finfish and shellfish, both of which are caught inshore and offshore. Of the estimated 19,120km² continental shelf area, some 10,994km² are considered trawlable.

The maximum sustainable yield of Kenya's marine and coastal waters is estimated at between 150 000 and 300 000 metric tonnes. However, optimal harnessing of these resources is hindered by infrastructural limitations and inappropriate fishing craft and gear. Artisanal fishers mainly restrict their operations to the continental shelf because they are ill-equipped in terms of craft and equipment to fish in the deep sea. Increasingly targeted for their high internal and external market prices are lobsters, crabs and octopus, all of which have also attracted the attention of seafood companies and local businessmen. The crab fishery thrives mainly in Mombasa, Malindi, Kilifi and Watamu, and is very active in Ngomeni-Marereni area, especially during the peak tourist season when the product fetches

much higher prices. Lobsters are mostly caught between October and March at the North East Monsoon period. The fishery is attractive to local entrepreneurs who engage the services of skilled diver-fishers for this purpose. In addition to local fishers from around the Kenyan coastline, many migrant fishers from Pemba Island in Tanzania fish lobsters. For the industrial shrimp fishery, the single fishing ground of commercial importance is located in the Ungwa Bay at the mouth of River Tana and is one of East Africa's largest. The target shrimp species include *Penaeus indicus*, *Metapenaeus monoceros*, *P.monodon*, *P.semisulcatus* and *P. japonicas*.

Kenya has a fully-fledged Ministry of Fisheries Development which is the responsible institution for the administration of fisheries and aquaculture, including enforcement of fisheries regulations, collecting and reporting statistics, licensing, fish quality assurance and control of imports and exports, and other related activities.

The Marine National Parks and the Marine National Reserves are all administered by the Kenya Wildlife Service. The Kenya Fish Processors and Exporters Association (AFIPEK), an assembly of fish industries which have adopted self-regulatory mechanisms to ensure that sustainability is adhered to amongst its member-factories, collaborates with relevant government agencies to foster public recognition and support for the fisheries sector, to promote high quality fish and fish products and to advocate for the effective management of inland marine fish resources.

Other major stakeholders in the fisheries sector are the six franchised aqua-shops located at Funyula, Nambomboto, and Bukiri shopping centres within Samia; and Ahero, Katito and Oboch in Nyakach Districts respectively. These outlets are intended to deliver a wide range of affordable fisheries and aquaculture products and services, including the provision of inputs and technical advice.

The Ministry of Fisheries Development manages all capture fishery activities. The management measures currently in place involve monitoring, control and surveillance (MCS), fisheries development, appraisal, improvement, and statistical data collection, etc. The Ministry has implemented measures to stem overfishing by reducing the number of fishing boats targeting certain species. Highlighting its goal to promote fisheries management best practices, Kenya in 2014 established the 'Agriculture, Fisheries and Food Authority' with objectives including prevention of the collapse of the small-scale fishing subsector.

The Ministry of Fisheries Development has a suite of management objectives and programmes, which include:

- Development and review of fisheries management plans and harvest strategies
- Protection and rehabilitation of critical fish habitats
- Fish harvesting rights administration through fisheries licensing, permitting and partnership agreements
- Monitoring fishing performance through an elaborate fisheries statistics programme including sample-based survey, frame survey and administrative data sources
- Protection of endangered, threatened and protected marine species from fishing activities such as turtles, marine mammals and vulnerable shark species.

The shrimp fishery is currently the only sector with a management plan, 'The Prawn Fishery Management Plan, Legal notice 20 of 2010', with management plans for the other fisheries yet to be drawn.

Aquaculture in Kenya can be categorized into two categories, thus:

- Marine aquaculture and
- Fresh water culture

Though Kenya has a long coastline which borders the Indian Ocean, and therefore has great potential for mariculture, this is yet to translate into much development as the resources remain largely unused. Kenya's mariculture activity has for some time now consisted of the traditional brackish water ponds and artisanal shrimp and oyster culture, while some measure of intensive shrimp culture is practiced along the coast. By 1998 intensive shrimp cultivation had been under experimentation, just

as there was an experimental oyster farm at Gazi. Indeed, potential for oyster farming exists on most of the coastline, even as there is possibility of exploiting marine algae as a crucial protein source.

Three types of marine fish farming activity could be achieved on the Kenyan coastline, viz, (i) pond culture in cleared mangroves or on land behind the mangroves; (ii) suspension culture (cage and raft) in sheltered waterways of adequate depth; and (iii) rack culture in the shallow intertidal zones.

Kenya is reputed for some of the best deep-sea fishing in the world. Fishing off the coast of Kenya is governed by the twin monsoons: 'Kusi' (Southeast Monsoon) blowing from late March until November, and 'Kaskazi' (Northeast Monsoon) which starts mid-December. Most visiting anglers to Kenyan waters target sailfish while the marlin, bonito, skipjack tuna, shortbill spearfish and broadbill swordfish are also target sport species.

All along Kenya's coastline are living coral reefs which occur as coral flats, lagoons, reef platforms and as a fringing reef colonizing the shallow parts of the continental shelf, save in locations where river inflow creates conditions of low salinity and high turbidity which inhibit coral growth. These have an immense value in attracting tourists. The coastline and the coastal lakes, as well as being important sources of fish protein, are also important for recreational activities.

Over the past 35 years the fishing industry has gradually evolved from a domestic consumption-oriented industry to an export-oriented industry with value-added processing being applied. The Lake Victoria fishery has undergone tremendous commercial transformation over the years and is now dominated by fish-processing plants funded by international agencies which aim at promoting fish export to developed countries.

The domestic-market fish is usually packed in ice placed in polythene bags and then heaped in traditional baskets for transportation. Overnight transport systems are more often than not used to convey such fish to Nairobi and Mombasa. Lobsters are usually kept alive until transportation to either the external market or by road to the local market of Malindi, Kilifi, Mombasa or Nairobi. Processed fish, including sundried Nile perch, tilapia and 'dagaa', as well as deep-fried Nile perch are transported by road to various internal urban markets.

Prime marine sector products include bigeye, cuttlefish, fish oil, lobsters, octopus, prawns, sharks and shark fins, swordfish, tuna loins and canned tuna, all of which are targeted at both the local and international markets. Wanachi Marine Ltd, Shimko, Trans Africa and Sea Harvest are the major tuna processing factories in Kenya that export tuna loins to the European Union market.

In 2012 the Kenyan government invested 240 million Kenya shillings (USD 2.3 million) in building four fish cold storage plants at Rongo, Imenti, Tetu and Lurambi. This was meant to accord fish farmers storage facilities for their products prior to marketing.

Kenya's fish market structure classifies traders according to their target market: internal or international market. For the local market, fish is largely sold fresh while the external market involves high quality standards during handling, processing and storage of Nile perch fillets, prawns, octopus, cuttlefish and lobsters. Export markets are usually the EU countries of Italy, the Netherlands, Germany, Belgium, Portugal, Spain, Cyprus, Malta, France and Poland; the Far East countries of Japan, Hong Kong, Singapore, Malaysia and China; the Middle East countries of Israel with a high demand for Nile perch and, to a much lesser extent, the United Arab Emirates (UAE). The United States of America (USA), Venezuela, Colombia and Cuba also import some quantities of Kenyan fish, just as some unverified but negligible amounts are exported to neighbouring African countries.

A total of 18 506 tonnes of Kenya's fish and fish products were exported in 2009. Fish and fish products exported included Nile perch fillets, fish maws, octopus, sharks, swordfish, crabs and fish skins. Export of Nile perch accounted for 87.4% of total fish exports and 84.73% of the total fish export earnings. Export of fish maws took 5.6% of total export quantity and 11.3% of total monetary value, while octopus contributed 2.4% in quantity and 3.2% of monetary value. Accounting for 4,420

tonnes, representing 45% of the total Nile perch exports, Israel was the preferred country of destination for this species.

Of Kenya's 2014 estimated population of 44.9 million, the fisheries sector provides employment to 2 million and livelihood for at least 2.3 million people. The sector also brings in valuable foreign exchange to the government, earning some 0.5% of the Gross Domestic Product per annum.

A significant proportion of Kenya's total fish catch caters to the protein needs of the local population. In 2007, 2008 and 2009, 86.6%, 86.7% and 92.2% of all fish caught from Kenyan waters were left for domestic consumption, thus contributing to the food security of the people. Kenya's per capita fish consumption was placed at 5kg in 2011, and remained the same in 2014.

The contribution of fish to overall protein intake is low at 7.6% and this is attributable to the fact that many Kenyans do not regularly consume fish for historical or cultural reasons. However, Kenya's fishing communities depend heavily on fish as a rich source of protein. Engaging largely in subsistence fishing, fishers usually take part of their catch to their families, friends and relatives for food. This proportion of the catch is locally known as 'kitoweo'. However, the prevailing decline of Lake Victoria's natural fish stocks directly threatens food security and income for livelihoods of lakeside communities.

The fisheries sector generates employment for more than 2 000 000 Kenyans through fishing, gear and craft repair, fish processing and distribution, and other related activities. As at 2008, 80 000 people were directly engaged as fishers and fish farmers while the sector provided livelihoods for about 2.3 million Kenyans mainly involved in fish processing and trade. A total of 41 912 fishers were actively engaged in the Kenyan fisheries in 2010, while in 2011 capture fishery directly employed 62 232 fishers. And in 2014, a total of 12 915 fishers participated actively in the marine capture fishery alone.

Factors which significantly diminish fish and coral productivity, species richness and diversity of the entire Kenya coastline are silt deposition from rivers draining agricultural land, industrial and domestic effluents, and discharges from tanker traffic. Reefs from outside the designated marine reserves are often degraded and unknown quantities of shells and corals are often harvested from Shimoni, Lamu and Kiunga areas.

Though Kenya's EEZ straddles the considerably rich tuna belt of the South West Indian Ocean (SWIO), exploitation of the resources is hampered by infrastructural limitations and inappropriate fishing craft and equipment. Artisanal fishers largely restrict their operations to the continental shelf because they are not well-equipped in terms of gear and craft to fish in the deep sea.

Lack of monitoring and surveillance capacity is the main cause of illegal fishing in Kenya's distant waters. Small-scale migrant fishers from Tanzania also come from the south during the north-east monsoon and target very valuable species such as sharks, Carangidae, Lethrinidae and Siganidae.

Kenya lacks capacity to monitor the activities of the distant-water fishing fleet operating within its EEZ. Its nationally registered fishing fleet operating in its deep-waters is small, and as a result of this and other lapses, distant-water fishing fleet operating within its EEZ land more than 20 000 tonnes outside the country.

Kenya's 2014-2017 National Nutrition Action Plan recognizes fisheries as one of the major sectors that contribute to the goals of the national nutrition agenda. Also, Vision 2030, its long-term development blueprint, recognizes the contributions of the fisheries sector towards transforming the country into an industrializing middle-income nation.

The Government of Kenya has launched its first ever Tuna Fisheries Development and Management Strategy, thereby upping its stake in the USD 4 billion global tuna fisheries industry. The Strategy which runs from 2013 to 2018 would build effective governance system of the marine fisheries sector by providing institutional framework to ensure compliance with relevant national laws and international standards and agreements. It aims to grow the country's largely underdeveloped tuna

supply chain that has rudimentary fishing vessels not capable of going beyond 20 nautical miles in undertaking tuna fishing. By so doing, Kenya's tuna fishery would transform into productive and sustainable modern, commercially-oriented coastal and oceanic fisheries with direct positive impacts on employment, wealth creation, improved outcomes and foreign exchange earnings.

Kenya's Marine and Fisheries Research Institute (KMFRI) is the State Corporation dedicated to conducting research, covering all the Kenyan waters and the riparian areas including Kenya's EEZ in the Indian Ocean. The major Government Aquaculture Research Institutions are:

- Sagana Fish Farm at Sagana, Kirinyaga District, Central Province.
- Kiganjo Trout Farm at Sagana, Nyeri District, Central Province.
- Moi University, Department of Fisheries, Eldoret, Uasin Gishu District, Rift Valley Province.
- Kenya Marine and Fisheries Research Institute, Mombasa District, Coast Province.

Various Kenyan universities which offer degrees in fisheries and allied fields also conduct research in fisheries.

USAID. *The Importance of Wild Fisheries For local Food Security: Kenya*. 2015.

(USAID, 2015)

Kenya's fisheries sector includes industrial and small-scale fishers, and produces fresh and processed fish for domestic and export markets. Yet, fisheries have experienced declines in both diversity and productivity due to poor management, and currently make a limited contribution to the country's Gross Domestic Product. Improved fisheries management and policies could increase the sector's contributions to Kenya's economy and food security.

Fishing communities in Kenya often experience high poverty rates. A recent study found that 64% of fish workers in western Kenya live below the poverty line and rates of poverty are higher in households that rely on fishing as their primary source of income (Olale & Henson, 2012).

Average per capita annual fish consumption is estimated to be 5 kg, and the contribution of fish to overall protein intake is low at 7.6%, likely because many Kenyans do not regularly consume fish for historical or cultural reasons. However, for communities along Kenyan lakes and coastlines, small-scale fishing is essential to overall household well-being as it provides both income and nutrient-rich food.

The fisheries sector, which includes both industrial and small-scale fishing and produces fresh and processed fish for domestic and export markets, accounts for about 0.5% of the country's Gross Domestic Product (GDP). Despite its limited contribution to the country's GDP, the fisheries sector generates employment for over two million Kenyans through fishing, boat building, equipment repair, fish processing, and other ancillary activities. Kenya currently derives little economic benefit from its valuable marine fisheries that are primarily exploited by foreign fishing vessels. Foreign vessels rarely land or declare their catches in the country, thus depriving the country of much needed revenue and processing jobs. Therefore, with improved management, there is great potential for increasing the contributions of marine fisheries to Kenya's economic development.

Fishing communities have few livelihood options due to lack of alternatives outside of the fisheries sector, or because fisheries overexploitation limits their income potential. Overfishing is recognized as a threat to the diversity and productivity of fisheries, and Kenya has implemented efforts to combat it, including reducing the number of licensed boats targeting certain species. Climate change also poses a significant threat to Kenya's coral reef fisheries. A recent analysis compared the vulnerability of several western Indian Ocean countries and found Kenya's coral reefs to be the most vulnerable among them to climate change-related coral bleaching. Headway is being made in implementing management strategies aimed at preventing the collapse of the small-scale fishing sector - the establishment of the Agriculture, Fisheries, and Food Authority in 2014 highlights the country's goal of

promoting best practices in fisheries management – but much more needs to be done to prevent further declines in fisheries and livelihoods.

AFIPEK, "Marine Fisheries " <http://www.afipek.org/marinefisheries.html> (accessed 16/01/2017 2017).

(AFIPEK, 2016)

Kenya's EEZ lies within the richest tuna belt of the South West Indian Ocean (SWIO), owing to its geographical location and proximity within the upwelling region of this part of the Indian Ocean. However exploitation of this rich resource by the Kenyan has been hampered by infrastructural limitations and appropriate fishing equipment and vessels.

The Kenya Fish Processors & Exporters Association (AFIPEK) was established in 2000, its initial purpose was to Coordinate the Harmonization of the Safety and Quality standards in all member factories involved in Harvesting, Processing, Packaging and Exporting fish in Kenya and Promote the Marketing of Kenya Fishery Products. Since then, both the industry and the association have changed dramatically and as today the focal point of the association is Sustainability of the fisheries.

AFIPEK members mainly target products from the coastal artisanal fishers with only one factory processing tuna loins. Due to the mode of harvesting of the coastal fishery the products are prime catch with our members posting very high quality products in the markets. This sub-sector contributes six percent to the export markets as large quantities of the fishes are consumed locally.

Members of AFIPEK continue to be the main fish exporters from the country with up to 95% of all the fish exports from the country emanating from this group. There has also been a strong industry consolidation trend - with a smaller number of larger, vertically integrated and more efficient companies.

Kenya Fish Processors & Exporters:

- Alpha Group
- Capital Fish Ltd.
- Crustaceans Ltd
- East African Sea Foods Ltd.
- East Africa Deep Fishing Ltd
- Fish Processors (2000) Ltd.
- Peche Foods Ltd.
- Sea Harvest
- Trans Africa Fisheries Ltd.
- Wananchi Marine Products Ltd.
- W.E. Tilley (M) Ltd.
- J Fish Ltd.
- Victoria Delight Ltd.

State Department for Fisheries and the Blue Economy. *Investment Opportunities 2016*.

(State Department for Fisheries and the Blue Economy, 2016c)

Aquaculture:

From: (FAO, 2016):

Aquaculture has great potential in Kenya given its numerous aquatic resources. The country has over 1.14 million hectare potential area suitable for fish farming with capacity to produce over 11 million metric tonnes of fish worth 750 billion Kenya shillings (about USD 7.3 billion).

The Government's promotion of aquaculture in Kenya started in 1921 when the colonial administration introduced trout, common carp and black bass into the country's waters with the original intent of enhancing recreational fishing. Thereafter, cultivation of these species, and later of tilapia and African catfish, commenced.

Tilapia farming expanded rapidly in the 1960s as a result of the Government's promotion of rural fish farming through the "Eat More Fish" campaign which gave birth to several small ponds, especially in the Central and Western provinces. However, because of insufficient extension services, shortage of quality fish seed, and poor technical skills especially amongst extension personnel, the number of productive ponds decreased sharply in the 1970s. But it was not until the mid- 1990s that a renewed interest in fish farming developed as a result of the renovation of many government fish farms, intensive training of fisheries extension workers and establishment of research programmes.

Under the two phases of the government's Fish Farming Enterprise and Productivity Programme (FFEPP) of between 2008 and 2011, a total of 3.84 billion Kenya shillings (USD 37.3 million) were allocated for the construction of a total number of 28 200 fish ponds in 160 constituencies, 3 shallow wells in each constituency, construction of 80 mini fish processing and storage plants, purchase of pond liners, fish seed and supplementary feed.

Kenya's aquaculture systems straddle the spectrum from small-scale extensive (non-commercial) to intensive polyculture of Nile tilapia and African catfish in earthen ponds, tanks, raceway and cage, and of monoculture of rainbow trout. Fish farming is practiced in all Kenyan provinces except the North-Eastern Province and Nairobi area. Aquaculture has recorded tremendous growth in Kenya in recent years. This growth is evidenced by the high demand for supplementary feed and seeds of Nile tilapia and African catfish, and has occurred as a result of growth in hatcheries and financial investment in the sector. The country's aquaculture production nearly doubled between 2010 and 2012 from 12 000 metric tonnes to about 22 000 metric tonnes, according to the National Aquaculture Research Development and Training Centre. This is so probably as a result of corresponding growth in hatcheries, and human and capital investments in the sector.

From (State Department for Fisheries and the Blue Economy, 2016c), Investment Opportunities:

Aquaculture:

1. Fish Feed Production: Inadequate and good quality fish feed remain a challenge in aquaculture and so there are opportunities to invest in the feed production.
2. Fingerling Production: this is an area of investment by private hatcheries
3. Intensive Aquaculture Production: This includes investment in Recirculating Aquaculture Systems (RAS) and Aquaponics.
4. Integrated aquaculture: Aquaculture can easily be integrated with conventional crop and livestock farming. This provides opportunities for diversification on crop and livestock farming and can put to productive use otherwise idle land during certain seasons. In ASAL, fish could be stocked in water reservoirs meant for livestock watering. This will increase the benefits accrued from such water bodies by diversifying sources of income and increasing security for quality food for livestock farmers in such areas.
5. Cage culture: This can be done in rivers, water reservoirs, lakes and the ocean. The advantage here is that more benefits can be generated from such water bodies.
6. Aquaculture inputs and equipment: These include fish rearing tanks, pond liners, harvesting nets, containers
7. Bait culture: There exists a very big market for bait fish (juvenile *Clarias gariepinus* and *Chanos chanos*) for the Nile perch capture industry in Lake Victoria and Tuna fisheries of the Indian Ocean.
8. Ornamental fish culture: There are only a handful of ornamental fish producers in Kenya. Resources for culture of both marine and fresh water species are available in Kenya. Potential markets for the ornamental fishes include local cities, the Africa countries, Europe and Asia.
9. Capture-based Aquaculture: This can be done in the many water reservoirs in the country. These include domestic water reservoirs, irrigation reservoirs and the hydroelectricity

reservoirs. It involves stocking of such reservoirs with appropriate fish species of commercial value which is later harvested when mature.

10. Training and aquaculture technology transfer- in emerging aquaculture technologies, innovations and procedures

Mariculture and Coastal fisheries in inshore waters:

1. Industrial fishing port at Lamu with fish port infrastructure (including dry dock, quay and service provider needs)
2. Artisanal fishing infrastructures (cold storage and jetties) in riparian counties
3. Fish auction markets at the coast
4. Fisheries laboratory to support products development and testing

Fish Inspection and Quality Assurance :

1. Improvement of fish landing facilities;
2. Development of cold chain facilities;
3. Establishment of accredited analytical laboratories for fish and fishery products;
4. Value addition for fish and fishery products and branding,
5. Development of fish auction centres
6. Technology adaptation for dry fish
7. Value chain development for selected fish species,
8. Development of fish markets in major towns
9. Investment in refrigerated fish transport vehicles
10. Develop marketing infrastructure.
11. Establish aquaculture market outlets to promote entrepreneurship and branding.
12. Promote market and product development through economic partnership and trade agreements
13. Promote per capita fish consumption. "Eat more fish campaigns" will be conducted throughout the country.

State Department for Fisheries and the Blue Economy. "Marine and Coastal Fisheries Division ", (2016).

(State Department for Fisheries and the Blue Economy, 2016d)

Marine and Coastal Fisheries Division is responsible for the management and sustainable use of the nation's ocean fisheries resources and their habitats. Kenya's State Department for Fisheries and the Blue Economy provides vital services to the nation by managing and monitoring artisanal, commercial and recreational fishing in the territorial sea and the Exclusive Economic Zone (EEZ) to ensure healthy fish stocks, habitats and a viable fishing industry. It continually aims to make sure that fresh wild caught seafood is available to all Kenyans for current and future generations.

- Development and review of fisheries management plans and harvest strategies
- Protection and rehabilitation of critical fish habitats
- Fish harvesting rights administration through fisheries licensing, permitting and partnership agreements
- Monitoring the performance of fishing through an elaborate fisheries statistics program including, sample based surveys, frame surveys and administrative data sources
- Enhanced community participation in fisheries management through the Co-management program
- Protection of Endangered, Threatened and protected marine species from fishing activities such as Turtles, marine mammals, and vulnerable shark species
- Active regional fisheries collaborative programs in the management of shared and migratory fish stocks
- Capacity building of counties in marine fisheries related matters
- At sea surveillance and patrols including boarding and inspection
- Fisheries Port state controls

- Vessel monitoring systems
- Observer program
- Active regional fisheries collaborative programs in fisheries surveillance

State Department for Fisheries and the Blue Economy. "Fish Inspection and Quality Assurance ", (2016).

(State Department for Fisheries and the Blue Economy, 2016b)

In 2015, the European Union approved imports of farmed fish and fishery products from Kenya following a successful submission of the Implementation of Residue Monitoring Plan. Other important international markets for fish and fishery products from Kenya include the United States, Israel, the Peoples Republic of China and the United Arab Emirates.

Core Functions of the Fish Inspection and Quality Assurance division:

1. convene on regular basis the standing and technical committees meetings;
2. monitor fish production, fish, fishery products and fish feed with a view to assessing risks to human health;
3. control fish handling, landing, transportation, processing and marketing;
4. collaborate with other Government agencies in matters related to food safety regulations;
5. assess and approve plans and structures of intended fishery enterprises;
6. carry out inspection of operational fishery enterprises for compliance with fish safety regulations;
7. lay down procedures to be followed for compliance with Kenya standards for fish handling and processing (see procedure for issuance of CoC);
8. specify conditions for the placing on the market of fish, fishery products and fish feed;
9. maintain a register of approved fishery enterprises (see list of approved establishments);
10. issue health certification of fish, fishery products and fish feed subject to the consignment fulfilling the requirements set out. For European Union market the Division uses the TRACES (TRAdE Control and Expert System) which is a system that notifies, certifies and monitors imports, exports and trade in animals and animal products (ec.europa.eu/food/animal/traces);
11. grant approval for the fishery enterprises that meet applicable requirements specified in fish safety regulations (see procedures for issuance of import/export permits);
12. perform such other functions as may be necessary or expedient for safety assurance of fish, fishery products and fish feed in accordance with fish safety regulations.

State Department for Fisheries and the Blue Economy. *Value Addition & Marketing* 2016.

(State Department for Fisheries and the Blue Economy, 2016e)

Functions of Fish Value Addition and Market Development Division:

1. Development and review of policies on post-harvest fisheries and production of value added fishery products;
2. Promotion of trade and marketing of fish and fishery products;
3. Development and review of technical packages and guidelines on post-harvest handling and value addition;
4. Promotion of Public-Private Partnerships in reduction of post-harvest losses and production of value added fishery products;
5. Development and review of training materials for post-harvest fisheries and value addition;
6. Development and undertaking post-harvest losses surveys and compilation of a national database;
7. Capacity building and technical support to counties;
8. Value chain analysis for fish and fishery products;
9. Establishment and maintenance of data base of export and imports of fish and fishery products;
10. Development of fisheries investment and business plans, projects and programs;

11. Participation in relevant national, regional and international meetings on fish marketing

State Department for Fisheries and the Blue Economy. "Current National Government Projects Status and Location." (2016).

(State Department for Fisheries and the Blue Economy, 2016a)

Projects

CURRENT NATIONAL GOVERNMENT PROJECTS STATUS AND LOCATION

STATE DEPARTMENT OF FISHERIES

Name of the Ministry	Project Name	Location in the Country	Goal/Objective	Status (on-going, completed ready for commissioning, ready for launch)
Agriculture, Livestock and Fisheries State Department of Fisheries	Aquaculture Mini processing plant, Nyeri	Wamagana, Tetu, Nyeri County	To reduce post-harvest losses and promote marketing farmed fish along aquaculture value chain	Completed ready for commissioning
	Aquaculture Mini processing plant, Meru	Nkuene, Imenti South	To reduce post-harvest losses and promote marketing farmed fish along aquaculture value chain	Completed ready for commissioning
	Aquaculture Mini processing plant, Kakamega	Kakamega County	To reduce post-harvest losses and promote marketing farmed fish along aquaculture value chain	Completed ready for commissioning

	Aquaculture Mini processing plant, Migori	Rongo, Migori County	To reduce post-harvest losses and promote marketing farmed fish along aquaculture value chain	On going
	Off-shore Patrol Vessel (OPV)	Kenya Coast	To conduct fisheries surveillance, boarding and inspection of fishing vessels in the Exclusive Economic Zone (EEZ) To complement fisheries research in the EEZ To conduct search and rescue mission in the EEZ	On-going and on schedule
	Construction of National Laboratory infrastructural civil works	Bellevue, Nairobi	To build capacity for National Fish testing laboratories To improve market access of fish and fisheries products	On going
	Construction of MCS command centre under Kenya Coastal Development Programme (KCDP)	Mombasa county	To facilitate Fisheries surveillance in the Deep Sea	New project

	Upgrading of the VMS under KCDP	Mombasa county	To facilitate Fisheries surveillance	New project
	Purchase/construction of improved boats under KCDP	Tana River county	To promote technology adoption by fishers	New project
	Modernization of fish landing infrastructure under KCDP	Kibuyuni and Shimoni, Kwale County	To improve fish handling	New Project
	Completion of Faza Cold store and modernization of fish landing infrastructure under KCDP	Faza, Lamu county	To improve fish handling and reduce post harvest losses	On – going
	Construction of Marine and Ocean Service Centre (MOSC)	Kenya Marine and Fisheries Research Institute (KMFRI)	To provide marine fisheries research	Phase I completed 2nd phase to start soon
	Procurement of two (2) heavy utility Aluminum boats with accessories under Lake Victoria Environmental Management Programme II (LEVMP II)	Kisumu	To conduct fisheries surveillance, boarding and inspection of fishing vessels in Lake Victoria	Boats delivered awaiting preparations for inspection and acceptance Commissioning tentatively scheduled on 20 th March 2015
	Establishment of infrastructure at Fish Landing Site, in Lake Victoria	Lake Victoria	To strengthen MCS, improve fish handling and hygiene.	32 bandas construction (5 completed) 6 boats and

KCDP is a multi-sectoral development project being implemented by government institutions based at the Coast, namely: Kenya Marine and Fisheries Research Institute (KMFRI); Coast Development Authority (CDA); Kenya Wildlife Service (KWS); Kenya Forestry Research Institute (KEFRI); the State Department of Fisheries (SDF); Department of Physical Planning and National Environment Management Authority (NEMA). The project is financed by the World Bank in the amount of 40 million US dollars (IDA credit of 35 million US dollars and GEF grant of 5 million US dollars) to be implemented over a period of six years (July 2011 –29 October 2016).

The Project development Objective (PDO) is to improve management effectiveness and enhance revenue generation of Kenya's coastal and marine resources. The Global Environmental Objective (GEO) is to strengthen conservation and sustainable use of marine and coastal biodiversity. The aim of this project is to achieve greater value and improved livelihoods from sustainable management of marine and coastal resources while strengthening conservation and sustainable use of marine and coastal biodiversity. The project targets coastal counties in the following three geographic areas of the coastal and marine environment: (i) inshore areas beyond the reef and offshore fisheries resources extending to the outer EEZ limits; (ii) inshore areas including coral reefs, beaches, mariculture areas, and mangroves and (iii) land areas of the coastal districts, particularly where use of terrestrial resources impacts on marine resources.

The Kenya Coastal Development Project has 4 components:

Component 1: Sustainable Management of Fisheries Resources with the objective of increasing revenue earning potential of GoK through sound monitoring, control and surveillance and a transparent process of licensing of foreign vessels. Other goals are to promote research for value addition, market chain analysis, alternatives beyond reef fishing and overall improvement of fisheries governance. The agencies that contribute to the activities in this component are the State Department of Fisheries and the Kenya Marine and Fisheries Research Institute;

Component 2: Sound Management of Natural Resources which aims to improve the sound management and regeneration of natural resources and biodiversity in the coastal and marine environment as well as provide assistance to communities in the development of eco-tourism ventures. The agencies that contribute to activities in this component are Kenya Wildlife Service (KWS); Kenya Forestry Research Institute (KEFRI) and the Kenya Marine and Fisheries Research Institute;

Component 3: Support for Alternative Livelihoods which aims to promote sustainable livelihoods within a sound governance framework that includes spatial planning and land capability mapping to identify sensitive areas, Integrated Coastal Management (ICM), and compliance with environmental regulations and safeguards. Within this institutional framework, the component aims to support community investments and MSMEs. The agencies that contribute to this component are the Coast Development Authority (CDA); the Department of Physical Planning and National Environment Management Authority (NEMA); and

Component 4: Capacity Building, Monitoring & Evaluation System, Project Management, Communication and HMP (Hazina ya Maendeleo ya Pwani) which aims to promote capacity in the project coordination and implementation teams, promote dialogue amongst national partners and regional stakeholders and develop a communication strategy for development outreach. The purpose of the Community Village Fund (CVF), which has been renamed Hazina ya Maendeleo ya Pwani, is to promote investment in village infrastructure and profitable alternative livelihoods. The Kenya Marine and Fisheries Research Institute is responsible for this component.

(Kenya Coastal Development Project, 2013b)

Seaweed farming will create employment opportunities to coastal communities especially women thereby increasing the number of direct beneficiaries from the project. Due diligence with respect to maintenance of environmental integrity will be carried out while up-scaling seaweed farming. Seaweed farming guidelines will be developed to ensure strict adherence to environmental and social safeguards.

Planned activities -

- ii. Value chain analysis to identify areas of intervention/ investment for different segments of the coastal communities/entrepreneurs nationally
- iii. Community mobilization
- iv. Environmental Impact Assessment
- v. Upscaling of *Cotonii* farming at Kibuyuni
- vi. Training workshops
- vii. Environmental and social monitoring and control (as per the Environmental Management Plan)
- viii. Construction of seaweed drying racks/domes
- ix. Construction of seaweed store
- x. Engaging other players for Public Private Partnerships targeted for the long-term Kenyan seaweed industry development which will address the entire value chain
- xi. Promotion of value addition/processing

Seaweed farming has been identified as a good prospect for social and economic development of coastal areas. It is aimed at diversifying livelihood opportunities for poor fishing communities whose livelihoods have been put at serious risk by diminished capture fisheries. The initiative for development of the seaweed industry falls within the framework of Integrated Coastal Zone management (ICZM), it supplements other efforts like the Kenya Coastal Development Project (KCDP) that are geared towards improving the socio economic status of poor coastal communities, as well as the Government of Kenya's vision 2030 that seeks to make Kenya a middle income country enjoying good quality life by the year 2030.

Seaweed extracts such as carrageenan and agar are used as thickeners and homogenizers in Pharmaceutical, food and cosmetic industries. Seaweed products are also used in soaps, shampoos, animal food and as fertilizer.

Status and future prospects for seaweed industry in Kenya

In the South Coast of Kenya small scale commercial farming has been piloted using the strain *Eucheuma denticulum* (spinosum) with initial economic indicators showing good prospects. About 100 farmers; mostly women are engaged in seaweed farming with an annual production of about 600 mt. The seaweed strain *Kappaphycus alvarezii* (cottoni) has also been introduced under controlled conditions for future upscaling once environmental mitigation measures have been put in place.

The current production of seaweed in the South Coast falls below the 1,000 mt threshold which represents commercial farming. To get traders interested in marketing seaweeds, the commercial threshold has to be attained. The socio-economic factors in the farming communities being favourable for seaweed farming in the target villages; coupled with room for expansion of farms, there are good prospects for up-scaling seaweed farming in these areas to a level of a viable commercial venture. Community mobilization and capacity building through support from KCDP will give this venture the necessary impetus to raise production and consequently develop a viable industry with the involvement of other players (including traders, processors) and stakeholders along the value chain.

Strengths

- i. Seaweed farming is a proven profitable commercial proposition for many coastal communities around the world
- ii. Net income from one hectare of a seaweed farm has been demonstrated to be five to six times the minimum wage of an agricultural worker.
- iii. Seaweed farming is a relatively simple technology and requires low initial capital investment
- iv. With grow-out cycles as short as six weeks, it offers rapid and high return on investment
- v. Seaweed farming has a corroborated positive impact on the socio-economic status of coastal villages
- vi. There are many coastal villages with suitable sites that have the potential to farm seaweeds

Challenges/Threats

Three biological factors that cause tremendous loss to biomass in farms; are ice-ice disease, epiphytism and grazing of seaweeds by herbivores besides unfavourable environmental conditions attributed to different seasons of the year

- i. Grazing of seaweeds by herbivores comprising mainly fish and sea urchins resulting in loss of biomass
- ii. Infestation of seaweeds with benthic filamentous algae; causing epiphytic blooms that cause retardation in growth of seaweeds
- iii. Seaweeds being affected by ice-ice disease which is attributed to bacteria and fungi; resulting in slow growth, pale thalli and presence of epiphytes.
- iv. Loss of seaweeds through breakage due to strong waves during the SE monsoon
- v. Slow growth attributed to sedimentation during rainy season
- vi. Slow growth due to very high water temperatures during the dry season
- vii. Unreliable marketing channels
- viii. Low prices for dry seaweeds
- ix. Lack of farming implements for poor farmers
- x. Potential conflict with fishermen due to possible blocking of their docking bays by seaweed farms
- xi. Lack of access to capital

Opportunities for development/investment

In order to supply the high demand for dried seaweeds as raw materials for carrageenan production the industry is expanding the farming of seaweeds to new sites/areas all over the world

- i. Opportunity for large scale production of seaweeds
- ii. The development of the floating methods of farming presently applied to deeper areas to the increase in farm areas and production.
- iii. Value addition and processing opportunities

Marketing and trade opportunities

- i. Farmers selling their produce to local traders
- ii. Opportunities to market produce through farmers' cooperatives and NGOs
- iii. Opportunities as exporters
- iv. Independent traders selling their stocks to local exporters
- v. Exporters selling the product to multinational processors
- vi. Seaweeds can be traded in the international market as dried seaweeds, semi refined carrageenan and refined carrageenan.

- Establishment of viable farms to spur/generate appropriate production
- Establishing a threshold of farmers per farming village to attain required volume of production
- Provision of required farming implement
- Provision of seaweed seed to farmers
- Maintenance of seaweed nurseries (in farming villages)
- Provision of harvesting/transportation facilities like boats
- Quality assurance of the produce
- Construction of drying racks/doms
- Construction of storage facilities and office space

The establishment of a strong international marketing network with potential investors is an important concern that the industry will pursue; there must also be a parallel development in human resources, through the training of key personnel in marketing, and strong linkages between the key players in the industry and their international partners. The key stake holders will be identified during a value chain analysis which is a necessary step for addressing a wholesome industry.

For effective marketing, the following will be undertaken:

- Conduct a value chain analysis
- Disseminate the seaweed value chain information to the value chain operators
- Protect producers from unfair middlemen
- Assist farmers to form farmers cooperatives/NGOs for marketing their produce
- Improve marketing infrastructure such as storage facilities, roads and communication channels
- Assist producers in promoting seaweeds products through agricultural fairs and other marketing opportunities
- Promote value addition of the seaweed products

Appropriate regulatory mechanisms management of control of the industry.

- Establishment of clear and secure user rights to land and water which are favourable to investment in the industry
- Simplify the process of acquisition of the necessary rights to land and water use for investment in the seaweed industry
- Regulate and control the use of alien and genetically modified strains
- Issue permits to commercial farmers, traders and processors which specify their rights and obligations
- Waive permits for non-commercial farming bicoastal villages as long as
- Government regulatory thresholds are not exceeded

Kenya Coastal Development Project. "Sustainable Management of Fisheries Resources ", (nn).

(Kenya Coastal Development Project, nn-b)

The Component's objectives are to increase benefits and revenue generation derived from coastal fisheries through:

1. Improving governance including monitoring, control and surveillance of the fishery in the EEZ.
2. Advancing research on coastal and near-shore fish stocks, promoting alternative fishing technologies, and supporting linkages between fishermen and processors and fishmongers.
3. Increasing fish production through aquaculture.
4. Promoting and developing value addition of fish catches in the coastal fisheries and the affected communities.

Sustainable Management of Fisheries Resources will promote long term management effectiveness of fisheries resources and enhance the benefits and revenue generation derived from coastal fisheries through:

1. Governance and management of offshore and coastal fisheries resources
2. Research on fish stocks, fish value addition and market chain enhancement;
3. Fish production through sustainable aquaculture development

Kenya Coastal Development Project. *Governance and Management of Offshore and Coastal Fisheries Resources*. nn.

(Kenya Coastal Development Project, nn-a)

Kenya Coastal Development Project Governance and management of offshore and coastal fisheries resources:

1. Improve fisheries governance, including adoption of appropriate legislation.
2. Increase fisheries management capacity.
3. Implement cost-effective monitoring control and surveillance (MCS) structures for the EEZ.

Invest in:

1. Increased licensing of DWFN vessels.
2. Improved MCS and capacity building, which will lead to increased revenues, reduced illegal fishing and reduced by-catch and waste.
3. Routine monitoring of vessels, licences, fish landings and reporting of vessel activity on a daily or seasonal basis to develop a transparent fisheries management information system and related activities.

Key activities for fisheries governance are as follows:

- Equipping the MCS centre and the Fisheries Regional office.
- Hiring technical assistants to review legal management systems, provide information on the licensing regimes of vessels, review of MCS capability.
- Capacity building of staff in various aspects of fisheries governance.

Kenya Coastal Development Project (2015). Assessing Fisheries Stocks along the Kenyan Coast. Mombasa.

(Kenya Coastal Development Project, 2015)

The need to better manage Kenya's marine and fisheries resources has been triggered by rising resource-use conflicts and stakeholder concerns over the overexploitation of key target fishery stocks.

Assessing the small and medium pelagic stocks through the ring net and reef seine fishery: The full potential of small and medium pelagic fisheries along the Kenya coast is not yet known. As such pelagic resources are believed to be under-exploited due to lack of capacity by the artisanal fishers. Ring nets and reef seines, are currently used to capture pelagic fish. The use of this gear has increased and currently there are 31 and 89 ring nets and reef seines respectively with a crews ranging between 8 and 40 per vessel. Target species belong to the families *Scombridae* (trevallies), *Sphyraenidae* (barracudas) and *Hemiramphidae* (halfbeaks), although demersal and reef associated species are also landed.

Assessing lobster stocks: The Spiny lobster is fished along the entire coastline from Vanga in the south to Kiunga on the border with Somalia. Lamu archipelago presents the best fishing grounds and a vast majority of the fishers are concentrated here. The fishing effort is highest in Lamu County where the number of fishermen ranges 79 to 307 per landing site and the number of fishers in Kiunga is between 20 to 40. In Msambweni/Funzi landing sites, the number of fishers is 8 to 10. The Lobster fishery targets local tourist hotels and the export market.

Small Scale prawn fisheries: The small scale prawn fishery of the Malindi-Ungwana Bay is an important livelihood for the people within Tana River and Kilifi Counties and along the entire coast. Total landings from this fishery approximate 363.5 metric tons (mt) based on the recent catch assessment survey data of 2013-2014 with the bay contributing up to 40% of this.

The Siganus fishery: Siganids belong to an economically important group of herbivorous fishes and they are cosmopolitan demersal fishes commonly found inhabiting shallow inshore reefs, within sea grass beds. The shoemaker spinefoot *Siganus sutor*, the most common species in the marine fisheries of Kenya accounts for ~180Mt (11%) of the artisanal fishery landings. Various fishing gears are used to target the siganids, with basket traps being the preferred gear especially in south coast Kenya where the fishery is dominant.

(Kenya Coastal Development Project, 2013c)

The main issues related to the status of local biodiversity at the South Coast identified during the survey included: overexploitation of natural resources; steadily narrowing spectrum of traded products from agriculture, forestry, and fisheries; economic systems and policies that inadequately value the environment and its resources; inequity in ownership and access to natural resources, including benefits from use and conservation of biodiversity; inadequate knowledge and inefficient use of information; and legal and institutional systems that promote unsustainable exploitation. It was however commendable that the majority of the respondents in the villages surveyed were reasonably aware of the changes in the local biodiversity and how human activities potentially contribute to these changes. This calls for a community participation and use of local knowledge would be advantageous in curbing destructive or unsustainable uses by those who are uninterested or uncaring.

Majority of the respondents in the five villages are reasonably aware of the changes in the local biodiversity and how human activities potentially contribute to these changes. Moreover, the results indicate that: overdependence on biodiversity resources for consumption; inequity in ownership and access to natural resources including benefits from use and conservation of biodiversity; inadequate knowledge and inefficient use of information; and legal and institutional systems that fail to guarantee sustainable exploitation were unanimously cited as the major conservation challenges by the respondents.

Recommendations:

1. The adoption of marine aquaculture, encouraging ecotourism activities, and engaging in agro-forestry and other afforestation activities as a means for alternative wood products could prove to be a viable way forward that can remedy the strain on ecological resources in addition to generating income.
2. Social, cultural and economic context for conservation and sustainable use measures should involve community participation and use of local knowledge; and the curbing of destructive or unsustainable uses by those who are uninterested or uncaring. In this respect, there is need to provide support for on-going community conservation initiatives (tengefu) which have already gained broad acceptance
3. Development of joint-management programs which do not seek to replace traditional forest practices and fishing activities but augment them with help in forest management planning, silvicultural practices, reduction of fishing effort and marketing. Successful joint management requires a significant transfer of responsibility from state agencies to villagers.
4. Development of biodiversity geo-referenced maps of areas with high social and ecological potential for community protection and natural regeneration

Byington, C. (2016). "Steering a New Course for Kenya's Fisheries."

(Byington, 2016)

While the 'dhows' have largely remained the same for countless generations, Lamu's fisheries have not been so fortunate. As in many other parts of the world where local fishermen depend on fishery resources that are becoming scarce from mismanagement and overexploitation, all of Kenya's fishing communities are in need of management advice, capacity and resources.

Located at the southern end of the Somali upwelling system, the nutrient rich waters of the Lamu seascape produce three of the seven most productive fishing areas in the country – everything from reef and pelagic (open ocean) fish to lobsters and shrimp. But the balance of man and nature has become unequal here as increased fishing and reduced fish sizes in recent years have raised concern over the sustainability of the fishery. Additional fears over the long-term condition of Lamu's rich marine resources are linked to expanding coastal development and a growing tourism industry.

"The number of fishers in Kenya has increased over the last 30 years," says George Maina, the Conservancy's Kenya Marine projects coordinator, who is based in Lamu. "And while total fish production has remained fairly consistent over the years, individual fishers are coming back to the fish landing sites in Lamu with fewer and fewer catch each day."

In October 2015 and March 2016, the FishPath partners organized two workshops with the Kenya State Department of Fisheries, the Kenya Marine and Fisheries Research Institute, Kenyan Fisheries scientists, and conservation practitioners to conduct trainings and improve Kenya's capacity in stock assessment and management of its data-poor fisheries.

"We had two great workshops with active participation from all attendees, including two days of stock assessment training for agency staff led by the NOAA fishery scientists in our team," said Dr. Jono Wilson, a Senior Fishery Scientist at The Nature Conservancy, who led the FishPath team effort in Kenya. After the workshop Wilson underscored his excitement "at getting these simple solutions to the people that need them most."

The goal is to develop and prove the efficacy of community-based management and innovative tools like FishPath to help coastal communities have more say over the management of the resources they depend on and conserve habitats so that they can benefit people and nature.

Kenya Gazette Supplement (2016). The Fisheries Management and Development Act, 2016. No. 156 (Acts No. 35).

(Kenya Gazette Supplement, 2016)

6. (1) There is hereby established an advisory body to be known as the Kenya Fisheries Advisory Council ("the Council"),

7. (1) There is hereby established a Service to be known as the Kenya Fisheries Service, which shall be responsible for the conservation, management and development of Kenya's fisheries resources in accordance with this Act.

20. (1) There is hereby established within the Service Monitoring, Control and Surveillance Unit (MCS) hereinafter referred to as "the MCS Unit".

29. (1) All fisheries resources vest in the State and shall be conserved, managed and developed consistently with this Act, including its objective and principles, and acknowledging their role as the heritage of the people of Kenya.

Fisheries Development Measures

30. The Director-General may, in consultation with County governments, other appropriate agencies and other departments of Government, promote the development of activities within the scope of this Act, through, inter alia-

- a. providing a national framework of extension and training services;
- b. conducting research and surveys;
- c. promoting co-operation among fishers;
- d. spearheading arrangements for the orderly marketing of fish;
- e. stocking waters with fish and supplying fish for stocking;
- f. promoting the adoption of alternative means of livelihood amongst fishers;
- g. promoting the development of ornamental fisheries;
- h. promote the development of other sustainable methods of insitu and exsitu fishing;
- i. providing for the establishment of investor friendly licensing and approval systems;
- j. developing a comprehensive fish marketing, system, including fish auction, through strengthening linkages along the market value chain;

- k. encouraging persons in the private sector to organize into associations and form a national coordinating mechanism to ensure efficient marketing systems that that adhere to sanitary and phytosanitary requirements;
- l. facilitating participation in national, regional and international trade negotiations and meetings;
- m. promoting value addition and utilization of fish by-products and bycatch;
- n. providing for the establishment of accredited fish safety and quality control laboratories and other infrastructural facilities; and
- o. such other measures and actions as may be approved by the Board.

34. (1) Each County may develop fisheries management measures and plans for fisheries resources within its jurisdiction as provided in the Fourth Schedule to the Constitution.

34. (2) In developing the management measures and plans, referred to in subsection (1), the relevant authorities in the County shall take steps to ensure that such plans and measures are consistent with the provisions of this Act, including its objective and principles, and that they take into account relevant measures taken, information and data available, and the economic and social value of the resource pursuant to this Act.

40. (1) The Director-General may in accordance with the best scientific advice and such other relevant information as may be available, with the approval of the Cabinet Secretary, by notice in the Gazette, impose, inter alia, any of the following measures for the conservation and management of any fishery—

- a. closed seasons and or areas for species of fish or methods of fishing provided that customary fishing rights are protected;
- b. prohibited fishing areas for all or designated species of fish or methods of fishing;
- c. limitations on the types of gear, including mesh sizes of nets, that may be used for fishing;
- d. limitations on the types and/or number of fishing vessels permitted to engage in fishing provided that customary fishing rights are protected;
- e. limitations on the amount, size, age and other characteristics and species or composition of species, of fish that may be caught, landed or traded;
- f. regulate the landing of fish and provide for the management of fishing ports, including fish landing stations;
- g. control of the introduction into, or harvesting or removal from Kenya fishery waters of any species of fish, including aquatic plants;
- h. define and identify fragile aquatic ecosystems and provide structures to enable collaborative protection;
- i. regulate trade in endangered species of fish and fish products;
- j. prohibit the possession, trade in or manufacture of prohibited gear in a specified area or areas; and
- k. any other measures consistent with the objective and principles of this Act.

62. (1) The Director-General shall, in consultation with the Oceans and Fisheries Advisory Council, prepare an aquaculture development plan for the review and endorsement by the Board and approval by the Cabinet Secretary, with the objective of promoting the sustainable development of aquaculture in Kenya in accordance with the principles and objectives of this Act.

62. (2) Any aquaculture development plan developed under subsection (1) shall be for duration of three years.

84. (1) A valid and applicable licence issued in accordance with section 92(3) shall be required for—

- a. using an industrial fishing vessel for fishing or fishing related activities in the Kenya fishery waters;
- b. using a semi-industrial fishing vessel for fishing or related activities in the Kenya fishery waters;
- c. using an artisanal fishing vessel for commercial purposes;

- d. commercial aquaculture; and
- e. such other activity or activities within the scope of this Act for which a licence or authorization may be required by the management measures in an applicable Fisheries Management Plan adopted in accordance with the requirements in this Act, or as may be prescribed from time to time.

84. (2) The respective county governments shall be responsible for issuing licences with respect to —

- a. using any vessel for recreational fishing in the Kenya fishery waters; and
- b. operating a fish processing establishment within the respective county.

84. (4) Each County Government may enact county specific legislation setting out the —

- a. criteria for the registration of a vessel and issuance of a licence to an applicant for a licence under subsection (2);
- b. information required to be submitted by an applicant for registration or issuance of a licence;
- c. process of determination of an application;
- d. conditions for the issuance or renewal of a licence under this Act;
- e. grounds for the rejection of an application or cancellation of a licence issued under this Act;
- f. process of application for the renewal of licences, de-registration of a vessel and revocation of a licence issued to an applicant by the county government; and
- g. appointment of inspectors or such other authorised officers to carry out such inspections as the county executive committee member responsible for fisheries may consider necessary for the implementation of this Act.

85. (1) Any person fishing only for purposes of non-commercial subsistence, intended to result in consumption of the fish caught, shall be exempt from the requirement for a licence but shall require to apply to the respective county government for registration.

87. (3) An industrial or semi-industrial fishing licence shall not be issued or have legal force or effect unless the relevant vessel submits to inspection at the port of Mombasa or such other port as may be required by the Director-General, at the expense of such vessel, and it is established in writing by an inspector, or in the case of a port outside Kenya a person duly authorized by the relevant government agency to carry out the duties of an inspector, that all required licence conditions have been met, including that all gear on board is authorized pursuant to the licence.

Appointment and functions of observers and inspectors

147. (1) There shall be established an observer programme Board for the purpose of collecting, recording and reporting reliable and accurate information for scientific, management, and compliance purposes including, among other things —

- a. the species, quantity, size, age, and condition of fish taken;
- b. the methods by which, the areas in which, and the depths at which, fish are taken;
- c. the effects of fishing methods on fish, and the environment;
- d. all aspects of the operation of any vessel;
- e. processing, transportation, transshipment, storage, or disposal of any fish;
- f. monitoring the implementation of management measures and applicable international conservation and management measures; and
- g. any other matter that may assist the Director-General to obtain, analyse, or verify information for fisheries scientific, management, and compliance purposes.

147. (2) Observers may be deployed as may be directed by the Director-General in accordance with this Act, or any applicable international agreement or arrangements, including an agreement or arrangement with the objective of carrying out fisheries monitoring, control and surveillance operations jointly or in co-operation with the Government of Kenya, or any international conservation and management measures on any vessel used for fishing, transshipment, transportation or landing of fish within and beyond the Kenyan fishery waters and such other uses as may fall within the scope of this Act.

150 (1) The operator of any fishing vessel required as a condition of licence granted to it to land all or part of its catch in Kenya shall cause such landings to take place only where an observer or inspector is present to monitor the offloading and otherwise perform his/her functions pursuant to this Act.

199. The object and purpose of the Fish Marketing Authority shall be to market fish and fisheries products from Kenya.

200. The functions of the Fish Marketing Authority shall be to —

- a. develop, implement and co-ordinate a national fish marketing strategy;

DESIGNATED FISH LANDING STATIONS

1. Indian Ocean

S/No.	Name of Landing site	District	Division/ Location	County
	Shimoni	Msambweni	Vanga	Kwale
	Mkokoni	Lamu	Hindi	Lamu
	Mombasa	Mvita	Mvita	Mombasa

Kenya Marine and Fisheries Research Institute (2015). Stock Assessment of Small and Medium Pelagics: Status of Ring Net and Reef Seine Fisheries along the Kenyan coast. No.OCS/FIS/2014 – 2015/X.

(Kenya Marine and Fisheries Research Institute, 2015a)

The small and medium pelagic fishery in Kenya is multi-species, multi-gear and multi-fleet. Fishing gear used include: cast nets, gill nets, beach and reef seines, hook and line vertical line, long line and trolling line, and more recently the use of ring nets. Unlike other fishing gear which target small and medium pelagic, the use of ring net has been associated with conflicts due to its perceived environmental and socio-economic concerns in addition to landing unknown catch composition.

The ring net and reef seine fishing gears are the best candidate for targeting the small and medium pelagic fisheries resources. Although these gears should target the small and medium pelagic from relatively offshore fishing grounds, their use has been raising mixed reactions over claims of being used in inshore areas, landing of under-sized individuals, with environmental implications. This led to the formulation of the final draft Ring Net Fishery Management Plan to advocate for the proper use of this gear. The management plan however, was formulated without adequate scientific data and information.

Results indicated relatively low catch-per-unit-effort (CPUE, Ring net: 296.5 ± 38.3 ; Reef seine: 55.1 ± 7.7 kg vessel-1 day⁻¹) and this differed ($p < 0.05$) among the fishing areas studied. Catch composition was different attributed to differences between the vessel-gear. The overall species richness was higher for the reef seines compared to the ring nets. Majority of the species landed were demersal and reef associated species, and mostly under-sized individuals. In view of the narrow range of natural mortality coefficient, E_{MSY} ⁴, $E_{0.1}$ and E_{opt} , recorded herein, it could be indicative that size and growth rate do not influence natural death in the small and medium pelagics. Long-term data surveys are needed for more robust findings.

⁴ E = exploitation rate

Before the actual data collection, stakeholders' consultative meetings were conducted in Vanga, Gazi, Takaungu and Kilifi to gain stakeholder support for the research activity. These consultative meetings involved ring net boat owners, fishermen, respective Beach Management Units (BMUs) representatives, fish dealers and staff from the State Department of Fisheries (SDF). The discussions involved a brief introduction of the Kenya Coastal Development Project (KCDP) fisheries components on Monitoring Control and Surveillance (MCS), co-management, fisheries research, aquaculture and quality assurance. The discussions concentrated on the fisheries research in particular stock assessment of small and medium pelagic where until now more data and information are still needed for the completed draft final ring net management plan, and the small and medium pelagic management strategy. The discussions were followed by in-depth description of the shore-based catch assessment activity that would be conducted by different research teams, one based in south coast and another in the north coast covering initially a total of four fish landing sites. Researchers would conduct their work from the shore where sampling of the catch would be carried out using catch assessment data forms. Detailed biological sampling would be conducted for certain identified priority fish species. The implementation of the ring net observer program would involve boarding of the ring net boats by trained members of the research team so as to ascertain the exact fishing grounds and to record as much information on the fishing activities while at sea. While in the meetings in the different areas, ring net stakeholders were informed that the aim of deploying ring net observers was not to impose restrictions on their fishing activities and therefore fishers were not expected to fear the on-board observers. After the explanation on the entire research activity, members in all the initial four fishing areas expressed their views on the activity and asked questions for clarification, as well as pledging support for the activity.

A total of 32 fishing grounds in the five fishing areas were recorded, with most of the fishing grounds located in Vanga in the south coast. The fishing grounds in Vanga were the most productive followed by those in Kilifi. Uyombo was equally relatively productive since higher landings were recorded compared to Gazi and Takaungu from a single catch assessment campaign. Although Vanga recorded the highest total landings, CPUE was the lowest and highest for Uyombo further north of Kenya coast. The low CPUE in Vanga was attributed to relatively higher number of fishers and fishing vessels compared to a single ring net vessel that was sampled in Uyombo. Vanga area is preferred in ring net fishing as the gear is easily operated in the sheltered fishing grounds. Vanga also is the home of most of the ring net fishers.

All ring net catches are expected to be dominated by the pelagic taxa and mostly the *Carangidae* (trevalies), *Scombridae* (tuna and mackerels), *Sphyraenidae* (barracudas), and *Hemiramphidae*. Even though these species were among those abundantly landed, the majority of taxa recorded were demersal species (see appendices 1 and 2). This implies that either majority of the fishing grounds accessed were not appropriate for the ring net gear. The relatively lower catch-per-unit-effort (CPUE) was also directly related to the poor quality of the catch since most individuals were juveniles and under-sized, especially for the case of Vanga area. It was observed that, the bigger 'mashua'-ring net vessels landed even smaller individuals in most instances than the smaller canoe-reef seines further raising more questions on the use of ring nets particularly in Vanga area.

"Small Scale Purse Seine net" means a long continuous stretch of netting of varied lengths, 200 – 300mm depths 20-30m and mesh sizes 0.5 -2 inches consisting of a float line and a bottom sink line fitted with small round metallic rings. A rope running through the metallic rings is used to encircle a group of fish. This net is commonly referred to as "Ringnet";

3.1. Small Purse seine fishing is defined as the use of long continuous stretches of netting of varied lengths and mesh sizes consisting of a top float line and a bottom sink line fitted with small round metallic rings. A plastic rope running through the metallic rings attached to a bottom line is used for the pursing process to capture fish. Most small purse seine are normally 0.5 to 1 and a few small purse seine nets are of 2 inch mesh size.

3.2. Purse seine fishing is conducted using a single vessel; however, one smaller vessel may also be used to aid deployment and safety of crew at sea. The vessels range from 7 metres to 13 metres in length, with the number of fishers ranging from 9 to more than 40 per boat. The reported fishing duration is about 5 hours per day.

3.3. The small Scale purse seine gear catches pelagic species and reef associated species. The pelagic species commonly caught by ringnet fishing gears are dominated by three families including Jacks and Trevallies (*Carangidae*), Tuna and Mackerels (*Scombridae*) and Barracudas (*Sphyraenidae*). Among the species targeted include Giant trevally (*Caranx ignobilis*), Blue trevally (*Carangoides ferdau*), Bludger (*Carangoides gymnothetus*), Golden trevally (*Gnathanodon speciosus*), Orangespotted trevally (*Carangoides bajad*), Bigeye trevally (*Caranx sexfasciatus*), Yellowtail amberjack (*Seriola lalandi*), Rainbow runner (*Elagatis bipinnulatus*), Little mackerel (*Euthynnus affinis*), Yellowfin tuna (*Thunnus albacares*), Frigate tuna (*Auxis thazard*), Indian mackerel (*Rastrelliger kanarguta*), Narrow-barred Spanish mackerel (*Scomberomoro commersoni*), Chub mackerels (*Scomber japonicus*), Skipjack tuna (*Katsuwonis pelamis*), Pickhandle barracuda (*Sphyraena jello*), Bigeye barracuda (*Sphyraena forsteri*) and Halfbeaks (*Hemiramphus far*). Demersal reef associated species targeted include Snappers (*Lutjanidae*), Surgeonfishes (*Acanthuridae*), Grunts (*Haemulidae*), Sicklefishes (*Drepanidae*), Unicornfishes. Other shallow water reef species reportedly caught include Rabbitfish, Goatfish, Angelfish, Parrotfish, and Triggerfish. Currently species composition is dependent on area and season.. Highest diversity is associated with Vanga during the North East Monsoon season (NEM). Small purse seine fishers visually locate schools of fish and can determine what volumes and species to capture. Usually fishers prefer mixed schools of carangids and scombrids.

The predominant grounds for small scale purse seining include areas off Vanga, Shimoni, Gazi, Likoni, Mkomani, Uyombo, Ngomeni, Mtwapa, Kilifi, Takaungu, Mayungu, Watamu and Kipini. The vessels migrate seasonally within the fishing grounds.

By the year 2012, the frame survey results reported twenty two ringnet fishing vessels operating in Kenya's waters as follows: Lamu - 0, Tana-0, Malindi- 2, Kilifi-1, Kwale-18 and Mombasa-1. The general distributions of the landings were as follows: Vanga-7, Gazi-3, Shimoni-2, Likoni-1, Mkomani-1, Takaungu-2, Kilifi-2, Uyombo-1 Watamu-2, and Kipini-2, Mtwapa-1. Currently the total number of ringnet boats is thirty one according to results of the marine fisheries frame survey 2014.

Small purse seining has higher catch rates compared to other fishing gears utilized along the Kenyan coast. On average, the CPUE ranges from approximately 100 to 460 kg/vessel/day. Based on catch assessment data there are spatial and seasonal variations in catch rates with highest catch rates reported for Vanga area during the South East Monsoon(SEM) season. Fishing season is from October to April peaking between the months of November and March for most areas but in Vanga small scale purse seine fishing is conducted all year round.

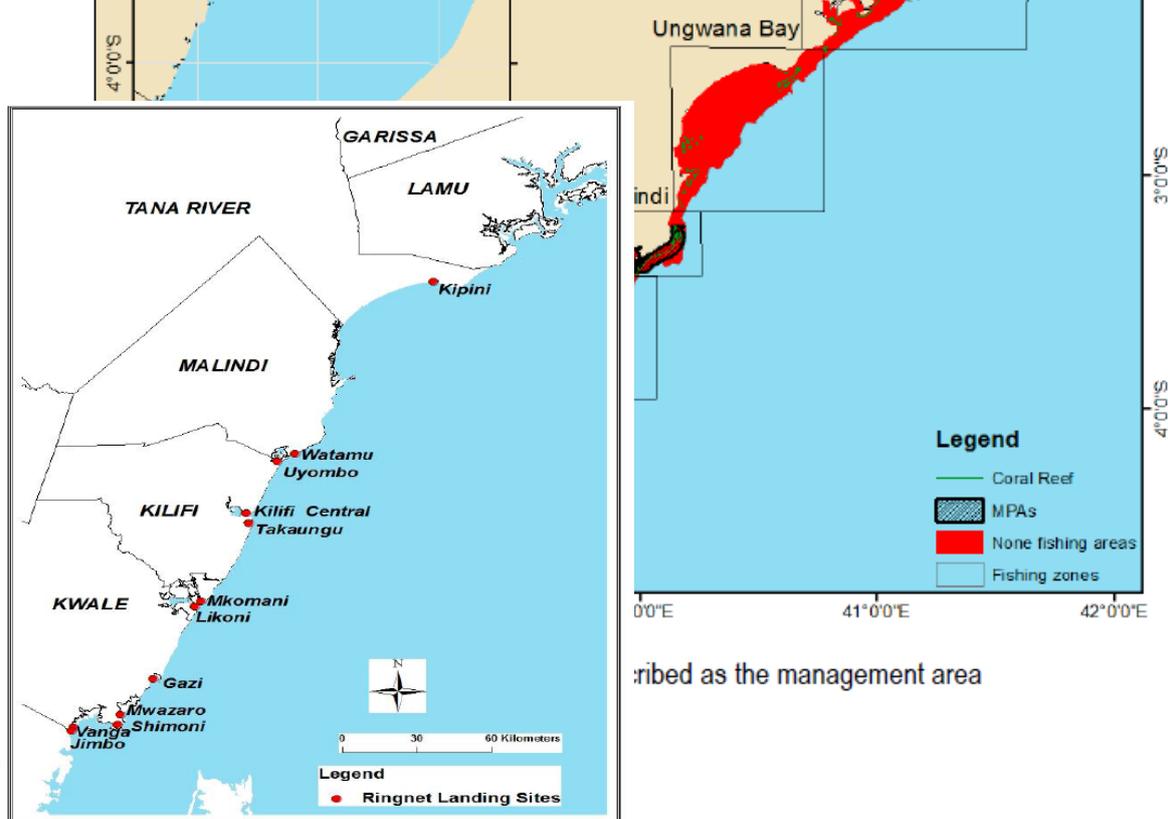


Figure E: Ringnet landing sites in Kenya (State Department of Fisheries, 2015)

The broad objective of this management plan is to enhance responsible exploitation of pelagic fish stocks through regulation of sustainable ringnet fishing practices that minimize resource use conflicts while providing long term biological and socio-economic benefits including food security, employment creation, and national revenues.

Specific objectives of the Management Plan are to:

- 5.1 Regulate the small scale purse seine catches, effort, trade and fishing zones;
- 5.2 Minimize conflicts through capacity building of resource user organizations, benefits sharing strategies, licensing schemes and environmental management;
- 5.3 Specify and monitor management reference points for the small scale purse seine fishery through research and data collection;
- 5.4 Improve the net income small scale purse seine fisher communities and national revenues through value chain development and improvement; and
- 5.5 Develop mechanisms to enhance enforcement and compliance for ecosystem management.

Management measures

7.1. Control small scale purse seine fishing effort:

- 7.1.1 As a precautionary measure, limit the number of licensed small purse seine fishing vessels subject to scientific research;
- 7.1.2 Limit the size of small scale purse seine fishing vessels to a minimum of 12 metres;
- 7.1.3 Limit fishing with purse seine nets to one per vessel; and exclude use of any other types of fishing gears during fishing operations;
- 7.1.4 Limit small scale purse seine net to a minimum length of 200 metres not exceeding 300 metres; and a minimum stretched width of 20 metres not exceeding 30 metres;
- 7.1.5 Restrict Small purse seine fishing operation time from 6a.m to 6p.m;
- 7.1.6 Issue a preferential licence for small purse seine fishing operations endorsed annually.

7.2 Specify Total Allowable Catch (TAC) for small scale purse seine fishing operations; and make provisions and guidelines for allocating Quotas including Individual Transferable Quotas (ITQs) based on the best available scientific evidence.

7.3 Minimize impacts of small scale purse seine fishing on juvenile fish, endangered species and marine habitats:

- 7.3.1 Introduce a minimum mesh size for small purse seine net subject to scientific research;
- 7.3.2 Introduce capture size limits for key target species especially barracudas and mackerels based on the best available science;
- 7.3.3 Enforce regulations on handling and/or trading of juvenile fish;
- 7.3.4 Enforce regulations on capture of endangered species;
- 7.3.5 Enforce a precautionary closed season from 1st April to 31st August;
- 7.3.6 Limit fishing activities 1 nm away from coral reef zones and designated fish breeding sites.

7.4 Zone small scale purse seine fishing grounds:

- 7.4.1 Zone critical fish habitats including nearshore coral reef areas, fish spawning and breeding sites where use of small scale purse seine net will be restricted;
- 7.4.2 Restrict small scale purse seining depth to designated zones as prescribed provided that the distance is not less than 1 nautical mile from the coral reef:
 - 7.4.2.1 A minimum of 50 metres northwards from Funzi Island;
 - 7.4.2.2 A minimum of 30 metres southwards from Funzi Island.

7.5 Regulate access to fishing grounds and markets:

- 7.5.1 Enforce relevant BMU bylaws on access to fishing grounds and markets;
- 7.5.2 Restrict the landing and selling of catches from small scale purse seine to designated fish landing stations;

7.6 Establish mechanisms to increase the income and other economic benefits from the small purse seine fishery through value chain development such as:

- 7.6.1 Improvement of fish handling to minimize post-harvest losses;
- 7.6.2 Enforcement of relevant BMU regulations and by-laws including development of co-management plans;
- 7.6.3 Supporting formation of marketing associations and cooperatives;
- 7.6.4 Supporting product development of small purse seine catches;
- 7.6.5 Development of a Marketing Information System;
- 7.6.6 Promotion of Public Private Partnership (PPP);

7.6.7 Promotion of capacity building and participation of small purse seine fishers; and

7.6.8 Promotion of innovative small and medium pelagics fishing technologies;

7.7 Establish mechanisms for Monitoring, Control, and Surveillance (MCS) to enhance compliance of small scale purse seine fishing operations through:

- 7.7.1 Enforcement of mandatory registration of vessels and fishers before licensing;
- 7.7.2 Mandatory use of electronic monitoring devices to ensure compliance to management measures during small scale purse fishing;
- 7.7.3 Development of standardized data collection protocols, storage, processing and analysis of small scale purse seine catch data;
- 7.7.4 Compulsory submission of catch, effort and electronic tracking data;
- 7.7.5 Requirement of small scale purse seine operators to allow boarding by authorized officers;
- 7.7.6 Introduce a small purse seine fishery observer program
- 7.7.7 Requirement of inspection of small scale purse seine fishing vessels and associated catch both at sea and on land by authorized officers; and
- 7.7.8 Enforcement of sea safety regulations;

7.8 Put in place a programme of co-management as provided in the Fisheries (Beach Management Unit) Regulations, 2007 through:

- 7.8.1 Development of co-management plans;
- 7.8.2 Enforcement of the relevant BMU regulations for compliance, security and safety;
- 7.8.3 Education and awareness creation; and
- 7.8.4 Training of BMU Assembly members on financial management, proposal writing, savings and credit accessibility, marketing and access to relevant financial institutions;

7.9 In consultation with relevant stakeholders, institute a benefit sharing strategy based on the underlying principles of the BMU regulatory framework.

7.10 Subject to necessary legal amendments to the Fisheries Act, the Cabinet Secretary shall, through a trust deed, establish a Community Trust Fund and cause the same to be implemented for the purpose of developing the small purse seine fishery and ensuring sustainable compliance to the management measures.

7.11 Ensure collaboration with the relevant sectors to develop complementary economic activities for the fishers

7.12 Require a small purse seine fishing vessel operator to provide a detailed fishing and marketing plan before licensing as may be prescribed

Monitoring and evaluation

9.3 In collaboration with County governments, BMUs, dealers and other stakeholders, disseminate M&E information for feedback purposes.

9.4 Permit research programmes to monitor and/or answer specific questions in the lobster fishery.

9.5 Monitor the performance of the indicators of the harvest strategy.

9.6 Establish a system for external review and audit of the implementation of the plan

Kenya Marine and Fisheries Research Institute (2015). Baseline stock assessment report of the Rabbitfish-*Siganus sutor*(Valenciennes, 1835) in the Kenyan marine waters. KMFRI Research Report No.2/OCS/FIS/FY=2014-2015/2.

(Kenya Marine and Fisheries Research Institute, 2015c)

Siganids belong to the family *Siganidae*. They inhabit the tropical and subtropical Indo-Pacific regions and eastern Mediterranean lagoons primarily in shallow waters <15m water deep (Woodland, 1990). Except for *S. vermiculatus* which is brackish, all other siganids are marine species. On the East African coastal waters, the siganids are among the most heavily targeted reef-fish species with a catch composition by weight of up to 63% in some fisheries (Guard, 1999). Siganids and lethrinids are listed as the most important marine fish constituting 31% of the total reef fish landings in Kenya over the last five years (FAO 1998, deSouza, 1988, Hicks and McClanahan, 2013). The marine fishery is dominated by small scale and the annual fish catches is estimated at 5 % of the national fisheries production with the bulk of the production from Lake Victoria (Fisheries statistics 2012).

Catch Assessment Surveys (CAS) along the Kenyan coastline from 2014 to 2015 gave an indication of gear-craft combinations and catches associated with them. The catch of *Siganus sutor* from the CAS data was 1,651,401kg. The total catches from different counties was highest in Kwale (535,300.69 kg) at 33% followed by Lamu (482,873.99 kg) at 29%, Kilifi (446,339.43 kg) at 27%, and Mombasa (186,886.71 kg) at 11% which had the lowest catch while Tana delta had no siganid catches.

The Siganid species are confirmed to be an economically important family since they are commonly landed throughout the coast and the preferred method of fishing is by use of basket traps especially within the inshore habitats. They are source of proteins for the local communities. Juveniles to adult fish were harvested indicating that this species is highly targeted and may suffer from overfishing if not managed given that multiple gears caught the fish. The proportion of juveniles in the catches was 19% as compared to adults at 81 from pooled data of mixed gears.

Data used in this stock assessment survey was fishery-dependent data. Fish sampling was conducted at respective landing sites for 8 days every month (April-December 2014). At each fish landing site,

fishers were approached and requested that their catch be weighed and assessed as they arrived from fishing activities. Different gear caught different sizes of fish. For example the basket traps caught some juveniles and most fish were between 18cm and 30 cm. Beach seines caught more juveniles and most fish ranged between 10 cm and 20 cm. Monofilaments caught more smaller sized fish while the gillnets caught more mature fishes with sizes more than 20 cm.

In terms of Siganid species they are common fish landed throughout the coast and the preferred method of fishing is by use of basket traps especially within the inshore habitats. Juveniles to adult fish were harvested indicative of the fact that such species were highly targeted and are now being overfished most probably due to the multiple gears catching the fish. This proves that there is high demand for this species thus sizes limits are disregarded by the fishers. Given that it is an important commercial fish for the local economy, gear restrictions should be imposed and proper management of this species could be done. There is need for continued monitoring of the species to understand what other factors may be contributing to its status.

Kenya Marine and Fisheries Research Institute (2015). Malindi-Ungwana Bay Small-scale Prawn Fishery Stock Assessment. REPORT NO. OCS/FIS/2014-2015/1.

(Kenya Marine and Fisheries Research Institute, 2015b)

The Malindi-Ungwana Bay artisanal prawn fisheries resources play an important role to the national and local economy through food production, employment creation and revenue generation. Prawns are harvested by small-scale fishers along the entire Kenyan coastline inshore areas and semi-industrial bottom trawlers within the Malindi-Ungwana Bay 3 – 5 nautical miles off the shoreline.

The prawn fishery in the bay has been associated with conflicts among stakeholders primarily due to poorly defined fishing zones, destruction of breeding grounds and high amount of fish and non-fish by-catch among others. Some measures to address some of these challenges were put in place in the Prawn Fishery Management Plan (PFMP) of 2010. However, the plan was largely designed by relying on existent information from the semi-industrial trawl fishery, thus missing out the equally important small-scale fishery that occurs within the shallow areas of the bay, estuaries, mangrove creeks and beach ridges.

Overall the national marine small scale prawn production was estimated at 363.5 metric tons/year that is generated by approximately 896 fishers that are employed in the fishery. These fishers harvest between 1 – 2.17 kg fisher⁻¹day⁻¹. The Malindi-Ungwana bay sites of Kilifi and Tana River Counties produce up to 41% of the total prawn production followed by Kwale (39%), and Mombasa with 19%.

Stock status for most prawn species indicates that the fishery is operating beyond the maximum sustainable yield (MSY) estimated reference rates. The average fishing mortality (F) of 1.99 is above the rate that would produce maximum sustainable yield thus indicating that overfishing is occurring in the fishery. Spawning stock biomass per recruitment (SSB/R) estimate of 0.06 is below that required for maximum sustainable yield of 0.2 thus indicating the stock is currently overfished. Current exploitation rate (F/Z) of between 0.59 and 0.76 for the prawn species is above 0.5 indicating that the fishery is overfished.

It is recommended that the current effort be reduced by approximately 89.5% to bring down the fishing mortality on the prawns from the current 1.99 to 1.05 either through mesh size regulations or reducing fishing pressure in the nearshore nursery. The revision of the current PFMP of 2010 to incorporate the missed aspects of the small-scale prawn fishery is also suggested.

During mapping, it was found that most of the small scale prawn fishing grounds mapped are not exclusively designated for prawn fishing. In these areas, other artisanal gears targeting mixed marine and estuarine fish are used, thus indicating overlap of small scale prawn fishing with the general artisanal fishery. Prawn fishing and trade was found to be the main occupation with up to 93% of all the respondents who were interviewed at the four landing sites involved, while the remaining few (less

than 7%) were mainly farmers. About 57% of the prawn fishers used monofilament nets (Mkano), 36% used prawn seines and the rest used an assortment of nets and traps that majorly targeted different fish species. The socio-economic study established that 60 % of the prawn fishers were reasonably aware of other prawn fishing gears (including bottom trawlers) that were in use by other fishers within the Malindi- Ungwana Bay. None of the fishers particularly saw any need for development of new fishing gears stating categorically that their catch problems were more pegged on financial inability and vessel unavailability. Moreover, when the same respondents were asked to propose mechanisms that ought to be put in place to improve catches for the artisanal prawn fisher (both in terms of quantity and quality of catches) most of them gave varying responses with preferences made for better gears and fishing vessels across all the sites.

WWF (2014). "Kenya launches strategy to increase stake in lucrative tuna fisheries industry." Retrieved 16/01/2017, 2017, from http://wwf.panda.org/wwf_news/?234957/Kenya-launches-strategy-to-increase-stake-in-lucrative-tuna-fisheries-industry .

(WWF, 2014)

Kenya is set to increase its stake in the US \$4 billion dollar a year global tuna fisheries industry after the government launched the country's first ever Tuna Fisheries Development and Management Strategy.

The Cabinet Secretary further noted that the strategy seeks to build effective governance system of the marine fisheries sector by providing institutional framework to ensure compliance with relevant national laws and international standards and agreements.

"This is a big move by the Kenyan government to position the country in the active and lucrative global tuna industry. However, a lot still needs to be done. The government and other key stakeholders will need to provide an enabling regulatory and infrastructural environment in order to bring about significant flow of benefits of tuna resources to the country at biologically, ecologically and socio-economically sustainable levels," noted Mr. Kimakwa

The strategy, which will run from 2013 to 2018, aims to grow Kenya's largely underdeveloped tuna supply chain that currently has rudimentary fishing vessels not capable of going beyond 20 nautical miles undertaking tuna fishing. In addition, the country does not have a commercial tuna fishing fleet and lacks even a single vessel capable of exploiting tuna resources prescribed to it by the United Nations Convention on the Law of the Sea which grants a state special rights over exploration and use of marine resources. Currently the country grants fishing access to Distant Water Fishing Nations at a fee, which is not commensurate to the real value of the resource.

Only one factory in the country with an installed processing capacity of 105 metric tonnes per day is dedicated to tuna processing. Kenya therefore, accounts for less than 5% of the Western Indian Ocean's processing capacity with the only tuna company in the country relying on supplies from distant water fishing nations for tuna supply.

Smart Fish; Programme for the implementation of a Regional Fisheries Strategy for the Eastern and Southern Africa and Indian Ocean Region (2011). Kenya Fisheries Governance. REPORT/RAPPORT: SF/2012/9.

(Smart Fish; Programme for the implementation of a Regional Fisheries Strategy for the Eastern and Southern Africa and Indian Ocean Region, 2011)

Fisheries governance in Kenya has historically being focused on the inland sector. Governance of the marine sector has and still is weak although the essential components of good governance are in place. Fisheries legislation is generally sound with the new bill aiming at strengthening Kenya's interests in the offshore sector – in particular the tuna and shrimp industrial sectors. Due to the high

level of community involvement on the coast, interaction with the industrial fishing sectors, such as the shrimp fishery, is a major governance and fishery management challenge.

Governance of Kenya's fisheries in the offshore sector is almost zero and limited to licensing fees with no culture of managing these licences. This has effectively led to "non-performance" of Kenya due primarily to weak governance in this sector.

Within territorial waters a key governance structure has been the implementation of Beach Management Units – essentially a co-management approach. There is little evidence to demonstrate the effectiveness of BMUs although in principle the concept is good.

Gaps in the governance of Kenya marine fisheries include:

- A. Inadequate financial and technical resources (capacity). In particular training of Fisheries Managers is seriously lacking – this impacts effective governance of the resources managed.
- B. A key governance concern relates to overlapping and uncoordinated jurisdictions. Most of the institutions with a stake in coastal zone management fall under different ministerial or sectorial disciplines, such as water, agriculture, transportation, regional development, local government, energy and others. This multiplicity, in the absence of adequate coordination mechanisms, makes it difficult to give focused attention to the coastal and marine environment. The fact that there is no single ministry or agency with dedicated or core competency to deal with coastal and marine issues is problematic for effective governance.
- C. There is a need to synergise the coastal zone and marine (fisheries) legislation as well as implementation of this legislation. Training and recruitment of personnel, acquisition of equipment and facilities, and more budgetary and other resources are required, if the implementation of the governance regime is to be effective.
- D. Marine protected areas can have an important transboundary function with benefit to the regional governance of fisheries and stock sustainability.
- E. Participation of Kenya in fisheries at an International level is weak -there is a need to develop a comprehensive, modern legal and regulatory framework for fisheries management. The status and progress of national laws is not reflected in the international legal and institutional arrangements. Consequently, conflict in law enforcement and the duplication of tasks in fisheries management arise.

Recommendations:

- 1) Integration of the national and regional Initiatives on fisheries governance The fisheries governance initiatives in the current internationally-funded programmes (KCDP / SWIOFP /SmartFish) need to be synergised to optimise the benefits to Kenya. Any new activities that are developed that relate to fisheries governance either in the region or at a national (Kenya) level should be integrated into the activities of these programmes.
- 2) Development of Fishery Management Capacity: Nearly all key components of the Fishery Management Framework are lacking in Kenya. Capacity development in this area is vital for long-term effective governance of fisheries in Kenyan waters. This should include addressing the communication gap between fisheries research and fishery managers. Ideally research components, such as stock assessment should be practically linked to the development of fishery management plans and operational management procedures for the different fisheries and stocks. The outputs of the training and capacity development should therefore not be pure science but should focus on fisheries management. This capacity should focus on fisheries with the greatest need which are the offshore tuna fisheries and developing an understanding of the artisanal fisheries impacts on stocks they exploit, in particular the seasonal migrating large pelagic species.
- 3) Harmonisation and Review of Fisheries legislation: Although the current new fisheries bill is a step up from the old Act and attempts to focus more on offshore fisheries, there are conflicts with other legislation (such as the management of MPAs and Marine Managed Areas). This should include the integration / effectiveness of the Act with respect to regional management and transboundary issues.
- 4) Transboundary and EEZ management: There is an urgent need for the coastal states (and many of the Indian Ocean Island states) to raise their profiles in the RFMOs (in particular IOTC). The management framework for offshore fisheries at the National level (in Kenya and

possibly other states in the region) does not support the development of a national offshore fishery for tunas. The governance and legislative framework should be streamlined and costs (taxes) reduced to facilitate the economics of the tuna sector. This will also encourage Distant Water Fishing Nations to utilise land-based facilities. This could be facilitated by the development of a common fisheries policy for the WIO region coastal and island states.

Kenya has a relatively small coastline with a narrow continental shelf. Fisheries are however a major activity in the country, although the marine sector is overshadowed by the freshwater sector – primarily the fishery on Lake Victoria targeting Nile perch. Surprisingly, marine fisheries are insignificant relative to the freshwater fisheries – off some 145 000 t reported in 2005 (Ministry of Fisheries Development web site), only about 5%, or 6 823 t was reported as “marine”. Whereas the marine fishery is largely “artisanal”, the fresh water sector is both “industrial” and artisanal. Landings are dominated by the Lake Victoria region (133 526 t in 2005) – in recent years catch volumes from Lake Victoria have however declined underpinning the need to better manage and increase utilisation of the marine sector. Fisheries are however recognised for their strategic value. In the 2008 -2012 (dated January 2011) “Fisheries Strategic Plan”, it is stated that “Fisheries are an important source of livelihood to fishing communities in the country. They also contribute to food security and provide raw materials for production of animal feeds as well as fish oil and bioactive molecules for the pharmaceutical industry. Fisheries support auxiliary industries such as net making, packaging material industries, boat building and repair, transport, sports and recreation”. The strategic plan further states that some 80,000 people are directly involved in fishing and about 800,000 indirectly involved. The fisheries sub-sector contributes about 0.5% to national GDP (Economic Survey 2008). Interestingly, the strategy also states that the “marine fishery potential is estimated at 150,000 t of commercial tuna and other species against actual landings of about 7,000 t annually” and that the potential this resource can provide through Fisheries Partnership Agreements (FPA) will require foreign vessels to land a proportion of the harvest in Kenya for processing thus creating employment opportunities at the coast.

The Kenyan marine zone approximates only 420 km in length with a total area of the Kenyan EEZ of about 230,000 km². There are two main river systems, the Sabaki, just north of Malindi and the Tana about 80 km further north. It is only in these areas that industrial (shrimp) fisheries have been active in the past.

High seas landings are poorly reported and most likely grossly underestimated. Licensed operators report landings to the Indian Ocean Tuna Commission (IOTC) 14 Smartfish Programme Report SF/2012/9 coastline is fringed by mangrove forest and swamp. Kenya’s known marine inshore fishing grounds include the rich inshore grounds around Lamu Archipelago, Ungwana Bay, North Kenya Bank and Malindi Bank. The “inshore” fisheries zone is however an important part of the whole Kenya coastal fishery. The zone is exploited predominantly by artisanal fishermen who operate some 4,800 mostly un-motorized boats (ref frame survey 2008) to produce around 6,000 – 7,000 t of fish annually, valued at over KShs 500 million (this figure quoted on MoD web site). Historically annual catches fluctuated between 4,000 and 10,000 t over more than a 20-year period.

The prawn fishery, from which approximately 400 t was landed each year, was fished by commercial trawlers from the two fishing grounds given above. This fishery however was closed in 2004 primarily due to problems between industrial and artisanal users. Large pelagic species that include many of the migratory tunas and bill fishes are caught by both the artisanal and deep sea fleets. The catch of the artisanal component is however small and probably under-reported as fishing occurs around the entire coast and in near-shore waters and is therefore difficult to assess. Historically Kenya has also licensed vessels from Distant Water Fishing Nations (DWFNs), including purse seine and longline vessels. In 2008 it was understood that some 28 purse seiners and nine longliners were licensed for a total licence fee approximating US\$628 000.

Until 1999, the rules and regulations governing Kenya’s coastal and marine environment were scattered in numerous sector-based statutes. The institutions mandated to deal with the sector had overlapping roles, and many had limited competencies. However, in 1999 Kenya enacted the Environmental Management and Co-ordination Act (No. 8 of 1999), which came into effect on 14

January 2000. The Act makes direct reference to the coastal and marine environment (s.55) and inland waters and wetlands (s.42). The Act established key environmental institutions, including the National Environment Management Authority (NEMA).

The following are the key legal instruments underpinning governance of fisheries in Kenya:

- i. The Fisheries Act of 1991 (Revised) – Chapter 378
- ii. The Wildlife (Conservation and Management) Act of 2002 (revised)
- iii. Kenya Forests Act, 2005
- iv. The Maritime Zones Act
- v. Environmental Management Act of 1999
- vi. Local Authority and Planning Act
- vii. Water Act
- viii. Maritime Authority Act
- ix. Kenya Ports Authority Act

The following key institutions relate to fisheries governance structures in Kenya:

- Ministry of Fisheries Development (MoD)
- Department of Fisheries (FiD) – a department under MoD
- Kenya Marine and Fisheries Research Institute (KMFRI)
- Kenya Wildlife Services (KWS)
- Coastal Development Authority (CDA)
- National Environment Management Authority (NEMA)
- Kenya Forestry Service
- Kenya Forestry Research Institute (KEFRI)
- The Beach Management Units (BMUs) and Locally Marine Managed Areas (LMMA)

The BMU regulation is an important governance instrument as it is a bottom-up approach embracing communities and all stakeholders who effectively become the stewards of the resources they exploit and are, therefore, involved in the decision making, implementation, and monitoring processes. BMUs also provide a framework for managing fisheries that often are of a transboundary or shared nature (only in the coastal zone though). BMUs are therefore a critical governance tool – application however has limitations as they can only be implemented on the coast (and inland waters) and conceptually are difficult to apply to fisheries beyond territorial waters.

BMU responsibilities include:

- Law enforcement [registration of boats, enforcement of gear regulations and protection of fishing grounds];
- Beach Development [fish bandas and sanitation];
- Collection of fisheries data;
- Conflict Resolution and welfare matters;
- Handling emergencies.

The BMU concept falls within a broader concept of Locally Marine Managed Areas (LMMAs). This is an aspect highlighted by the ReCoMaP State of Coast Report (2009). Typically, the process of implementing an LMMA involves the participation of non-governmental organisations, as well as FiD. In Kenya, a typical scenario is to have a degree of division of labour, with government performing the overall institutional management role, a local NGO supporting local implementation, with a third NGO providing ecological planning and monitoring support (ReCoMaP, 2009 refers). However, these initiatives are not without their problems and challenges, and the Fisheries Department is keen that they are developed in a coherent and systematic way.

Oluoch, S., et al. (2009). "The capacity of fisherfolk to implement beach management units in Diani-Chale."

(Oluoch, Obura, & Hussein, 2009)

High population increase, influx of immigrants, poverty, unemployment and lack of livelihood options has exerted increased pressure on coastal resources. The marine fishery in Kenya is considered to be heavily exploited and catches are declining over much of the coastal region.

The current management regime has not been effective in ensuring sustainable exploitation of the many resources, fisheries included. The continued use of destructive gears, illegal fishing activities, increased fishing effort, conflict among fishers and other resource users has made the management of fishery resources increasingly difficult. Government policies, so far, have given marine fisheries little attention, and coupled with the inability of the state to enforce management regulations; this has further complicated their management. The coastal artisanal fisheries in Kenya are therefore at best poorly managed (Alidina 2004).

The main objectives of the newly instituted Beach Management Unit (BMU) regulations are to strengthen the management of the fish-landing stations, fisheries resources and the aquatic environment (DFRE 2003). The legislation is also expected to support the sustainable development of the fisheries sector, ensure the achievement of high quality standards of fish and fishery products and prevent or reduce user conflicts. According to the regulations, each BMU shall have jurisdiction over a beach, the geographical area that constitutes a fish landing station and is adjacent to the local fishing grounds. An official of the fisheries department designates a co-management area for each BMU in which the BMU will undertake fisheries management activities jointly with the Department of Fisheries.

The main objective for the formation of fisher groups in Diani-Chale was the initiation of development projects to improve their living standard and achieve self-reliance (20 out of 61 respondents; Table 6.1). Advocacy for fisher rights, equipment/gear purchase and fishers welfare were mentioned as additional objectives (in order of importance). Revenue collection and conflict resolution were stated as objectives by a few members, but not by officials. Conversely, conservation/sanitation and marketing of fish was an important objective for group officials but not for the membership.

Muthiga, N. (2009). "Evaluating the effectiveness of management of the Kisite-Mpunguti marine protected area."

(Muthiga, 2009)

Given that the Kenyan government has made substantial investments in the establishment of MPAs, there is need to ensure that these are providing the benefits for which they were established.

Kenya has six MPAs, including four no-take marine parks and six restricted fishing marine reserves (Muthiga 1998), that cover approximately 9% of the coastal shelf (Wells et al. 2007). Although these MPAs have been in existence since the 1960's and are relatively well resourced – except for the Diani-Chale MPA – in terms of staff and infrastructure.

MPA plan: Goal 1) enhancing biodiversity conservation through participatory approaches and Goal 2) promoting sustainable nature tourism. One objective was selected for each goal: Goal-Objective 1) maintaining the variety of marine life and Goal-Objective 2) encouraging local tourism.

Additional general issues that require attention for all MPAs include: revision of the MPA plans to target objectives more closely, creation of formalized communication mechanisms, improvement of financial sustainability, retention of technical expertise and systematic data gathering to inform management.

Hoorweg, J., et al. (2009). "Artisanal Fishers on the Kenyan Coast; Household Livelihoods and Marine Resource Management."

(Jan Hoorweg, Wangila, & Degen, 2009)

From 1948 to 1958 there was a large expansion in the quality and the value of fish sold mainly because of the successful introduction of modern equipment and new methods of catching fish (Martin 1973). The hand lines of local cotton thread were replaced by nylon lines, which were stronger and more efficient.

Particularly successful was the introduction of a blue-grey nylon shark net, which was almost invisible to the sharks. Shark catches in Malindi multiplied fourfold. During the initial years, there was little concern for any environmental consequences of the improved fisheries, which was understandable given the small number of fishers and their modest production.

During the initial years, there was little concern for any environmental consequences of the improved fisheries, which was understandable given the small number of fishers and their modest production:

The duty of the Department is to foster the development of the fishing industry in all its aspects. With few exceptions, the Department is not concerned with the conservation of fish, for there is no evidence that man's efforts from our coast have reached a stage at which they would endanger the Colony's marine assets (Kenya 1955: 20).

Still, it did not take long before adverse effects came to be noticed in respect to certain species and certain areas. There were signs that all was not well:

The Kenya shark fishery ... is declining rapidly, and is reaching the point at which it is no longer profitable (Kenya 1960: 11). Turtles were incorporated into the Wild Animals Protection Act in Kenya to protect them ... [from extinction] ... However, little development can be envisaged for the fishery and the Department's efforts are directed mainly at enforcing this legislation (Kenya 1964a: 11). Of great concern has been an alarming increase in the collection of live coral, shells and reef-fish for exports overseas (Kenya 1968: 21).

These and other concerns led to the start of the first Marine Protected Areas on the Kenyan coast in 1962.

For fishing purposes, Kenyan waters can be divided into three zones. The first extends five nautical miles seawards and fishing in this zone is for artisanal and sport fishers only. Prawn trawlers, however, are often accused of fishing illegally in this zone. Artisanal fishers may venture further out but most of their activities occur within the five nautical miles. Sport fishers, however, often set out further seawards.

The professional sport fishers in Kenya have recently formed the Kenya Association of Sea Anglers (KASA) with about 35 charter boats. In addition, there are, perhaps, another 35 charter and private boats. KASA members are required to submit records of their catches, which is not the case with the non-member boats, although the catches of the latter are likely to be much lower than those of the professional charter boats. In 2002/2003, the total catchweight reported by sport fishers was 235,308 kg (Wright 2008) with the largest landings in Malindi (46%) and Watamu (37%). The main species caught were tuna (48%), tiger shark (10%) and sailfish (10%), and smaller quantities of billfish (black marlin, blue marlin, striped marlin, broadbill), shark (hammerhead, mako, tiger, other) and gamefish (barracuda, cobia, dolphin, kingfish, trevalley, wahoo) (Wright 2008).

The second zone is between five and twelve nautical miles seawards and together with the first zone constitutes the territorial waters. This is the zone where the prawn trawlers are allowed to operate against payment of an annual licence fee (Ksh 22,800). Currently there are seven vessels active which are all Kenyan registered. The trawling season is open from March 1 to October 31 and the average annual catch totals 237 metric tons (Kochev 2008).

The third zone exists between 12 and 200 nautical miles offshore and is the Exclusive Economic Zone (EEZ). Commercial fisheries are permitted here but fishers are actually instructed to respect a 15 nautical mile zone. The potential yield of the EEZ has been estimated to be as high as 150,000 tons (Hemphill 2008; Mageria, Makogola & Ndegwa 2008). Vessels have to be licensed and there is an urgent need for a monitoring system (Aloo 2007). The fleet consists of 'long-liners' and 'purse-seiners' that are required to keep records of their catches but it is likely that much of the catch is not reported (see MRAG 2005).

Long-liners fish with long lines and large hooks. The number of vessels at any time of the year ranges between 20 and 50, depending on season. There is one registered Kenyan vessel among them, the rest are mostly from China and Taiwan. They are required to obtain licences from the Mombasa Fisheries Office for either one month (\$5,000), three months (\$7,000) or twelve months (\$12,000). In addition, they are required to keep catch records by species, which are registered and accounted for internationally. The Fisheries Office in Mombasa keeps records of long-liner catches; these figures do not appear in Kenyan statistics because catches are taken mostly elsewhere.

Purse-seiners use large nets that close at the bottom. There are 35 vessels of this kind active mostly from Spain and France (operating out of Mauritius). Annual licences, which are issued by the Director's Office in Nairobi and paid there, cost \$20,000 per vessel. No catch records are available and, as far as known, none are kept in Kenya until now.

... small-mesh nets, beach seines, poison and explosives (Ochiewo 2004), can alter the terrain as well as the ecological balance of the reef and seafloor (Mangi & Roberts 2006). Local fishers generally do not approve of destructive fishing methods since they are aware that these will ultimately lead to poorer catches. Indeed, nearly all fishers were concerned with the degradation of marine resources and declining fish catches.

Fisher households can continue to draw a livelihood from fishing with access to better fishing techniques, enough desirable species in catches and proper marketing facilities. This requires sustainable fishing methods in combination with improved care of breeding grounds to assure the long-term future of the fisheries. However, an increase in the use of illegal and destructive fishing methods is equally possible. For example, there have been reports of the placing of traps in breeding sites, the use of poison in Ungwana Bay⁴ and even the occasional use of explosives on the south coast (East African 2000). (Dynamite is commonly used in Tanzania; see Guard & Masaiganah 1997; Horrill & Makoloweka 1998; Jacquet & Zeller 2007). Although the sales of shells and corals are banned in Kenya, they are still being collected. It is also likely that local aversion to Marine Protected Areas will increase. Resistance was already expressed to the proposed Diani Reserve, which then was rejected by the local population (Alidina 2005). Nevertheless, the Reserve was officially established by the authorities in 1995 (WIOMSA 2007).

In spite of the impending plight of fishers, little is being done. Fishers have been largely neglected and few, if any, alternative forms of livelihood are available to them. Furthermore, there is little knowledge about social and economic characteristics of inshore fishing. Income opportunities of fisher households differ greatly as they depend not only on the characteristics of the coastline and the fishing grounds but also on other geographical as well as social and cultural factors. The impression is that household incomes and income composition vary greatly among fishing villages and within villages. In some parts of the coast, fishers are regarded as the 'poorest of the poor'; elsewhere they are considered 'well off' (Mwadime 1996). Moreover, little is known about other resources that fishers may possess, the nature of these resources, and to what extent households are dependent on them.

The majority of fishers targeted finfish but they used different types of vessels. Others fished for crabs, octopus, and lobster. Some fishers used nets, others traditional traps, spear guns, hand lines or fixed fences. This diversity in craft and gear implied a high disparity in interests and stakes. Since there were no co-management arrangements existent at the time, enforcement of fishing regulations was ensured by sporadic patrols by the District Fisheries Officer.

Vessels were owned by owner-captains (45%) or hired from a *tajiri* (almost 40%). A *tajiri* is a trader and entrepreneur who buys the catch that fishers bring in and also leases vessels and gear to fishers in return for a share of 20-50% of the daily catch; the remainder is shared among the fishers operating the vessel (Glaesel 1997a).

One-third of the fishers always landed their catch at the same site. Two-thirds of the fishers visited other landing sites on the occasion when they fished elsewhere or because they deemed marketing opportunities better there.

The catch was usually divided as follows: the owner of the boat typically took 40-50% of the catch, either the *tajiri* or the captain himself; the remaining half of the catch was divided in equal shares among the captain and crewmembers with an extra share for the owner of the gear. Sometimes, an experienced captain was entitled to an extra share when taking out an inexperienced crew. These arrangements, however, were flexible and subject to change.

Once the catch was landed, the fish were sold to various traders. Almost all marine fish marketing in Malindi and Kilifi Districts was on a local scale. This type of marketing involved buying and selling at landing sites, open markets or fish shops. The sellers included both fishers and traders in their individual capacities. Most of the fish was sold fresh and consumed locally, although some dealers took them to Mombasa, Nairobi and elsewhere. The fish were nearly always sold to traders and intermediaries, hardly ever directly to consumers. In about a third of the cases they were sold to a *tajiri* who had the right of first refusal for the catch of certain fishers; clients who rented his boat or who had been assisted in some way in the past. This occurred more often in the coastal tracts of Ngomeni, Kilifi and Takaungu. At least half the traders were women.

Traders usually had a specialty such as small finfish (29%), medium finfish (35%), large finfish (18%) or shellfish (14%). They differed significantly in the average amount of fish they purchased daily; roughly a third bought less than 10 kg (small-scale buyers), a third between 10 and 50 kg (medium) and a third more than 50 kg (large-scale). Half these traders had more than five years of experience in the trade. Most traders frequented only one landing site while almost 40% of the traders frequented two, three or even more sites. Only a third of the traders offered incentives such as financial assistance (15%) or foodstuffs (9%) to the fishers during times of hardship. Almost half the traders, fried the fish before selling them. Only a third of the traders had access to a cooler or freezer. The destination of the fish included the nearest village (29% of the traders), the nearest village on the tarmac road (27%) and urban destinations such as Malindi or Mombasa. Transport was either on foot (43%), bicycle (23%) or matatu/bus (33%).

For pricing purposes, finfish were divided into five categories, namely small (<20 cm), medium (20-50 cm) and large fish (>50 cm) with the medium and large fish being further divided into Grade A and Grade B, depending on the degree of freshness ("some fish are more dead than others"). Fixed prices for the five categories were generally accepted with possible differences among landing sites (depending on accessibility and transport costs). Fishers and traders rarely argued about the price for a certain category of fish, but arguments did occur about the size classification of the catch and between grade A and B. The buying prices and selling prices reported by the traders for the five categories of fish were recorded. On average, there was a price difference of Ksh 5/kg between the different categories of fish, starting from about Ksh 60 for small fish to Ksh 80 for large (A) fish.

... marketing constraints. The constraint that was most often mentioned was the lack of storage facilities for the highly perishable commodity (Kenya 1997); which calls to mind the same observation made by the coastal fish warden, Allfree, in the 1950's (see Chapter 1). This often led to the disposal of fish at throw-away prices in order to reduce losses (alternatively, the fish were given to relatives or

business contacts of the traders). This was further compounded by the general poor state of the roads leading to the landing sites. As a result, many traders had to incur high transport costs to reach landing sites and markets.

The marine fisheries sector also suffered from lack of credit facilities (Kenya 1997) which negatively affected the development of the sector. Availability of credit ensures that traders can invest in processing, storage and transport facilities.

The failure of many of the co-operative societies also affected marine fish marketing negatively. Some local co-operatives collapsed because of improper management by poorly educated officials who had low managerial skills and lack of foresight, not to mention greed and corruption (Mwakilenge 1996). The government identified the need for education and training as essential to the development of co-operatives and organized a number of courses to train secretaries, managers, chairmen and the general membership but this effort did not yield encouraging results as the cooperatives did not recover.

Everybody can start fishing whenever he wants and in the way he wants. It is not like you have to look for it a long time and to go through a lot of trouble. (Mijikenda fisher⁵, Takaungu)

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

My family had been farming for a long time, my grandfather and his father and so on. But when I was young, the harvest was not that good anymore and it would become a problem for me to live from farming alone when I wanted to start a family. So I started fishing. Other fishers took me out and taught me how to do it. And some of my sons started to help me fishing and they will become fishers as well! (Mijikenda Fisher, Uyombo)

We do not own the sea, it is the KWS who thinks you can own sea! Sea is for everybody; so one fisher can never deny another fisher to go fishing. Unless that fisher must be fishing in a way that is not accepted by the fishers. You know like the Wapemba⁶, we chased them because they were ruining everything! (Former Bajun fisher, Uyombo)

Restricting access to fishing grounds, in the form of a seasonal or all-year ban, is an important conservation measure. In the past, there were restrictions such as the 'sadaka', traditional ceremonies in which certain areas were designated as off-limits for local fishers, but these ceremonies have fallen largely into abeyance. In November 2000, a 'sadaka' was called in Takaungu but only nine fishers attended. The nine were all Muslims and over the age of forty. The ceremony itself consisted of eating on the beach, offering some food to the sea and not fishing in that spot on the day of the ceremony.

There is a ceremony in which blood should be given to the sea. A goat is slaughtered and prepared and eaten. Some is given to the sea. Elder fishers say some words to the gods of the sea to ask them

⁵ The number of fishers has been increasing over the past decades with the entry of the *Mijikenda* into the arena, a group not known for its fishing prowess until now (with the exception of the Digo on the south coast). Reasons for their entry included the open and easy access of the resource, the lax enforcement of licence regulations and the need for employment.

⁶ Migrant fishers from Tanzania

for a higher catch. After the ceremony there should not be fishing at the spot of the ceremony for a week. This ceremony is not there anymore, the fishers have become too many and are not co-operating anymore. The elder fishers who were always arranging this have died years ago. I think the last ceremony like this must have been 10 years ago. (Swahili fisher, Takaungu)

Artisanal fishers on the Kenyan Coast face dwindling resources and heavy competition from tourism and human settlement, as is happening in many coastal areas in the third world. This will necessitate access to better fishing techniques and improved marketing facilities to continue with fishing as a means of livelihood and employment for local people. Sooner or later, however, fisher households, out of necessity, will have to broaden their resource base. Households that secure additional resources, notably non-maritime employment, strengthen their livelihood strategies in this way and improve household security.

If employment opportunities were to be actively stimulated by government measures, there are two aspects that require careful consideration, namely, the type of employment and the geographical distribution. Employment opportunities within the fishing industry are limited by current catch levels that, already in 1996, were judged to be at maximum sustainable yields (McClanahan 1996). Employment opportunities outside the fishing industry will inevitably attract workers from outside the fishing communities as well. If the new industries are situated near Mombasa they will not offer easy access for fishers living a long distance away. But if the new industries are situated in more remote areas and near the coastline (to be in easy reach of the fishers), then it is likely that outsiders will follow. These newcomers will find accommodation locally and will realize the possibilities of taking up fishing for an extra income. The authors have learned that 'new' fishers usually stay near the coast, around the coral reefs. This will most certainly increase the pressure on this delicate part of the marine ecosystem, which is already under high pressure from tourism and pollution. A paradoxical scenario threatens in which employment opportunities designed to assist fishers will attract other people to the coastal strip where they will fish as an additional source of income and increase pressure on the marine environment.

The locally used word *dau* or *dhau* refers to specific vessels; the word *dhow* common in English usage refers to a much broader class of vessels including *dau*, *mashua* and *jahazi*. Therefore, a *dhow* is not always a *dau*.

Mwirigi, F. M. and F. S. Theuri (2012). "The challenge of value addition in the seafood value chain along the Kenyan north coast."

(Mwirigi & Theuri, 2012)

Currently, most sea food in Kenya is handled, processed, transported and stored without proper equipment and through fairly unhygienic and un standardized processes, which makes it very difficult for Kenya's sea food products to easily access the outside market. Even in the face of these challenges, very little in the way of enhancing the entire fish processing and marketing value chain has happened in the last decade. The Kenyan seafood industry presents a complexity of interwoven value chains which cut across fresh and processed fish, industrial and artisanal processing, domestic and export markets and food and feed products. The sea food sector would have probably grown further if value addition at the various stages of the supply chain are considered and post-harvest losses minimized. The biggest challenge, therefore, is how to enhance the sea food value chain by adding value at various points in order to make the industry and its products competitive both within and outside the Kenyan market.

Projects initiated to improve the industry have not achieved expected results. Although several facility upgrading processes have taken place and a few chain based initiatives initiated, the entire effort has been rather myopic in focus. Studies show that strategic efforts are required in order to strengthen existing weak financial structures, reengineer industry governance structures, and resolve socio-

cultural and environmental concerns (Ardjosoediro & Neven, 2006). According to Ardjosoediro and Neven (2006) the high levels of post-catch losses indicate that the introduction of coolers and improved ice distribution systems would be an upgrade strategy that could stimulate value chain growth.

One of the biggest challenges faced by the seafood sector in the Kenyan coast is value addition. There lacks adequate value addition facilities. Most of the seafood products are therefore sold in their raw form. Since most of the products are sold raw, fishermen reap insignificantly from the chain. There is, also, inadequate information on market opportunities and ignorance on prices, trends and customer needs. The chain is also significantly underdeveloped given that there is very little linkage between the value chain nodes. Moreover, there is very little value addition at various points in the chain. Most of the seafood products are sold in their raw forms.

Mwakio, Philip, "Seaweed Farmers in Shimoni, Kwale, Prosper as Pioneers Eye Chunk of Lucrative Global Trade " <https://www.standardmedia.co.ke/business/article/2000179926/seaweed-farmers-in-shimoni-kwale-prosper-as-pioneers-eye-chunk-of-lucrative-global-trade> (accessed 19/12/2017).

(Mwakio, 2015)

Kenya's first ever seaweed farm has weathered the storm since its establishment more than a decade ago as the price offered by buyers begins to rise and with it farmers' profits. A farm in Kibuyuni village in Shimoni, Kwale County has also increased its produce, largely on account of training offered by the Kenya Marine Fisheries Research Institute (KMFRI). Kibuyuni Seaweed Farmers Organisation, production quotas rose and today the group boasts 50 members, most of them women, registered in 2012.

East African Seaweed Company, buys and exports the raw material to markets in South Africa and China. Experts estimate that seaweed farming could earn the country up to Sh40 million annually and help uplift thousands of lives of those who depend on fisheries.

Studies have uncovered a market potential that could place the country in the same league as its neighbours Tanzania, which, for 20 years, has been supplying the global seaweed market with a sizeable product. KMFRI first set up Kibuyuni, a seaside village of 2,500 people, as a model farm. Over the years, other farms have been developed at Mkwiro in Wasini Island with 1,000 people, Funzi with 1,000 inhabitants and Gazi with 15,000 residents. "Seaweed farming has been identified as a good prospect for social and economic development of coastal areas. It is aimed at diversifying livelihood opportunities for poor fishing communities whose source of income has been seriously put at risk by diminished capture of fish," said Morris Mukaraku, the officer in charge of the Corporate Affairs Department at KMFRI.

Extracts of dried seaweed are used as food thickeners and in the global pharmaceutical and cosmetic industries. Seaweed has also been used as an additive to soils, mainly in coastal areas where the partly dried seaweed is transported to areas that need to be fertilised. The high fibre content of the seaweed acts as a soil conditioner and the mineral content as fertiliser.

From each farm, one metric tonne of dry seaweed is harvested every six weeks, translating to between eight to 10 harvests a year. A metric tonne of produce at current market rates sells at Sh12,000. The seaweed is mainly exported to America and Asia where demand has been rising. Two strains of seaweed known as *Kappaphycus alvarezii* (cottonii) and *Euchema denticulatum* (spinosum) are available at the South Coast.

Oduor-Odote, P. and J. Kazungu (2008). "The body composition of low value fish and their preparation into a higher value snack food." *Western Indian Ocean Journal of Marine Science* 7(1).

(Oduor-Odote & Kazungu, 2008)

In Kenya, marine catfish (*Galeichthys feliceps*) and ribbonfish (*Trichurus lepturus*) are both under-utilized species from the prawn fishery where they occur as by-catch or discards. They represent a potentially valuable source of protein mince. The current study assessed the feasibility of increasing the value of this by-catch by testing its suitability to the production of snack foods which was prepared with locally available flour from rice, wheat and maize. The ratio of fish mince to flour, the carbohydrate component, was tested in the snack foods at ratios of 2.5:1; 2:1 and 1:1. An untrained taste panel using a hedonic scale of 1 to 9 tested preference. Protein content, fat, moisture, amino acid and fatty acid composition are reported and both indicate the nutritional suitability of the selected fish. The overall order for preference was ribbonfish with rice then ribbonfish with wheat, catfish with rice, ribbonfish with maize and catfish with wheat. Rice was preferred for value addition and ribbonfish was the preferred fish in the formulations.

Wastage in terms of by-catch, fish discards, and low value and or under-utilized fish from the prawn trawl fishery was estimated to be 1,800 tonnes per annum (KMFRI- Ungwana Bay report, 2002). This by-catch is a significant portion of the fishery resource that is not currently utilized for human consumption due to the lack of technology, handling, or process methods to transform the fish into stable and acceptable products. In addition, such fish are not utilized, or available for human consumption because they are either small, bony, devoid of taste, un-economical to process, and may not be landed by trawlers due to storage limitations.

POSEIDON, et al. (2014). Ex ante evaluation of a possible future fisheries partnership agreement and protocol between the European Union and Kenya (Framework contract MARE/2011/01 – Lot 3, specific contract 7). Brussels, 91 p.

(POSEIDON, MRAG, COFREPECHE, & NFDS, 2014)

Table 1.3: Kenya's GDP by sector (million EUR)

	2008	2009	2010	2011	2012	Change (2008-2012)	Average change (2008-2012)
Agriculture and forestry	4 519	4 998	5 022	5 800	8 121	79.71 %	15.94 %
Fishing	91	89	135	121	148	62.64 %	12.53 %
Mining and quarrying	143	109	162	169	215	50.35 %	10.07 %
Manufacturing	2 192	2 111	2 320	2 339	2 882	31.48 %	6.30 %
Electricity and water supply	420	398	326	258	430	2.38 %	0.48 %
Construction	772	877	1 005	1 001	1 288	66.84 %	13.37 %
Wholesale & retail trade, repairs	2 055	2 097	2 400	2 567	3 186	55.04 %	11.01 %
Hotels and restaurants	228	355	391	404	513	125.00 %	25.00 %
Transport and communication	2 074	2 113	2 365	2 426	2 922	40.89 %	8.18 %
Financial intermediation	939	1 159	1 320	1 544	1 616	72.10 %	14.42 %
Real estate, renting and business services	1 030	1 050	1 133	1 078	1 331	29.22 %	5.84 %
Public administration and defence	1 022	1 068	1 306	1 220	1 695	65.85 %	13.17 %
Education	1 269	1 280	1 460	1 411	1 714	35.07 %	7.01 %
Health and social work	495	542	596	594	745	50.51 %	10.10 %
Other community, social and personal services	687	715	778	774	988	43.81 %	8.76 %
Private households with employed persons	79	92	103	106	138	74.68 %	14.94 %
Less: Financial services indirectly measured	- 175	- 232	- 199	- 254	- 253	44.57 %	8.91 %

Figure F: Kenya's GDP by sector (POSEIDON *et al.*, 2014)

Kenya's coastal waters are relatively consistently lined with reef, providing near-shore fishing grounds for artisanal vessels. Primary production levels are relatively high compared to levels in the region as a whole, meaning that offshore tuna resources are also abundant.

Kenya's development strategy is driven by its 'Vision 2030' document. The document sets out a series of 'economic', 'social, political', and 'enablers and macro' strategic pillars, and within each of these pillars there are a series of higher-level 'goals' per sector.

In respect of trade of fish products in and out of Kenya, trade is primarily driven by the unit cost of the product and the best prices that can be fetched in different markets; higher priced fish products (mainly Nile Perch from Lake Victoria, but some marine products such as lobster, octopus, shark and tuna) from Kenya tend to be exported to higher income export markets, while fish protein imported to Kenya tends to be in the form of lower quality and cheaper small pelagic fish products.

The Ministry of Agriculture, Livestock and Fisheries is responsible for fisheries policy, with the Ministry's State Department for Fisheries (SDF) in charge of implementation of policy in relation to fisheries management and conservation. The designation of a specific department for marine and coastal fisheries is a new development with potential implications for the staff to be included in any negotiations over a possible FPA/Protocol with the EU.

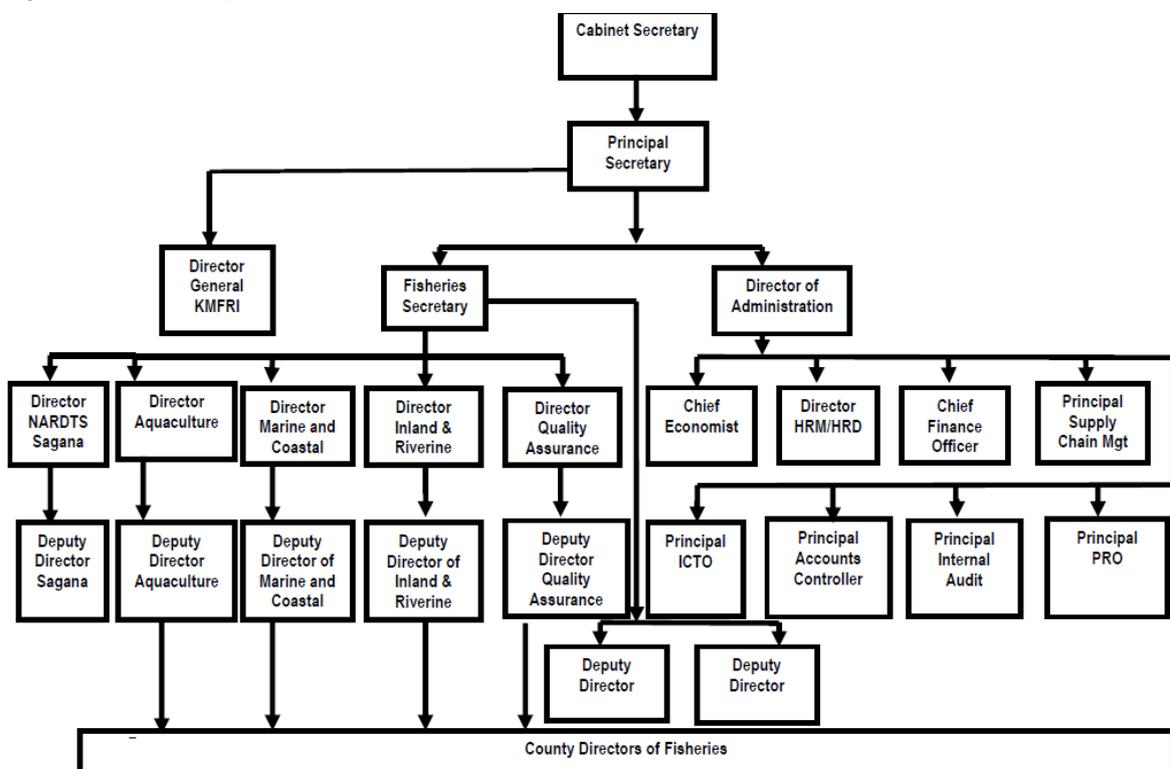


Figure 2.1: State Department of Fisheries organogramme

Figure G: Organogram State Department of Fisheries (POSEIDON *et al.*, 2014)

The Kenya Marine and Fisheries Research Institute (KMFRI) is the principal research organisation in the country. Other departments and organisations relevant to the management of fisheries are the Kenya Maritime Authority (KMA), responsible for vessel registrations; the Kenya Ports Authority, the Kenya Navy and the Marine Police, which have a role in monitoring, control and surveillance (MCS); and the National Environmental Management Authority (NEMA).

Kenya Maritime Authority:

- o vessel registration in Kenya;
- o liaison with the seafarers union;
- o maritime training and standards; and
- o monitoring of vessels passing through Kenya's EEZ.

Kenya Ports Authority:

- o port operations;
- o port maintenance; and
- o port entry regulation.

Kenya Navy:

- o defending maritime interests;
- o coastguard duties and surveillance;
- o sea patrols; and
- o EEZ surveillance.

Marine Police:

- o area of operations focuses on inshore and coastal areas out to 12 nm;
- o customs surveillance (smugglers, etc.);
- o illegal immigration surveillance; and
- o inshore fisheries compliance.

National Environmental Management Authority (NEMA):

- o oversees the Environmental Management and Coordination Act 1999;
- o assesses stock of natural resources in Kenya; and
- o identifies necessary projects for which environmental impact assessment is required.

Recent developments include the preparation of the Fisheries Development Flagship Project under the Kenya Vision 2030 mentioned above (budgeted at EUR 348 million, and including a wide range of inland and marine fisheries activities), and the Kenya Tuna Fisheries Development and Management Strategy 2013-2018, which outlines the intended development of tuna fisheries value-chain activities, including fishing, management (including MCS and scientific observers), governance, and processing and value addition. Kenya has also implemented a range of protected areas, but all declared marine protected areas (MPAs) are in coastal regions and are not beyond the 12 nautical miles (nm) territorial sea (and do/would not therefore have an impact on EU vessels fishing in Kenya).

The low levels of funds and human capacity in Kenya limits its ability to effectively manage its fisheries sector, despite the development support mentioned above, and despite the fact that within the IOTC management framework it remains Kenya's responsibility to translate into law and enforce IOTC Resolutions it is a party to. MCS, observer, vessel monitoring systems (VMS), and at-sea enforcement capabilities are low, and while some port inspections take place of fisheries landings, Kenya's ability to know which vessels are fishing in its waters and to control them is limited given the assets at its disposal. In respect of the EU Illegal, Unreported and Unregulated (IUU) Catch Certificate Scheme (CCS) laid down in Council Regulation (EC) No 1005/2008 and subsequent legislation for third countries exporting marine fisheries products to the EU, Kenya as a flag state notified the EU certifying that a) it has in place national arrangements for the implementation, control and enforcement of laws, regulations and conservation and management measures which must be complied with by its fishing vessels, and b) its public authorities are empowered to attest the veracity of the information contained in catch certificates and to carry out verifications of such certificates on request from the Member States. Hence, Kenya can validate EU catch certificates for fishery products.

Kenya does not have an industrial tuna fleet, and the only domestic tuna-catching sector is therefore an artisanal fleet of around 800 small-scale vessels, all of which are typically confined to within 3-5 nm of the coast, catching around 300 tonnes (t) of tuna a year. The stocks of tuna being caught by the domestic fleet are regional stocks of skipjack, yellowfin and bigeye tuna, none of which is assessed by the IOTC as being overfished or subject to overfishing. The domestic prawn/shrimp and demersal fisheries are also exploited by small-scale vessels, and while research is poor, stocks are probably overfished and subject to overfishing (despite the lack of any industrial activity) due to poor fisheries management.

There are three principal companies providing supplies to visiting foreign fishing (and non-fishing) vessels employing around 500 people. One of these companies also engages in tuna processing,

operating on a 'fee for service' basis for major tuna traders, with raw material landed directly by EU purse seine vessels to the company's private berth before tuna is processed into loins to send to the EU for canning. The volume of processing is very sporadic, being dependent on good catches of yellowfin tuna in/near the Kenyan EEZ (in some years the company may process no tuna at all).

In 2013, 36 foreign purse seine vessels purchased vessel authorisations in Kenya for an annual fee of EUR 22 730: Republic of Korea (2), Spain (14), Seychelles (7), France (8), Mayotte (5). This fee has been discounted from the fee stated in legislation (EUR 37 880) for the past few years, because of the piracy situation in the WIO and a desire by Kenya to encourage foreign vessels to purchase authorisations, but could be raised in 2014. EU purse seine vessels are currently purchasing authorisations in Kenyan waters even if vessel catches are low. They currently do so under private access agreements, as part of the regional network of fishing opportunities that is so critical for the fleet because of the unpredictable migration of tuna in the WIO. The only data available on purse seine catches in Kenya are for French and Spanish flagged vessels between January and October in 2013 – this was 236 t, but catches are sporadic and in some years can be much higher depending on tuna migrations.

There have not been any foreign longline vessels authorised to fish in Kenya's EEZ since 2007, because of the threat of piracy. The Fisheries Act allows for varying timelines of fishing authorisation validity for longline vessels and thus at varying costs: EUR 7 575 for one month; EUR 15 151 for three months; and EUR 22 727 for 12 months. With the improving piracy situation, Asian longline vessels are showing interest in fishing in Tanzanian waters again, but have not yet applied for any authorisations to fish in Kenyan waters.

Kenya's needs from a possible FPA/Protocol include maximizing revenue and providing support for its domestic tuna sector in line with its Tuna Fisheries Development and Management Strategy and the new Fisheries Bill, as described in paragraph 8 above (i.e. support for the artisanal sector, value addition, improved MCS, etc.). Kenya also has a need that any sectoral support funding should pay particular attention to the activities identified and then either funded or not funded by the Kenya Coastal Development Project (KCDP).

The EU's needs from a possible FPA/Protocol with Kenya include fishing opportunities for 22-40 purse seine vessels, and around five longline fishing opportunities to be provided on a trial basis. In the case of both fleets the need is for opportunities to target highly migratory species, i.e. tuna and tuna-like species, to support its network of fishing opportunities for the EU fleet fishing in the WIO. A particular need for the EU fleet is to increase the security of fishing opportunities as currently EU purse seine vessels negotiate yearly authorisations under private agreements. While recognising the legitimate desire of Kenya to support its local tuna-processing sector, given the nature of tuna fisheries in terms of the migratory patterns of fish, the infrequency of landings, and the commodity nature of the product, the EU fleet needs a free market in terms of where it lands fish in order to maximise landing prices and use efficient landings and vessel support services in different ports. To meet the requirements of EU processors and EU consumers, the inclusion of purse seine and longline fishing opportunities in a possible FPA/Protocol is also needed.

Attempts in the mid-2000s by the EU and Kenya to sign an FPA were not successful, and a similar failure was experienced by the EU and Tanzania, suggesting that successful conclusion of FPAs/Protocols is not assured even if a mandate is given for negotiation. Other FPAs/Protocols in the region have however been successfully concluded.

Current private access arrangements by EU vessels with Kenya indicate likely demand by the EU purse seine fleet for an FPA/Protocol. There are currently no private agreements with EU longline vessels to fish in Kenyan waters, and use of longline opportunities in other FPAs/Protocols in the WIO has sometimes been low. However, the improving piracy situation in the WIO (if maintained) could encourage such vessels to fish in Kenyan waters in the future if fishing opportunities are provided.

There is a dispute over the maritime boundary to the north with Somalia, which would need to be taken into account in any FPA/Protocol between the EU and Kenya.

EU purse seine and longline activity in the fishing zones of countries in the WIO region result in considerable direct economic and employment benefits in the catching sector, upstream supply sector, and downstream landings and processing sector. While the benefits created by the longline fleet are not well documented, the economic and social benefits generated by the activities of the purse seine fleet alone are estimated to be 420+ jobs and EUR 140 million of value added in the EU, and 4 000+ jobs and EUR 22 – 40 million of value added in the WIO. The high level of processing of catch within the region, and the resulting economic and social benefits, are of special note. In the WIO Kenya is one country that already processes tuna caught in the WIO.

Catches made in the WIO by EU purse seine and longline vessels contribute significantly to the EU market, with product flows to the EU from the WIO of around 99 000 t of canned tuna, 18 000 t of loined tuna, 11 000 t of frozen tuna for processing, and 7 200 t of frozen tuna for direct consumption.

Table 1.1: specific details on Kenya's EEZ

Indicator	Value
EEZ	111 999 km ²
Shelf area	8 874 km ²
Inshore fishing area (IFA)	8 759 km ²
Coral reefs	0.2 % of world
Sea mounts	0.0 % of world
Primary production	611 mgCm ⁻² day ⁻¹

Figure H: Details on Kenya's EEZ (POSEIDON *et al.*, 2014)

The EU has engaged in fisheries development support through structured programmes and funding through sub-projects to these programmes. Most importantly such support has included:

- SmartFish;
- A two-year project 'Accompany Developing Countries in complying with the implementation of Regulation 1005/2008 on IUU fishing' (EU IUU project); and
- The African, Caribbean and Pacific (ACP) FISH II Programme. East Africa Projects

The following sections summarise relevant legislation.

Fisheries Act Cap. 378, 1991 (2012 Revision)

This Act provides the legislative basis for the Fisheries Director (subject to directions and approval from the Minister) to develop and implement any necessary regulations and policies necessary to manage the fishery – including landing controls, area restrictions, gear restrictions and harvest rules. The Act also specifies the authorisation requirements of vessels (differentiating between local and foreign vessels) in order to legally harvest living marine resources from Kenya's fisheries – though it does also allow provisions of free access for persons fishing in order to meet their own subsistence consumption requirements.

Fisheries (General) Regulations

This regulation provides more specific management measures on various fisheries as opposed to higher-level clauses in the Fisheries Act. Fishing authorisation fees are established within this regulation for both foreign longliners and purse seiners. The regulation bans the use of trawl gear within 3 nm of Kenya's coast – this has important implications for the prawn trawl fishery (see section 3.2). Furthermore, the need to obtain processing licences from the Director is specified.

National Oceans and Fisheries Policy, 2008

This policy covers both marine and inland fisheries, and was set as a wide-ranging policy and strategy of future fisheries management in Kenya. The policy recognises the unsustainable utilisation of Kenya's fisheries resources and the failings of management at the time driving this. The policy sets out its overall objective as "to enhance the oceans and fisheries sector's contribution to wealth creation, increased employment for youth and women, food security, and revenue generation through effective private, public and community partnerships". Amongst other points, the policy makes statements regarding the importance of monitoring, control and surveillance (MCS) and states that the government will facilitate the establishment of formal mechanisms for MCS systems. The policy also recognises the importance of international organisations with respect to their fisheries management and will harness regional collaboration to assist with policy objectives. A commitment was made to evaluate the progress of this policy, but reports did not appear to exist. A lack of development of the fisheries sector since this policy was introduced (as observed by the contractor) suggests that many components in the marine sector have not yet been addressed.

Fisheries (Beach Management Unit) Regulations

In schedule four of the Fisheries (General) Regulations, a list of designated landing stations are declared. Unless declared by the Director, each of these stations is to establish a BMU. This regulation is linked to the artisanal fishery and is not particularly relevant to the establishment of an FPA/Protocol, but it does demonstrate the methods of monitoring catches in Kenya. These BMUs have been mandated with the following objectives: to strengthen the management of aquatic resources, to assist with alleviating poverty through good governance, to recognise varying roles played by different community members, to ensure high quality standards, to prevent or reduce user conflicts in the sector. As a primary method of monitoring catches from vessels not landing at major ports (artisanal vessels), BMUs are to collect quantity and price information of all catch landed at designated landing sites.

Prawn Fishery Management Plan, 2010

The prawn fishery management plan covers the Malindi-Ungwana Bay, which is the main prawn fishing area in Kenya. It was introduced in 2010 following conflict between artisanal and industrial sectors and declining catch rates in the early 2000s, which saw the industrial fishery closed in 2006. The prawn fishery management plan was introduced in March 2011, and provided the basis for the industrial fishery to be re-opened on a limited scale (one vessel is now operating, but the plan allows for up to four vessels with a maximum engine size of 300 HP), with industrial vessels allowed to fish outside 3 nm between 1 April and 31 October and up to four industrial vessels with capacity of more than 300 HP to fish beyond 5 nm (Macfadyen, 2012).

Kenya Tuna Fisheries Development and Management Strategy 2013-2018

The tuna management strategy states that it is in line with several national plans, including the National Oceans and Fisheries Policy and the State Department of Fisheries Plan. Whilst not specifically stated, the tuna management strategy is also aligned well with the Fisheries Development Flagship Project discussed above. The plan provides a strategic step-by-step guide to the development of an industrialised tuna sector in Kenya, including development of tuna fisheries value chain activities, such as fishing, management (including MCS and scientific observers), governance, and processing and value addition.

The Fisheries Management Bill, 2013

This new Bill is currently being debated, and while its approval may be imminent⁴⁵, it has taken a long time to get to this point and so is only considered for this evaluation as a possible future development. Depending on which Act (the current one or the proposed new Bill) may be relevant for a future FPA/Protocol, it is worth noting two things. Firstly, this Bill will supersede the current Fisheries Act if passed. Secondly, the Bill states that any fishing authorisations⁴⁶ agreed upon under the current Fisheries Act will be upheld if this Bill is passed. The Bill is comprehensive and provides for many changes to the current Act. Importantly for the purposes of this evaluation, it provides for the development of an interagency MCS unit and landing obligations for any vessels fishing in Kenya's EEZ. The interagency unit is useful when considering the MCS capabilities of Kenya's authorities and how Kenya intends to conduct future MCS deployments.

Under this Bill, purse seine and longline vessels will be required (over the course of a year) to land 30 % of the catch from Kenya's EEZ into Kenya. These obligations (which may not be fully in line with the principles of a market economy as specified in the Cotonou Agreement) will exist unless trans-shipment has been authorised or otherwise prescribed.

Currently, there is no vessel monitoring system (VMS) operating in Kenya. A system has existed in the past, but the software running the system is not compatible with a large majority of the fleet fishing in the IOTC and therefore was not receiving signals.

Five observers are trained to conduct scientific observer trips on commercial vessels⁵⁷. However, two of them are not available to conduct trips due to full-time work commitments within SDF. Whilst the capacity exists to conduct observer trips, none is currently being conducted. This is due to lack of financial resources to pay observers and the ability to physically place observers on board vessels. Given foreign offshore fishing vessels rarely call to port in Kenya, some form of trans-shipment of the observer would be required, but a trans-shipping craft is not currently available to SDF.

Up until 2011, a Spanish-owned but Kenyan-flagged longliner was licensed to operate in Kenya's EEZ. This vessel primarily targeted swordfish, marlin and shark – with only a very small percentage (sometimes $\leq 1\%$) of tuna as bycatch. The vessel was hijacked by Somali pirates and once a ransom was paid, the vessel declined registration in 2011 and it is reportedly now operating in the Atlantic Ocean⁶⁴. As a result, and of importance to this evaluation and the ability of EU vessels to catch 'surplus resources' under a possible future FPA/Protocol, there is now no domestic commercial tuna fleet in Kenya.

Name of business	Service	Labour employed ⁷³	Storage capacity (tonnes)	Species	Products	Markets ⁷⁴
J. Fish Kenya Ltd	Processors	48	40	Nile perch	Chilled and frozen fillets, skins, maws, frozen and chilled H&G, chilled steaks and portions,	EU 75 %
Victoria Delight Ltd	Processors	38	40	Nile perch	Chilled and frozen fillets, skins, maws, frozen and chilled frozen H&G	EU 75 %
W.E. Tilley (Muthiaga) Ltd	Processors	126	60	Nile perch	Chilled and frozen fillets, skins, maws, frozen and chilled frozen H&G, chilled steaks and portions, maws	EU 75 %
Wananchi Marine Products Ltd	Processors	238	100	Tuna	Cooked and frozen tuna loins	EU 100 %
Sea Harvest (K) Ltd	Processor	44	8	Octopus, lobster, squid, cuttlefish, finfish	Whole, tails, chilled and frozen fillets	EU 75 %
Transafrica Fisheries Ltd	Processors	14	12	Octopus, squid, lobster, crab	1st stage process frozen, (past application for tuna loins)	EU 75 %
Crustacean Processors	Processors	9	2	Octopus, lobster	Whole and tails, 1st stage process (poor market for octopus, applying for finfish)	Domestic market
Amco Foods Ltd	Processors	13	6	Octopus, Nile perch	Chilled and frozen fillets, skins, maws, frozen and chilled frozen H&G	EU and domestic

Figure I: Overview of main seafood processors in Kenya (POSEIDON *et al.*, 2014)

Government of the Republic of Kenya (2007). Kenya Vision 2030.

(Government of the Republic of Kenya, 2007)

The Kenya Vision 2030 is the national long-term development policy that aims to transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment. The Vision comprises of three key pillars: Economic; Social; and Political. The Economic Pillar aims to achieve an average economic growth rate of 10 per cent per annum and sustaining the same until 2030.

The Social Pillar seeks to engender just, cohesive and equitable social development in a clean and secure environment, while the Political Pillar aims to realize an issue-based, people-centred, result-oriented and accountable democratic system. The three pillars are anchored on the foundations of macroeconomic stability; infrastructural development; Science, Technology and Innovation (STI); Land Reforms; Human Resources Development; Security and Public Sector Reforms.

Vision 2030 Delivery Secretariat is charged with the mandate of spearheading the implementation of Vision 2030 as the country's blueprint and strategy towards making Kenya a newly industrializing middle-income country . VDS provides strategic leadership and co-ordination in the realization of the overall goals and objectives of the Vision 2030 and its Medium Term Plans.

Kenya will raise incomes in agriculture, livestock and fisheries even as industrial production and the service sector expand. This will be done by processing and thereby adding value to her products before they reach the market. She will do so in a manner that enables her p[roducers to compete with the best in other parts of the world. This will be accomplished through an innovative, commercially oriented and modern agriculture, livestock and fisheries sector.

Government of the Republic of Kenya (2013). Second Medium Term Plan 2013-2017

(Government of the Republic of Kenya, 2013)

Similar efforts will be made to increase value addition and employment in fisheries and in the exploitation of our rich marine resource. In order to meet the goals of job creation, value-addition in agriculture, fisheries and livestock, and export diversification, the government will, therefore, establish special economic zones in partnership with private investors to support increased manufacturing and exports with high value added.

Efforts will be put in place for increased involvement of the youth in income generating ventures in the Agriculture, Livestock and Fisheries sector.

Fisheries Development and Management: This will be achieved through expanding the area of fish farming from the current high potential areas to Arid and Semi-Arid Lands (ASALs) and developing fisheries related infrastructure and strengthening of monitoring, control and surveillance systems.

Marine Resources and Fisheries: Kenya's marine resources are substantial and constitute a huge base for employment and incomes generation and improved livelihoods, especially for residents of coastal regions. In collaboration with the relevant stakeholders such as Kenya Marine and Fisheries Research Institute (KEMFRI) and KWS among others, efforts will be made to harness this potential through creation of more marine reserves and protection of Kenya's fish stocks by enforcing fishing regulations and more effective policing of our marine parks and resources.

Development of Coastal Beach Ecosystem Management: This project will entail the re-development of Kilifi , Kwale and Lamu into modern resort destinations by upgrading transport infrastructure and beach management programmes. Private sector will renovate existing hotels and build new ones, and participate in improving hygiene and sanitation facilities and beautification programmes. The project will also entail development of new niche products that include water sports (scuba diving, surfing,

water skiing), development of Marina along the marine continental shelf, enhanced security and safety (such as establishment of a coast guard service).

Programmes / Projects	Objectives	Expected Output/ Outcome	Implementing Agency
Fisheries Development	To increase fish production from capture and culture fisheries by 10% annually To reduce post harvest losses from approximately 25% to 5% by 2017; Development of the 200 mile EEZ for marine fisheries	Stock assessment & set reference points Increased fish production from capture and culture fisheries; Reduced fish post-harvest losses per annum; Increased exports of marine products.	NTD, FAO, MOEWNR, MOALF, CG

Bolton, J. J., H. A. Oyieke and P. Gwada. "The Seaweeds of Kenya: Checklist, History of Seaweed Study, Coastal Environment, and Analysis of Seaweed Diversity and Biogeography." *South African Journal of Botany* 73, no. 1 (2007): 76-88.

(Bolton, Oyieke, & Gwada, 2007)

The seaweeds of Kenya are fairly well-studied floristically, relative to other Indian Ocean countries but there has not been a thorough listing of the species recorded in Kenya for almost 30 years.

The first marine botanists to collect, identify and publish their own extensive works on the marine flora of the whole of the Kenyan coast were W.E. Isaac and F.M. Isaac. During the 1960's they carried out the first extensive survey from Manda Island in the north to Gazi in the south, including information on ecology and distribution.

The Kenyan seaweed flora thus far recorded comprises 386 species (214 Rhodophyta, 116 Chlorophyta and 56 Phaeophyceae: Appendix 1), and also includes 19 additional infraspecific taxa. This is a high figure, in keeping with the biogeographical position of Kenya, forming part of the Indo-West Pacific—the most speciose world marine coastal region (Lüning, 1990; Van den Hoek, 1984).

The narrow continental shelf on much of the Kenyan coast has implications both for seaweed ecology and commercial utilization. It limits the available habitat for seaweed growth and consequently limits natural populations with commercial potential. In addition, it also limits the area available for commercial seaweed aquaculture operations and this is exacerbated by the common occurrence of estuaries, with the concomitant lowered salinities that prevent successful cultivation. Bearing in mind the potential conflict with other coastal uses (e.g. fishing, nature conservation, tourism), it is imperative that studies be carried out to assess the existing habitat which could be used for seaweed cultivation systems (Wakibia, 2005, 2006, in press).

State Department for Fisheries and the Blue Economy. Marine Artisanal Fisheries Frame Survey 2014 Report. 2014.

Fisheries frame surveys play a vital role in the management of coastal artisanal fisheries resources by availing accurate and regularly updated information for policy and management decision-making and provide sampling frames to support various research initiatives. Since 2004, five bi-ennial frame surveys have been conducted in 2004, 2006, 2008, 2012 and 2014 but no survey was conducted in 2010 due to lack of funds. The Government of Kenya through the State Department of Fisheries has funded three of the surveys; 2004, 2006 and 2008. Funding for the 2012 and 2014 frame surveys was from resources provided by the Kenya Coastal Development Project (KCDP). The 2014 frame enumerated fishing effort variables including; the number of fishers, crafts, gears by type and mode of propulsion. Information on facilities at the landing sites including related infrastructure and services at the landing sites was also captured in the survey. Unlike other previous surveys, the 2014 survey incorporated gender disaggregated data so as to be congruent with the current national gender policy. Further, other fishing vessel attributes and navigational aids on board artisanal fishing crafts such as GPS, Compass, and fish finders were also enumerated. This report provides the current state of Kenya's marine artisanal fishing capacity and updates the current socio economic developments including the infrastructure developments and services provided at the landing sites. An analysis of the key findings from the survey and key recommendations are provided.

Table 2: Craft type descriptors used in the frame survey

Craft Type	Description
1. Dugout canoes	Is a craft curved out of a log of wood / tree trunk. It has no joints or planks
2. Hori	Flat bottomed fishing craft pointed at both ends used mostly in the shallow waters propelled by sail/paddles. It is strengthened by ribs (<i>mataruma</i>) on sides and the floor
3. Ngalawa	Is a craft pointed on both end and have outriggers on both sides (<i>mirengo</i>) propelled using sail
4. Dau	Flat bottomed fishing craft with ribs at the bottom and pointed at one end.
5. Mashua	Is a craft pointed on one end ,V-shaped bottom and sail propelled or engine. <i>Jahazi</i> is a bigger <i>Mashua</i> normally more than 12 meters.
6. Mtori	A craft with V- shaped bottom pointed at both ends with ribs propelled by an outboard Engine/or sail
7. Surf board	Is an elongated platform normally in the sport of surfing but currently used for the purpose of fishing
8. Fishing Rafts	A single or jointed fabricated floating platform made from locally available material including; Styrofoam, wood, bamboo etc
9. Foot fisher	Is a fisher fishing without use of a fishing craft

Figure J: description of fishing gear in the artisanal fishery (State Dept for Fisheries and the Blue Economy, 2014b)

The survey was a complete census of crafts, gears, and fishers operating at the coast and all landing sites facilities and services. The results of the survey showed that the total number of landing sites increased by 23.1% from 160 landing sites recorded in the 2012 frame survey to 197 in 2014. The number of fishers dropped to 12,915 compared to 13,706 recorded in 2012. There were 167 women fishers compared to 12,748 male fishers representing 1.3% of the total fishers. The number of active fishing crafts also reduced from 3,090 in the 2012 survey results to 2,913. Dugout canoes were the most prevalent fishing craft type accounting for 47.9%, 'Dhow' with flat at one end ('Mashua') (22.1%), 'Hori' (10.8%), 'Dau' (9%), Outrigger boats pointed at both ends ('Ngalawa') (5.7%), 'Mtori' (3.1%) Surf and rafts (1.4%) with catamarans recorded as others trailing at 0.1%. Based on the mode of propulsion, most of the crafts are non-motorised, sails (43%) and paddles (33%) are the

most important forms of propulsion for the crafts. Other forms of craft propulsion recorded include outboard engines (15%), pole locally known as 'Pondo' (7%) and Inboard engines (2%).

A total of 3,325 gill nets of varying mesh sizes were recorded in 2014 a 25.4% decrease from 4,168 recorded in 2012. The largest decline in the number of gears was noted in the longline hooks. A total of 8,127 hooks were recorded compared to 16,476 recorded during the 2012 frame survey. This represented a 50.7% decline in the recorded hooks. Hook size <4 were 3,327 (40%) and size 8- 10 were 3,794 (45%). The fence traps and basket traps were separated during the 2014 survey. Basket traps recorded were 3,898 while the fence traps were 118 all totaling to 4,016 which was a decrease by 9.5% in 2014 compared to 4,438 recorded in 2012.

The number of recorded illegal gears decreased across all gear categories as compared with the 2012 frame survey results. The survey recorded 193 beach seines compared to 217 recorded in 2012. Most beach seine nets are in use Lamu 97 (58%), Kwale 43 (22%) with Kilifi and Mombasa recording 26 (13%) and 13 (7%) respectively. Monofilament nets are also decreased with 2,692 nets recorded compared to 3,239 in 2012 survey. The number of spear guns slightly reduced by 7.4% to 962 in 2014 from the previous 1,039 recorded in 2012. The use of fishing and navigational aids was found to be in 149 crafts, depicting minimal use of technology in fishing operations.

Foot fishers represent 42% of the overall fishing capacity for the year 2014. The trend in the number of footfishers has been a marginal decline biennially since peaking in the year 2008 at 2536 footfishers. The overall count of footfishers active in the fishery is highly dependent on the time and season of the frame survey. The lowest numbers of footfishers ever recorded was in 2006 when the frame survey was conducted during the rough South East Monsoon season when most of the footfishers are out of the fishery and engaged in other economic activities.

As a general observation small dugout canoes are most abundant in the southern coastal counties of Kwale, Mombasa and Kilifi however, a definite shift in craft composition was observed in Tana River and Lamu Counties as larger crafts 'Mashua' and 'Hori' are the most dominant crafts used by fishers in these counties. Mtori vessels which were hitherto restricted in Lamu were evidently observed during the frame survey in other coastal Counties albeit in smaller numbers when compared with those in Lamu County. Outrigger fishing crafts locally known as 'Ngalawa' were most enumerated in Kwale counties, a few in Kilifi, Tana River and Lamu counties and no record of 'Ngalawa' fishing crafts were observed in Mombasa County. 'Hori' Fishing crafts were recorded in all the coastal counties but most abundant in Lamu and Kilifi counties. More than half of the 'Dau' type of fishing crafts was recorded in Kilifi County. The use of surf boards as fishing crafts was noted in both Mombasa and Kilifi Counties while in the other Counties surfboards were largely nonexistent. On aggregate terms the counties with the highest number of recorded constructed fishing crafts are Kilifi 35%, Kwale 33%, Lamu 18%, Mombasa 12% and Tana River County 2% respectively. These results are consistent with the frame survey results of 2012 and 2008 where similar observations were noted.

The most predominant mode of propulsion for the fishing crafts for the entire marine and coastal fishery is by sails consisting 43% of the total enumerated fishing crafts. Paddles were used to propel about 34% of the crafts. Mechanization of local crafts using outboard engines is observed to have increased from 10% of all fishing vessels in 2012 to 15% in 2014. However, the use of inboard engine in 2014 remained at 2% similar to the level in 2012. Overall, mechanisation of fishing crafts increased from 12% to 17% over the past two years. The remainder (7%) use a wooden pole locally known as Pondo for propulsion primarily the dugout fishing crafts in sheltered areas including, creeks and mangrove inlets. The primary mode of propulsion for dugout canoes is paddles, sails, and Pondo respectively in order of importance. Mashua crafts are propelled by Sails, outboard engines and inboard engines respectively in order of importance.

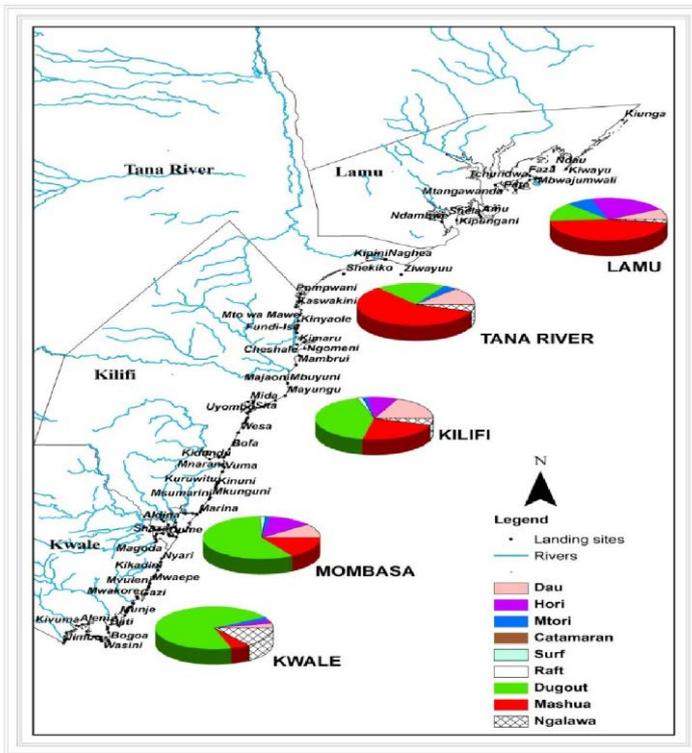


Figure K: Spatial distribution of artisanal fishing gear by Kenyan County in 2014 (State Dept. for Fisheries and the Blue Economy, 2014b)

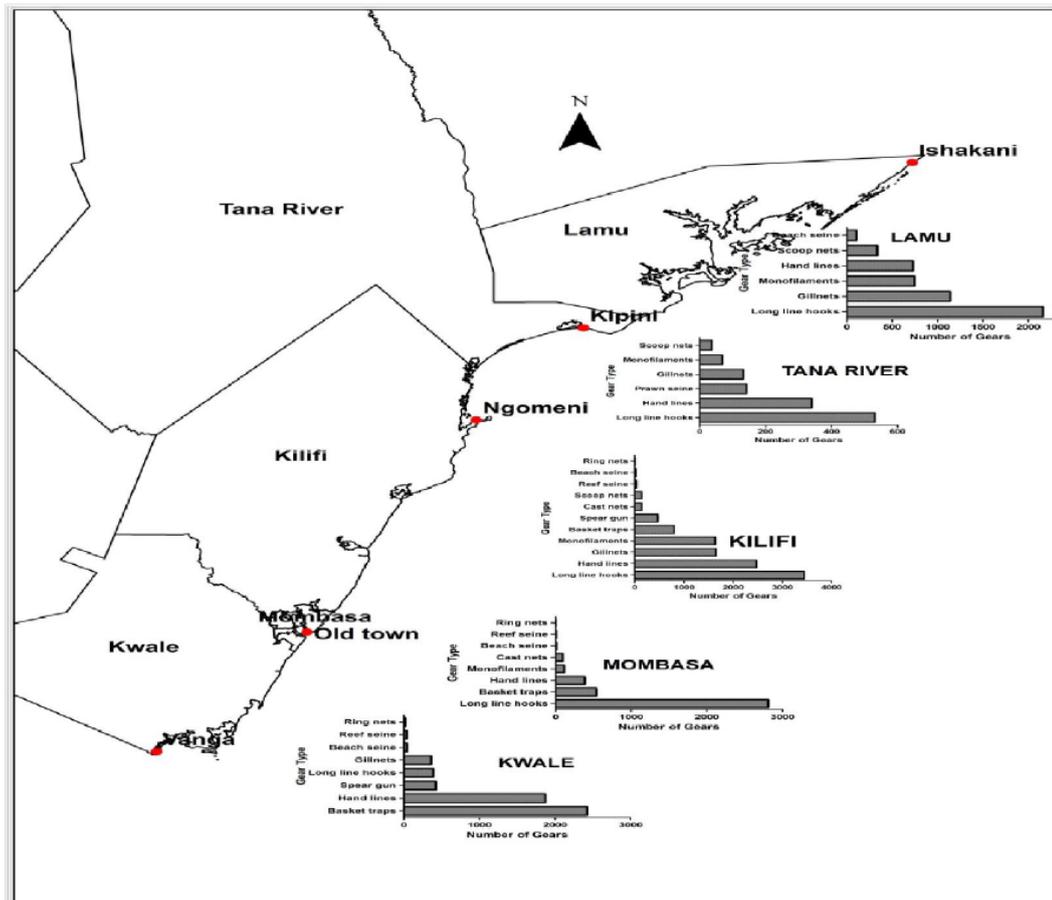


Figure L: Distribution of fishing gear by Kenyan county in 2014. (State Dept. of Fisheries and the Blue Economy, 2014)

Beach seine is an illegal gear in marine waters, but still in use. The number of beach seines in marine artisanal fishery waters has remained more or less the same since 2008 with records of 139, 211 and 193 in 2008, 2012 and 2014 frame surveys after reducing from 294 and 560 in 2004 and 2006 frame surveys respectively.

Monofilament nets are illegal gears and still in use in most areas of the Kenyan coast. The numbers have declined by 17% from 3,239 in 2012 to 2,692 in 2014 marine frame survey. Monofilament gillnets increased from 902 in 2004 frame survey to 1,050, 1,472 and 3,239 in 2006, 2008 and 2012 frame surveys respectively. Majority of these nets were recorded in Kilifi County where the number of monofilament nets increased from 1,496 in 2012 to 1,636 in 2014 FS.

Spear gun is an illegal fishing gear but a very common gear with the foot fishers. Until the 2012 frame survey, spear guns and harpoons were categorized as the same type of gear. In 2004, the number of spear guns together with harpoons was 449 and this increased to 1,039 in 2012 frame survey. A total of 962 spear guns were recorded in 2014 a decline of 7% from the number recorded in 2012 FS. Most of the spear guns were in use in Kilifi (465) and Kwale (420) in 2014 FS. In Mombasa County, a total of 77 spear guns were recorded in 2014 frame survey. Whereas the numbers declined in Kwale, spear guns have increased in Kilifi and Mombasa County in the 2014 FS. No records of spear guns use in Lamu and Tana River counties.

Migration of the fishers due to changes in the sea conditions and seasonal abundance of target species is a common phenomenon among the coast fishers. As expected, fishers tend to operate in areas that would generate maximum earnings during a particular fishing season.

The fisheries' services to the fishers ranged from daily to never. It is also clear from the trends that the sites near fisheries offices get more attention than those that are far from the fisheries personnel. The involvement on the BMUs to work with fisheries staff at the county level should be enhanced through BMU restructuring and capacity building for existing ones and increased coverage of the co-management through formation of more BMUs. Also resources need to be availed to county field staff to enhance the frequency of provision of services to the BMUs/Fishers.

State Department for Fisheries and the Blue Economy. Fisheries Annual Statistical Bulletin 2013. 2014.

(State Department for Fisheries and the Blue Economy, 2014a)

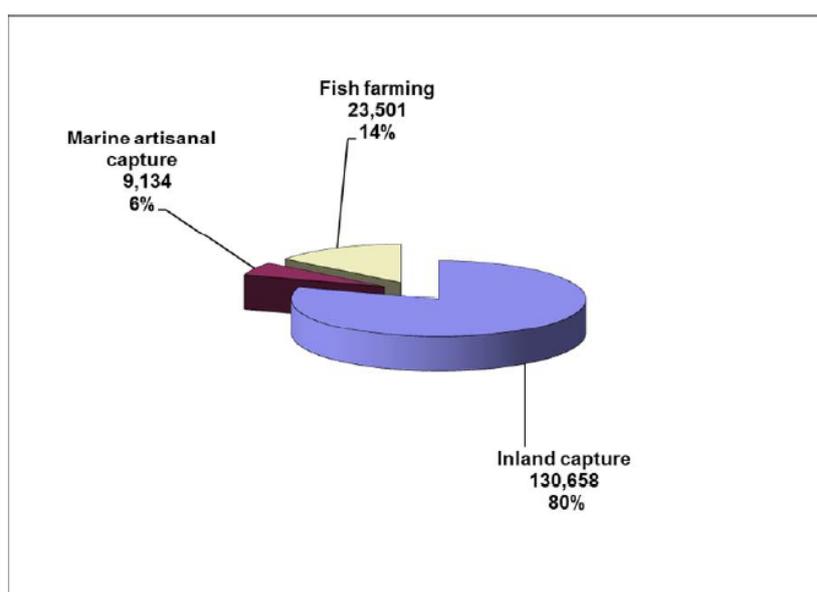


Figure M: National fish production by fishery category 2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

Marine capture production	Tonnes	000 Kshs.	Number of fishers	Number of craft
Demersal	4,433	523,153		
Pelagic	2,362	309,893		
Crustaceans	762	250,851		
Other marine (sharks, rays, sardine)	908	110,752		
Molluscs	669	103,523		
Total	9,134	1,298,172	12,915	2,913

Figure N: Marine fish landings by sector, weight and value in 2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

In Kenya, fisheries data collection structure relies mainly from designated officers in the field. The data collection system is centralized where a landing site data collector usually a Fisheries Assistant or a member of a Beach Management Unit (BMU) collects daily primary data from the landing site, compiles monthly catch totals for each respective landing site and files returns to the County Director of Fisheries who compiles a county monthly statistical report including all the landing sites within the county and submits the monthly reports to National State Department of Fisheries head office.

The Kenyan fishery is mainly artisanal with very few commercial/industrial vessels targeting mainly shrimps and several tens of purse seines and long liners owned by Distant Water Fishing Nations (DWFN) which operate under Kenyan licence in our Economic Exclusive Zone (EEZ) targeting Tuna and Tuna like species. The artisanal fishery accounts for almost all the inland and marine water catches reported in this bulletin and consequently it is currently the most important fishery in the country, even though our EEZ which is predominately for commercial fishing is under exploited with an estimated potential of between 150,000 to 300,000 metric tonnes.

	2011		2012		2013	
	M. tons	000 Kshs	M. tons	000 Kshs	M. tons	000 Kshs
MARINE FISH						
Lamu County	2150	138987	2,062	170,483	2,147	177,666
Tana River County	704	51735	596	43,979	698	66,158
Kilifi County	2152	250305	2,061	335,820	2,136	319,831
Mombasa County	860	121327	782	129,236	855	158,104
Kwale County	1879	174510	1,976	198,066	1,867	222,039
TOTAL	7,744	736,864	7,477	877,584	7,703	943,798

Figure O: Quantity and value of marine fish landings 2011-2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

The fisheries sector plays a significant role in employment and income generation. During the year under review the sector supported a total of 61,252 people directly as fishermen and 67,883 fish farmers with 69,194 stoked fish ponds. The sector supports about 1.1 million people directly and indirectly, working as fishers, traders, processors, suppliers and merchants of fishing accessories and employees and their dependents. Besides being a rich source of protein especially for riparian communities, the sector is also important for the preservation of culture, national heritage, and recreational purposes.

The inshore waters which are fishing grounds for artisanal fishermen are over-exploited and degraded.

Great potential exists in the exploitation of the Kenyan EEZ where estimates done in 1975-1980 indicate potential of 100,000 to 150,000 metric tonnes annually (FAO, 1980) and more recent estimates indicate potential of 300,000 metric ton (Habib 2003). This fishery is currently exploited by

Lobsters	93	80,899	98	94,255	123	114,952
Prawns	275	54,719	408	83,747	365	77,752
Crabs	206	40,922	235	55,251	274	58,146
TOTAL	574	176,539	739	233,253	762	250,851
MISCELLANEOUS						
Oysters	30	1,903	74	6,942	32	2,179
Beche-de-mers	46	30,832	36	18,676	48	35,296
Octopus	419	40,093	394	49,402	446	45,899
Squids	134	17,600	144	21,241	143	20,149
TOTAL	629	90,427	649	96,260	669	103,523
TOTAL ARINE	8,947	1,003,830	8,865	1,207,098	9,134	1,298,172

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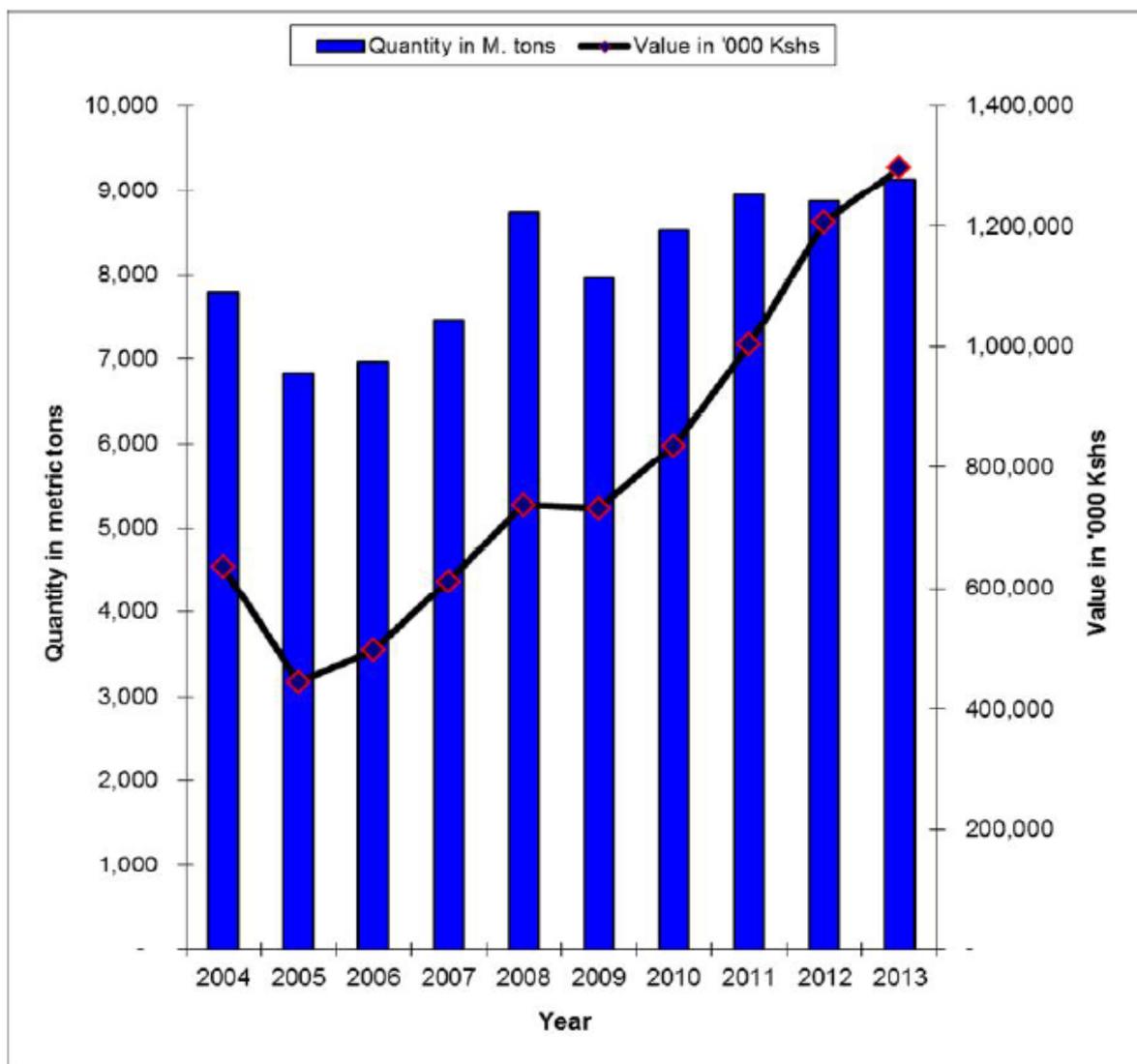


Figure P: Trends of marine fish production by quantity and value 2004-2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

Table 7: Marine fish landings by Species, Weight and Value 2011 - 2013

SPECIES	2011		2012		2013	
	M. tons	000 Kshs	M. tons	000 Kshs	M. tons	000 Kshs
DEMERSAL						
Rabbit fish	791	82,522	645	81,778	794	105,888
Scavenger	683	63,759	602	71,633	685	81,641
Snapper	346	38,443	432	54,197	347	49,224
Parrot fish	538	42,151	416	44,989	540	53,973
Surgeon fish	94	8,332	104	11,295	94	10,888
Unicorn fish	154	14,692	133	13,680	154	18,812
Grunter	160	14,919	161	19,855	161	19,103
Pouter	164	14,403	168	17,277	165	18,442
Black skin	174	14,146	225	20,890	175	18,114
Goat fish	115	11,460	125	14,940	115	14,674
Steaker	48	3,224	45	4,186	49	4,128
Rock cod	198	18,861	248	30,391	199	24,151
Cat fish	173	15,444	215	21,833	174	19,776
Mixed dermasal	778	66,211	781	79,531	781	84,780
TOTAL	4,416	408,567	4,300	486,451	4,433	523,153
PELAGICS						
Cavalla jacks	283	27,005	241	29,098	274	33,108
Mulletts	228	22,807	292	31,381	220	27,962
Little mackerels	339	32,183	329	37,998	328	39,457
Barracudas	327	33,869	260	31,386	317	41,523
Milk fish	63	5,578	79	9,521	61	6,839
King fish	173	20,835	121	17,942	168	25,544
Queen fish	199	20,711	179	20,889	192	25,393
Sail fish	145	17,735	142	21,193	140	21,743
Bonitos/Tunas	302	33,902	201	30,807	292	41,583
Dolphins	18	1,810	61	5,756	17	2,219
Mixed Pelagics	365	36,332	391	52,183	353	44,543
TOTAL	2,444	252,767	2,297	288,152	2,362	309,893
Sharks & Rays	306	31,602	373	46,064	314	46,339
Sardines	211	15,238	194	17,449	217	22,344
Mixed fish/Others	367	28,690	313	39,468	377	42,069
TOTAL	884	75,530	881	102,981	908	110,752
CRUSTACEANS						
Lobsters	93	80,899	96	94,255	123	114,952
Prawns	275	54,719	408	83,747	365	77,752
Crabs	206	40,922	235	55,251	274	58,146
TOTAL	574	176,539	739	233,253	762	250,851
MISCELLANEOUS						
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TOTAL ARINE	8,947	1,003,830	8,865	1,207,098	9,134	1,298,172

Figure Q: Marine fish landings by species, weight and value 2011-2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

AQUACULTURE

Prior to the year 2007, several initiatives on fish farming in Kenya had been executed by the Department of Fisheries, The main activities were geared towards using fish farming as a tool for poverty alleviation and food security, and were addressed through various project activities that included but not limited to: pond construction and management, stocking rates trials, feed trials, integration of fish farming with other agricultural activities, brood stock management, seed quality and evaluation of growth performance of Nile tilapia and Catfish strains.

These initiatives had limited impacts due to slow uptake of fish farming by entrepreneurs emanating from lack of information on fish farming technology and culture practices, limited funding by Government, and limited political support from the policy makers.

The Initiation of the Fish Farming Economic Stimulus Programme started during the 2009/2010 financial year in Kenya, has revolutionized fish farming practices in the country and has made Kenya a fish producing and fish eating Nation. The project was implemented in high aquaculture potential areas of Western Kenya, Nyanza, parts of Rift Valley, Eastern, Central Kenya and Coast regions. These regions are endowed with a lot of water resources that include springs, wetlands, rivers, water reservoirs and the temporary water bodies. The State Department of Fisheries has aggressively been promoting aquaculture development in the country to counter the declining production from capture fisheries. Aquaculture, being a food production sub sector, is being mobilized to positively contribute towards food security, generate income and create employment to our young generation.

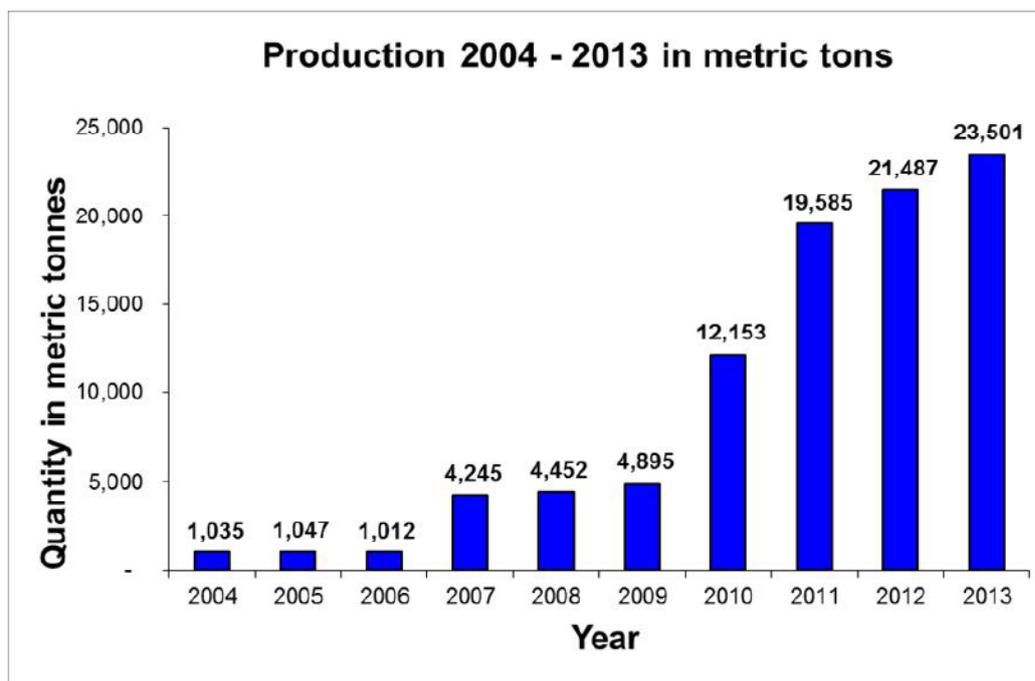


Figure R: Aquaculture production for the last ten years (2004-2013) (State Dept. of Fisheries and the Blue Economy, 2014a)

To enhance aquaculture production, up to date (end of 2013), the State Department has trained fishers, implementing officers and stakeholders on fish farming practises; conducted a national aquaculture suitability appraisal and developed suitability maps for 210 Constituencies in the country; developed a fish breeding structure with a holding capacity of over 200,000 brood-stock; developed fish feed specifications for tilapia, catfish and trout and related supply chain; procured 54 Fish Feed Pelletizing machines and distributed them to the constituencies; procured 148 Motorcycles and recruited 286 Fisheries Extension Officers for extension service delivery in the constituencies; constructed (4) Fish Processing Plants in Tetu, Imenti South, Rongo and Lurambi constituencies; constructed a state of the art fish processing factory in Mitunguu, Meru County in collaboration with private sector investors; constructed 3 Recirculation Aquaculture Systems (RAS) in Kiambaa (Jambo Fish Farm & Samaki Tu Fish Farm) and Kisumu Rural (Thinqubator Fish Farm) Constituencies; constructed over 69,194 fish ponds country-wide (46,824 fish ponds in 160 Constituencies country-wide by GOK, and some other 22,370 ponds under the multiplier effect by farmers and investors and stocked them with over 100 million fingerlings; increased the area under aquaculture from 722 hectares in 2008 to 2,076 hectares in 2013; increased national aquaculture production from 4,452 metric tonnes in 2008 to 23,501 metric tonnes in 2013.

IMPORTS AND EXPORTS OF FISHERY PRODUCTS

Commodity	Quantity (M. Tons)	Quantity (Pieces)	Value ('000Kshs)	% Quantity	% Value
Frozen Lizardfish	82		4,316	1.6	0.8
Frozen Mackerels	2,916		169,053	55.3	32.3
Frozen Mixed Marine Fish	356		24,502	6.8	4.7
Frozen Pangasius Fillets	116		9,597	2.2	1.8
Frozen Pangasius Fingers	1		157	0.0	0.0
Frozen Sardines	370		18,514	7.0	3.5
Atlantic salmon	2		823	0.0	0.2
Fresh Salmon	11		1,272	0.2	0.2
Frozen salmon	34		10,960	0.6	2.1
Smoked Salmon	2		1,607	0.0	0.3
Frozen Tuna	258		23,856	4.9	4.6
Frozen Tilapia	392		37,286	7.4	7.1
Frozen Tilapia fillets	347		137,623	6.6	26.3
Frozen Prawns	85		47,960	1.6	9.2
Frozen Shrimps	9		4,128	0.2	0.8
Frozen King fish	16		3,195	0.3	0.6
Frozen Reef Cod	81		6,029	1.5	1.2
Frozen Dorado	4		717	0.1	0.1
Frozen Herrings	75		4,018	1.4	0.8
Frozen Galate	1		115	0.0	0.0
Frozen Sword fish	1		168	0.0	0.0
Frozen Fillets	18		6,124	0.3	1.2
Assorted fish products	7		2,391	0.1	0.5
Fish feed	25		2,154	0.5	0.4
Tuna fishmeal	60		6,966	1.1	1.3
Sub Total	5,269		523,531	100.00	100.00
Aquarium fish		20,649	629		
Trout ova	-	450,000	1,049		
TOTAL	5,269	470,649	525,209		

Figure S: Imports for fish and fishery products 2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

Commodity	M. Tons	000Kshs	% Quantity	% Value
Nile perch Fillets	5,156	1,958,999	76.5	76.3
H & G Whole Nile perch	428	143,456	6.3	5.6
Fish maws	199	272,391	3.0	10.6
Frozen Lobsters	15	18,417	0.2	0.7
Live Lobsters	11	7,150	0.2	0.3
Live Crabs	17	5,897	0.3	0.2
Frozen Octopus	455	118,651	6.7	4.6
Frozen Squids	3	1,120	0.0	0.0
Bech-der-mer	5	2,572	0.1	0.1
Shark fins	6	3,929	0.1	0.2
Marine shells	134	7,552	2.0	0.3
Frozen Seabream	5	1,951	0.1	0.1
Frozen Snappers	26	7,918	0.4	0.3
Frozen Mixed fish	23	1,961	0.3	0.1
Tilapia	205	13,546	3.0	0.5
Barbus	54	3,376	0.8	0.1
TOTAL	6,742	2,568,886	100.0	100.0
Tuna loins	1,509	215,260		

Figure T: Exports of fish and fishery products 2013 (State Dept. of Fisheries and the Blue Economy, 2014a)

Okemwa, GM, B Fulanda, EN Kimani and J Ochiewo. "Exploitation of Marine Aquarium Reef Fisheries at the Kenyan Coast." *Advances in Coastal Ecology*, (2009): 28.

(Okemwa, Fulanda, Kimani, & Ochiewo, 2009)

Ornamental marine species (corals, invertebrates and fish) are the highest value-added product that can be harvested from coral reefs and are an important source of income for rural, coastal communities in developing countries (Lem 2001). The global aquarium trade (both marine and freshwater) involves approximately 350 million fish annually with a value of \$963 million (Tissot & Hallacher 2003). The marine aquarium trade accounts for approximately 10% to 20% of the global aquarium trade with an estimated 1,471 species of fish being traded (Wabnitz et al. 2003). With over 1.5 million people keeping marine aquaria in their homes or businesses, the value of the trade is estimated to be between \$200 to \$330 million per year (UNEP 2003).

Kenya's marine aquarium fisheries was established in the early 1970's but it has received limited attention by way of research and monitoring. The industry is important in providing a source of foreign exchange for the country as well as a source of livelihood for fish collectors and their families. The limited knowledge on the dynamics of exploitation has contributed to increased concerns by stakeholders (artisanal food fishers, dive-tourism operators, resource managers and environmentalists) that the fishery is having negative impacts on targeted populations and their habitats.

The supply network in Kenya is fairly simple, running directly from the collectors to the exporters and straight to the export market. Thus, there are no middlemen involved in Kenya's trade. The industry has experienced notable growth, with the number of export companies licensed to export marine aquarium fish doubling from 4, during 2000 (Wood 2001) to 8 at the time of this study. However, the airfreight data indicated that only two companies dominate the market exporting approximately 65% of the consignments. Similarly the number of registered fish collectors increased from 65 to 145 indicating that the fishery is experiencing increased pressure.

The exporters contract local fish collectors who are paid according to a set price per fish that has been determined for each species that is delivered alive and in a healthy state to the holding facilities. The price paid to the collectors varies among companies and is competitive as it is determined by various factors including the size of the fish, market demand, rarity, and catchability, ornamentation, and seasonal abundance.

To maintain high quality of fish and minimal mortalities, the exporters invest heavily on aquarium maintenance equipment (e.g. aeration and filtration equipment). However, the handling of fish also varies among the companies although there are some standard measures. Generally, the harvested fish are temporarily packaged in plastic bags or containers at the jetty and transported in vans to the holding facilities where they are kept in quarantine for acclimatization to life in captivity, as well as to detect and treat any injuries or infections before shipment. Any fish with infections are isolated and treated accordingly but treatment depends on the level of expertise of the handlers. The fate of fish that do not recover remains unknown although it can be assumed that they eventually succumb to injuries or infections of a fatal nature.

Upon receipt of an order from a client, the exporter must obtain an export permit from the Fisheries Department before any consignment can leave the country. Once this is done, the fish that have been certified to be in good condition are then packaged in plastic bags filled with oxygen and sealed. The sealed plastic bags are placed in insulated boxes and taken to the airport. Upon clearance by the customs department, the consignments are then air freighted to the destination markets.

The survey indicated that fish collectors were men of 25 to 42 years, with a mean age of 34 years. At the time of the study there were 145 licensed fish collectors working full time in the fishery. The authors however noted that there are some unlicensed fish collectors who collect aquarium fish for the local market (mainly hotels). The study also revealed that some fishermen who are licensed to target

Common name	Scientific name	Total harvested	Percent harvested
Allard's anemonefish	<i>Amphiprion allardi</i>	1666	10%
African pygmy angelfish	<i>Centropyge acanthops</i>	1442	9%
Rainbow wrasse	<i>Halichoeres iridis</i>	1192	7%
Palette surgeonfish	<i>Paracanthurus hepatus</i>	979	6%
Lyretail anthias	<i>Pseudanthias squampinnis</i>	851	5%
Striped sailfin tang	<i>Zebrassoma veliferum</i>	791	5%
Beautiful prawn goby	<i>Amblyeleotris aurora</i>	669	4%
Fire dartfish	<i>Nemateleotris magnifica</i>	641	4%
Skunk anemonefish	<i>Amphiprion akallopisos</i>	594	4%
Vermiculate wrasse	<i>Macropharyngodon bipartitus</i>	520	3%

There is a need to improve current regulatory and monitoring mechanisms concerning the marine aquarium fishery. Enforcement of the current regulations stipulated in the Fisheries Act needs to be improved at all stages of the local supply chain. Strengthened monitoring of the fishery will be an instrument for improved validation of data thereby leading to better characterization of changes and trends in the volume of exports and ecological impacts of the trade.

Ministry of Fisheries Development. A Management Plan for Fisheries Targeting Small and Medium Sized Pelagic Fish. 2013.

(Ministry of Fisheries Development, 2013)

The overall purpose of the plan is to ensure that the artisanal fishery targeting small and medium sized pelagic fish in Kenya is sustainable in the long term, providing the maximum social and economic benefit to the fishers that depend on fishing for their livelihood.

With respect to artisanal and sport fishery targeting small and medium sized pelagic fish, the general objectives of the Government of Kenya are:

1. Ensure long-term biological sustainability and ecological integrity of the pelagic fishery
2. To ensure development of a pelagic fishery that addresses community, national and regional concerns and interests
3. To optimize sustainable utilization and benefits from the pelagic fishery
4. Develop and improve governance of the pelagic fishery

It is estimated that that pelagic fishery accounts for 18% of the marine fishery landings, with 80% of the total marine products from shallow coastal waters and reefs, and about 20% from offshore fishing. The majority of marine fishing in Kenya is small-scale artisanal that operate in the coastal near-shore waters. This area is reported to have a potential to yield ~20,000 mt per year, however the annual marine catch from reef areas is thought to be closer to 12,000 mt per year. The pelagic fishery (last 20 years) accounts for about 25% of the landings, varying between 977 mt and 2096 mt. The fishery operates most effectively during the NE Monsoon when non-powered boats can venture into open waters.

Although not quantified, the current fishing methods are having a detrimental impact on the general ecology of the near shore environment. Of particular concern are the large amounts of bycatch (mainly juvenile fish but also marine mammals and sea turtles on occasion), destructive fishing gears, ghost fishing and some loss of habitat.

Competition on the use of coastal areas between various resource users targeting pelagic fish such as fishers using destructive fishing methods (beach seine and ringnets) versus other fishers is evident. Conflict between the artisanal and commercial fishers/sport fishers have been reported in fishing areas such as Watamu banks and Ungwana bay. Establishment of MPAs and community conservation areas has also created conflicts among resource users and managers.

It has been reported that for 2012 the six fish processing establishments along the coast employ 552 workers, although there are some 86 000 people directly dependent on the artisanal fish resources. The domestic fish market is not well defined and organized infrastructure is poor. Fishers sell fish at the beach to small scale traders who sell to various open-air markets further afield. It is evident that intervention is required to maximize benefits to the coastal communities.

Based on the outcome of the assessment those issues given a high or medium risk were further condensed into the following generic issues:

1. Ecological wellbeing:

- 1.1 Effectively open access system for the capture of small and medium pelagic species, and concomitant lack of adequate management measures and effect on the ecosystem.
- 1.2 Patchiness of information necessary to understand both anthropogenic and fisher effects.
- 1.3 Damage to the reef systems, including use of chemicals
- 1.4 Catch of juvenile fish: lack of gear restrictions
- 1.5 Climate related changes (General increase in water temperature and coral bleaching, algal blooms)

2. Community wellbeing:

- 2.1 Lack of use of information on traditional knowledge for management
- 2.2 Conflict between fishers using different gears and with the commercial fishery
- 2.3 Lack of economic and social information on the all aspects of the fishery.
- 2.4 Poor communication between fishers and Government
- 2.5 Lack of understanding of fisheries management by the fishing sector.
- 2.6 Lack of infrastructure, fishing (new gear), processing and marketing skills
- 2.7 Lack of alternative livelihoods in some cases
- 2.8 Inadequate capacity to oversee safety at sea

3. Ability to achieve:

- 3.1. Clear detailed policy required to inform the Management Plans
- 3.2 New ACT not yet signed into legislation
- 3.3 Management capacity and facilities lacking
- 3.4 Research capacity, infrastructure and equipment require attention
- 3.5 Inadequate financial planning of the management requirements for the sector: both Gov. and NGO's
- 3.6 Inadequate awareness of Government, fishers and general public of the need to ensure ecological wellbeing in the inshore waters of Kenya
- 3.7 Data management strategy requires revision.
- 3.8 Unclear mandates for safety at sea
- 3.9 Little management of fishing gear
- 3.10 Inadequate planning of specific management measures
- 3.11 MCS requires re-assessment and revision
- 3.12 Co-management initiatives require revision, particularly area bound management
- 3.13 Fees and levies structure requires restructuring
- 3.14 Funding implications to implement the management plan

The management and operational objectives are as follows:

Management objective 1: To optimize the social and economic benefits of the fishery to the people of Kenya

Operational objectives:

- 1.1: Effective rights based management introduced
- 1.2: An economic development strategy for the fishery in place
- 1.3: Traditional knowledge is an integral component of management
- 1.4: An adaptation strategy for climate change is in place

Management objective 2: To ensure the long term sustainability of the resource

Operational objectives:

- 2.1: Substantive and effective data informed by agreed assessment and management practices
- 2.2: Gear used is appropriate and does not result in substantial damage to the ecosystem

Management objective 3: To develop and improve governance of the fishery locally, nationally and regionally

Operational objectives:

- 3.1: There is adequate staff to implement the management plan
- 3.2: Effective motoring, surveillance and compliance in place
- 3.3: An effective fees and levies structure exists with clear guidelines for the use of available funds.
- 3.4: Adequate financial planning exists for the implementation of the management plan

Olale, Edward and Spencer Henson. "Socio-Economic Characteristics of Fish Workers in Western Kenya." *International Journal of Fisheries and Aquaculture* 4, no. 7 (2012): 139-153.

(Olale & Henson, 2012)

Note: This article is on Lake Victoria fish workers, so less relevant for the marine fisheries scoping study.

(1) 20% of the fish workers had secondary education, while 80% had primary or no formal education; (2) a fish worker had an average of seven dependents; (3) 98% of the fishers were males, while 83% of fish traders were females; (4) about 26% of fish workers had their diversified income; (5) 64% of the fish workers lived below the poverty line; and (6) fish workers who diversified income had lower incidence and depth of poverty.

The results implied that most fish workers (74%) rely on fish work as the sole income source and are therefore, vulnerable to declining and unpredictable fish catch. The impact of this vulnerability is reflected by the high poverty levels among fish workers. The results also indicated that fish workers who diversify income have lower levels of poverty. This means that income diversification should be considered as a possible strategy for reducing poverty.

Lang'at, JK, F Tamoooh, J Okello and JG Kairo. "Mangrove Plantation Experiments for Controlling Coastal Erosion at Gazi Bay." *Advances in Coastal Ecology*, (2009): 131.

(Lang'at, Tamoooh, Okello, & Kairo, 2009)

In Kenya, the main threats to mangroves are overexploitation of wood resources, conversion of mangrove areas for other land uses and oil pollution. Losses of mangroves have affected the local economy as witnessed by shortages of firewood and building poles, reduction in fishery, and increased coastal erosion. For most coastal areas in Kenya, coastal erosion has become of major social, economic and environmental concern.

This study aimed at testing whether the authors could use the easily cultivable mangrove species, *R. mucronata*, to control soil erosion. The inherent root architecture in *R. mucronata* (Tomlinson 1986) makes the species ideal for use in coastal protection. Under natural settings, the intertwined rooting complex of *Rhizophora* species stabilizes sediment by reducing erosive capacity of water passing through the root system (Wolanski et al. 1992). In fact, countries like Bangladesh have introduced large scale mangrove afforestation programs to minimize damage to coastal village and agricultural land from frequent cyclones (Saenger & Siddique 1993). The high mortality observed in encased saplings may be partly associated with poor installation of the bamboo tubing rather than natural causes. In the future the authors plan to experiment with different encasement types and installing saplings deeper into the sediment to reduce the probability of washing away.

Cinner, J, TR McClanahan, C Abunge and AW Wamukota. "Human Dimensions of Conserving Kenya's Coral Reefs." *Advances in Coastal Ecology*, (2009): 60.

(Cinner, McClanahan, Abunge, & Wamukota, 2009)

At the sites examined, fish marketing was done primarily by small and medium-scale traders. Small-scale traders include fish mongers and middlemen that generally bought fish at landing sites, did some processing (scaling, gutting, and possibly cooking), and either sold fish in local open air markets or transported fish to urban centres (i.e., Mombasa or Malindi) for sale in retail fish shops. In sites like Vuma, Marina, Vipingo, Kuruwitu, Mayungu, Mijikenda, and some landing sites in Takaungu, fish was sold mostly to small-scale traders on the beach. These small-scale traders typically lacked private motorized transportation and were limited by what they could carry on a bicycle, their head, or as 'carry-on' luggage on public transportation.

Medium-scale traders included traders with freezers or refrigerated storage capacity. Most medium-scale traders purchased fish directly from fishers and later sold to consumers in Mombasa or Nairobi and hotels in Malindi and Mombasa. Medium-scale traders were present in Bamburi, Shela, and one landing site in Takaungu. In the one site in Takaungu with a medium-scale trader, the trader owned a variety of vessels and gears and hired people to utilize his gear to capture fish. Large-scale traders that export fish by the ton were only present in Mombasa and Malindi.

Conflicts over marine resources were also reported, and typically were between gear users. Only Mayungu, Vuma, and Kuruwitu did not report fishery conflicts. Key informants in Bamburi Beach and Takaungu reported conflicts with Pemba (Tanzania) fishermen using a small purse seine net called a ring net. Local resource users complained that the gear was destructive and wanted the gear banned from use. In Takaungu, the gear was allowed by the landing site chairman for a fee of 5 shillings per kilo of fish landed. The money reportedly disappeared and was never accounted for. Interestingly, in Mijikenda, the chairman supported the use of the ring net because it would provide employment and when used properly in pelagic waters, would divert pressure from inshore marine resources. In Vipingo, community leaders suggested conflicts existed between local fishermen and aquarium fishermen.

The recently conceived BMU legislation began the process of the codification of an increase in local control of fisheries resources in 2006. The BMU essentially delegates local management authority of the fishery from the government fisheries department to elected representatives at each landing site. These local representatives form a beach management committee that can develop local by-laws to manage the fishery. Local by-laws could include closed areas, gear restrictions, effort, size, and species limits. Areas with limited access to fish landing sites may be able to use the BMU legislation to secure continued rights and access, which may be particularly important in Marina and Mijikenda.

Fondo, Esther Nazi. "Assessment of the Kenya Marine Fisheries from Selected Fishing Areas." Kenya Marine and Fisheries Research Institute, (2004).

(Fondo, 2004)

The true status of Kenya's marine resources is not known and the last resource assessments were done in the 1980s. Therefore, there is a need for updated assessments. Catches by artisanal fishers, who exploit the near shore resources on the continental shelf, are believed to have declined in recent years and catch rates have fallen. It is believed that the offshore marine resources are not yet fully exploited due to the lack of ability of artisanal vessels to fish offshore and the limited licensed offshore foreign fishing. However, scientific information to confirm this is lacking.

The most common objective of fisheries data collection is the regular publication of a yearbook or Annual Fisheries Statistics by the government, which in Kenya, is done by the Department of

Fisheries. The Department has the responsibility of registering fishing vessels. Basic catch data comprising of weight and value of landings by administrative units (districts) are also recorded.

Gleasel, Heidi. "Community-Level Marine Resource Management and the Spirit Realm in Coastal Kenya." *Women in natural Resources* 21, no. 4 (2000): 8.

(Gleasel, 2000)

Regulations are set by fishing community leaders in coastal Kenya to maintain social control and access to critical community resources through mediation with the spirit.world. Although fishing regulations set by these leaders (elders) may result in conservation effect, indigenous conservation originated in practices that focused on satisfying human needs and reducing anxieties about society. It did not originate from altruistic concern for the environment (Western and Wright 1994). Concern for conserving plants, animals, and habitats stemmed from beliefs that each could house spirits whose placation was crucial to the well being of society.

For example, in -recent decades, increasing literacy among younger generations of Muslims, their distress over low and declining catches, and elders' seeming inability to correct the situation has led to efforts, especially by youths, to separate practices concerning the spirit realm into those clearly acceptable in Islam as described in the Koran, and those of more "pagan" origins (Parkin 1968). These inter-generational conflicts have fractured local fishing communities, and decreased their ability to deter non-locals and users of environmentally destructive fishing techniques from entering the fishery. In recent decades younger, more strictly orthodox Islamic fishers have refused to observe spirit-appeasing taboos stemming from integration of religions. This refusal provides these fishers with additional means by which to challenge the authority of elders and potentially gain leadership positions in fishing, boat blessing ceremonies, and fisher cooperatives that were previously reserved for elders. Thus, a more Orthodox interpretation of Islam, sanctioning the ignoring of these taboos, can also be a means to obtain greater control over and access to valued resources.

Hoorweg, JC, Nicole Versleijen, Barasa Wangila and Allan Degen. "Income Diversification and Fishing Practices among Artisanal Fishers on the Malindi-Kilifi Coast." (2006).

(JC Hoorweg, Versleijen, Wangila, & Degen, 2006)

Kenya's coastal and marine environment is threatened by naturally occurring processes, the growing subsistence needs of the coastal population and increased economic activities (Hoorweg 1998). Examples of natural processes are coral bleaching, sea-level change and beach erosion. Growing subsistence needs are behind the over-harvesting of mangrove trees, illegal shell collecting and intensive fishing. Increased economic activities result in greater sewage and waste disposal from tourist hotels, the industrial pollution of the waters near Mombasa and siltation at river exits as a result of soil erosion upcountry.

Artisanal fishers also contribute to the degradation of marine resources, as intensive fishing can affect the ecological balance and result in a loss of local biodiversity (McClanahan & Shafir 1990; McClanahan & Arthur 2001). Destructive fishing practices, such as the use of seine nets, poison and explosives, alters the terrain as well as the ecological balance of the reef and seafloor. Local fishers generally do not approve of destructive fishing methods since they are aware that these will ultimately lead to lower catches. Indeed, nearly all fishers interviewed in another study were concerned with the degradation of marine resources and mentioned declining catches (Hoorweg et al. 2009). Other reasons for reduction in marine resources given by fishers included the increased number of fishers, gazettement of no-take areas, rough weather (notably the heavy El-Niño rains of 1997/98) and competing fisheries such as commercial trawling.

Nearly all the fishers in the Household Survey (91.3%) were negative about current fishing trends and reported declining catches. The increased number of fishers was most frequently mentioned as the reason for this trend because of the sector's easy access and the lack of alternative employment. The

fishers believed that anyone could fish whenever he wanted to and in the way he wanted to but many also felt that if there were other jobs available they would chose to do something else, but jobs were hard to find.

Only 30% of fishers limited themselves to one type of equipment; the large majority reporting two or more kinds of gear (Table 3.1). About 15% of fishers freely admitted to using destructive equipment – 9% reported using spear guns, 5% mentioned beach seines and 3% used a net mesh size of less than 1 inch. These gears were used more often by Mijikenda fishers than Bajun fishers.

The number of fishers has been increasing over the past decades with the entry of many Mijikenda into the arena, a group not known for its fishing until recently (Glaesel 1997). The reasons for their entry into this sector were: the open and easy access of the resource, the lax enforcement of licence regulations and the need for employment. Half the fishers expressed an interest to opt for alternative employment, if it was available, although it is doubtful whether they would abandon fishing completely if they found other employment. It is more likely that they would try to combine the two, as was the case with many of the new entrants. Fishers with a low fishing income were less willing to choose alternative employment, which is in line with the finding that families with higher incomes are usually in a better position to diversify than poor families (Ellis 1999).

In developing countries, fisheries management depends mainly on two sets of instruments (Allison & Ellis 2001): controls to limit access (operating licences, vessel capacity, closed seasons, closed zones) and technical measures to restrict efficiency or selectivity (prohibited gear, mesh size regulations). On the Kenyan coast, traditional restrictions on fishing grounds have largely fallen into abeyance, although they are still reported to exist on the south coast (McClanahan et al. 2005b). Their role has been taken by the marine parks and marine reserves. Integrated Coastal Management is still in its infancy.

Neither earner nor activity diversification provided fishers with the feeling that their fishing incomes had become any less important for survival. Instead, what emerged was that fishers with multiple income-generating activities fished in a smaller area of water, used destructive gear more often and did not show any more willingness to stop fishing for alternative employment.

Ministry of Fisheries Development. "National Oceans and Fisheries Policy." (2008).

(Ministry of Fisheries Development, 2008)

The history of management and utilization of fishery resources can be traced back to the early 1900's. The colonial Government gave prominence to the fisheries that were of interest to them namely; Pearls, Beche-de-mer and Ambergris amongst others. Emphasis was on sport fishing enjoyed by settler communities and troops. Consequently, they enacted the Fish Protection Act (Cap 379 of the Laws of Kenya) in 1902. In 1905, trout were introduced in the rivers around Mt Kenya. And as a result the Trout Ordinance (CAP 380) in 1948.was enacted. Because of racial segregation, indigenous communities were not allowed to catch the trout fish. To enforce this, a Division of Fisheries headed by a Fisheries Warden was established under the Game Department in 1954. Later the posts of the Chief Fisheries Officer and finally the Director of Fisheries were established under the Fisheries Protection Act (CAP 379) in the then Department of Fisheries.

In early 1960s, interest by local communities in commercial fisheries developed considerably and the Department expanded its mandate to include commercial exploitation of fresh water, marine fisheries and subsistence fish farming. Since 1963, a fishery as a sub-sector has been managed by not less than twelve Ministries at different times. These were: Ministries of Information and Tourism; Natural Resources; Tourism and Wildlife; Environment and Natural resources; Regional Development; Water, Irrigation and Land Reclamation; Agriculture and Rural development; Livestock and Fisheries Development. This kind of movement inhibits the development of a sector. The Government of Kenya recognized the critical role that fisheries play in food security, creation of employment, and other

economic benefits to those engaged in the industry. It is in this respect that the Government has now established fully fledged Ministry responsible for fisheries development.

Prior to the establishment of the East African Common Services Organisation (EACSO), fisheries research in Kenya was conducted through expatriate expeditions, which targeted specific water bodies. The East African Marine Research Organisation (EAMFRO) and the East African Freshwater Fisheries Research Organization (EAFFRO) of the defunct East African Community (EAC) were responsible for fisheries research in the marine and Lake Victoria waters respectively. Research on the other water bodies remained sporadic and limited to expatriate expeditions. Following the collapse of the EAC, fisheries research was undertaken through the department of fisheries. In 1979, the Kenya Marine and Fisheries Research Institute (KMFRI) was established by the Science and Technology Act (CAP 250), with the mandate for fisheries research. Nonetheless a Presidential Circular Paper no 1 of 2008 created the Ministry of Fisheries Development and placed KMFRI under her.

Kenya's marine fishery potential is largely unknown given that the last available estimate was done in 1975- 1980 puts the estimate at 100,000 to 150,000Metric tones annually (FAO, 1980). The production from inshore marine in 2006 was 6,959 metric tones. At present, inshore exploitation is by artisanal fishers who fish for fin fish, mollusks, and crustaceans. Due to lack of research and capacity to venture offshore, little is known about the migratory nature of the straddling and migratory fish stocks in Kenya. Tuna and tuna like fish are trans-shipped in Mombasa by foreign industrial vessels operating in the Indian Ocean.

Aquaculture is an important fisheries sub-sector that has substantial potential to significantly contribute to food security, poverty reduction, employment creation and reduction of pressure on capture fisheries. Moreover, it is an enterprise that can easily be integrated into small-holder farming systems currently; aquaculture is practised more on a subsistence basis rather than as a commercial activity. Factors that have hampered commercialization are lack of an elaborate infrastructure and support services system that facilitate: input supply and efficient production of high quality seed; competitive and high quality feeds; efficient storage, processing and marketing; credible quality control; comprehensive extension and information service; and organization for fish farmers. Over the years, the production from aquaculture has been hampered by lack of appropriate technologies, fish feed, fish seeds and weak extension services. Existing production is based on tilapia, catfish, trout, common carp and Prawns. There is enormous potential for expansion and improvement to include cages in coastal waters, lakes, rivers and dams and to create capacity for fish feeds and fish seed production.

CHALLENGES AND OPPORTUNITIES

2.1 Unsustainable Utilization of Fisheries Resource

- 2.1.1 Excessive fishing effort, destructive fishing technologies and environmental degradation in some inland lakes, rivers and the inshores of Kenya's EEZ has contributed to a decline in fish production.
- 2.1.2 Fishers, especially at the coast, have difficulty accessing landing sites on islands and other riparian lands due to development of private properties, hotels and other tourism infrastructure.
- 2.1.3 Currently, there are no domestic fishing fleets in the EEZ. Thus, straddling and highly migratory fish stocks in the EEZ are exploited by Distant Water Fishing Nations (DWFN). Consequently, the local communities do not benefit from the exploitation of the EEZ stocks.
- 2.1.4 The current licensing system for fishing in Kenya's EEZ does not encourage and ensure sustainable exploitation of the stocks and does not adequately benefit the resource owners.
- 2.1.5 The inadequate physical infrastructure such as roads, fish ports, landing sites, and inadequate credit facilities, as well as insecurity have slowed the growth of the sector. This resulted in: high

post harvest losses, high production and distribution costs as well as underutilization of the resources.

2.1.6 The current environmental management and conservation programmes are inadequate to control depletion of fish stocks and loss of biodiversity.

2.2 Fisheries Management

2.2.1 The Ministry of Fisheries Development cannot perform its core functions satisfactorily due to lack of critical facilities such as modern equipment (including but not limited to aircraft, boats and vehicles) and modern communication system.

2.2.2 The lack of policy and a master plan for development and management of the fisheries sector has hindered rapid advancement of the sector.

2.2.3 It has been difficult to enforce management measures because the fisher communities have been slow in taking up their roles as co managers of the resources.

2.3 Conflicts on resource use, gender rights issues and equity.

2.3.1 Inadequate legal and institutional framework for coordination and collaboration with other law enforcement agencies, greatly limits surveillance efforts in the Kenya fishery waters. This has led to many cases of Illegal, Unregulated and Unreported (IUU) fishing.

2.4 Stagnated Aquaculture Development

2.4.1 There is lack of an elaborate infrastructure and support services system that facilitate:

- i. input supply and efficient production of high quality seed;
- ii. affordable high quality feeds;
- iii. efficient storage, processing and marketing;
- iv. Credible quality control;
- v. Comprehensive extension and information service; and technology transfer
- vi. Organization of aquaculture producers into viable groups
- vii. centers of excellence for aquaculture research, training and demonstration
- viii. Underdeveloped Recreational and Ornamental Fisheries
- ix. Due to the rich species diversity vast potential exists for further development of recreational and ornamental fisheries. Despite this opportunity, recreational and ornamental fishing is generally underutilized.

2.5 Inadequate capacity for Quality Assurance

2.5.1 Fishery products have a relatively short shelf-life, and rapidly lose quality and economic value if not handled properly. It is necessary to minimize post-harvest losses, assure fish quality and safety for human consumption, and comply with sanitary and phyto-sanitary (SPS) measures.

2.5.2 Lack of incentives and investments, inadequate quality assurance infrastructure has hampered utilisation and trade in fish and fishery products. These are necessary for product development, value addition and marketing.

2.5.3 Inadequate Infrastructure and Human Resource Capacity

2.6 Inadequate infrastructure

2.6.1 This is a major constraint that impedes the oceans and fisheries sector from making its full contribution to the country's economy. Examples include:

- i. Roads;
- ii. Electricity supply to fish landing sites;

- iii. Fish landing infrastructure
- iv. Potable water supply;
- v. Market infrastructure including waste disposal facilities;

2.6.2 Human resource development

2.6.3 The fisheries sector lacks training institutions and sufficient numbers of suitably trained personnel.

2.6.4 Inadequate funding, Poor dissemination and linkage of Fisheries Research information

2.6.5 There has been poor linkage between KMFRI and the Department of Fisheries which has hampered the dissemination and use of research information. Further, the fisheries sector has also been poorly funded which has adversely affected promotion of research.

2.7 *Ineffective Participation at International Level*

2.7.1 There is a need to develop a comprehensive, modern legal and regulatory framework for oceans and fisheries management because the status and progress of national laws is not reflected in the international legal and institutional arrangements. Consequently, conflict in law enforcement and the duplication of tasks in fisheries management arise.

2.8. *Lack of a Comprehensive Legal and Institutional Framework*

2.8.1 There is urgent need to enact a legal framework which will reflect the status of the oceans and fisheries sector as a result of the reorganization of government ministries through the Presidential Circular No. 1 2008. This circular elevated the Department to a Ministry of Fisheries Development and placed KMFRI in the new Ministry.

2.8.2 There are difficulties in regulating the fisheries sector because of the numerous statutes governing activities related to oceans and fisheries management. Often they raise or cause conflict in law enforcement and cause duplication of tasks in government operations

2.9 *Cross-Cutting Issues*

2.9. 1 There are a number of issues that would require an integrated approach in order to develop the welfare of fisher communities and mitigate the adverse effects on the fisher community. These include:

- i. Environment concerns
- ii. Financial skills and services
- iii. Health and sanitation
- iv. Gender inequity
- v. HIV/AIDS and drug abuse
- vi. Demographic profiles

2.10 *Lack of Safety at Sea*

2.10.1 There are no provisions for control and orderly development of Kenya waterways this is of concern with regard to navigation, equipment, communication, search and rescue services, marine insurance, safety of crew and vessels, standards or certification, seaworthiness, among others.

2.11.1 *Low Ocean Development*

Lack of proper legal and institutional framework for the ocean exploration and development.

Guiding principles of the policy

The guiding principles applied in developing the oceans and fisheries policy include:

- (i) Good governance (co-management and transparency)
- (ii) Ecosystems approach (holistic approach to resource management)
- (iii) Pro-poor
- (iv) Precautionary approach (taking management measures based best available information),
- (v) Public private partnership,
- (vi) Sustainability and environmental integrity,
- (vii) Subsidiarity (making and implementing decisions at the most relevant levels)
- (viii) Equity (generational equity, fair access and use of resources)

Versleijen, Nicole and JC Hoorweg. "Marine Conservation: The Voice of the Fishers." (2006).

(Versleijen & Hoorweg, 2006)

Some areas further offshore have the potential to increase their yields (McClanahan & Obura 1996) but this requires investments in vessels and equipment that are beyond the means of most fishers. Major increases in fish catches are unlikely in the near future. Artisanal fishers are contributing to the degradation of marine resources because intensive fishing in a certain area can affect the ecological balance and result in a loss of fish stock. Destructive fishing practices, such as the use of explosives, seine nets and poison, can alter the terrain as well as the ecological balance of the reef and the sea floor. Fishers are aware that their increasing numbers are putting pressure on marine resources but do not know how to deal with the situation.

Fishers living near a marine park, however, often face a struggle to gain access to sea resources. Collecting shells, fishing, harvesting forest products from mangrove swamps and leisure pursuits associated with water have been restricted or curtailed by the requirement of a fee or a license. In addition, ecological and socio-cultural considerations have not been taken into account in the construction of beach hotels at picturesque beach sites. It could be claimed that the construction of tourist hotels has foreclosed the sea ethic of the local people and has alienated them from tourism development.

An attempt is being made in Kenya to involve stakeholders in controlling access and entry with the introduction of the Beach Management Units (BMUs). Each BMU will have jurisdiction over a landing site and the Fisheries Department designates a comanagement area where the BMU and the Fisheries Department join in management activities (Oluoch *et al.* 2006). In addition, fishers who want to fish at a different landing site will have to seek permission from the local BMU.

As a result of its modest size and poor accessibility, income-generating activities in Uyombo are related to either fishing or agriculture, such as fish mongering, palm-wine tapping and selling, cash-crop cultivation, plaiting makuti (roofing material from palm leaves) and farm labour. A more diverse scale of activities might have been expected, especially considering the nearby marine national park. Other groups of people have found employment in Watamu as Kenya Wildlife Service (KWS) rangers, hotel employees, safari guides, beach operators (curio sellers) and boat operators. In Takaungu there is a much wider range of income-generating possibilities such as furniture making, block cutting, building construction and teaching. In addition there are shops and small eating places. There are craftsmen and tailors resident in Takaungu but none in Uyombo so that people have to go to Matsangoni on the Malindi-Mombasa road.

Traditional methods of conservation

Traditional methods of conservation focused on access and fishing methods. In the two study locations, access regulation took the form of a regulating committee and a ceremony called sadaka. The ceremony used to exist in Takaungu but had not been performed in Uyombo in living memory. Most of the fishers from Takaungu are aware that there used to be something called sadaka.

One reason for the decline of the sadaka is that fishing has become a multi-ethnic activity. Fishing used to be dominated by the Bajun and Swahili and their beliefs and practices were strongly connected to the sea. When the agriculturalist Mijikenda started fishing they did not value the sadaka and it lost its importance. Religious convictions also played a role as Mijikenda fishers refused to participate in the ceremony because they considered it non-Christian.

Due to declining catches, the 'younger Kenyans' faith in their elders' ability to commune with sea spirits has waned and the elders' authority has been challenged leading to intergenerational conflicts' (Glaesel 2000a: 35). According to Glaesel, these conflicts have fractured fishing communities and allowed the arrival of fishers with destructive fishing techniques.

Fishers used to be flexible in their choice of gear, although they usually had strong preferences that were influenced by their knowledge and experience as well as economic and environmental considerations (Tunje & Hoorweg 2003). One of the companion surveys to this study showed that many fishers reported two or more kinds of gear and only 30% of fishers limited themselves to one specific gear (Hoorweg *et al.* 2009a). Gear differed greatly in their effects on the environment, some were potentially damaging, others less so. Roughly, there were three types of destructive effects: (i) damage to the marine environment; (ii) the capture of non-targeted species; and (iii) the capture of immature fish among the targeted species.

Some fishers in Takaungu pointed out that conservation could only be done in traditional ways if one was wealthy, i.e. if a person's catches were high throughout the year. Nowadays, it would immediately have a negative effect on their income and their household's standard of living. Households have to be fed every day and the indigenous ways of conservation are, therefore, no longer suitable.

Glaesel (1997) also reported that the fishers found the loss of fishing grounds hard to accept and that spillover from the protected areas was not making up for this loss. Others have also confirmed that fishers are often dissatisfied with the benefits of the marine parks (Ochiewo 2004; McClanahan *et al.* 2005). None of the fishers in the study regarded the establishment of a marine park as a suitable conservation method but 30.8% of the fishers in Uyombo said they would be more positive if the park was managed differently (Table 5.1). Most fishers claimed that the main goal of the marine park was the promotion of tourism and that the tourists were the people who benefited the most from the marine park. 'Apparently, the government would prefer foreigners to benefit rather than the local people.' Others narrate similar concerns, namely that marine-protected areas were seen as a means for the wealthy to gain at the expense of the poor (Glaesel 1997) and as a means of attracting tourists and raising government revenue (Malleret-King 2000) although the latter author also showed that communities close to MPA's had better food security.

A few fishers mentioned benefits from the marine park (Table 5.1), although they emphasized that these would never outweigh the disadvantages, particularly the loss of their best fishing grounds. The benefits included improved security because of the presence of KWS rangers. Visits by tourists and resident foreigners gave local people the chance to sell fish at a higher price but the downside was that tourists like to look around the village and the villagers regarded their style of dress as highly improper. Fishers did tend to blame their contact with the 'other culture' for some of the problems they were facing with the younger generation. Disrespectful behaviour towards parents, AIDS, prostitution and drug use were increasing problems. Sindiga (2000) also suggested that tourism caused all kinds of social problems at the coast.

Fishers suggested several ways they might benefit from the marine park. First of all, parts of the Watamu Park could be opened up to fishing during the low (kusi) season. Secondly, the fisher communities could receive a proportion of the KWS's gate collection. Thirdly, employment, or related employment such as in hotels, should be offered to the fishers in the Watamu Park.

To understand the attitude of the fishers of Uyombo towards conservation in general and the Watamu Park in particular, it is important to realize that the interests of the KWS and the fishers are contradictory. While the fishers want to make an income out of fishing, the KWS is out to control and limit fishing activities. The clearest example of the conflict situation between the KWS and the fishers

occurred when someone was caught fishing illegally in the marine park and subsequently fined and deprived of his vessel and equipment. Since the fishers associated all forms of conservation with the Watamu Park and the KWS, this did little good for the case of marine conservation and it may be difficult to involve them in any meaningful conservation activities in the future.

Local fishers in Uyombo believe that they are carrying most of the costs associated with marine conservation. They have lost large parts of their fishing grounds, had lower catches and are being blamed for the degradation of marine resources, while they depend on these very resources for their livelihoods. In the meantime, they perceive that foreigners benefit from the areas they have lost as fishing grounds without any government restrictions being imposed on these outsiders. This perceived favouring of tourists, Wapemba fishers and trawlers over local fishers gave the fishers – and especially those from Uyombo – little reason to trust the government. It has also made them suspicious of attempts at marine conservation.

McClanahan, TR, B KAUNDA-ARARA and JO Omukoto. "Composition and Diversity of Fish and Fish Catches in Closures and Open-Access Fisheries of Kenya." *Fisheries Management and Ecology* 17, no. 1 (2010): 63-76.

(McClanahan, KAUNDA-ARARA, & Omukoto, 2010)

Catch composition, relative abundance and diversity of fish catches in open access and three old fisheries closures were compared and contrasted with previous ecological studies. There was less variation in catch community composition among the fishing grounds than the closures, suggesting that fishing has homogenised catch composition.

Ochiewo, Jacob, Maricela de la Torre-Castro, Charles Muthama, Fridah Munyi and JM Nthuta. "Socio-Economic Features of Sea Cucumber Fisheries in Southern Coast of Kenya." *Ocean & Coastal Management* 53, no. 4 (2010): 192-202.

(Ochiewo, de la Torre-Castro, Muthama, Munyi, & Nthuta, 2010)

A socio-economic assessment was conducted at Vanga, Shimoni, Majoreni and Gazi villages in the Kenyan south coast with focus on the sea cucumber fishing patterns, the social and economic characteristics of the fisher communities, the contribution of sea cucumbers to the local livelihoods, and analysis of the management systems. The results indicate that sea cucumber fishers are mainly men. Fishing is done in sub-tidal areas (3–10 m deep) and inter-tidal areas depending on the species being targeted. Those who fish in the sub-tidal areas do skin diving without using SCUBA diving gear. Sea cucumber fishing is heavily done during the northeast monsoon season when the sea is calm and water is clear. About 32% of the sea cucumber fishers also collect other marine products such as octopus. The sea cucumbers are sold fresh from the sea to local first level middlemen who process and sell them to the second level middlemen and exporters in Mombasa. The fishers occasionally borrow money from first level middlemen especially when they fail to catch sea cucumbers but this in turn creates conditions of dependence and possible exploitation. Almost all sea cucumber fishers have stated that they are not willing to make sea cucumbers part of their daily diet. The economic value of the product was substantial; the average monthly revenue for dry sea cucumbers in the area was estimated to US\$ 8000. The relative highest profits are derived from juvenile species, thus there is an economic incentive hindering local stocks to reach sexual maturity, which in turn may create a situation in which recruitment success is highly dependent on faraway populations. The present management system falls into general fisheries regulations and was found weak. No specific management plan for sea cucumbers was found.

The sea cucumber fishery is an important source of livelihood to many households in the coast of Kenya [1]. It has existed since the 1900s and the number of fishers involved has been increasing over time. In the last 50 years the rate at which sea cucumbers are harvested has increased almost sevenfold reaching 28,376 tones (dry weight) in 2003 [2]. As fishing effort has increased over time due to the need to meet the high demand for sea cucumber products from the Asian market, reports

of over-exploitation are also increasing [3]. It is important to note that fish production (including harvesting of sea cucumbers) from the inshore areas is determined by among other factors, the amount and quality of effort that is applied in the fishery and the availability of stocks [4]. Over the years the number of people joining the sea cucumber fishery has increased thereby putting considerable pressure on the limited stocks. Catches have been declining over the last 10 years and fishers are catching smaller and reproductively immature individuals of at least two commercial species (*Holothuria fuscogilva* and *Holothuria scabra*) at the main landing sites in Kenya.

Collection of the previously low-value species and small-size sea cucumbers is increasing due to high demand in the Asian market and the high profits from these sizes. There is demand for different grades of processed sea cucumbers, grade 1 (the biggest size sea cucumbers), grade 2 (the medium size sea cucumbers) and grade 3 (the small-size sea cucumbers). Grade 3 sea cucumbers include low-value species and juvenile sea cucumber catches. The demand for grade 3 sea cucumbers may result into increased fishing of juveniles and may consequently affect stock reproduction and recruitment. It may therefore be important to establish size limits for sea cucumbers that enter the market, potentially enforced by checking the length and width of processed sea cucumbers.

There are strong indications that the fishers are exploited by local level middlemen since they often do not have a say over the prices given to them and the time to process their catch themselves. For a few fishers who have tried to process their catch, they do not have the needed training to enable them to meet the high quality standards and they are not in contact with the exporters who are based in Mombasa. It is therefore important to provide training to the fishers on sea cucumber processing so that those who are ready to process their catch can do so. It will also be useful for the sea cucumber fishers to form an association that can market their catch. The association could negotiate competitive prices with the buyers and undertake sea cucumber processing on behalf of the members when necessary. If these were done, the fisherman dependence relationship with the middlemen will be changed.

Mangi, Stephen C, Callum M Roberts and Lynda D Rodwell. "Reef Fisheries Management in Kenya: Preliminary Approach Using the Driver–Pressure–State–Impacts–Response (Dpsir) Scheme of Indicators." *Ocean & Coastal Management* 50, no. 5 (2007): 463-480.

(Mangi, Roberts, & Rodwell, 2007)

Kenya has high levels of unemployment. The 2001 estimate of unemployment for Kenya was 40% [22]. Apart from fishing, the other main occupations of local coastal residents are in tourism, factory work and farming. Many coastal residents have also ended up in self-employment through odd jobs and small businesses as a result of low levels of training. Low education standards among coastal residents hinder their ability to compete effectively in the job market. Many coastal people are also landless, or occupy lands owned by absentee landlords [23]. They therefore cannot make long-term plans and investments in farming. This coupled with a low agricultural production due to aridity of the climate makes many residents turn to fishing as an alternative livelihood.

Many coastal residents consider fishing as a way of life and an integral part of their social and economic existence [24,25]. They treat fishing as a traditional occupation that has been passed down from generation to generation.

Among traditional coastal communities, coral reefs and the near-shore fisheries they support are often the focus of elaborate systems of customs and traditions. Along the Kenyan coast belief systems are prevalent and often manifest themselves in systems of customary marine tenure or traditional management [26]. Most of the smallscale fishery activities have traditionally been regulated through taboos and omens controlled by community elders. These beliefs and rules govern where and when to fish as well as how one should fish, and act to maintain social control and access to common pool resources. However, many of these traditions have decayed in the recent past due to, among other reasons, Islamization of culture [26]. The management authority for the fisheries has also shifted to the national government thereby weakening the effectiveness of traditional leaders. This has led to a

loose organization of the fishers, with many young fishers choosing fishing gears that are not approved of by their elders.

The deepening poverty among coastal residents in Kenya is one of the driving forces exerting huge pressures on the reefs.

Due to the increase in population, unemployment, poverty and declining tourism (Fig. 2) many people have turned to fishing as a last resort in order to feed their families. As the barriers to outsiders who want to enter the fishery are minimal, many see the fishery as offering opportunities for those with limited financial resources. As a result, fisher numbers have greatly increased and both traditional and non-traditional fishing gears such as beach seines have been adopted.

One of the major changes in the state of the coral reefs in Kenya is the dramatic decline in the number and individual size of finfish [33]. Fishing activities have reduced fish populations in studied reefs causing a severe decline in the species richness of the fished lagoons.

However, the level of compliance to most of these fisheries regulations by fishers has been low due to increased poverty, poor enforcement, and in some cases the rules are unknown and unclear. For instance, many fishers do not know if spear fishing is illegal, as it is not stated in the Fisheries Act. Due to poor enforcement, some of the fishing regulations have rarely led to noticeable changes in reef fisheries management, e.g. beach seining is prohibited but the practice continues. However, it is likely that if the regulations did not exist, the practices would be far more widespread than they are today.

The predominantly small-scale and subsistence nature of the coastal fishery means that the real benefit of the coral reef resource is often overlooked by the government. In Kenya, marine fisheries comprise less than 5% of the national fisheries production [21], dwarfed by catch from inland lakes (predominantly Lake Victoria) and rivers. As a result, despite declaring some gears illegal for many years, enforcement has been irregular, as the government has played little part in active management.

Ochiewo, Jacob. "Changing Fisheries Practices and Their Socioeconomic Implications in South Coast Kenya." *Ocean & Coastal Management* 47, no. 7 (2004): 389-408.

(Ochiewo, 2004)

Unrestricted accesses into the marine fishery in Kenya's South Coast and the increased use of improper fishing technology have resulted in increased scarcity and over-exploitation of fish stocks. There is a positive relationship between fish catch (output) and fishing effort, age, level of education and income, and a negative relationship between output and distance to the fishing ground, and price.

The artisanal fishermen of the South Coast have not been able to venture offshore because of technological constraints. It would be useful for these fishermen to receive support in acquiring appropriate fishing technology (vessels and gears) that could enable them exploit offshore resources and ease pressure on the over-fished inshore fisheries. It is also worth noting that acquiring new technology may correspond with increased environmental damage. In this regard, attempts should be made to acquire fishing technology with minimal environmental impacts. Damage abatement measures should also be defined and put in place in the fisheries policy framework.

Kenya's South Coast has experienced considerable changes in fishing practices. These changes revolve around ownership and type of vessels used, type of fishing gears used, increased involvement of women in primary fishing activities, and changes in the fishing patterns as artisanal fishermen tend to travel from one fishing location to another in search of a better fishing areas.

3.4.5 Marine and coastal aquaculture

Kenya has a shoreline of approximately 640km on the Indian Ocean. The majority of the coast is rather underdeveloped, and the combination with abundant unpolluted seawater provides opportunities for the development of coastal aquaculture.

- Aquaculture in Kenya consists of three sub-sectors: fresh water aquaculture in warm waters (mainly tilapia and African catfish in earthen ponds), cold fresh water aquaculture (trout in raceway culture systems) and marine aquaculture (underdeveloped, limited in number and small-scale backyard farms, there are no commercial farms).

3.4.5 Marine and coastal aquaculture

Kenya has a shoreline of approximately 640km on the Indian Ocean. The majority of the coast is rather underdeveloped, and the combination with abundant unpolluted seawater provides opportunities for the development of coastal aquaculture. However, present mariculture operations are very limited and small scale (backyard). There are no commercial farms.

Mariculture of fish basically consists of community-based pond culture of milkfish (*Chanos chanos*) in polyculture with shrimp. The KWETU training centre for sustainable development - an NGO - supports a mariculture programme with demonstration, training and extension services. They have trained seven communities to farm milkfish in approximately 30 ponds of 340m² each (1 ha total).

The productivity ranges from 5,000 to 8,000 kg per ha. According to KWETU staff, the productivity can be increased if the ponds can be stocked with sufficient numbers of fingerlings.

Despite the presence of suitable sites and an interest from the business community, there are at present no commercial shrimp farms. The only large-scale shrimp farm (North of Malindi) has been out of operation for a while due to land tenure issues. The Kenya Marine and Fisheries Research Institute (KMFRI) will rehabilitate the farm for research and production of giant tiger prawn (*Penaeus Monodon*), as part of the Kenyan Coastal Development Project (KCDP).

The making of salt is an important economic activity in certain coastal areas. Both large-scale commercial and small, artisanal companies produce salt for export and the local market, respectively. The large companies (Kensalt, Krysstaline, Malindi, Kemu, Tana, Mnakani and Kurawa) operate often on more than 1,000 ha of land. Artemia (a live feed used in the larviculture of freshwater and marine fish and shrimp) has been introduced in several salt works in 1984-1986 by KMFRI, and has since then remained. However, no regular production of Artemia cysts has been achieved. Recently, KMFRI, with Belgian development assistance and Belgian and Vietnamese expertise, has constructed an

experimental Artemia and salt farm, with the intention to develop commercial cyst and biomass production techniques that can be used by the private sector. If this succeeds, the availability of relatively cheap Artemia cysts will contribute to enlarged and more reliable production of catfish fry.

The farming of sea weeds (mostly *Eucheuma denticulatum*) is practiced by small-scale farmers. Started as a research project by KMFRI, now approximately 100 farmers culture seaweed on ropes. This off-bottom production technology is simple and does not require inputs, except for pools and nylon ropes. The sun-dried seaweed is sold to Zangue Aqua Farms (Zanzibar) at KES12-14/kg, for further export to the USA, EU and China. From the dried seaweed, products are obtained for use in foods, pharmaceuticals and cosmetics.

In general, the commercial culture of marine fish and shrimp requires more capital and technology compared with tilapia or catfish farming, resulting in higher risks. Added to this, the difficulties in acquiring land with good soil properties, the absence of good quality stocking material and feeds, and competing interests with tourism, means that mariculture is not developed in Kenya. Recently the Kenyan government, together with multilateral donors, have initiated the 5-year KCDP project, with a total budget of USD25m. It includes a mariculture component (USD1.3m), aimed at the establishment of a marine hatchery, shrimp farm, and technology development and extension for seaweed, marine finfish, and Artemia farming. These project activities are implemented by KMFRI and the Fisheries Department.

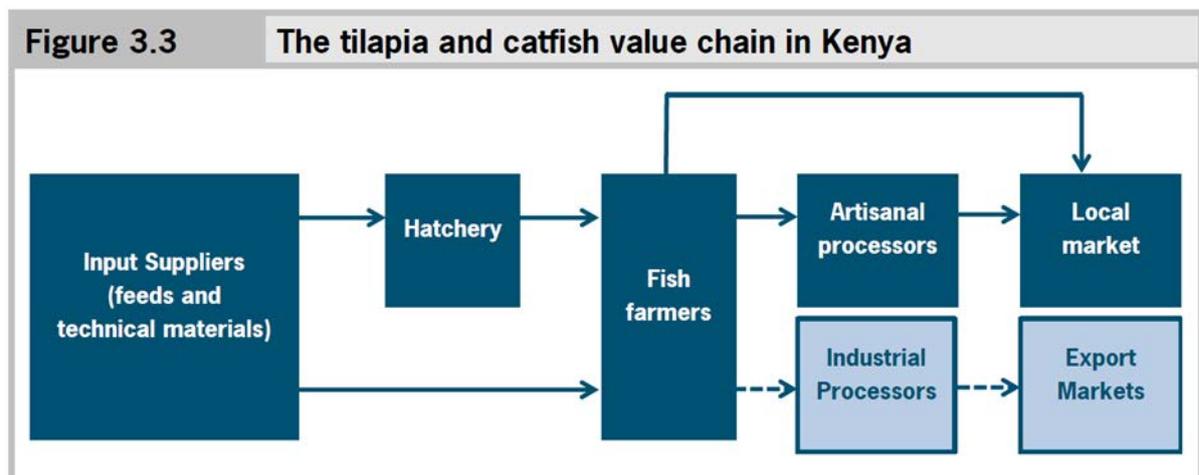


Figure U: The tilapia and catfish value chain in Kenya (Rothuis *et al.*, 2011)

Annex 2: List of informants

Meeting 1 at the Ministry of Agriculture, Livestock and Fisheries; State Department for Fisheries and the Blue Economy (SDFBE)

Monday 30 January 2017

Name:

Prof. Dr. Micheni Japhet Ntiba
Prof. James Njiru
Institute

Organisation:

Principal Secretary, SDFBE
Director Kenya Marine and Fisheries Research

Meeting 2 at the Ministry of Agriculture, Livestock and Fisheries; State Department for Fisheries and the Blue Economy

Monday 30 January 2017

Name:

Bethuel Omollo
Harrison Charo
Shadrack Kamau
Paul Mumina

Organisation:

Acting Head of Aquaculture, SDFBE
SDFBE
SDFBE
SDFBE

Meeting at the State Department for Fisheries and the Blue Economy (SDFBE), National Office Mombasa

Tuesday 31 January 2017

Name:

Mrs. Mwaka Barabara
Rashid Imam
Nana Omar
Elizabeth Mulwa
Ernestina M. Kalaghe
Mwaka Said
C.E. Mutai
Mika O. Nyaberi
Mercy Wasai Mghanga
Margareth Mkutano
Kennedy A. Shikame
Mercy Wasai Mghanga
Isabelle Vreeke
Elizabeth Kiamba

Organisation:

Managing Officer, SDFBE National Office
Fisheries officer, SDFBE National Office
Intern, SDFBE National Office
Assistant director, SDFBE National Office
Officer assistant, SDFBE National Office
Kenya Fisheries Service
Intern, SDFBE National Office
Kenya Fisheries Service
Beach Management Unit
State Department for Fisheries
Kenya Fisheries Service
Mombasa Beach Management Unit network
Netherlands Embassy
Netherlands Embassy

Meeting with fishermen at Local Ocean Trust, Watamu

Wednesday 1 February 2017

Name:

Mohamed A Shiebli
Mohamed ABDI
Kahindi Ngumba
George Mwarandu
Peter Kaingu
Ahmad Omar Said
Jackson Fondo
Hunker K. Charo
Abdul Mohamed
Amina Mzee
Kahindi Nkai
Khamis Omar

Organisation:

Shella BMU Malindi
Watamu BMU
Watamu BMU
Jacaranda BMU
Jacaranda BMU
Mayungu BMU
Uyombo BMU
Umomgo BMU Eco Tour Group
Watamu BMU
Watamu BMU
Roka BMU
Mccfag

Simeon K Kitsao
Mbura Mbagu
Masumbuko Nzovu
Willys Osore
John M. Gachwa
Casper van de Geer
Sammy Safari Elijah
Jeroen Hooyboer
Isabelle Vreeke
Elizabeth Kiamba

Mayungu BMU
Roka BMU
Watamu BMU
KWS Malindi
Kilifi County Director Fisheries
Local Ocean Conservation
Local Ocean Conservation
Local Ocean Conservation
Netherlands Embassy
Netherlands Embassy

Meeting at Watamu Beach Management Unit

Wednesday 1 February 2017

Name:

Feiswar Lali
Fundi Gunga
Saidi Lali
Ali Omar
Omar Kombo
Kassim Azi
Lali Athman
Bakari Gulam
Lutfah Mohammed
Athman Omar
Ali Hamadi
Fadhili Haji
Mohammed Athman
Ahmed Fahim
Casper van de Geer
Sammy Safari Elijah
Jeroen Hooyboer
Isabelle Vreeke
Elizabeth Kiamba

Netherlands Embassy
Netherlands Embassy

Organisation:

Watamu BMU
Local Ocean Conservation
Local Ocean Conservation
Local Ocean Conservation

Meeting at Uyombo Beach Management Unit

Wednesday 1 February 2017

Name:

Over 30 BMU members (name list not available)
Casper van de Geer
Sammy Safari Elijah
Jeroen Hooyboer
Isabelle Vreeke
Elizabeth Kiamba

Organisation:

Local Ocean Conservation
Local Ocean Conservation
Local Ocean Conservation
Netherlands Embassy
Netherlands Embassy

Meeting with scientists of the Kenya Marine and Fisheries Research Institute (KMFRI)

Mombasa, 2 February 2017

Name:

Dr Renison K. Ruwa
Dr. Edward Kimani
Dr. James Mwaluma
Drs. Jacob Ochiewo
Dr Nina Wambiji
Dr. Lilian Daudi
Ms. Morine Mukami
Shaban Mwachireya
Peter Odote
Frida Munyi

Organisation:

Deputy director, KMFRI
KMFRI scientist
KMFRI scientist

Dr. Judith Okello	KMFRI scientist
Keneth Werimo	KMFRI scientist
Julius Okondo	KMFRI scientist
Dr. Mirera David	KMFRI scientist
Victor Mwakha	KMFRI scientist
Drs. Gladys Okemwa	KMFRI scientist

**Stakeholder workshop, held at the Kenya Marine and Fisheries Institute (KMFRI) offices
Mombasa**

Friday 3 February 2017

<i>Name:</i>	<i>Organisation:</i>
Mercy Wasai Mghanga	Mombasa MBU Network
Edward Kimani	KMFRI
Kenneth Werimo	KMFRI
Philip Niranjana	EASF Limited
Roy Wafula	Amoc-K LTD
Bernard Fulanda	Pwani University
Sidi Ngumbao	Kilifi County Fisheries
Mwaka Said Barabara	SDF BE
Cornell Omondi	Taita Taveta County
Maxwell Azali Kodia	Wildlife Conservation Society
Cheruiyot Elijah Mutai	SDFBE
Nana Omar Athman	SDFBE
Robert O. Bosire	Diocese of Mau-FO
Rashid Imam	SDFBE
Agnata Ototo	KMFRI
Dr. Jacqueline Uku	KCDP-KFMRI
Benedict K Kiilu	SDF BE
Caroline Wanjiru	KMFRI
Morine Mukami Ngarari	KMFRI
Millicent Kurgat	East Africa Sea Foods
Elizabeth Mulwa	SDF-BE
Gladys Okemwa	KMFRI
Julius Okondo	KMFRI
Jim Mwangi	SDF BE
David Mirara	SDF BE
Mustafa Yassini	KMFRI
Samuel Ngari	CGM
Fridah Gacheri	Kenyatta University
Dijna Kagendo	Kenyatta University
Nashon Odongo	Kenyatta University
Dr. Renison Ruwa	KMFRI
Jacob Ochiewo	KMFRI
Peter Oduor - Odote	KMFRI
James Mwaluma	KMFRI
Thaddeus S. Ombati	KWETU Training Centre
Brendan Muli	Kwetul/FAO
Nina Wambiji	KMFRI
Elizabeth Kiamba	Netherlands Embassy
Isabelle Vreeke	Netherlands Embassy
Bert Rikken	Netherlands Embassy
Apollo Milton	KMFRI

Informants and interviews held prior, during and after the mission week (30 January-3 February 2017)

Name:

Stephen Wathome

Dinesh Aryal

Veruschka Schmidt

Mercy Wasai Mghanga

Nasoro Mohammed

J. M. Gachwa

Willys Osoke

Mohammed Jelle

Casper van de Geer

Oluyemisi Oloruntuyi

Various fishers and traders at Mombasa Fish Market whose names are unknown

Organisation:

European Commission

World Bank (via Skype, prior to the mission)

World Bank (via Skype, after the mission)

Fish trader & Mombasa BMU Network

Kibuyuni Seaweed Farmers

Kilifi County Director of Fisheries

Assistant warden, Kenya Wildlife Services

East Africa Seaweeds (via Skype, after the mission)

Local Ocean Conservation

Marine Stewardship Council (by email)

Annex 3 Brief notes of meetings and workshops

Group meeting with representatives of the State Department for Fisheries and the Blue Economy, Nairobi, 30 January 2017

In this meeting the consultants had a joint meeting with several employees of the State Department for Fisheries and the Blue Economy in leadership roles. Because of the new Fisheries Act and the resulting restructuring, these employees are in 'acting' positions, i.e., will be employed in new roles in the near future. The group was positive about the change and the focus on developing the blue economy. It was pointed out that blue economy in Kenya not only means marine waters, but all water including boreholes.

The group saw the following opportunities for the blue economy in relation to business development and food security:

- Develop fisheries and mariculture for local food security and awareness building of the general Kenyan population of the importance of consuming seafood.
- Improve the value chain of seafood products that are interesting for the export market.
- Exploit untapped deep-sea fishing opportunities in the EEZ for both Kenyan and distant water vessels, but make sure there is a good stock assessment ("we cannot promise resources which then turn out not to be there"). Public-private partnerships are a way of tapping from the potential in the EEZ. Tuna in particular has high potential.
- Improve licensing and control for and enforcement of the distant water fleet and create a good landing facility. 30% of the catch should be landed in Kenya. Tuna will mostly be exported, but by-catch will stay in the country. Attempts are being made to get 100% observer coverage on all vessels fishing under a Kenyan license.
- Improve fish handling infrastructure for all fisheries.
- Develop coastal mariculture by empowering people and assisting with facilities. There is scope for seaweed, shrimp, lobsters, milkfish and low impact extensive prawn and crab farming in the mangroves.
- Develop offshore aquaculture: sea ranching (tuna fattening).
- Diversification in aquaculture.
- Windfarming and tidal energy.

Challenges:

- Aquaculture: high investment costs, market development, potential pollution (depending on type of aquaculture), lack of land, multi-use conflicts in coastal areas.
- Fisheries: lack of fishing ports and infrastructure, high energy cost, and implementation of monitoring, surveillance and control.

Visit to Mombasa Fish Market, 31 January 2017

The team was guided through the Fish Market in Mombasa. The facility was made of materials (floor, walls, cutting spaces) that were easy to keep clean and aired well. Large freezer rooms were operational. In terms of hygiene, the consultants noticed that some wooden chopping boards that were badly damaged (splintered) were used. This could be potential source for bacteria.

The consultants spoke with a number of traders and fishers. Summary of the main points:

- Two fishermen who fished with hook and line in small boats offshore mentioned that compared to 10 years ago their catches were halved and fish size had halved as well. The number of fishermen in this fishery had doubled. It was estimated that since the mid-1980s the number of artisanal fishers had increased ten-fold.
- Two traders confirmed the observations on catch development. Tuna was declining. They also pointed out that some species like red snapper, kingfish, blue merlin and big prawns were rarely seen. The red fish currently sold as red snapper was not the 'real' red snapper from the past.

- The decline in catches was mainly attributed to the increase in fishing capacity and effort of the distant water fleet. One trader also mentioned seismic surveys as a possible cause as these took place in the blue merlin breeding areas.
- The collapse in tourism has had a major impact on influx into the artisanal fishery (unemployment and poverty) and led to loss of market.
- Traders who also bought fish at other landing sites along the coast mentioned that keeping the fish fresh was difficult due to lack of cooling on board and cold stores at landing sites and during transport. Most fish are still transported in baskets without ice.

The following solutions to these issues were proposed: (a) low interest loans to enable fishers to go offshore fishing; (b) cold stores and solar powered freezers at landing sites; (c) low interest loans for solar powered cool boxes/freezers to be used on board and during transportation; (d) attracting international buyers by pooling fish catches and properly handling them; (e) increasing gear selectivity; (f) continued capacity building of fishermen, BMU and traders; (g) provision of alternative income opportunities in coastal communities.

Group meeting at the State Department for Fisheries and the Blue Economy, National Office, Mombasa, 31 January 2017

In this meeting the consultants spoke with employees and interns of the State Department for Fisheries and the Blue Economy, National Office in Mombasa, active in a number of fields: aquaculture (including mariculture), licensing and monitoring, control and surveillance, quality control, co-management with Beach Management Units and capacity-building. The consultants learnt more about the activities of the National Office, and the challenges and opportunities for marine fisheries development.



Photo 1: Group meeting at the State Dept. National Office (Nathalie Steins)

Key points brought forward in the meeting:

- The Kenyan Coastal Development Project (KCDP) has been driving a lot of positive developments such as pilots in mariculture, stock assessments, improvements in the monitoring, control and surveillance system (MCS) and capacity-building of fishermen on conservation aspects. The best achievements of KCDP are: (a) quality improvement; (b) restructuring and training of BMUs; (c) development of management plans and gear improvements, that can now be used as a basis for further implementation; (d) capacity building of fisheries staff; (e) opportunity to pilot and try things; (f) involvement of university students to build capacity for the future. KCDP will end in June 2017. It has laid the foundations on which to build on. It is important that the county government does not lean back now and takes over. They have a key role in implementation, in conjunction with the national government.

- The information on the status of marine fish stocks is improving. There are concerns about the status of the stocks targeted by the artisanal fleet. Catches are in the range of 16,000 tonnes [Note: this is higher than the catches reported in the statistical bulletin (9,134 tonnes in 2013) (State Department for Fisheries and the Blue Economy, 2014a). The artisanal boats cannot really go beyond 3 nautical miles. In the EEZ, there are big opportunities for exploitation. The potential is at least 150,000 tonnes. A problem is the open access nature of the fisheries. Anybody can get a license and there is no limit to the number. The fisheries need to be regulated and for this research is important.
- With respect to MCS, facilities have been completed to store equipment and to make use of a Vessel Monitoring System (VMS). The objective is to have the VMS operational for all foreign vessels and the semi-industrial and industrial fleet of Kenya. These activities were supported by KCDP. The State Department for Fisheries has also purchased a new patrol vessel. Staff has already been recruited.
- The new Fisheries Act affects the staff of the national office in a number of ways. They will be expected to be more active in the field as opposed to working from the office, which is seen as a positive development. Also, there will be institutional changes such as the establishment of an advisory service, a fisheries board, a marketing board and an MCS unit. Fisheries are grouped in one ministry as opposed to being in many different ministries (a result of colonial law). The new law means that fisheries have been given a priority status. To embrace the new structure, staff resources are deemed necessary. It was mentioned that fishers perceive the fisheries department now being more close to them, but that the change of name to 'Fisheries Service' also has resulted in some fear as this name is associated with the Wildlife Service and communities had negative experiences with them.
- In implementing management plans, there still has to be a lot of cooperation between agencies, including the county government, the environment agency and the wildlife service. It is important all roles are clearly defined and this has been done.
- With respect to the BMUs, leadership is a problem. The BMUs in principle have a good organisational structure but enforcement of the rules by the chair is often a problem ("How can you penalise your family?"). An improvement would be if they were run by outsiders. In addition, communities are not that well trained in collecting and managing money (the fees).
- The coast is an unexploited area for aquaculture and mariculture; this would alleviate pressure on fish stocks and provide fishers with an alternative income. Milkfish, seaweed and crab farming have been proven successful on a small-scale. Sea cucumbers could be integrated with seaweed farming. Cage farming should be explored. Important challenges are weather conditions, topography / assessment of suitable sites.
- In the value chain, the lack of information on the chain and market opportunities is an issue. Adding value to fish is an issue, although pilots have shown it is possible (e.g. fish cakes, packaging filets). Kenya is importing more fish because it cannot get its own fish processed for the market. Quality control and reduction of post-harvest losses is another challenge. In terms of capacity, universities deliver good fisheries officers but there is no real training on quality management.
- In relation to improved management and adding value, pilot work on Marine Stewardship Council (MSC) ecolabeling has been carried out in the lobster fishery driven by WWF. But the assessment showed the fishery needs lots of improvements. There is now a management plan but more information is needed on stock development and ecosystem impact. There is also interest in MSC certification from the octopus fishery.

Group meeting with fishermen from various Beach Management Units (BMUs) at the Local Ocean Trust, Watamu 1 February 2017

The meeting was facilitated by the Local Ocean Trust, a private not for profit organisation committed to the protection of Kenya's marine environment. This NGO works on ensuring the future of sea turtles, the protection of a fragile marine environment and the promotion of sustainable livelihoods in the Watamu area. It works closely with 350 local fishers in its Sea Turtle By-Catch Release Programme. Fishers who accidentally have turtle by-catch are encouraged to report them. Fishers receive a small payment in return. Sick or injured turtles are taken to the rehabilitation centre in Watamu. Through this programme, Local Ocean Trust was able to organise a meeting with fishers from various BMUs in the region. A total of 16 fishers and BMU chairs participated, including one woman. Translation was provided by an employee of the Local Ocean Trust.



Photo 2: Meeting at the Local Ocean Trust, Watamu (Isabelle Vreeken)

A summary of the main points raised during the meeting:

- An older fisher said: "30 years ago, the catches were good, with a lot of mature fish. But now the fishing gears collect everything, even the eggs. In a few years to come, we'll have nothing left". This statement was acknowledged around the table.
- Main causes for the current state of the fish stocks: illegal fishing activities including illegal gear, gear developments (more effective), lack of enforcement, unemployment and poverty driving people into the fishery and use of illegal gear, increasing number of sea urchins that affect the seaweed habitat, coral bleaching due to environmental and climate change.
- A problem gear according to this group of fishers is the ringnets. The mesh size they now use is only 0.5 inches and not selective. Corals are also collected. The fishers who use it come from Tanzania (Pemba fishers). They do not follow the rules and fish inside the reef which is illegal. The fishers in the meeting perceive that this ringnets fishery is very destructive. The management plan for ringnets - to which some people present in the meeting gave input - should be implemented and monitored. Until this is the case, it should be stopped. The ringnet fishery should use a larger mesh size and be properly enforced by an observer programme.
- Another problem gear is the use of mosquito nets, which is happening in the creek fishery and mainly done by villagers. A community group tried to patrol but the activity has now changed to the night time; also, the local group has no mandate to enforce the rules. The Kenya Wildlife Service is perceived to be inactive in relation to this problem.
- Another problem gear are the metal traps which have replaced the local small reed-made traps. They catch more and are less selective. Attempts to convince fishermen to use adapted traps with escape mesh have failed because fishers believe they will either lose a lot of catch or because they feel it does not make sense to loose fish if someone else who is not using the adapted trap then catches the escapees anyway.
- Spearguns are also considered to be a problem gear.
- The BMUs have responsibility relating to fisheries access. If a BMU agrees on a fishing method and believes the gear is acceptable, it can be licensed. But the government's role is then to enforce this. The group of fishers perceive that enforcement is a problem. In the meeting, it is also pointed out that there is sometimes conflict within the BMU about which gears should be approved. In some BMUs the rules are not taken so seriously because people need to fish, they need food. There is general agreement that the fisheries department should do more to ensure the BMUs are doing their job.
- In relation to the functioning of the BMUs it is pointed out that sometimes members do not agree with decisions made by the board. But they have to abide with the decision anyway.

- There have been conservation initiatives working together with local fishers. While these are perceived as good and important, the problem is the temporary nature. When the project funding ends, the work and progress dwindles.
- The boats are usually owned by the traders and not by the fishers.
- Going out further to sea where it is possible to catch more, is problematic. The boats are not suitable. Also, it is dangerous and there is no rescue service.
- To deal with challenges the following solutions were proposed: (a) giving fishers bigger boats so that they can go beyond the reef and fish with long-lines; (c) storage facilities to reduce losses and increase prices; (c) generate employment opportunities so that there is an alternative to fishing or to overcome loss of income due to temporary fish stock recovery measures or establishment of no-take zones; (d) education and awareness training about sustainable fishing.

Meeting with members of Watamu Beach Management Unit, 1 February 2017

In this meeting, 15 BMU members participated including one woman; these included fishers and traders. Translation was provided by an employee of the Local Ocean Trust. The meeting took place in the unfinished fish handling facility of the BMU.



Photo 3: Meeting at Watamu BMU (Nathalie Steins)

Summary of the main points raised during the meeting:

- The BMU facility is owned by Kilifi County government. Because of a conflict with the contractor it is not completed. The walls still need to be plastered/tilled, the work space for cleaning the fish is merely a brick construction and the floor is rough concrete. There is no electricity. The BMU cannot tell when the facility will be completed. The BMU hopes that when the facility is ready they will be able to market fish directly to local customers besides sales to traders.
- Watamu BMU is very active in registering all landings. Data are going to KMFRI and have been used in some of the recent stock assessments. Other activities the BMU takes up are: awareness-building, patrolling, conflict negotiation.
- A number of changes were identified: (a) in the past, fishers used to catch a lot but the price was low; now the catch is low but the price has gone up; (b) change in vessel types; (c) change in gears used; (d) growing number of fishers due to poverty.
- With respect to the BMU the following challenges were mentioned: (a) financial support: difficult to collect the fee from members who are struggling for their livelihoods; (b) BMU board member is a voluntary job, which affects commitment particularly in times of hardship or conflict; (c) conflicts amongst the group over which rules to set, enforcement and financial management; (d) lack of support from the fisheries department; (e) boat ownership is with traders, which creates dependency relation ("traders determine the price, so you cannot complain because then they take the boat"); (f) young people do not want to stay in fishing anymore; (g) illegal activities by

the sports fishing companies; (h) lack of enforcement; (i) lack of transparency about who is responsible for what.

- To deal with the challenges the following solutions were proposed: (a) giving fishers bigger boat so that they can go offshore; (b) a rescue boat; (c) assistance with marketing; (d) storage facilities, i.e., completion of their facility; (e) management of BMU should be paid job.

Meeting with members of Uyombo Beach Management Unit, 1 February 2017

In this meeting, over 30 BMU members participated including four women; while some traders participated most of the attendants were fishers. Six fishers fished in the creek, the remainder in the coastal waters. About 10 fishers had their own dugout canoe and one owned its own bigger boat; the others did not own a boat (hired from boat owners/traders). The BMU has 100 members. Translation was provided by an employee of the Local Ocean Trust. The meeting took place in the unused but completed fish handling facility of the BMU.



Photo 4: Meeting with Uyombo BMU (Nathalie Steins)

Summary of the main points raised during the meeting:

- The BMU facility is owned by Kilifi County government. The facility is not in use because the water supply is not functioning yet; there is a problem at the water company. Also the county governor still has to do the official opening.
- According to the group the main responsibilities of the BMU are: (a) to bring together traders and fishers to work together in managing the landing site; (b) education and awareness-building, for instance not to cut the mangroves; (c) security of the landing site and community. When asked if the BMU was also responsible for decisions about access to the fishery (license, gears to be used), the collective answer was negative.
- Compared to ten years ago, the fishery has declined. Ten years ago, the harvest was good compared to now; the price was not so good then and is a lot more than 10 years ago. Some species are rarely seen anymore: parrotfish, sardine. Beyond the reef there is a lot of fish as those who venture out there return with good catches, but most fishers do not have appropriate vessels and gears to fish offshore (“raising 1mln KSh to buy a fibre boat is the problem; the petrol we can buy from the catch”).
- Main reasons for the decline of catches in the coastal area: (a) increase in the number of fishers due to poverty (in this context, the increasing number of children involved in fishing was mentioned “children do not go to school anymore, they go fishing”); (b) lack of food for fish because of explosive growth of sea urchins; (c) tsunami covered breeding areas for fish with sand; (d) environmental destruction; (e) climate change (less rain: “when there was lots of rain, we used to have lots of fish; now there is no rain and that means there is no food for the fish”).
- The market is seen as a problem. There is a substantial amount of fish in the BMU freezer because they cannot sell it. If they sell it, it will go to Mombasa but the prices are low. Sometimes the dealers tell them to fish, but when they land the fish there is no market after all.

- The county government apparently bought nets, a freezer and stalls for the fish mongers and engines for the boats. But they did not buy boats, so the engines are just lying there. The BMU was not involved in this project. Politics are flagged as an issue: “a person wants to get votes so then he gives these things to the people”.
- Solutions for the issues: (a) give fishers fibre boats to fish beyond the reef; (c) train fishers to use these offshore boats and gears properly; (d) provision of alternative income sources; (e) create market opportunities; (f) cold store rooms for fishers; (g) insurance for fishing boat crew.

Group meeting at the Kenya Marine and Fisheries Research Institute (KMFRI), Mombasa, 2 February 2017

The deputy director, Dr Renison K. Ruwa, and 12 scientists participated in this group meeting. The scientists covered the following fields: freshwater aquaculture, fish larvae, mariculture, biochemistry, pollutants, microplastics, benthic ecology, reef ecology, seagrass ecology, physical oceanography, socio-economics, fisheries science, quality and marine conservation.



Photo 5: Group meeting at KMFRI (Nathalie Steins)

KMFRI employs 80 scientists in Mombasa. Most of the funding is from government and is supposed to be used as seed money. Research proposals are guided by the strategic plan of the institute. KMFRI is also engaged in transboundary research. The strategic plan focuses on: food security and moving into the blue economy through aquaculture. The institute has a research vessel and can do acoustic surveys.

Challenges for the blue economy:

- Stock status inside the reef. Coastal stocks are overexploited.
- Influx of more fishers into the artisanal fishery (poverty, easy to get access as a license is very cheap).
- By-catch in trawl fishery and sometimes dolphin bycatch in gillnet fishery.
- Sea urchin outbreaks affecting the seagrass.
- Post-harvest losses (estimated at 50-60%).
- Last stock assessment was done in 1980s. For fisheries in territorial waters (prawn, small and medium pelagics, ringnet) work has been done with assistance from the Kenyan Coastal Development Project (KCDP). The landing data from the BMUs are available for stock assessments, with occasional survey information being added. The South West Indian Ocean Fisheries Project did a survey focussing on shallow water prawns and shellfish in 2010. For offshore stocks capacity is lacking.
- Ring net fishery controversy: the fishery is meant to take place in deeper water targeting pelagic species but sometimes the nets are used in the coastal waters. This is illegal. They then also catch demersal species. There is a management plan but implementation is lacking.

- Monitoring, control and surveillance is not optimal yet. Vessels >12m need VMS and observers on board. The State Department is responsible for implementation.
- Poor landing and storage facilities for artisanal fisheries. Lack of good landing and processing facilities to develop fisheries in the EEZ.
- System of middlemen who want to capitalize traps fishers. Prices are low.
- Fish processing factory in Mombasa does not have enough supply. Landing facilities for industrial fleet are needed.
- Lack of a good market analysis, which is needed for developing a market and providing targeted support.
- Paradox: Kenya is importing fish to meet demand while local fishers cannot sell their fish. The supply and demand are not linked properly.
- Keep the momentum going the KCDP has started.

Addressing the challenges, improving food security and opportunities for business development:

- Underexploited opportunities for fishing in EEZ (pelagics, and tuna in particular).
- Reduction of post-harvest losses: development drying systems.
- Set up direct links between fishers and market.
- Reduce number of artisanal vessels by 60% but hand in hand with creating alternative income opportunities otherwise illegal fishing will be the result.
- Establishment of cooperative societies in support of developing a market for fish and reduce post-harvest losses.
- Assist artisanal fishers in buying boats so that they can fish beyond the reef where fishing opportunities are good.
- Develop a national fleet for the EEZ fishery and only allow Kenyan companies access (public-private partnership).
- Sustainability certification (stock assessment of lobster by KCDP was done in support of MSC certification).
- The KCDP has laid a basis for further aquaculture development: milkfish, finfish, crab and shellfish farming and seaweed. These could provide alternative employment. The advantage of aquaculture is that supply and demand can be linked well together.
- Development of floating rafts seaweed farming system (like in Philippines) in order to grow the more valuable species.
- Artemia which is available in good quantities and for which there is high international demand. Set up a public-private partnership for canning it in Kenya; use it locally for fish farmers.
- Development of marine wind farms.
- Continued institutional support and capacity building will be needed in developing the blue economy.

Stakeholder workshop Dutch embassy scoping mission on fisheries and food security, Kenya Marine and Fisheries Institute (KMFRI), Mombasa, Kenya 3 February 2017



Photo 7: Stakeholder workshop Mombasa (Nathalie Steins)

The stakeholder workshop was convened by the Embassy of the Kingdom of the Netherlands in Nairobi and took place at the KMFRI office. In total 43 participants coming from different backgrounds: science (15), fisheries/fishing companies (2), BMU (1), university students (2), trade (3), processing (1), aquaculture (1), NGO (2), Government (10), KCDP (1), the Dutch Embassy (3) and Wageningen Marine Research (2).

Mr Bert Rikken, Agricultural Councillor of the Dutch Embassy gave some background to the workshop. The embassy has been involved in many food security projects, but not in fisheries. Also Aid to Trade. This means that the Netherlands is pulling out as a donor in 2020 to adopt an alternative approach: develop a relationship based on trade and investment. In this context, the embassy asked Wageningen Marine Research to carry out a scoping study into the seafood sector, its importance for food security, sustainable development of marine fisheries and aqua/mariculture and opportunities for business cooperation. Mr Rikken noticed that there are not so many representatives from the present in this stakeholder workshop, but hoped this meeting would be a first step.

The meeting included breakout groups and a plenary debate. The breakout groups focussed on an assignment in two parts: (1) describe a marine seafood chain and (2) what improvements can be made to this value chain. This enabled the consultants to get additional information to that collected from the literature review and meetings held during the mission.

For small-scale fisheries value chains, two groups independently decided to select the octopus fishery as their examples. The value chain descriptions and improvements are shown in figures a-d.

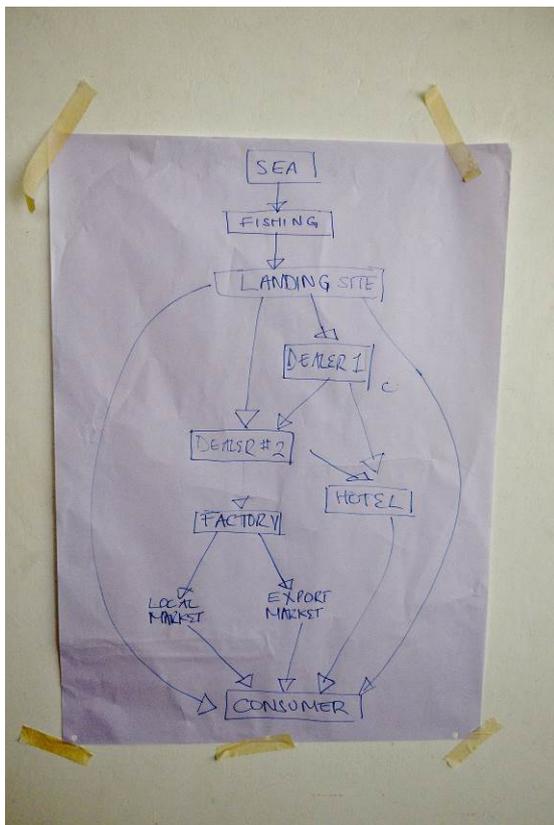


Figure a: Value chain octopus

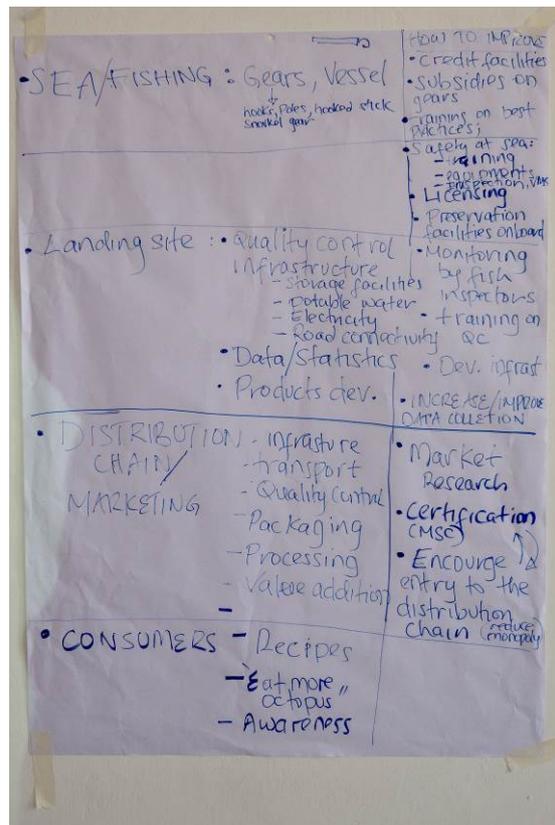


Figure b: Octopus value chain improvements

Questions put forward during the discussions on the octopus value chain improvements focussed included: What 'selling points' does this fishery have to attract investors? Do we have enough octopus? How are the improvements going to be funded? Most discussion was on the biomass of octopus. There were diverging views.

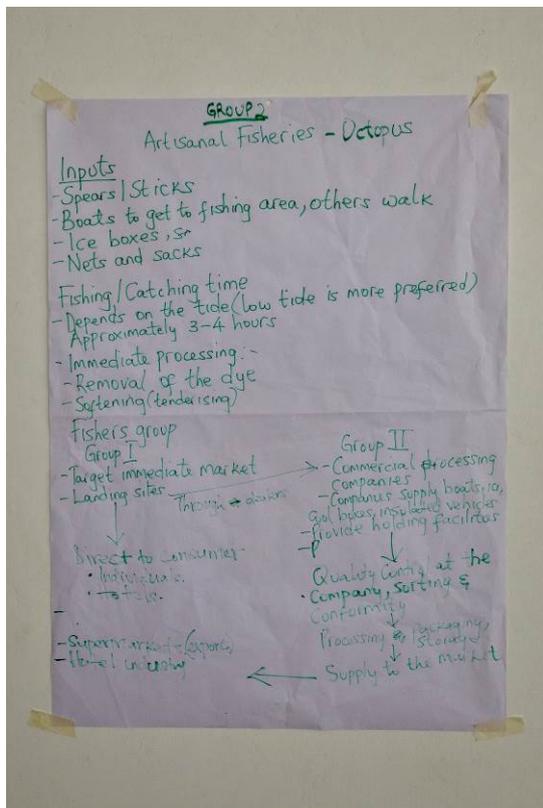


Figure c: Value chain octopus

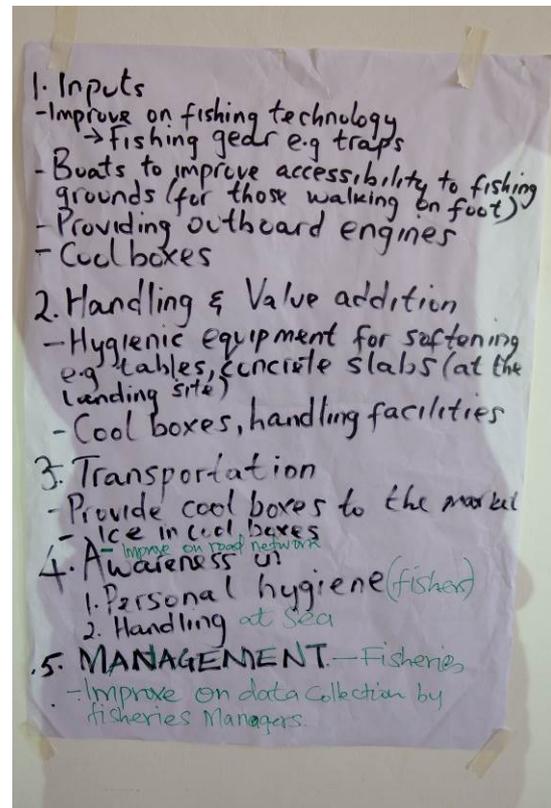


Figure d: Improvement value chain octopus

The breakout group that got the assignment to work on a deep sea fisheries value chain, chose tuna. The value chain descriptions and improvements for the tuna fisheries are shown in figures e-g.

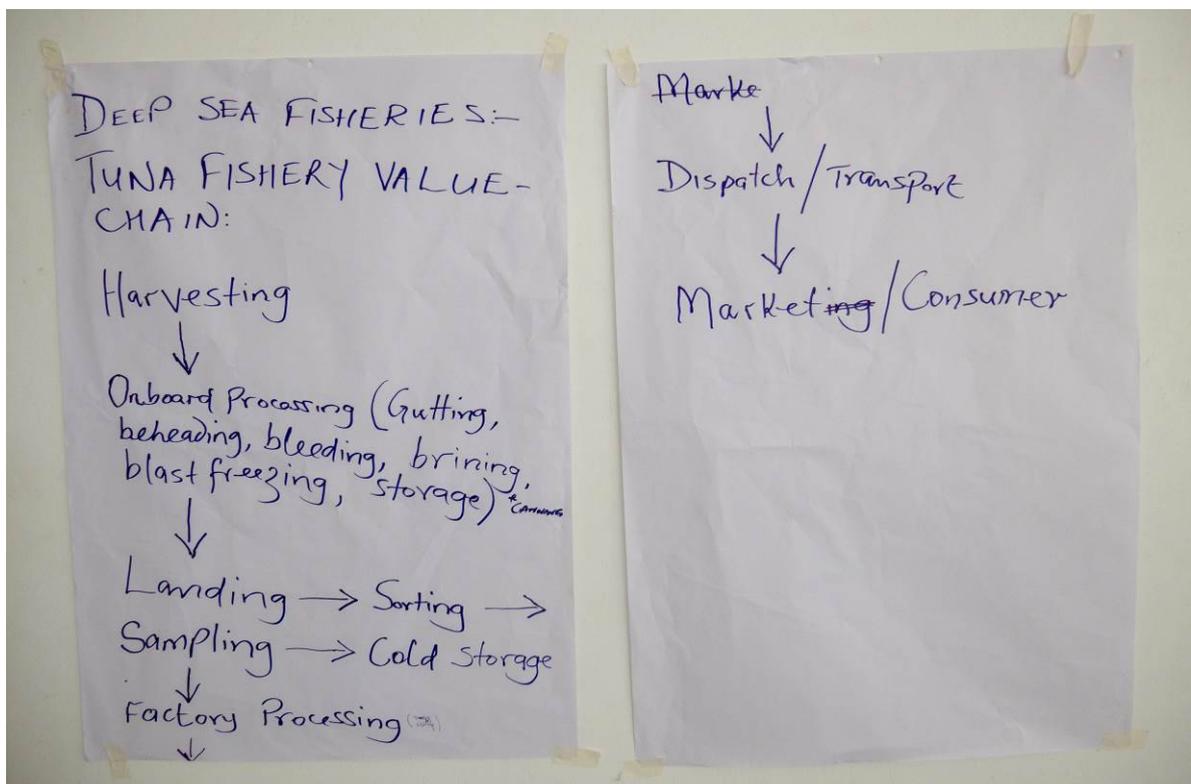


Figure e: Value chain tuna fisheries

A key issue that was raised in the discussions on improvements of the value chain was that many vessels process their catch on board and need no further handling. Taken this into account, even if 30% of the fish caught by foreign vessels fishing under Kenyan licenses could be landed in Kenya, this may not result in substantial employment and revenue opportunities.

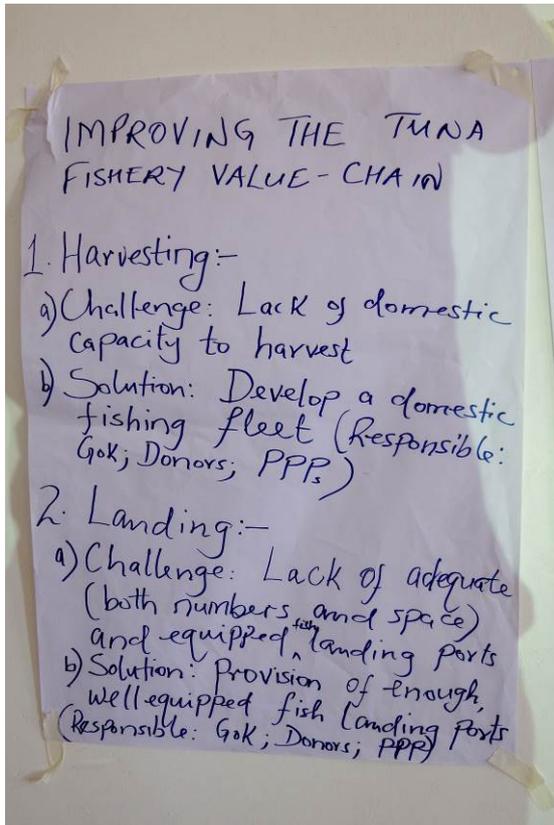


Figure f: Tuna value chain improvements (1/2)

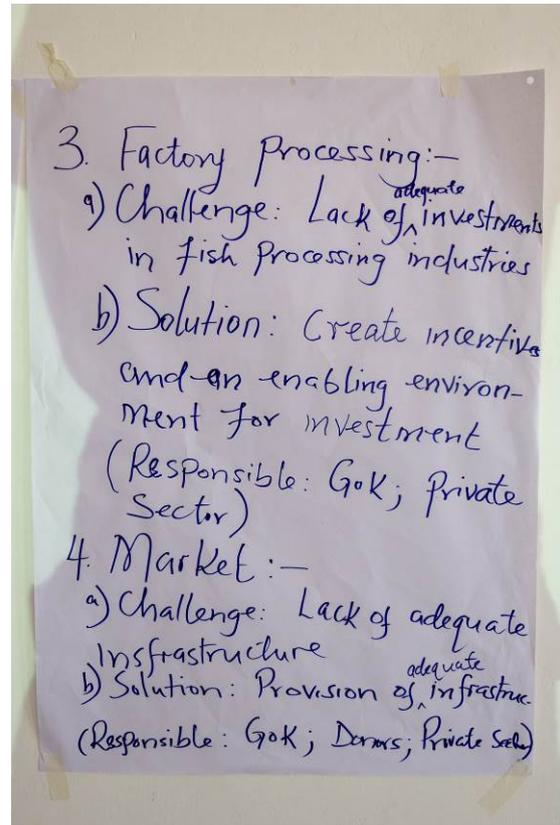


Figure g: Tuna value chain improvements (2/2)

Breakout group 4 looked at the value chain for aquaculture. The value chain and improvements are shown in figures h-j.

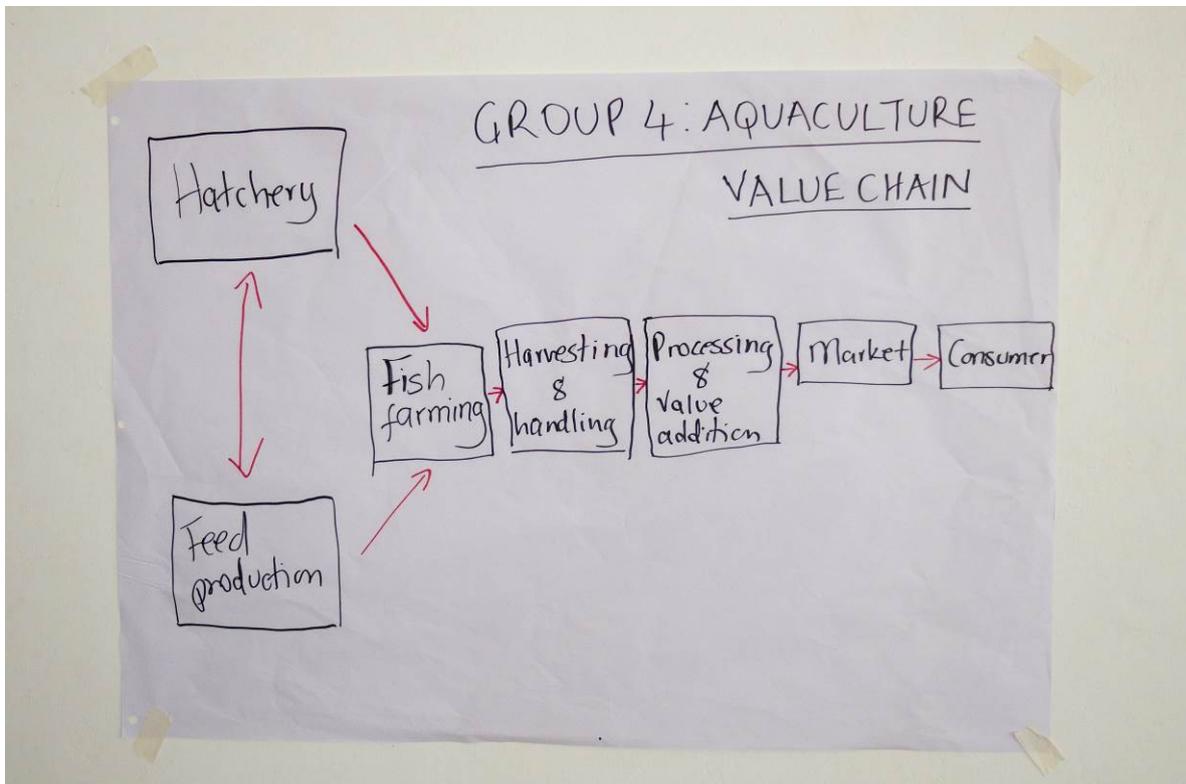


Figure h: Value chain aquaculture

In the discussions on the aquaculture value chain it was emphasised that this chain involves many different players and these all have to be involved. Questions were raised whether there is enough fish/broodstock to rear.

GROUP 4	
Opportunities	Challenges
<u>1. Feed production</u> → Potential market → Availability of ingredients	→ No investment → Limited market linkage → Lack of capital → Poor research/industry linkage → Limited strategic partners
<u>2. Wild seeds</u> → Hatchery deep → Live feeds available (artemia)	→ Non existent hatchery → Lack of funds → Need for capacity building → Impact on recruitment → Poor quality of species → Seasonality supply
<u>3. Fish farming</u> → High potential due to availability of land/water → Technical expertise available for some spp.	→ Limited policy of marine dept → Lack of extension work → Limited serious investment → Poor quality fish/seeds → Capacity in fish diseases → R & D → Low technology uptake
<u>4. Harvesting</u> → Income from sales → Demand for seafood → Technology transfer available	→ Poor uptake of technology → Limited handling skills & facilities → Low & inconsistent production

Figure i: Aquaculture chain improv. (1/2)

Opportunities	Challenges
<u>5. Processing</u> → Investment in processing plants → Local & international trade eg packaging, value addition product development etc	→ Low investment in processing → High initial investment → Low & inconsistent production
<u>6. Marketing</u> → Availability of market → Stimulation of trade → Export	→ Poor market linkage & information - Poor market segmentation - Stringent market requirements - Low technology uptake
<u>7. Consumers</u> → High population	→ Consumer awareness → Limited culture of eating marine fish for upcountry people.

Figure j: Aquaculture chain improv. (2/2)

Breakout group 5 worked on the value chain for seaweed. The value chain and improvements are shown in figures k and l.

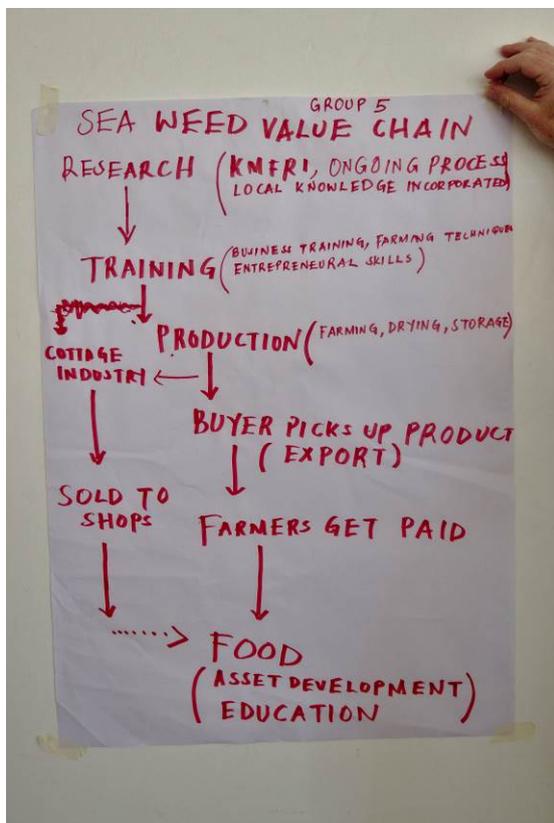


Figure k: Value chain seaweed

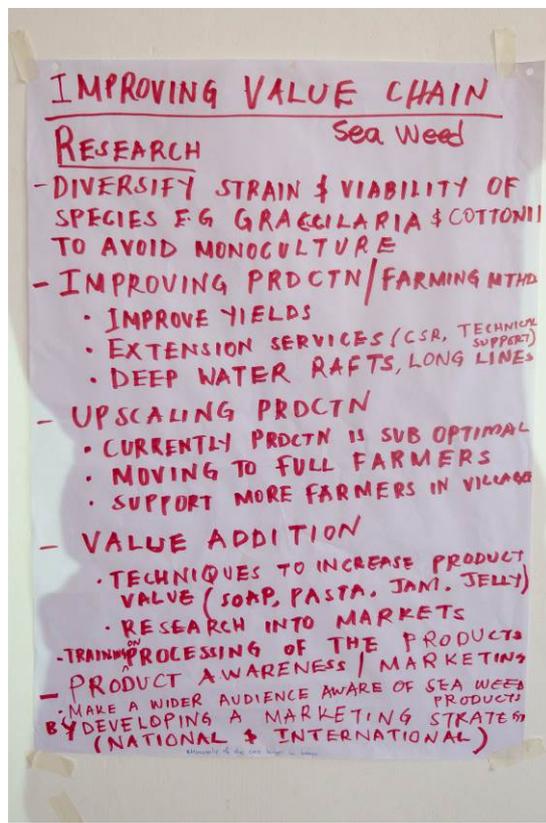


Figure l: Seaweed value chain improvements

In the discussion on the seaweed supply chain it was emphasized that this sector offers employment to many more people than does involved. Production of the poles and ropes offer indirect employment opportunities. Seed bank development also offers opportunities.

Following the plenary session a debate was held using a number of statements (including some jokes). Participants were asked to stand up if they agreed with the statement and sit down if they did not agree. This enabled the consultants to crosscheck some of their findings during the mission.

Propositions:

1. *Kenya is the most beautiful place in the world* – Everyone agrees.
2. *There is potential for fisheries development in Kenya* – – Everyone agrees.
3. *If artisanal fishers can fish further out, fishing pressure in the coastal zone will be relieved* – 5 disagree.
4. *Helping fishers to fish further out, will solve the problem of declining fish resources* – Everyone disagrees.
5. *We can't help fishermen to fish further if we do not know the state of the stocks* – 1 person disagrees.
6. *Because there are no jobs, we have overfishing* – 5 agree.
7. *Developing aquaculture in the coastal zone is a good idea* – Everyone agrees.
8. *There is a large potential in seaweed production* – 1 person disagrees.
9. *Unless we can find a buyer, there is no use in promoting seaweed production* – Half of the group agrees, half does not agree.
10. *Bringing down post-harvest losses is key to improving food security* – Everyone agrees.
11. *Improving infrastructure at fish landing sites will be key to reducing post-harvest losses* – Everyone agrees.
12. *Putting up cold stores will just encourage artisanal fishers to increase fishing for no market* – 4 agree.
13. *If Kenya wants to profit more from EEZ fisheries, a fishing harbour is to be developed* – 4 disagree.
14. *We need our own fleet to fish in the EEZ* – 7 agree.
15. *Kenya should stop licensing other nations to fish, we will fish for it ourselves* – 1 person agrees.
16. *Conservation of marine resources and securing fisher livelihoods go hand in hand* – – Everyone agrees.
17. *Seaweed culture is very good as it produces and serves as a mini-MPa*- 1 person disagrees.
18. *We actually know nothing about our fish stocks, as we do not have data* – 5 agree.
19. *We tried fibre glass boats to fish offshore but we couldn't* – Everyone disagrees
20. *BMUs can play an important role in sensitizing the fishermen*- Everyone agrees.
21. *BMUs today are not really co-management: we do not do it together and we do not manage the fisheries* – 3 agree.
22. *We are going to make a group picture* – Everyone laughs.
23. *Investing in aquaculture is really a good idea* – Everyone agrees.
24. *There is a large market inside Kenya but we are not reaching it* – Everyone agrees.
25. *We need a fish processing plant*– Everyone agrees.
26. *With declining fish stocks, competition between fishers is likely to increase* – Everyone agrees.
27. *Mosquito net fishing should be banned and strictly controlled* – Everyone agrees.
28. *As long as you get away with using illegal fishing methods, it is not likely to change* – Everyone agrees.
29. *After you have been capacity build but still have no job, it is all done for nothing* – 5 agree.

With respect to statement 6 it was pointed out that the fisheries is open access so people who lose their job can always go fishing: "It is the job of last resort". Going into agriculture means one needs land and input and be patient with the growing. Others said that people go into fishing even if they have land or other opportunities, because it is the easiest. It was also remarked that lots of people from inland come to work in the tourist in the industry. When the season closes they start fishing. But the lack of jobs in itself is not the cause of overfishing.

With respect to statement 13, the people who disagree remarked that there is space in the current harbour in Mombasa but the foreign vessels are not coming. The licensing policies are flawed. If it is only about offloading processed packs, the foreign vessels can do this in our harbour. What is needed is storage and processing in the current harbour.

The people who disagreed with statement 14 question why fishing in the EEZ has to be done by own vessels. It can also be done in a partnership. It is not about our own fleet, but about where it is landed. A foreign vessel that fishes on a Kenyan license in Kenyan waters could also employ Kenyan people.

With respect to statement 18 it was pointed out that Kenya had fisheries data but the issue is that these are perhaps not adequate or too little. The question is how reliable the data are and how representative. People who disagree said that there are five stock assessments. For tuna may be issues, but for other important fisheries the stock assessments are available. People have been working on the assessments with help of the KCDP and spent lot of time to collect the data; this should be acknowledged. Data available but not always accessible.

Luc van Hoof thanked all the participants on behalf of the team. The next step is to discuss the findings with the Dutch Embassy to see where they see scope for continued work. The report will be made available through the embassy. Agricultural councillor Bert Rikken thanked everybody for their input.

Annex 4: Programme of the mission

Monday 30 Jan	Tuesday 31 Jan	Wednesday 1 Feb	Thursday 2 Feb	Friday 3 Feb
<p><i>Morning (8h-13h)</i></p> <p>8h Meeting with PS and CS at Kilimo House - Prof Ntiba</p> <p>9h30 Meeting with senior policy officers Fisheries at Museum Hill - Mr. Bethuel Omollo</p> <p>Lunch meeting with FoodTechAfrica Location TBC</p>	<p><i>Morning (8h-13h)</i></p> <p>9h-10h Meeting with Mrs. Mwaka and Mr. Imam Rashid (+7 others), Mombasa National Office</p> <p>11h-12h30 visit to: - Fish trader - Fish Market</p>	<p><i>Early morning travel to Watamu (taxi)</i></p> <p>9h Meeting at Local Ocean Trust</p> <ul style="list-style-type: none"> - Mr. Casper van de Geer - Representatives from Kilifi County Government Fisheries Office, Roka BMU en Shela BMU from Malindi <p>11h30-13h Visit Watamu BMU</p>	<p><i>Early morning travel to Mombasa (taxi)</i></p> <p><i>Afternoon</i></p> <p>Visit to the Kenya Marine and Fisheries Research Institute - Prof. Njiru + 8 researchers</p>	<p><i>Morning (9h-13h)</i></p> <p>Workshop in Mombasa @KMFRI</p>
<p>14h Meeting at EU Delegation (arrive +/- 30 min early)</p> <p><i>Flight to Mombasa Departure 19h00 (JKA)</i></p>	<p><i>Afternoon</i></p> <p>14h Skype meeting with East Africa Seaweed Processors Interview with Kibuyuni Seaweed Farmers spokesperson</p> <p>Evening: report writing/workshop preparation</p>	<p><i>Afternoon</i></p> <p>15h-17h Visit Uyombo BMU landing site (1 hour drive)</p> <p>Evening: report writing/workshop preparation</p>	<p><i>Afternoon</i></p> <p>TBT Report writing/workshop preparation</p>	<p><i>Afternoon</i></p> <p>Debriefing</p> <p><i>Flight back to Nairobi Departure 20h40</i></p>
<p><i>Overnight in Mombasa</i></p>	<p><i>Overnight in Mombasa</i></p>	<p><i>Overnight in Watamu</i></p>	<p><i>Overnight in Mombasa</i></p>	

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'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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