A BASELINE REPORT FOR THE KENYAN SMALL AND MEDIUM MARINE PELAGIC FISHERY

Prepared for:

Ministry of Fisheries Development, South West Indian Ocean Fisheries Project (SWIOFP) and EAF-Nansen Project,

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INTRODUCTION

Kenya has a coastline of about 640 km stretching from 1o 30'S at the Somali border to 5o 25'S at the Tanzanian border. The continental shelf is narrow with fringing coral reefs that extend between 0.5 and 2 km offshore. Coastal waters off Kenya are warm tropical and are influenced by the monsoon seasons – warmer during the NE monsoon and cooler during the SE monsoon. The ocean current regime along the Kenyan coast is influenced by the East Africa Coastal Current and the seasonally reversing Somali Current. Most of marine fishing in Kenya is small-scale artisanal that operate in the coastal near-shores (McClanahan & Mangi 2004; Samoilys et al. 2011).

Some of the rich inshore grounds include grounds around the Lamu Archipelago, Ungwana Bay, the North Kenya Bank and the Malindi Bank. Gill nets, longlines, beach and reef seines are the main gears used in the exploitation of small and medium pelagic. Large-mesh sized gill nets capture large pelagic. The artisanal fishery is confined to a small strip of 2.5 to 3.0 nautical miles within the reef. The annual production for Kenya's marine fisheries has remained between between 4,336 mt to 8,736 mt over the last two decades from 1990. Marine fisheries production recorded declines from 1991 to 1995 and from 1997 to 2000. The current production is low considering that Kenya has a 640 km coastline, a 200 nautical miles of EEZ (230,000km^2) and is said to be located within the richest tuna belt in the Indian Ocean. Information concerning the status of the Kenyan EEZ is limited in spite of an increase in offshore fisheries in the region from 1990s .The marine capture fisheries potential is largely unknown with only a few estimates. The inshore waters are reported to have a potential to yield ~20,000 mt per year (Odero 1984). FAO, (1990) reported that annual marine catch from reef areas might be closer to 12,000. The pelagic fishery over the 20 yr period accounted for 27.0% of the landings, with catches oscillating between 977 mt to 2096 mt. Wakwabi *et al*. (2003) estimated the pelagic fishery accounts for 18% of the marine fishery landings, with 80% of the total marine products coming from shallow coastal waters and reefs, and about 20% coming from off-shore fishing.

Kenya is in the process of introducing an Ecosystem Approach to Fisheries (EAF) for the management of the artisanal fisheries under the umbrella of the EAF Nansen Project "Strengthening the Knowledge Base for and implementing an Ecosystem Approach to Marine Fisheries in Developing Countries". This document gives the baseline information pertaining to the Kenyan marine small and medium pelagic fisheries that will contribute towards the development of the plan for the management of artisanal fisheries in accordance with the principles of Ecological Approach to Fisheries

Methods

This study focused on collating fisheries information small and medium pelagic fisheries of the Kenya's coast through literature review and analysing available fisheries catch data, mainly from Ministry of fisheries development. Information on mesh sizes for gillnets was collected by visiting or interviewing fisheries officers at key fish landing sites that target small and medium pelagic fisheries. Development of this report was guided by specific objectives (ToRs) listed on Appendix 7. Based on the national data gap-analyses report on pelagic fishes of the 9 countries of

the WIO was used to guide the categorisation of different pelagic fisheries groups (Lucas et al. 2009, Table 1).

Table 1. SWIOFP Prioritized pelagic species by functional group and family

Categories	Functional group	Family
Large pelagics	Pelagic sharks (coastal and oceanic)	Carcharinidae (8 spp), Lamnidae (2) Sphyrnidae (1)
	Billfishes	Istiophoridae (4), Xiphiidae (1)
	Tunas	Scombridae (7)
Medium pelagics	Large & medium Carangids (trevally, threadfin, amberjack, rainbow runner)	Carangidae (16)
	Small tunas & bonitos	Scombridae (3)
	Spanish mackerels (seerfishes)	Scombridae (3)
	Gempylids and other discard, bycatch spp.	Bramidae (1), Gempylidae (2), Alepisauridae (1)
	Other medium pelagic (dolphin fish, barracuda, cobia, shad)	Coryphaenidae (1), Sphyraenidae (2), Pomatomidae (1), Rachycentridae (1)
Small pelagics	Small mackerels	Scombridae (2)
	Scads	Carangidae (5)
	Sardines and round herrings	Clupeidae (13)
	Other small pelagics (needlefish, halfbeaks, anchovy, flying fish)	Belonidae (2), Hemiramphidae (2), Engraulidae (1), Exocoetidae (1)

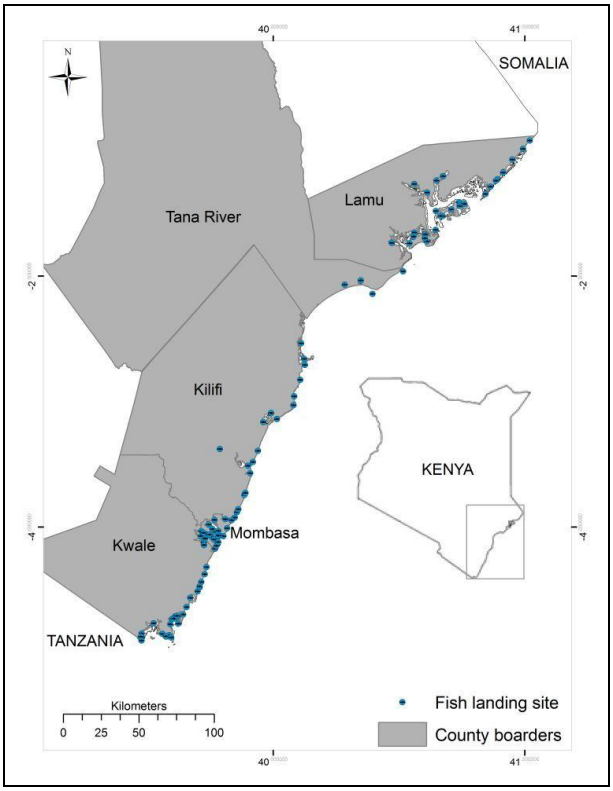


Figure 1. A map showing the coastal counties and the spatial distribution of fish landing sites.

1. **THE EXISTENCE OF A MANAGEMENT PLAN**

There exists no management plan directly addressing the small and medium pelagic fishery along the Kenyan coast. The Prawn Fishery Management Plan 2010 (Legal Notice 20)" (*see Chapter 3iv)* is the only management plan addressing marine fisheries of Kenya. Three other fisheries management plans are at different stages of development and have objectives beneficial to the pelagic fishery ecosystem. These include; the draft lobster fishery management plan, the draft aquarium fishery management plan and the draft ringnet fishery management plan, with the later directly addressing the pelagic fishery.

*i. Draft Ringnet Fishery Management Plan (*RFMP*)-*

The broad objective of draft Ringnet Fishery Management Plan (RFMP, May 2012) is to ensure an ecologically sustainable pelagic fishery that provides long term socioeconomic benefits to Kenyans in terms of food security, employment creation and national revenues; and promote co management in the sustainable use of ringnets. The specific objectives of the Management Plan are to:

a) regulate the harvesting of pelagic fishes using ringnets
b) develop mechanisms to enhance responsible exploitation of pelagic fish stocks;
c) improve the net income for fishing community and national revenues;
d) develop regulations and mechanisms to enhance enforcement and compliance for ecosystem management;
e) initiate long term monitoring and implement demand driven research for the pelagic fishery

Ringnet fishing operations are prominent in Vanga, Shimoni, Gazi, Mtwapa, Kilifi, Takaungu, Mayungu, Ngomeni, Kipini and Watamu (see appendix 4). Ringnet fishing season starts from October to April with peak productivity occurring between the months of November and March (Okemwa et al. in prep, Munga et. Al 2010, Taskforce report 2005). The preparation of the ringnet management plan was triggered by the many socio-economic issues and conflicts arising from mixed perceptions about the gear within the fishing communities between artisanal, fish traders, sport fishers, dive operators, government agencies, and environmentalists (RFMP Discussion paper, Okemwa et al. in prep). The consultation meetings on ringnet operations date back to year 2005. The draft of the ringnet fishery management (RFMP May 2012) was circulated to stakeholders for review and a presented to the public in a workshop held in Malindi in May 2012. The final draft is expected to be submitted to the DoF after incorporating the stakeholders views.

ii. The prawn fishery management plan 2010 (legal notice 20) - PFMP

The PFMP is the first marine fisheries management in Kenya. The management plan adopted under section 5 of the Fisheries Act covers shallow and deep water prawn species. The Management Plan covers the method of single vessel otter trawl, stern trawl and paired beam-trawl fishing methods and other methods that are legally approved, such as prawn seine nets and cast nets by artisanal fishers. The Prawn fishery (shallow water species of the Family Penaeidae) covered in this Management Plan is concentrated in the shallow coastal waters around Malindi-Ungwana Bays and the deep water prawns. It provides several management measures to ensure a biologically sustainable and economically viable prawn fishery. The aim is to ensure creation of employment, wealth, national revenues and foreign exchange earnings, fish products and protection of the prawn fishery and habitat in the long term. To ensure equitable sharing of

benefits, it recognises the need to empower local people to utilise the prawn fishery using artisanal technology and employment of local people in semi-industrial prawn fishery. The plan it recommends for the establishment of a Community Trust Fund whose benefits shall be distributed through the BMUs.

*iii. The Draft Lobster Fishery Management Plan for Lamu District, 2010 (*LFMP*)*

The need for an ecologically and economically sustainable lobster fishery in Kenya led to the development of a draft management plan led by the Ministry of Fisheries development from 2009. The Management Plan shall cover all species of Lobsters of the Family Pinuliridae including: the principal five shallow water species of spiny lobsters: *Panulirus ornatus, P. longipes, P. penicillatus, P. versicolor, P. homarus* locally known as "Mwani", ''Mwilo", "Kijiwe", "Kurabu", "Springi" respectively and *P. dasypus* occasionally appearing in the catches. The Management Plan shall also cover the deep water species: *Scyllarides squammosus, S. tridacnophaga and Thanusorientalis sp.* The main shallow water artisanal fishing method in the lobster fishery is skin diving, using fins and face mask and using octopus to scare the lobster from crevices into a scoop net (*Kimia na pweza*). Other known and legal methods of fishing include gill netting and trapping.

The broad objective of the Management Plan is to ensure the continuation of a biologically sustainable and economically viable fishery thereby providing benefits to Kenyans in terms of creation of employment, wealth, national revenues, fish products and certification of the lobster fishery to meet and maintain the Marine Stewardship Certification (MSC) standards. The specific objectives of the Management Plan are to:

i. Regulate the lobster harvesting so that the size of the stock tends towards that which will give the sustainable yield, through the management of fishing capacity so as to ensure a healthy stock for the present and future generations
ii. Promote safe, harvesting, handling and transportation of lobsters so as minimize impacts on the environment, non target species, marine mammals and turtles.
iii. Establish and define mechanisms for management standards, enforcement and compliance;
iv. Establish a monitoring and evaluation mechanism for the prawn fishery.
v. Promote co-management of the fishery; data collection and development of marketing information system.

The consultation meetings held during the preparation of the draft management plan were an important step in bringing together fishermen, researchers and managers (Mueni et. al. 2009; 2010, Maina and Samoilys 2010). During the meetings, it was evident that the biological, ecological and socioeconomic implications of fishing for lobsters need to be better understood (Maina and Samoilys 2010). Since the draft management plan only covered areas within Lamu, there has been a view that the draft LFMP be expanded to cover the whole Kenyan coast. This is also to fulfill the Marine Stewardship Council (MSC) certification requirement. In response to the concerns within the lobster fishery industry, and the high value of the trade, the Ministry of Fisheries Development selected this fishery to undergo pre-assessment for MSC certification. The fishery is currently in process of undergoing fishery improvement process.

iv. The Development of marine aquarium fishery management plan

The aquarium fishery had been under subsistence practice from 1970's to and expanded to attain commercial significance in 2000's. It commercialization has exerted enormous pressure on the coral reef fisheries and has resulted to a myriad of complains from the fisher community. The ministry of fisheries development through the Provincial Director of Fisheries, Coast, initiated a process of drafting the marine aquarium fishery management plan in 2010 (FiD 2010). Since

then, no other activities have been held to steer this activity forward. The purpose the fishery management plan is to develop a vibrant ornamental industry that provides sustainable and equitable benefits to all while conserving the long term ecological integrity of the targeted species along the coast of Kenya.

2. THE EXISTENCE OF SPECIFIED OBJECTIVES OR DE FACTO SMALL AND MEDIUM PELAGIC FISHERY IN THE ABSENCE OF A MANAGEMENT PLAN

In the absence of a management plan, the objectives of the government of Kenya with regard to the small and medium pelagic fishery are addressed indirectly through various policy documents, legislations and Acts particularly the National Oceans and Fisheries Policy 2008 (*see section3iii)*, The Prawn Fishery Management Plan 2010 *(see section 2ii)*, Fisheries (Beach Management Units) Regulations, 2007 (*see section3iv and 10x)* and the Fisheries Act CAP 378, 1991 *(see section 3ii)*. The ring net fishery management plan (zero draft) seeks to address the marine fisheries waters of Kenya with objectives directly addressing the small pelagic fishery with far reaching impacts on the medium pelagic fishery (*see section 1 above*).

3. THE LEGAL FRAMEWORK WITHIN WHICH THE SMALL AND MEDIUM PELAGIC FISHERY IN KENYA IS OPERATING

The main laws governing fisheries activities in Kenya (including small and medium pelagic fisheries) are the Fisheries Act Cap 378 (1991) and the Wildlife (Conservation and Management) Act Cap 376. The Fisheries Management and Development Bill will become the new Principal Fisheries Act upon approval by the parliament and ascent by The President. There are also a number of other national, regional and international legal frameworks covering Kenyan coast fisheries, and are listed and discussed in detail in Appendix i.

National legal and policy frameworks

a) Constitution of Kenya Act, 2010
b) National Oceans and Fisheries Policy 2008
c) Fisheries Act CAP 378, 1991
d) The Fisheries (Beach Management Units) Regulations, 2007 (Legal Notice 402)
e) Fisheries (safety of fish, fishery products and fish feed) Regulations, 2007 (Legal Notice No. 170.)
f) Fisheries (Foreign Fishing Craft) (Amendment) Regulations, 2004. (Legal Notice No. 20.)
g) Draft Environmental Policy, 2009
h) Integrated Coastal Zone Management (ICZM) Action Plan for Kenya, 2011
i) National Environmental Action Plan 2009 - 2013 (NEAP
j) Provincial Environment Action Plan (PEAP) for Coast - 2009-2013
k) Environmental Management and Coordination Act (EMCA) 1999
l) Maritime Zones Act, Chapter 371, 1989
m) Merchant Shipping Act, 2009
n) The Poverty Reduction Strategy Paper (PRSP) 2001
o) Economic Recovery Strategy (ERS) 2003-2007
p) Strategy for Revitalizing Agriculture (SRA) 2004-2014
q) Vision 2030.

International legal frameworks

r) *EAC Treaty and protocols*
s) *UNCLOS 1982*
t) *The Convention on Biological Diversity* (CBD) *1992*
u) *The Nairobi Convention 1985*
v) *The FAO Framework*
w) *Agenda 21 (1992), chapter 17*
x) UN Fish Stock Agreement, 1995
y) Reykjavik Declaration on Responsible Fisheries on the Marine Ecosystems,2001

i. Constitution of Kenya Act, 2010

The importance of environmental protection is elevated though several articles on rights of the people and responsibilities of the state on environmental matters. Article 42 gives "every person the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures". Chapter 5, Part 2 covers environment and natural resources. To eliminate processes and activities likely to endanger the environment, Article 69: states that "1) The State shall a) ensure sustainable exploitation, utilisation, management and conservation of the environmental and natural resources, and ensure the equitable sharing of the accruing benefits; b) work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya; c) protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities; d) encourage public participation in the management, protection and conservation of the environment; e) protect genetic resources and biological diversity; f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment; g) eliminate processes and activities that are likely to endanger the environment; and h) utilise the environment and natural resources for the benefit of the people of Kenya". Article 70 of the Kenyan Constitution deals with enforcement of environmental rights while Articles 71 and 72 deal with agreements relating to natural resources and legislation relating to the environment respectively

ii. Fisheries act cap 378, 1991

The Act's objective is to provide a legal framework for the management, exploitation, utilization and conservation of fisheries resources in Kenya. It is however applied in cross-reference with other related laws. The Act restricts destructive practices and advocates for the protection of fish breeding areas. It considers illegal use of certain nets or under-sized mesh, beach seine, spear guns and dynamite fishing. It also protects coral reef fisheries away from protected areas. The Fisheries Act also regulates licensing of local and foreign fishermen and fishing vessels, fisheries scientific research, landings and landing sites and puts restrictions on purchase of fish. The Fisheries Bill (awaiting parliamentary approval) will become the new Principal Act that will cover all fisheries activities.

iii. National Oceans and Fisheries Policy 2008

The policy provides a coordinated framework for addressing the challenges facing the fisheries sector and guides the sustainable development of fisheries in line with the Economic recovery Strategy (ERS), the Strategy for Revitalizing Agriculture (SRA) and the National Vision 2030. It recognizes inter-jurisdictional aspects of marine fisheries, calling for collaboration and cooperation in the management of migratory/shared stocks. It further encourages the development of specific fishery management plans.

iv. The Fisheries (Beach Management Units) Regulations, 2007 (Legal Notice 402)

The regulations outline the objectives of BMUs, their administrative structure, area of jurisdiction and mandate in co-management. They promote the co-operation amongst fishermen and their participation in the overall management of fisheries resources and landing areas, as is provided for in the Fisheries Act CAP 378, 1991 and its subsidiary legislations. Fishermen are given co-management rights, enshrined in by-laws, which must be approved by the Director of Fisheries.

v. Fisheries (safety of fish, fishery products and fish feed) regulations, 2007 (legal notice no. 170.)

The Fisheries Department (FiD) is given the responsibility for the official control of the safety of fish, fishery products and fish feed. The Competent Authority – Fisheries Department – is therefore mandated, in collaboration with other Government agencies, to oversee the implementation of regulations governing proper monitoring of fish from harvest, sorting, handling, transportation, processing, storage and market. The competent authority monitors and controls these processes to ensure that there is no risk to human health.

vi. *Fisheries (foreign fishing craft) (amendment) regulations, 2004* (Legal Notice No. 20)

These regulations outline the license fees and conditions for foreign fishing craft operating in the Kenyan waters of the Indian Ocean.

vii. Draft environmental policy, 2009

The policy provides a framework for sound environmental and natural resource governance by mainstreaming environmental considerations into sectoral policies and strengthening regional and international cooperation in environmental management.

viii. Integrated coastal zone management (ICZM) action plan for Kenya, 2011

It aims to "conserve the coastal and marine environment and to ensure that its resources are utilised in a sustainable manner for the benefit of coastal communities and the national economy". It guides stakeholders in conservation and development of the coastal zone. It further supports institution of a legal framework and strengthening institutional framework for ICZM. The action plan hopes to ensure effective and efficient implementation of environmental plans and that they are mainstreamed into development processes.

i. National environmental action plan 2009 - 2013 (NEAP)

The plan aims at enhancing the integration of the environment in development planning. It describes the country's main profile, environment and natural resources, human settlements and infrastructure, environmental aspects of trade, industry and service sectors. It also discusses environmental information, networking and technology, Governance, Policy and Legal Framework as well as Institutional arrangements and implementation modalities and monitoring and evaluation strategies. It proposes for instance, interventions against environmental concerns for the fishery industry. Interventions proposed in the plan include; enhancing water catchment and land use management, enforcement of relevant legislation, promotion of sustainable fisheries development and management, undertaking research and strengthening collaborations on invasive and alien species management and intensification of surveillance of fishery activities within the Exclusive Economic Zone (EEZ). It further includes an Environment and Natural Resources Implementation Strategy that integrates environmental concerns into development planning and implementation. The strategy states the different sectors such as fisheries and coastal and marine resources, the priority issues, objectives; output expected activities to be undertaken, the lead institutions, the time frame and the budget.

ii. Provincial environment action plan (PEAP) for coast - 2009-2013

The Plan provides environmental management strategies and actions that integrate environmental concerns into social and economic development planning at at District (DEAPs), Provincial (PEAPs), and National (NEAP) levels as per the provisions of Articles 37 and 38 of EMCA 1999. National Environment Action Plan (NEAP) highlights priority themes and activities for the country towards achieving sustainable Development.

iii. Environmental management and coordination act (EMCA) 1999

The National Environment Council (NEC) was established by Section 4(1) of EMCA. The NEC's primary function is policy formulation and direction for the purposes of EMCA. EMCA provides for an appropriate legal and institutional framework for the management of Kenya's environment and matters connected to the protection of the environment. Section 7 (1) established National Environment Management Authority (NEMA) as the principal instrument of government in the implementation of all policies relating to the environment. NEMA became operational in 2002. Section 55, of EMCA acknowledges the central role of ICZM in the protection of marine and coastal systems. Section 71(d) of the Act stipulates that the Standards and Enforcement Review Committee, in consultation with relevant lead agencies, shall prepare and recommend to the Director-General guidelines or regulations for the preservation of fishing areas, aquatic areas, water sources and reservoirs and other areas where water may need special protection.

iv. Maritime zones act, chapter 371, 1989

The Act consolidates the laws relating to the territorial waters and the continental shelf of Kenya. It recognizes the existence of a 200 nautical mile Exclusive Economic Zone (EEZ) from the baseline and sets out the limits of Kenya's territorial waters extending up to 12 nautical miles from the baseline. The Act gives the Minister's powers to make regulations on the exploration, exploitation, conservation and management of the maritime zones. The Act also provides a legal framework for the management and development of fisheries resources.

The Act provides rules for the licensing and control of maritime service providers. This Act provides for the registration and licensing of Kenyan ships. It has a crucial role in regulating shipping activities in inshore areas and in the Kenya's EEZ. The Act has provisions for maritime safety, security, pollution control and environmental conservation.

Other Policy Instruments

v. The poverty reduction strategy paper (PRSP) 2001

The PRSP identified the following key issues in fisheries: low incomes for fish farmers and low earnings in the fish industry; low production of fish; and lack of fish marketing infrastructure. The paper proposed priorities for intervention including the need for: improvement of infrastructure such as access roads, portable water, cold storage, land ownership and access to beaches and landing sites. Other proposed priorities include a review of legal framework for fisheries, development of innovative saving and credit system and promotion of fish marketing.

vi. Economic Recovery Strategy (ERS) 2003-2007

The Economic Recovery Strategy (ERS) 2003-2007 proposed several interventions in fisheries such as development of facilitative infrastructure including landing beaches, cooling plants and access roads to reduce wastage and to achieve required sanitary and health standards. It also proposed entering into agreements to promote closer regional cooperation in the management and regulation of transboundary fishery resources.

vii. Strategy for Revitalizing Agriculture (SRA) 2004-2014

The Strategy for Revitalizing Agriculture (SRA) 2004-2014, reiterates the interventions proposed in the Economic Recovery Strategy (ERS) paper. It proposes the promotion of the production of salt-water products such as shrimps, whilst providing for better legislation and enforcement of fishing gear, trawling and pollution control. The SRA 2004-2014 also acknowledged that high costs have prevented development of modalities for utilizing fishery resources in the Exclusive Economic Zone (EEZ). Value addition through processing is also emphasized in the SRA 2004-2014.

viii. Vision 2030

Vision 2030 identifies fisheries alongside crop agriculture and livestock as key sectors. It proposes, *inter alia*, to raise incomes in the fisheries sector by processing thereby adding value to products before they reach the market. Innovative, commercially oriented and modern technology will be adopted in the fisheries sector. It is expected that improved fishery management will have a significant impact on efforts to achieve Millennium Development Goals (MDGs) in Kenya. Improved fisheries management is expected to assist in reducing by half the proportion of the human population that suffers from hunger and malnutrition. The challenge is to ensure that those who depend on fish for food and livelihoods, particularly coastal/marine populations, continue to get these important benefits.

International frameworks

ix. EAC Treaty and protocols

The regional intergovernmental organization of East African Community includes Republics of Kenya, Uganda, the United Republic of Tanzania, Republic of Rwanda and Republic of Burundi. The treaty for the establishment of the EAC aims at achieving food security by developing fish farming. It aims at adoption of common policies and regulations for the conservation, management and development of fisheries resources. It also proposes establishment of a common fisheries management and investment guidelines.

The objective of the cooperation in agricultural sector is stated in Chapter 18; Article 105 of the treaty is to achieve food security and rational agricultural production within the Community. Chapter 19 Article 114 b (ii) emphasizes the need for common policies and regulations for the conservation, management and development of fisheries resources. Article 10 (1) of the protocol grants free movement of workers who are citizens within their territories. The protocol allows for free movement of goods, services, labour and capital plus the right of establishment and residence. This means that migrant fishers are allowed to move freely between Kenya and Tanzania.

x. UNCLOS 1982

The Law of the Sea Convention constitutes the overall legal framework for the seas and oceans of the world. It provides a more effective framework for the management and conservation of marine living resources. It establishes maritime zones and boundaries, including the territorial waters (12 nautical miles from the baseline) and Exclusive Economic Zone (EEZ) (200 nautical miles from the baseline).

xi. The Convention on Biological Diversity (CBD) 1992

The Convention (and its Cartagena Protocol on Biodiversity) provides the main global framework for the protection of all types of biodiversity. The CBD's second conference of parties (Jakarta Mandate) on marine and coastal biological diversity expressed deep concern "at the serious threats to marine and coastal biological diversity". The conference of parties decision also affirms the FAO's Code of Conduct for Responsible Fisheries, the Agreement for the

Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and the Washington Declaration and Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, and supports their implementation.

xii. The Nairobi Convention 1985

The Nairobi Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region and its additional protocols constitute the regional legal framework for our maritime zone. Its additional Protocol on Specially Protected Areas and Wildlife (SPAW) applies specifically to coastal and marine biodiversity; this is applicable to the small and medium pelagic fishery as it supports regulating the fishery to protect endangered species and coral reefs.

xiii. The FAO Framework

The Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries and the FAO Technical Guidelines for Responsible Fisheries, as well as various Technical Papers, also provide further context and basis for pelagic fisheries management. Adopted in 1995, it is a voluntary rather than mandatory instrument, and is aimed at everyone working in, and involved with, fisheries and aquaculture, irrespective of whether they are inland or oceanic. It was developed through contributions from representatives from the 170 FAO members; inter governmental organizations, the fishing industry and nongovernmental organizations. It therefore represents a global consensus or agreement on a wide range of fisheries and aquaculture issues. Through the FAO Code of Conduct, States are expected to encourage industry and fishing communities to develop codes of good practice that are consistent with, and support, the goals and purposes of the Code of Conduct.

xiv. Agenda 21 (1992), chapter 17.

Chapter 17 highlights some of the key issues in oceanic fisheries, including poor management of fisheries resources, over utilization of resources, with problems of unregulated fishing, over capitalization, excessive fleet size, vessel re-flagging to escape controls, insufficiently selective gear, unreliable data bases and lack of sufficient cooperation among the states. Agenda 21 helps clarify the issues in marine and coastal fisheries and proposes management interventions.

xv. UN Fish Stock Agreement, 1995

The agreement is concerned with conservation and management of straddling and highly migratory fish stocks. This is due to the transbaundary nature of these stocks, whose conservation and management require cooperation between coastal States and States fishing on the high seas.

xvi. REYKJAVIK Declaration on Responsible Fisheries on the Marine Ecosystems, 2001

The declaration recognized among other things that sustainable fisheries management takes into account the impacts of fisheries on the marine ecosystem and the impacts of the marine ecosystem on fisheries. The objective of including ecosystem considerations in fisheries management is to contribute to the long-term food security and to human development and to ensure the effective conservation and sustainable use of the marine ecosystem. The declaration further declared the commitment to implement the FAO Code of Conduct, international plans of action as well as the Kyoto Declaration and Plan of Action on the Contribution of Fisheries to Food Security. Other agreements included the need for effective management plans, strengthening regional and international fisheries management organizations, prevention of adverse effects of non-fisheries activities on marine ecosystems and fisheries and advancing the scientific basis for incorporating ecosystem considerations in fisheries management. It also called

for international support and cooperation for developing countries to successfully incorporate ecosystem considerations into fisheries management.

4. THE ADMINISTRATIVE AND INSTITUTIONAL (FORMAL OR INFORMAL) FRAMEWORKS FOR THE NATIONAL FISHERIES MANAGEMENT.

The main institutions and their relevance to the small and medium fishery are highlighted in Table 2 below and key institutions discussed further.

Table 2. Main institutions relevant in the fisheries Sector

Institutions	*Role-INTERST*
Government institutions	
Fisheries Department	Exploration, exploitation, utilisation, management, development and conservation of fisheries resources
Kenya Marine and Fisheries Research Institute (KMFRI)	Research on aquatic and coastal resources and environment
Beach Management Units (BMUs)	Exploitation and participatory management fisheries resources and landing areas
Kenya Wildlife Service (KWS)	Conservation and management of wildlife and enforcement of related laws and regulations. In charge of MPAs
Forestry Department	Management and conservation of Kenya's forests
Kenya Navy	Security and Surveillance international boarders including EEZ
Kenya Maritime Authority (KMA)	Custodian of laws relating to the territorial waters.
Kenya Ports Authority (KPA)	Port management including cargo handling and regulation
National Environmental Management Authority (NEMA)	Oversee the implementation of EMCA, 1999. Supposed to be Kenya's lead environmental watchdog
Coast Development Authority (CDA)	Initiates and support developmental projects at the Kenyan coast.
East African Community (EAC)	Promote integration of East Africa states. Provides for a legal framework to effectively streamline the management of trans-boundary ecosystem to enhance the quality of environment and ensure sustainable utilization of shared natural resources
Marine police	Maintain security and order within the maritime zones
Local Universities	Marine and coastal based studies
Non-government organizations	
Worldwide Fund for Nature (WWF)	Environment conservation and management
Tuna Fisheries Alliance of Kenya (TUFAK)	Advocacy on Tuna fishery in the Kenya and regionally.
Kenya Fish Processors & Exporters Association (AFIPEK)	Ensure vibrant fish processing industry and sustainable management of fisheries resources
Kenya Marine Forum (KMF)	Advocacy on marine environment
CORDIO East Africa	Coastal oceans Research and development, climate change
Wild life Conservation Society	Research and monitoring of coral reefs ecosystems, climate change
Eco-Ethics International Kenya Chapter	Advocacy, social development, environment education and awareness

Coast Development Research Organization (CDRO)	Advocacy, social development, environment education and awareness
Coastal and Marine Resources Development (COMRED-Africa)	Coastal oceans Research and development
East Africa Wildlife Society (EAWLS)	Environment and wildlife conservation, and Advocacy
KWETU training centre	Promoting diversified and sustainable livelihood activities, management of natural resources and community capacity building.
Act Change and Transform (ACT)- *formerly PACT Kenya*	Capacity building and development, advocacy
Community Action for Nature Conservation (CANCO)	Advocacy, capacity building and training

i. Fisheries Department

A government authority charged with the responsibility of regulating commercial and artisanal fishing in Kenya's waters. It is mandated under the Fisheries Act Cap 378 with the development, management, exploitation, utilization, and conservation of the Kenyan fisheries resources. The Fisheries department is rolling out of Beach Management Units (BMU) to strengthen co-management of marine fisheries resources.

ii. Kenya Marine and Fisheries Research Institute

KMFRI was established by the Science and Technology Act, Cap 250 of the Laws of Kenya to conduct research on marine and freshwater fisheries, aquatic biology, aquaculture, environmental chemistry, ecological, geological and hydrological studies, as well as chemical and physical oceanography. The institute undertakes research sustainable management and exploitation of coastal and marine resources. Some major regional and national projects relevant to marine fisheries are housed at KMFRI; South West Indian Ocean Fisheries Project (SWIOPF) and Kenya Coastal Development Project (KCDP) which aims to promote environmentally sustainable development at the coast.

iii. Kenya Forestry Service (KFS)

Kenya Forestry Service is a state corporation established under the Forest Act 2005 to conserve, develop and sustainably manage forestry resources for socioeconomic development. The service is responsible for the protection and management of forests in Kenya, including mangrove forests.

iv. Kenya Navy

The Kenya Navy primary roles include policing of Kenya's territorial waters, protection of vital areas and surveillance of the EEZ. Recently, Kenya Navy has been involved in ensuring security along Kenya's coastal waters and boarder with Somalia, greatly affecting fishing activities.

v. Marine police

Marine police assist in maintaining security, law and order along the marine waters. Functions of the Kenya marine police that are relevant to pelagic fisheries include provision of internal security along the Kenyan coast, keeping vigil of maritime operations and activities, controlling terrorism activities, carrying out search and rescue operations for fishermen and enforcement of IMO rules, observations and regulations.

vi. *Kenya Maritime Authority*

Mandated under KMA Act 2006 to regulate, co-ordinate and oversee maritime affairs in Kenya. It helps in the protection of the environment (e.g. prevention of maritime pollution which benefits

fisheries) in compliance with national laws and international conventions. The KMA is also involved rescue operations within the sea and in registration of fishing vessels and prescribing regulations for their safety. KMA has powers to regulate the exploration, exploitation, conservation and management of the maritime zones.

vii. National Environmental Management Authority (NEMA)

A government parastatal established to oversee the implementation of the Environmental Management and Coordination Act (EMCA), 1999. It is supposed to be the lead environmental watchdog with the official mandate to ensure environmental compliance and enforcement and undertake public awareness and education, among other mandates. NEMA has been in the lead in development of Integrated Coastal Zone Management (ICZM) action plan and other policies, guidelines and programmes relevant to the coastal and marine environment. This is aimed at ensuring sustainable utilization and conservation of coastal and marine resources (GoK 2011).

viii. Kenya Wildlife Service

KWS established by an Act of Parliament, Cap 376, (revised edition 1985, see Legislation review report No.3) is mandated conserve and manage wildlife in Kenya for the Kenyan people and the world and to enforce related laws and regulations. KWS has sole jurisdiction over National Parks, supervisory role in the management of National Reserves, local and private sanctuaries, license, and control and supervise all wildlife conservation and management activities outside the protected areas and is also tasked with conservation, education and training and conducting wildlife research.

ix. Coast Development Authority

CDA is a statutory body (established by an Act of Parliament, Cap 449, 1990) whose mandate is to initiate, plan, coordinate and implement integrated development programmes and projects mainly within the coastal region and its environs. CDA aims to ensure sustainable utilization of coastal resources including those in the EEZ (e.g. fisheries) for the benefit of communities in the coastal region. The CDA is involved in activities such as construction of fishponds. It also supports artisanal fishermen through establishment of microcredit and savings schemes to enable them acquire capital for purchase of better and improved fishing gears.

x. *Kenya Ports Authority* (KPA)

KPA is a statutory body established by an Act of Parliament Cap 391, 1978. KPA is mandated to maintain, regulate and improve seaports. It ensures among other things that there is safe navigation and controls pollution of the coastal waters.

5.0 OVERVIEW OF THE FISHERY AND RESOURCES EXPLOITED

i. Details of the fishing gear used and fishing areas

Most of marine fishing in Kenya is small-scale artisanal that operate in the coastal near-shores (McClanahan & Mangi 2004; Okemwa et al 2009; Samoilys et al. 2011a). The major fishing areas reported along the Kenyan coast are the Kiunga coastline and Lamu islands in the North, Tana River mouth, Ungwana Bay and Malindi area including the offshore North Kenya Bank and Shimoni, Vanga, Funzi Island and coral reef areas on the Southern border (Oduor 1984, Fondo 2004). Some of the rich inshore grounds include grounds around the Lamu Archipelago, Ungwana Bay, the North Kenya Bank and the Malindi Bank (Odero1984, KMFRI 2002, Fondo 2004, Munga et al 2012). As a multispecies fishery, several gears are used to capture pelagic including nets (castnets, gillnets, beach and reef seines, purse seine/ ring nets) and hook and line (vertical line, longline and trolling line) (see Table 3). Gill nets, longlines, beach and reef seines are the main gears used in the exploitation of small and medium pelagic whereas large pelagic are captured by large-mesh sized gill nets. Ring nets and set nets are intended for use outside the reef, so their use is restricted to the calm north east monsoon (NEM). However some ringnets have been modified to suit use within shallow waters hence used during south east monsoon. Use of beach seines, is predominant in the south east monsoon (SEM) (Tuda et al 2008) due to turbulent waters in the open sea. Accordingly higher catches are recorded during the NEM compared to the SEM season (McClanahan 1988, Okwemwa et al 2009, Fulanda et al. 2011). Factors affecting observed seasonality include: reduced effort by fishermen during the SEM due to rough sea conditions, fish migrations and decreased density and activity due to a deeper thermocline and cooler waters in the SEM (McClanahan 1988).

The artisanal fishery is confined to a small strip of 2.5 to 3.0 nautical miles within the reef. The small and medium pelagic fishery mainly consists of sardines (Clupeidae), anchovies (Engraulidae), and scads (Carangidae). The medium sized pelagic are mainly captured outside the immediate inshore areas. Industrial fishing is limited operating within the EEZ. This offshore fisheries zone is mostly exploited by vessels from Distant Water Fishing Nations (DWFNs). Information concerning the status of the Kenyan EEZ is limited in spite of an increase in offshore fisheries in the region from 1990s (Kamau et al 2009). The sports fishing operate from the outer reef out to about 15 nautical miles from the shore along the entire coast. As a recreational activity, it has been taking place all along the Kenyan coast within the confines of various registered tourist clubs and at times on an individual basis. The fishing season normally lasts eight or nine months operating from the outer reef out to about 20 km from the shore targeting tunas and other big game fishes. The main sportfishing areas are Shimoni, Diani, Mombasa, Mtwapa, Kilifi, Watamu, Malindi and Lamu (see section 7, Ndegwa 2011).

Table 3. Main fishing gears targeting the small and medium pelagic fishery (source: Samoilys et al 2011a)

Fishing gear type	**Description**	**Main pelagic target families/species**
Hand line (Mshipi)	A single monofilament nylon line attached to one or more steel hooks onto which baits are fixed.	Jack/trevally (*Carangidae),* tuna/mackerels *(Scombridae)*
Longline - droplining and drift longlines. *(zulumati)*	Single main line of nylon anchored and buoyed in a horizontal position on or near the bottom (set longlines), near the surface or at a certain depth (drift longlines) at times deployed vertically (droplining).	Tuna/mackerels *(Scombridae, Scomberomorus commerson),* Sharks *(Carcharhinidae),* swordfish (*Xiphiidae),* billfish *(Istiophoridae).*
Trolling (*mshipi wa kurambaza)*	Nylon monofilament main line(s) used within the pelagic offshore waters beyond the fringing reef. The line is attached to either an artificial lure (rapala) or a baited hook and towed through surface waters.	*Scombridae; Scomberomorus commerson; Scomberoides spp.;* barracuda (*Sphyraenidae);* Dolphinfish *(Coryphaenidae);* billfish (*Istiophoridae).*
Set gillnets *(Jarife, nyavu ya kutega)*	Gill nets made of multi-filament nylon, suspended with floats and held vertically with sinkers. Set on or near the bottom but often catch pelagic. Lest	Sharks, rays, herring, sardines, and also larger pelagics such as tuna, and squid. Tuna/mackerels *(Scombridae, Scomberomorus commerson),* Sharks *(Carcharhinidae),* swordfish (*Xiphiidae),* billfish *(Istiophoridae*
Drift gillnets *(Jarife, nyavu ya kuogelesha)*	Gill nets made of multi-filament nylon with large mesh size set suspended mid water but drifting and/or connected to the operating vessel.	Sharks, rays, tuna
Ringnets *(nyavu ya kufunga)*	A multifilament nylon mesh netting similar to a purse seine suspended from floats and weighted at the bottom to hold the net vertically in the water. A foot-rope threaded through metal rings at the bottom of the net is used to close the net (hence the name "purse") to enclose a school of fish.	Intended for pelagics; *Carangidae, Scombridae; Clupeidae, Engraulidae*
Cast nets *(kimia)*	Circular nets often made with monofilament nylon line, with weights attached around the edge. They usually comprise three parts: the upper section, the middle section and the weighted lower section. A foot-rope is used to close the net during retrieval.	Sardines (*Sardinela)*
Beach and reef seine *(juya, buruta, nyavu ya kukokota)*	Small variable mesh sized nets made of multifilament nylon with a floatline and a weighted footrope. A section of larger-mesh netting on each wing of the net corals fish towards the smaller-mesh centre (codend) of the net.	Sardines, half beaks. *Hemiramphidae*
Fence traps *(uzio, rasaka, wando)*	Stationary semi-permanent traps and fences set in the intertidal zone. Usually made of mangrove stakes, plaited mats, or palm frond with midribs tied tightly together.	Sardines (*Sardinela)*

Fishing effort along the Kenyan coast varies by geographical area and across the gear types (Figure 2 - 3). Gillnets and hook and line gears are the most dominant in the entire coast. The most common mesh size for gillnets was 6 inches with over 1200 nets recorded by FiD (2008). According to Okemwa et al 2009, use of gillnets was highest in Lamu (Kiunga, Kizingitinini and Amu). Pelagic such as tuna are fished by artisanal fishers using gillnets, troll lines, longlines and handlines. A synopsis of the fishing gears by sector and extent of fishing presented in table 4 while the spatial distribution of artisanal fishing gears and crafts used along the Kenya's coast is presented in figure 4.

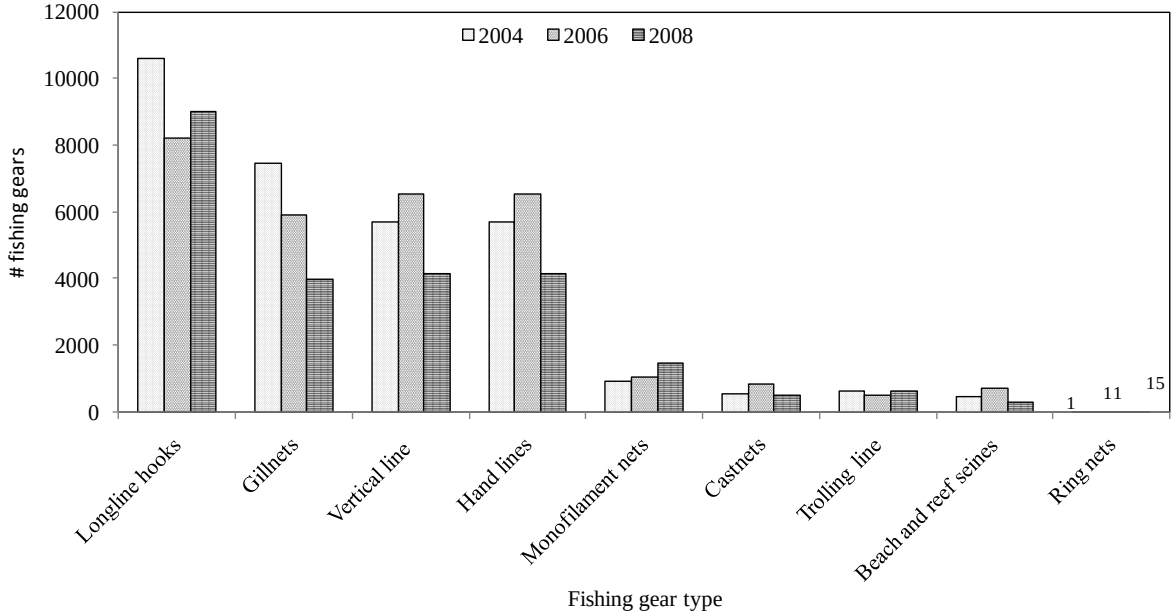


Figure 2. Number of fishing gears targeting small and medium pelagic in year 2004, 2006 and 2008, (FiD 2008).

Longline fishing effort indicates hooks smaller than size 10 are the most common with over 4000 hooks of size class <4, size 4-7 and size 8-10 being recorded in 2004, 2006 and 2008. The majority of longline lines use hooks smaller than size 4 (figure 3). Longline fishery is artisanal, recreational or industrial/commercial (Table 4) operating from coastal, reef platforms, bays, and offshore areas. The longlines catch a wide range of species including the tunas yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*), and albacore (*Thunnus alalunga*), the billfishes striped marlin (*Tetrapturus audax*), black marlin (*Makaira indica*), blue marlin (*Makaira nigricans*), shortbill spearfish (*Tetrapturus angustirostris*), sailfish (*Istiophorus gladius*), and swordfish (*Xiphias gladius*), the sharks including thresher shark (*Alopias vulpinus*), black shark (*Carcharhinus melanopterus*), hammerhead shark (*Sphyrna zygaena)*, tiger shark (*Galeocerdo cuvier*), and mako shark (*Isurus glaucus*), dolphinfish (*Coryphaena hippurus*), barracuda (*Sphyraena* spp.), rainbow runner (*Elagatis bipinnulatus*), moonfish (*Lampris regius*), and wahoo (*Acanthocybium solandri*).

A wide range of net mesh sizes are used along the Kenyan coast (Samoilys et al 2011). Offshore stationary gillnets are usually 2–5 inches; inshore nets 1–4 inches; drifting 4–18 inches; monofilament ~2–2.6 inches; ringnets ~0.5–3 inches; Prawn seine ~2 inches; Cast net: <0.3–1.2 inches; beach seine ~1 inch. A rapid assessment of net mesh sizes used in 15 landing sites (Appendix 1) established that set nets had the highest mesh size averaging 8.8±5.1 (SD) inches

whereas cast nets and ringnets had the least mesh sizes at 0.9±0.8 (SD) and 0.6±0.3 (SD) inches respectively. Only two gears were found to have a mesh size of above 3 inches; drift and set nets.

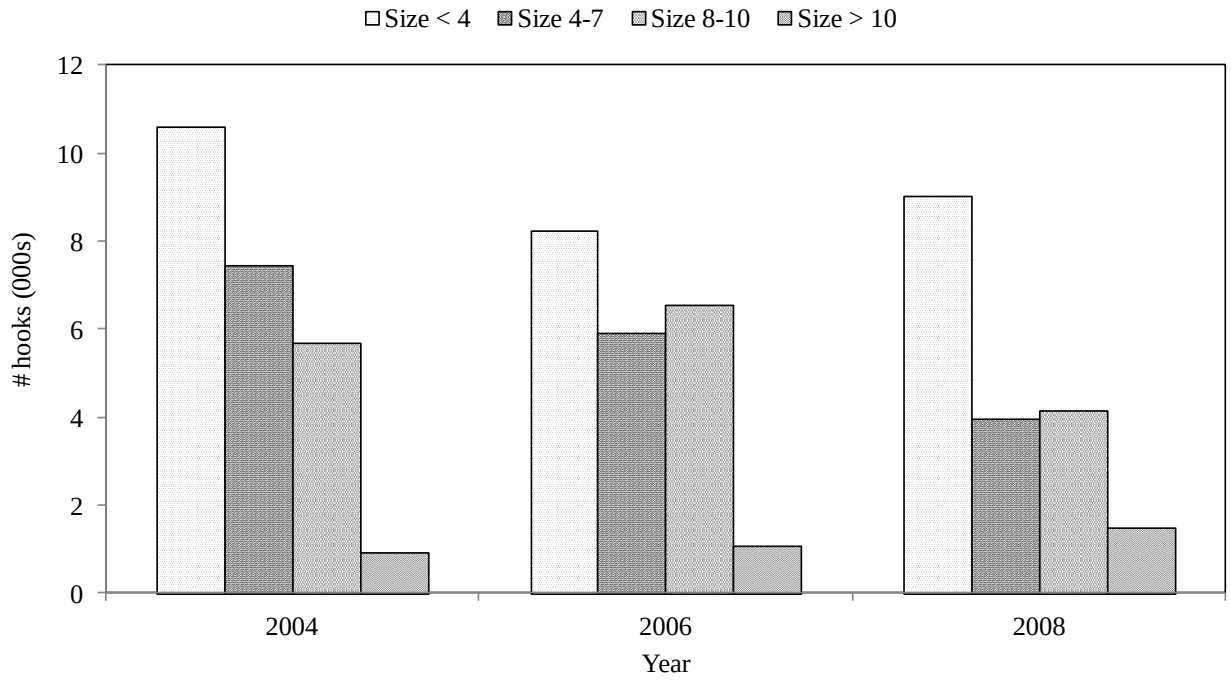
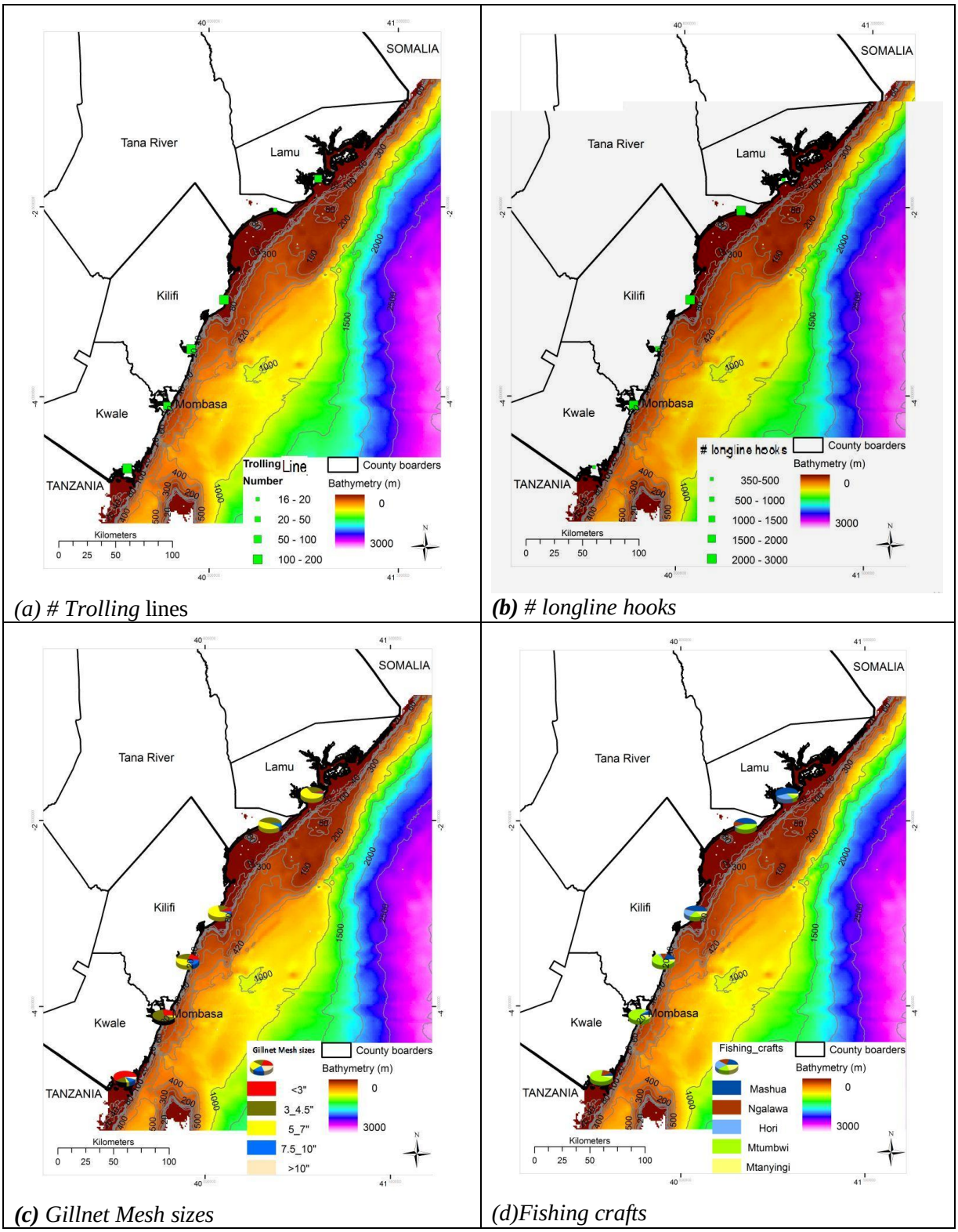


Figure 3. Number of hooks used in the longline artisanal fishery in year 2004, 2006 and 2008, (FiD 2008).

Table 4. Synopsis of the fishing gears by sector and extent of fishing

Method	Sector	Fishery	Pelagic groups targeted	Fishing areas
Cast nets	Artisanal	Artisanal	Small pelagics	coral reef platforms, mangrove creeks
Gillnets	Artisanal	Artisanal	Small, medium pelagics	tidal, sub-tidal and reef areas
Purse seine nets	Artisanal	Artisanal ringnet fisheries	Small, medium pelagics	Coastal
Beach seines	Artisanal		Small pelagics	shallow coastal bays and seagrass
Vertical line without FADS	Artisanal	Commercial line fishery	Medium large pelagics	Coastal, coral reef platforms
Vertical line without FADS	Recreational	Recreational boat-based line fishery	Medium large pelagic	
Longline	Industrial	Commercial longline fishery	Tuna, swordfish	General offshore area (EEZ)
Longline	Industrial	Commercial longline fishery	Pelagic sharks	

The Spatial distribution of fishing effort by gears and vessels in 2008 along the Kenya's coast is shown in figure 4. Malindi in Kilifi county had the highest concentration of gillnets in 2008 (1599) followed by Msambweni (FiD 2008).



(a) # Trolling lines

(b) *# longline hooks*

(c) *Gillnet Mesh sizes*

(d)Fishing crafts

Figure 4. Spatial distribution of the number of fishing gears and crafts along the Kenyan coast, commonly used in targeting pelagic fisheries; (*a*) trolling lines, (*b*) longline hooks *(c) gillnet* mesh sizes *and (e)* fishing crafts.. Rectangle sizes are proportional to the number of hooks or lines (Data source: FiD 2008)

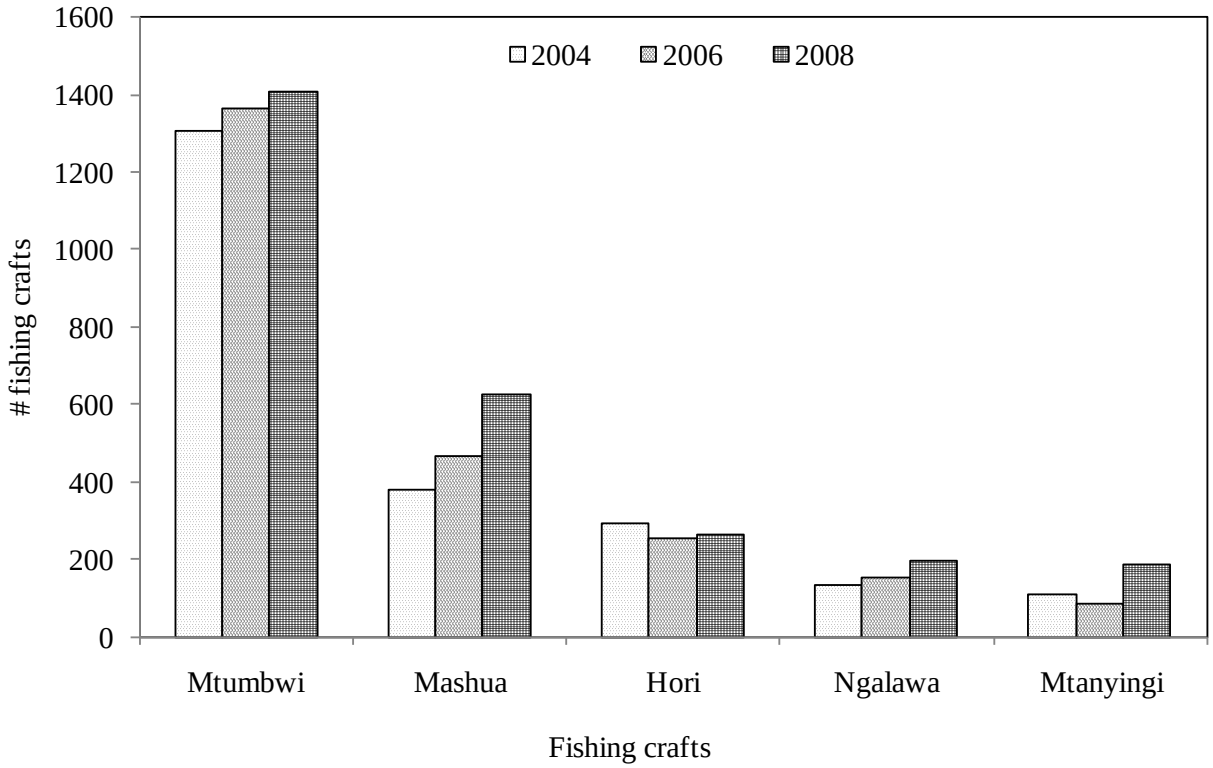


Figure 5. Trend and type of fishing crafts used in marine artisanal fisheries (FiD 2008).

Only ~10% of fishing craft are motorized (Okemwa et al. 2009). Dugout canoes *Mtumbwi* and *sailboats mashua* are the most prominent fishing crafts in use along the Kenyan coast (Figure 5). In Shimoni for instance 85% of fishing vessels are dugout canoes (Okemwa et al 2009). The fishing crafts can be described as; dugout canoes (*mitumbwi*) curved out from a log of wood or tree trunk with no joints or planks boats; *(ngalawa*) pointed at both ends, with outriggers on both sides (*mirengo*) and propelled using sail; d*hows/mashua* pointed on one end with V-shaped bottom and sail propelled or engine; *Jahazi* a bigger *Mashua*, >12 meters long; Dau (*mtanyingi*) are flat bottomed fishing craft with ribs at the bottom and pointed at one end; *hori*, flat bottomed fishing boat used mostly in the shallow waters and propelled by sail or paddles and strengthened by ribs (*mataruma*) on sides and the floor. Most of fishing crafts are small and hardly go beyond the reef during the Southeast Monsoon (May to August) due to the strong winds and rough seas. However sailboats (*mashua*) and outrigger canoes (*ngalawa*) are made to suit rough weather and open offshore pelagic fishing expeditions. They are mainly equipped with shark net, drift net, ringnet, other set gillnets and line gears (Fondo 2004, Okemwa et al 2009).

ii. *Summary of information on exploited resources*

Pelagic fishery is more effectively exploited by artisanal fishers during NEM when non-powered boats can venture into the open waters as opposed to SEM. It has been pointed out that large schools of migratory pelagic stocks abound in the offshore waters of Kenya during the SEM period. Such large shoals include tuna, skipjack, travelly, sardinella, mackerels, marlins, sailfish and swordfish (Mbuga 1984).

First pelagic fisheries resources survey was conducted by the East African Marine Research Organization in 1951. The survey established that considerable stocks of unexploited pelagic fish aggregate in large surface schools in coastal waters. Thus subsequent surveys conducted from 1951 to 1954 also focused on pelagic fish (Williams, 1956, 1958, 1962, 1964, 1965). Pelagic species encountered include *Scomberomorus commerson,* yellow fin tuna *Thunnus albacares* , *Thunnus alalunga*, frigate mackerel *Auxis thazard*, the dogtooth tuna *Gymnosarda unicolor*, small tuna *Euthynnus affinis* and skipjack *Katsuwonus pelamis*, striped marlin *Tetrapterus audax*, black marlin, *Makaira indica*, blue marlin, *Makaira nigricans* the round scad *Decapterus spp*. and horse mackerel *Trachurus spp*.. The sardines and anchovies (mainly round herring *Etrumeus micropus*) were caught in substantial quantities of completely different species, suggesting that schools are discrete and locally distributed. In terms of depth, the larger pelagic fishes comprising the tuna and tuna-like species and the larger carangids were caught in large numbers between 15–200 meters depth mostly in June and July

Based on surveys from R.V. Dr Fridtjof Nansen in 1980-1983 along the Kenyan coast, small-sized pelagic species were caught in waters shallower than 200 m particularly within 10–50 m depth. The main families caught were Clupeidae (mainly *Pellona ditchela, Sardinella gibbosa, Sardinella longiceps, Dussumieria acuta*), Carangidae (*Scomberoides commersonianus, Decapterus macrosoma,*), Scombridae and to some extent Sphyraenidae. Spanish mackerel, *Scomberomorus commerson, S. plurilineatus* and Indian mackerel, *Rastrelliger kanagurta* were reported to be caught accidentally in nets.

The contribution of pelagics families and species in landings is variable in terms of gear and location. In the biological and socio-economic assessment of ring net fishing in Kipini, the family Carangidae (*Carangoides ferdau, Gnathanodon speciosus, Carangoides bajad, Caranx ignobilis, Caranx sexfasciatus, Seriola lalandi* and *Elagatis bipinnulatus*) had the highest species composition of 33.3 %, followed by Scombridae (*Euthynnus affinis, Rastrilleger kanagurta, Scomber japonicus* and *Scomberomorous commersoni*) with a composition of 19 % and Sphyraenidae (*Sphyraena forsteri* and *S. jello*) with a composition of 9.5 % (Munga et al. 2010). The Malindi fishing grounds are equally important and significantly contribute to the fisheries catch of mixed pelagic and Carangidae at 13.8% and 9.2% respectively (Munga et al. 2012). The shark net fishery operating in south coast (Msambweni - Vanga) was dominated by Scombridae accounting for 50% of the entire catch (Okemwa et al 2009aaaa). The Diani-Chale fishery had Scombridae, Sphyraenidae, Carangidae and Hemiramphidae accounting for 5.2, 4.5, 2.4 and 1.3% respectively (Maina et al., 2008). Individual pelagic species caught by the common gears operating between Marina and Chale landing sites accounted for less than 3% of the catch (McClanahan and Mangi, 2004). In a beach seine survey by Kimani et al. (1996) in Gazi area, small-sized pelagic fish species: *Herklotsichthys quadrimaculatus, Gerres oyena, Atherinomorus lacunosus,* were the most abundant species accounting for 77.3%. Clupeidae, principally *Herklotsichthys quadrimaculatus* dominated the population. Number of pelagic species by family ranged between 1-5, Clupeidae (3), Scombridae (1), Sphyraenidae (3), Hemiramphidae (3), Engraulidae (2) and Carangidae (5)

In general small pelagic commonly harvested in from inshore waters include sardines (Clupeidae), anchovies (Engraulidae), and Scads (Carangidae). Majority of other small and medium sized pelagic are found outside the immediate inshore areas. Other species such as Spanish mackerel (*Scomberomorus commerson*), frigate tuna (*Auxis thazard*), Eastern little tuna *Euthynnus affinis* and other large tunas, usually categorized as 'medium pelagics' are found far offshore. High priority medium-sized pelagic fishes include the larger carangids, smaller scombrids (i.e. small tunas and seerfishes), some gempylids, dolphinfish and cobia (Table 5, Raboanarijadna et. al., 2009).

Table 5. Medium (MP) and small (SP) pelagic fishes exploited along the Kenyan Coast, the asterisk (*) indicates the SWIOFP prioritized species. These species are important to fisheries in various sectors (i.e. artisanal, sport, and industrial fisheries

Species	**Family**	**Common name**	**MP**	**SM**
*Euthynnus affinis**	Scombridae	Eastern little tuna	√	
*Sarda orientalis**	Scombridae	Striped bonito	√	
*Elagatus bipinnulata**	Carangidae	Rainbow runner	√	
*Coryphaena hippurus**	Coryphaenidae	Dolphinfish Dorado	√	
*Scomberomorus commerson**	Scombridae	King mackerel	√	
Scomberomorus plurilineatus	Scombridae	Queen mackerel	√	
*Auxis thazard**	Scombridae	Frigate tuna	√	
*Carangoides chrysophry**	Carangidae	Longnose trevally	√	
*Carangoides gymnostethus**	Carangidae	Bludger	√	
*Carangoides malabaricus**	Carangidae	Malabar trevally	√	
Carangoides bajad	Carangidae	Orange spotted trevally	√	
Caranx heberi	Carangidae	Blacktip trevally	√	
*Caranx ignobilis**	Carangidae	Giant trevally	√	
*Caranx melampygus**	Carangidae	Bluefin trevally	√	
*Caranx sexfasciatus**	Carangidae	Bigeye trevally	√	
*Alectic indicus**	Carangidae	Indian threadfish	√	
Gnathodon specious	Carangidae	Golden trevally	√	
Sphyraena barracuda	Sphyraenidae	Great barracuda	√	
*Decapterus macrosoma**	Carangidae	Slender scad		√
*Decapterus macarellus**	Carangidae	Mackerel scad		√
*Decapterus russelli**	Carangidae	Indian scad		√
*Selar crumenopthalmus**	Carangidae	Bigeye scad		√
*Scomber japonicas**	Carangidae	Chub mackerel		√
*Trachurus delagoa**	Carangidae	African scad		√
*Rastreliger kanagurta**	Scombridae	Indian mackerel		√
*Megalaspis cordyla**	Carangidae	Torpedo scad		√
*Ablennes hians**	Belonidae	Barred needlefish		√
*Sardinops sagax**	Clupeidae	Pilchard		√
*Amblygaster sirm**	Clupeidae	Rainbow sardine		√
*Dussumieria acuata**	Clupeidae	Spotted herring		√
*Herklotsichthys puntatus**	Clupeidae	Blue strip herring		√
*Sardinella abella**	Clupeidae	White sardinella		√
Seriola lalandi	Carangidae	Yellowtail amberjack		√
Sardinella gibbosa	Clupeidae	Goldstripe sardinella		√
Sardinella longiceps	Clupeidae	Sardinella		√
Pellona ditchela	Clupeidae	Indian pellona		√
Etrumeus teres	Clupeidae	Red-eye round herring		√
Etrumeus micropes	Clupeidae	Round herring		√
Sardinella sirm,	Clupeidae	White sardinella		√
Herklotsichthys quadrimaculatus	Clupeidae	Blue stripe herring		√

iii. Number of fishermen and shore workers by sector

There were about 15,000 fishermen on the coast in early 1990s operating some 4,800 boats with over 80 % being un-motorized. The number of fishermen reduced to about 7,700 in late 1990s and the number of boats to 2,400 reducing the fishing effort by half. The total number of artisanal fishermen increased from 9,017 in 2004 to 10,254 in 2006 and 12,077 in 2008 increasing at the rate of 12 and 15% respectively over a four year period (figure 6). With a dependency ratio of 1:7 reported in southcaost Kenya (Maina et al. in prep), there were about 84,539 people directly dependent on the artisanal fishers along the coast in 2008. A number of facilities have been established the government and other stakeholders to enable proper fisheries management and minimize post harvest losses (Appendix 2).

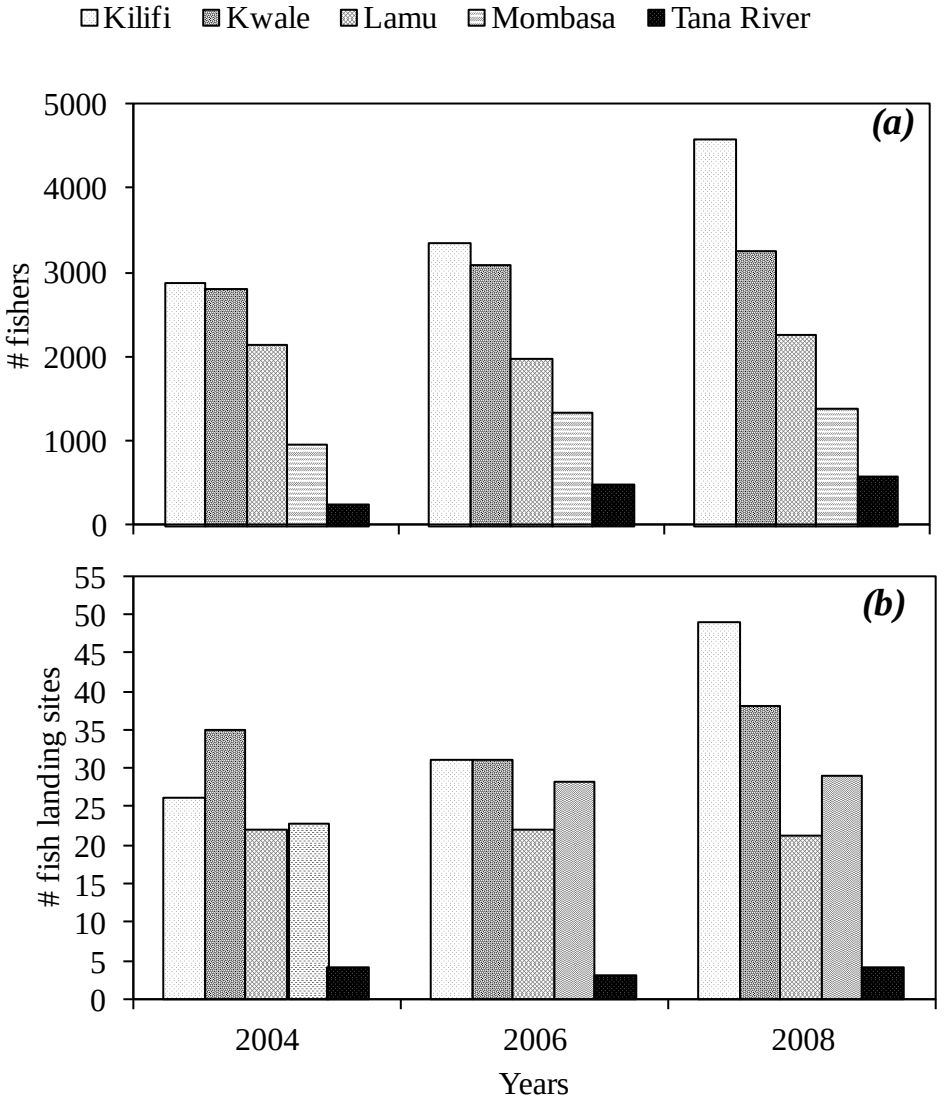


Figure 6. Artisanal fishermen ***(a)*** and fish landing sites ***(b)*** distribution by County along the Kenyan coast (Data source: FiD Marine fisheries frame surveys 2004, 2006, 2008).

iv. Interactions with other fisheries and competition on the same target species

Interaction of pelagic fishery with other fisheries is mainly seen through capture of by-catch and demersal reef species by various fishing gears (see table 3 and table 6). Apart from targeting small pelagic, beach and reef seines also target demersal reef fish species such as rabbitfish (Siganidae), snapper (Lutjanidae), emperor (Lethrinidae), goatfish (Mullidae), sweetlips (Haemulidae) and parrotfish (Scaridae) (Mclanahan & Mangi 2004, Church & Obura 2004). Important demersal families caught by ringnet include Lutjanidae (*Lutjanus gibbus, Lutjanus rivulatus and Aprion virescens*) with a composition of 14.3 % (Munga et al. 2010a). Table 6 annotates the interaction in capturing pelagic and demersal fishes. There is also competition on the use of coastal areas between various resource users which has increased the intensity of conflict among various stakeholders (McClanahan et al 2005, Munga et al 2010b, Ndegwa 2011). Conflicts between fishers using beach seine and ringnet versus other gear have been registered in South coast, Watamu and Kipini in the north. Incidences of resource use conflicts between the artisanal and commercial fishers are reported to be on the rise (Fulanda et al 2011). Declining fishery production, huge amount of discard/by catch mainly juveniles loss of valuable diversity including pelagics, degrading aquatic and terrestrial ecosystems has led to loss of sustainable livelihood of the local communities.

Table 6. Interactions of small and medium pelagic fishery with other fisheries and competition on the same target species, by-catch fishery affecting other fisheries

Fishing gear type	**Habitat**	**Interactions with ecosystem (threats)**	**By-catch**
Hand line	Inshore area and reef slopes, platforms and bommies	May get entangled in corals so fishers will cut the line abandoning it on the reef. Small hooks are responsible for high capture of juveniles	
Longline (droplining and drift longlines)	Offshore pelagic waters	Targets Vulnerable and Endangered large predators such as sharks	Seabirds, whales, sharks and turtles
Trolling	Offshore pelagic waters		Sharks, turtles, sea birds and other marine mammals
Set gillnets	Inshore area	Snagging of corals	Turtles, sharks, marine mammals (dugongs) and sea birds.
Drift gillnets	Inshore area	Snagging of corals	Marine mammals, seabirds, turtles, dolphins and whales
Ringnets	Reef Slopes,	Damages sea grass and corals when deployed close to the beach or on the reef. Sand used as sinkers cause increased sedimentation	Dolphins, turtles and lobster, reef fish
Cast nets	Sheltered areas - creeks, sea grass and coral reef habitats	Abrade polyps and the upper layers of corals.	
Beach and reef seine	Seagrass beds, shallow coastal bays, intertidal zone and inshore areas	Destruction of seagrass beds,	*Trichiurus lepturus, Hemiramphus far, Odonus niger*
Fence traps	Intertidal zone	Capture of juvenile	
Trawling	Shallow areas 12–18 m deep and bays	Capture of juveniles and excessive discarding of low value bycatch at sea	*Otolithes ruber*, *Johnius sp.* (Sciaenidae) and *Pomadysis sp*. (Haemulidae),

6.0 AVAILABLE SCIENTIFIC AND TRADITIONAL KNOWLEDGE ON THE RESOURCES

The main catch for the pelagic families comprise of families Carcharidae, Rhinobatidae, Clupeidae, Sphyrainidae and Scombridae (figure 9-10 and 16). The Small pelagic fishery comprised mainly of sardines, herrings, anchovies and mackerel. Information on pelagic species specific studies and data by species and categories is limited as noted during the SWIOFP national gap analysis workshop (Lucas et al 2009). Small epipelagic tuna / tuna-like species such as *Euthynnus affinis, Sarda orientalis, Scomberomorus commerson* were identified as a priority group that is not adequately covered by the IOTC for the SWIOFP region. The biology and distribution of some of the species commonly in the Kenyan waters and catches (see section 7) is highlighted below.

i. Brief biology of the major fish species

a) Rainbow sardine, *Amblygaster sirm*

Amblygaster sirm is a fast-growing schooling fish that occurs in coastal waters and lagoons. The species feeds mainly on copepods, nauplii and zoea larvae, larval bivalves and gastropods, as well as *Peridinium* and *Ceratium.* This sardine is medium sized fish having a maximum length of 27 cm (Randal, 2005) with a short lifespan (Conand 1991). Reproduction takes place from October to December. First maturity is attained when fish reach 1 year of age and at this time their size is about 16-17 cm (Conand 1991). Mortality is high and most fish die before the age of 2 years. The species has been recorded in temperatures of 28.5-29.8°C and salinities of 31.6-32.3 ppt (Burhanuddin et al. 1974). Used as bait in the tuna fishery.

b) Dolphinfish Dorado, *Coryphaena hippurus*

The species forms schools in open waters but also near the coast (Collette, 1995). Their foods comprise all forms of fish and zooplankton; crustaceans and squid. A study by Collette (1995) determined *C. hippurus* become sexually mature after 4-5 months and spawns in the open sea when water temperature rises. Eggs and larvae are pelagic. Marketed frozen and fresh and is of high value.

c) Mackerel scad, *Decapterus macarellus*

A fast moving schooling pelagic fish that prefers clear oceanic waters, frequently around islands and sometimes near the surface, but generally caught between 40 and 200 m depth (FISHBASE, 2012). Found along the reef edges near deep water feeding mainly on zooplankton. Eggs are pelagic and the fish products are marketed fresh and salted or dried.

d) Slender scad, *Decapterus macrosoma*

As a pelagic schooling species, *Decapterus macrosoma* is occasionally seen in small groups along reef slopes adjacent to deep water in pursuit of zooplankton. Feeds mainly on small invertebrates and is marketed fresh and salted or dried.

e) Rainbow runner, *Elagatis bipinnulata*

Form large schools, occurring in oceanic and coastal waters, generally near the surface over reefs or sometimes offshore. Feed on invertebrates (larger crustaceans of the zooplankton) and small fishes. Eggs are pelagic (Smith-Vaniz, 1986). Good food fish and a valued game fish; marketed fresh and salted or dried; also frozen and used for sashimi.

f) Eastern little tuna - Kawakawa, *Euthynnus affinis*

Euthynnus affinis occurs in open waters but always remains close to the shoreline and are suspected to spawn near the coast. The young may enter bays and harbors and attains maturity at about 38 cm. Forms multi-species schools by size with other scombrid species comprising from 100 to over 5,000 individuals. A highly opportunistic predator feeding indiscriminately on small fishes, especially on clupeoids and atherinids; also on squids, crustaceans and zooplankton (Collette, 2001).

g) Striped bonito, *Sarda orientalis*

A coastal species (Collette, B.B. 1995) found schooling with small tunas and known to occur at depths from 1 to 167 metres. Also found around some islands (Collette, B.B. 2001). The fish feeds on clupeoids, other fishes, squids and decapod crustaceans. Spawning varies with the monsoon season (Collette, B.B. 2001).

h) Chub mackerel, *Scomber japonicas*

A coastal pelagic species, to a lesser extent epipelagic to mesopelagic over the continental slope (Collette,. and. Nauen 1983). Schooling by size is well developed and initiates at approximately 3 cm (Collette,and. Nauen 1983); may also form schools with Sarda chiliensis, Trachurus symmetricus and Sardinops sagax (Collette, B.B. 1995). Adults stay near the bottom during the day; go up to the open water at night, (Maigret, and Ly 1986) where they feed on copepods and other crustaceans, fishes and squids (Collette,. and Nauen 1983). They spawn in batches (Murua and Saborido-Rey 2003). Eggs and larvae are pelagic (Collette1986). In Asian waters, they move to deeper water and remain inactive during the winter season (Nikol'skii, 1954). Commercially cultured in Japan.

i) King mackerel, *Scomberomorus commerson*

Scomberomorus commerson is distributed from near edge of continental shelf to shallow coastal waters, often of low salinity and high turbidity (McPherson,. 1985; Kuiter,. and Tonozuka 2001). It is also found in drop-offs, and shallow or gently sloping reef and lagoon waters (McPherson,. 1985; Myers,. 1991; Kuiter, and TTonozuka 2001). Usually hunts solitary and often swim in shallow water along coastal slopes (Kuiter and Tonozuka 2001). Known to undertake lengthy long-shore migrations, but permanent resident populations also seem to exist. Found in small schools (Collette, 2001). Feed primarily on small fishes like anchovies, clupeids, carangids, also squids and penaeoid shrimps. Eggs and larvae are pelagic (Collette1986).

j) Bigeye scad, *Selar crumenopthalmus*

Bigeye scad is a mostly nocturnal pelagic species that can reach 70 cm TL (Froose & Pauly 2011). The species prefers clear oceanic waters around islands to neritic waters occasionally in turbid waters. The species feeds on small shrimps, benthic invertebrates, and forams when inshore, and zooplankton and fish larvae when offshore. It travels in compact groups of hundreds of thousands of fish.

ii. Geographical distribution of the species and estimated status of the stocks.

Data available from the Indian Ocean Tuna Commission (IOTC) shows that Kenyan waters are some of the richest in tuna and tuna-like fishery stocks, and that the country's EEZ is part of the richest yellow-fin tuna belt in the Indian Ocean. These stocks migrate between Somalia, Kenya, Tanzania, Mozambique, Mauritius, Madagascar, and Seychelles waters during various periods in a year. The country's marine fisheries potential annual production has been variously estimated. Table 7 presents a brief summary of estimated marine fishery stocks or production based on available information.

Table 7. Some estimates of status of pelagic fishery stocks along the Kenya's coast.

Year	Estimated fishery stocks	Comments	Reference
1979/83	150,000 -350,000 mt	Kenya's potential annual production	1979/83 Five-Year Development Plan
1997/2001	200,000 mt.	Potential annual production of the tuna and tuna-like fisheries	1997/2001 National Development Plan
1990-2010	4,000-9,000mt/yr	Artisanal fisheries	FiD and this study,
??	20,000 mt/yr	Potential yield of inshore waters comprising demersal and pelagic fish, crustacea, and other species	Odero 1984
1981	125,000 mt	Total exploitable stocks with Kenya's 12 nautical miles coastal area	FAO 1981
(F/V *Professor Metsyatsev* survey)	10,000	Small pelagics around Ungwana Bay	Burczynski, 1976;
	18,000-20,200 mt	Small pelagics mostly scads and mackerels	Habib 2003

Large concentrations of highly migratory tunas and billfishes and large pelagic sharks have been known to pass through the Kenyan zone each year although the size of those concentrations is yet to be fully determined. Inshore coastal pelagic survey by F/V *Professor Metsyatsev* found stocks of small pelagics around Ungwana Bay to be about 18,000 mt. Species in this fishery included anchovy (*Engraulis* sp., *Stolephorus* sp.), round herring (*Etrumeus teres*), spotted herring (*Herklotsichthys* sp.), sardinellas (*Sardinella sirm, S. jussieu*), Indian oil sardinella (*Sardinella longiceps*), scad (*Decapturus macrosoma* & *D. maruadsi*), bigeye scad (*Selar crumenophthalmus*), hairtail scad (*Megalaspis cordyla*), and Indian mackerel (*Rastrelliger kanagurta*). Other notable species included coastal pelagic tuna and tuna-like species such as kawakawa (*Euthynnus affinis*), wahoo (*Acanthocybium solandri*), dogtooth tuna (*Gymnosarda unicolor*), frigate tuna (*Auxis thazard*), striped bonito (*Sarda orientalis*), kingfish (*Scomberomorus* spp.), barracudas (*Sphyraena* spp.), and fusiliers (*Caesio* spp., *Pterocaesio* spp, *Gymnocaesio* spp.). Most of these species, because they have a propensity to aggregate in large schools, lend themselves to capture by the purse-seine method and so any fishery exploiting this range of species would apply that method. Habib (2003) estimated its potential to be 20,200 mt.

By location, the potential yield of Lamu, Ungwana Bay, Mid-Coast, South Coast as surveyed by *Professor Mesyatsev* were estimated at 1,700, 5,200, 1,800 and 990 mts respectively. Exploratory fishing with bottom set longlines undertaken by EAMFRO during 1969 – 1976 identified the North Kenya Bank as a place that could provide catches at very high catch rates. As a major fishing areas in the northern part of the Kenyan zone, the North Kenya Bank is stratified in the following manner: i) shallow waters out to 20 m depth, area 5 sq miles; ii) 20 – 50 m depth, 75 sq miles; iii) 50 – 200 m, 905 sq miles; iv) 200 – 500 m depth, 415 sq miles; v) over 500 m depth, 270 sq miles (Iversen, 1984). Using bottom set longline surveys; Tarbit (1976) estimated the total standing stock of fish on the Bank at 10,000 to 17,000 mt. The sustainable yield calculated from the standing stock estimates was 1,000 to 1,700 mt. Venema (1984) gave the following potential yields for the Banks fishery – sharks and rays 161 mt; big commercial fish (snappers, grunters, groupers, emperors, sicklefish, jacks, mackerels) 517 mt; small commercial fish (jacks, silver bellies) 14 mt; small non-commercial fish (mainly deep water species) 141 mt; swimming crabs

1,000 mt; cephalopods (squids, cuttlefish, Sepia, Loligo) 77 mt. The potential is therefore estimated at 2,000 mt.

A survey using monofilament gillnets conducted off Mombasa between March 1976 and February 1977 produced 255 kg of fish, the bulk of which was needlefish (Belonidae), sharks and rays (Nhwani, 1980). Also taken were barracudas, carangids, parrotfishes, sweetlips, and other species. Bottom nets produced about 400 kg of fish, including carangids, snappers, needlefish, rabbitfish, barracudas, swetlips, parrotfishes, surgeonfishes, sharks, rays, and other species.

Nzioka, (1984) noted that yellowfin tunas are present in Kenyan waters throughout the year, with marked increase during the Southwest Monsoon, being capable of being found as close as 4 km from the shore. Catches of albacore (*Thunnus alalunga*), have been made in southern parts of Kenya at depths exceeding 120 m in the cooler waters below the thermocline; dogtooth tuna (*Gymnosarda unicolor*) also reported from the of the area particularly during the NE Monsoon; frigate tuna (*Auxis thazard*) abundant in inshore waters during the NE Monsoon; and bonito (*Euthynnus affinis*) present year-round but found in abundance during August/September and January/February (Williams & Newell, 1964). Occurrence of sardine fishery in Kenyan waters mainly comprised goldstripe sardinella (*Sardinella gibbosa*) and bluestripe herring (*Herklotsichthys quadrimaculatus*) species was noted by Wakwabi, (1981).

Early surveys also recorded a number of billfishes including striped marlin (*Tetrapturus audax*), a species of wide distribution in the Indian Ocean that was found in heavy concentrations from Pemba Island and around Malindi, and registered high catch rates in East African waters during the NE Monsoon when the fish were on post-spawning feeding migrations (Williams & Newell, 1959b, 1959c, 1960; Williams, 1967; Uenagi & Wares, 1975); black marlin (*Makaira indica*) widespread in the western Indian Ocean and reported as occasionally caught close to shore near Malindi; blue marlin (*Makaira nigricans*) also widespread in the west Indian Ocean and reported from time to time in sports fishery in Kenya; sailfish (*Istiophorus platypterus*) abundant in coastal waters on the Kenyan coast with the main seasons being December to February and April to September; and swordfish (*Xiphias gladius*) relatively rare in inshore surface waters but common in offshore longline catches (Nzioka, 1981).

Pelagic species found in considerable abundance in nearshore coastal waters included the kingfish (*Scomberomorus* spp.), occurring in large offshore schools from about October through March, and large inshore schools from April through August/September; wahoo (*Acanthocybium solandri*), occurring in small schools close inshore, and Indian or little mackerel (*Rastrelliger kanagurta*), occurring sometimes in very large schools particularly during the NE Monsoon (Nzioka, 1981; Williams, 1956; Williams & Newell, 1957, 1958, 1959a, 1965).

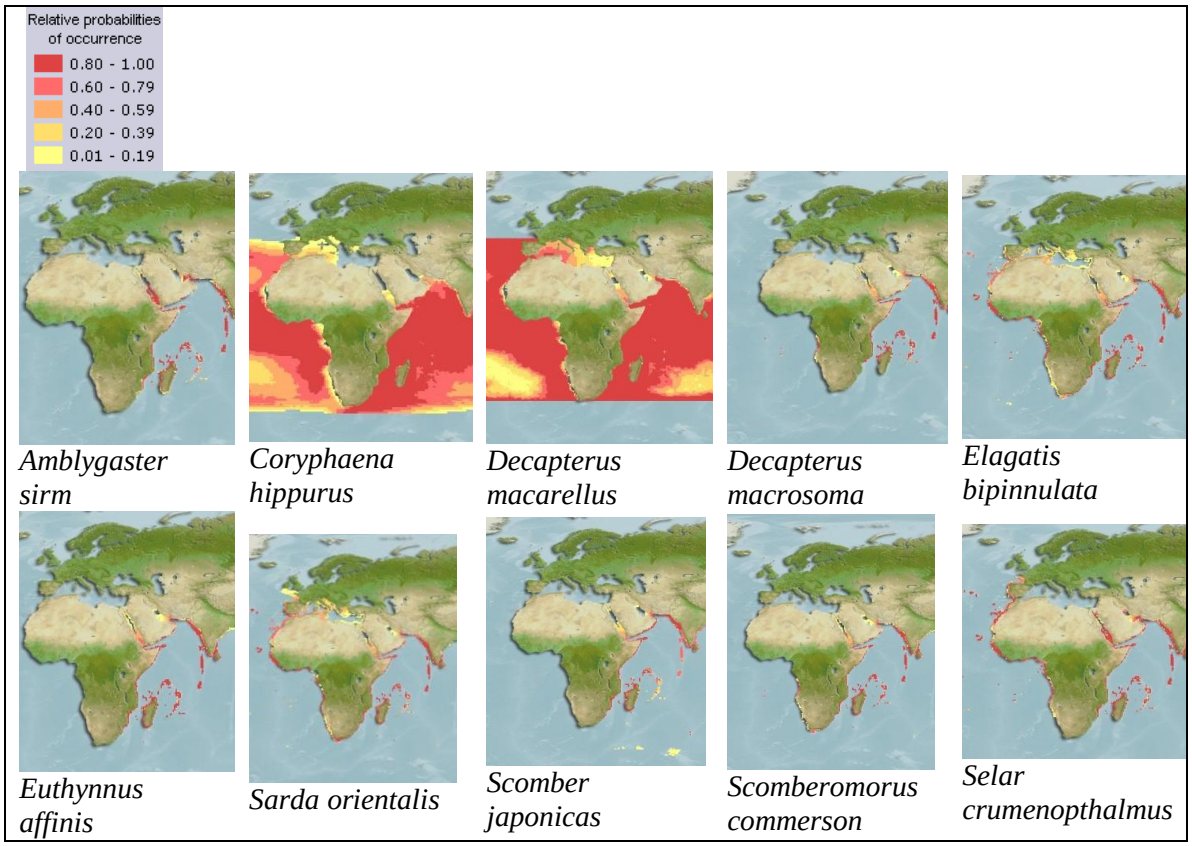


Figure 6. Global distribution of some pelagic fish species common in the Kenya's marine waters (SOURCE: Aquamaps).

iii. Direct interactions with the ecosystem

Information on small and medium pelagic fisheries interactions with other fisheries and competition on target or non-target species is presented in other sections (see section 5).

iv. The traditional knowledge about the marine fishery and the resources exploited

The coastal strip of Kenya is an area with rich traditions (Spear, 1978). Cultural traditions are transmitted in the form of social attitudes, beliefs, taboos, sacred sites, principles and conventions of behaviour and practice derived from historical experience. The coastal communities have practiced these traditions for ages. The key community elders are the traditional keepers and users of local traditions, knowledge and wisdom and are involved in many community level decisions. Along Kenya's coast, some of these traditions particularly those practiced by fishing communities and enforced by social and cultural means have been known to have positive impacts on fisheries management, and are as good as modern forms of management (McClanahan *et al.*, 1997, table 8). However, societal change over time has resulted to weakened cultures and adoption of new practices and technologies replacing these traditions. This is due to the loss of identity, culture and traditional resource areas and erosion of community structures, mainly as a result of influences from economic developments, formal education, religion, immigrants, change in land tenure systems, governmental command and controlling regimes. As a result, in many coastal locations, the local traditions that governed fisheries or practiced to appease spirits within fishing areas are slowly becoming irrelevant.

Subsistence fishing is culturally and economically important to many coastal rural communities in Kenya. Traditional fishing gears used include basket traps (*madema*), hooks and lines (*mshipi*) and gillnets (*nyavu*) while spearguns (*bunduki*), beach seine nets (*juya*) and ringnets are introduced gears. The traditional system had some social and cultural controls on fishing where disciplined behavior before, during and after fishing was strictly required (Rubens, 1996, Glaesel, 1997, McClanahan *et al.*, 1997, Tunje, 2002). Fishing was controlled in time and space without disrupting important fisheries habitats and processes thereby providing for sustainable harvest of fisheries resources in the process of appeasing spirits. These beliefs are concurrent with contemporary management system such as restrictions on gear types, limited access (*ubani*), time limits (*sadaka*), size restrictions and sacred sites or protected areas (*mzimu*) (McClanahan, 1995, Rubens, 1996, Glaesel, 1997, McClanahan *et al.*, 1997, Tunje, 2002).

Studies on traditional community-based fisheries management systems along Kenya's coast are few. Thus, comprehensive studies are required to harness the potential usefulness of traditional management systems or local traditions as a tool for local fisheries management. Some of the local tradition practices relevant to fishery management, and which could be in-cooperated in to the fishery management planning along Kenya's coast is highlighted in the table 8 below.

Table 8. Local tradition practices relevant to fishery management

Tradition	**Description**	**Relevance to fisheries management**
Kaya	Sacred forests on land	Some landing sites are associated with *Kaya*. *Kaya* elders were responsible for management of land as well as fish landing sites
Bandari	Fish landing sites	Fishers form socio-groupings around the *bandari* constituting of key stakeholder within that fisheries. Key decisions concerning fisheries management are made at the bandari
Mzimu	Sacred sites at sea	They include fishing grounds where fishing was restricted or not allowed, acting as no take areas
Sadaka	Traditional ceremonies	Held once a year to appease spirits, or when catches declined, or when there are unusual incidents or happening at sea. Draws fisher to the attention of precautions when fishing, wise use of the resource and appreciation of nature. Fishing effort goes down during days of *sadaka*.
Ubani	Fee to allow access to Landing site or fishing territory.	Controlled fishing effort by limiting access to fishing grounds. Protects the fisheries resources from overexploitation. Screening of fishers using the area.
Kivumbi /harusi ya samaki	Fish spawning aggregations	Traditional knowledge of fish spawning aggregations among fishers exists and the aggregations are targeted. Opportunities for protecting the sites and aggregating species. Fishers used to offer *sadaka* before or during the spawning aggregation period.

a) Restrictions on fishing areas, time of fishing and gear use

Mzimu were viewed as sacred sites and areas of unusual phenomena or dangerous areas believed to be inhabited by spirits (McClanahan *et al.*, 1997). Fishing within and around *mzimu* was prohibited by the community acting as a self-imposed marine refuges. Sacrifices and prayers meant to appease spirits were held in the *mzimu*. No fishing was allowed during the day of offering *sadaka (*sacrifices*)*. In non-Digo areas, fishers ate fish caught on the morning of the *sadaka* instead of slaughtering animals. Sacrifices consisted of foods such as bread made of rice, flour-based sweet (*halua*), sweets, animal blood and incense (*ubani, udi*). The sacrifices were

done annually ostensibly to increase catches, to ensure safety at sea, provide relief from illness and other troubles. The ritual ceremonies were also held when schools of pelagic fish such as tuna and sardines pass (November - February). Offering of *sadaka* is elaborate and can be expensive and time-consuming beginning at sacred sites on land (*Kaya* or *Mzimu*) to sacred sites at sea (*Mzimu*).

Other restrictions included prohibitions on the use of certain gear types such as pull seines, use of harmful poisons for fishing, prohibitions on over harvesting fish and landing of high catches of juvenile fish. Traditional elders from two fish landing sites in South coast Kenya were very instrumental in stopping landing of beach seine catches at their fish landing sites in mid 2000s. Elderly fishers in some areas regularly castigate use of destructive fishing gear such as speargun. Traditional fishers associate poor catches with breaks from traditions such as sacrifices, prayers or the use of untraditional fishing gear. Elder fishermen are supposed to call for meetings in response to declined catches or occurrence of unusual events. Decline in fish stocks and culture have resulted to relaxation of rules and the sacred sites have become unrestricted to fishing (McClanahan *et al.*, 1997).

b) Restrictions on access to fishing territories

Although, Kenya's marine waters are an open access, a village's fishing territory was in most cases defined by proximity or adjacency to the settlement with prominent land marks acting as boundaries. Fish landing sites and settlements are associated with sacred coastal forests known as *Kaya*. *Kaya* elders represent and uphold the traditions of the sacred forests including fish landing sites and associated culture. The elders pass down knowledge and leadership to their eldest sons. Landing sites have four leaders (two elected and two inherited) independent of government appointed positions. Access controls were applied to outsiders particularly fishers from distant fish landing sites (local migrant fishers) and foreign fishers (migrants from neighboring countries) but allowed migrant fishers associated with the residents either through marriage. The visiting fishers were required to pay a certain fee (*ubani*) or an agreed portion of the catch, to be permitted use of fish landing site and village's sea territory. The foreign fishers had to seek clearance from resident community leadership. Economic (improving income, poverty), social (marriage, change of life) and ecological (ecological degradation, seasonal migration of fish) factors drive fishers to migrate and their choice of destinations (WIOMSA, 2011). Despite the positive impacts (such as boosting economy, new technology, helping locals and intermarriage e.t.c.) that migrant fishermen bring to their destinations, they are associated with the declining fisheries among other negative impacts.

The *Bajuni* and *Wapemba* fishing communities have been migrants for decades (Fulanda *et al.*, 2009). Their movement is seasonal and during the North East monsoon (between October and April) when the sea is calmer and prevailing winds favorable for fishers to access more distant and productive fishing grounds (Crona *et al.*, 2010; WIOMSA, 2011). Seasons (NEM and SEM) are influenced by trade winds that control the weather and ultimately fishing patterns. Migration is often related to the type of fish targeted and gears used, which in turn determines choice of time and area of migration (WIOMSA, 2011).

c) Safety during fishing, Hygiene and proper fish handling

Traditionally among the coastal fishing communities, disciplined behavior before, during and after fishing was a strict requirement with traditional coastal fishers establishing general principles for proper behavior e.g on propriety, order, proper fish handling, personal hygiene, safety e.tc. In order to avoid misfortunes safety precautions had to be adhered to and have been documented as follows:

- Disciplined behavior was required when fishers were dealing with women during fishing, if not, they get bad luck.
- The person who gets in the boat first should be the first one to get out.
- Animal names such as cattle were not supposed to be mentioned when fishing.
- Making sounds that destruct fishers' concentration such as whistling or making noise during fishing was not allowed.
- Fishing was not done when a fisherman was in a bad mood or annoyed.
- Entering a fishing vessel when the other is hanging may lead to accidents.
- Drunken fishermen were not allowed to go fishing since they may drown or the *dau* might capsize.
- The container (*upo*) used to draw seawater out of the boat should not be placed upside down, so that it is readily available in case of any emergency.
- Females were not allowed to move near or enter a fishing vessel so that fishermen may loose concentration leading to accidents.
- Before a boat is taken into the sea for the first time, chicken had to be slaughtered and the boat repairer paid. If this is not done, someone might get hurt during fishing.

To ensure personal hygiene and proper fish handling during fishing:

- Entering a fishing vessel in shoes was not allowed to avoid contamination of fish that may cause health problems to the consumer.
- Not taking bath and untidiness when fishing was culturally unaccepted so as to avoid contaminating fish.
- Relieving oneself while standing in the fishing vessel is not allowed as urine may contaminate fish caught.
- A pregnant/menstruating woman is not supposed to enter a fishing vessel or hold a bucket with fresh fish. This is because she is considered unclean and may contaminate fish.
- Green raffia was not to be used in tying fish, since it may have a sour taste and contaminate fish.
- Removing fish scales using a stick or green stick was prohibited to avoid fish contamination.
- Fresh fish from the fishing vessel should not be placed in a soot-coated *sufuria* since it may contaminate fish.

d) Traditional knowledge on tides, fish aggregation and migrations

Fishers have for a long time made observations on the resources they exploit, some of which are consistent with scientific facts. Traditional knowledge revolves around exploitation and conservation. Fishers understand, in their own way fish behavior, biology and ecology. Though the fishers may not fully understand migratory dynamics of pelagics (sardines, tunas, etc), they possess adequate knowledge that suits their fishing needs, such as the direction and season of migrations. Quite often, fishers are aware of the breeding grounds of species of interests and their feeding habits.

The coastal communities have vast knowledge of the moon calendar. They use this knowledge for timing marine and terrestrial environment events which enables them to plan for fishing trips, predict occurrence of fish spawning aggregations, fish migrations, feeding habits and planting activities. Islam is the main religion among coastal fishing communities hence use of the Islamic calendar is widespread increasing the understanding and use of the lunar periodicity in fishing (Tuda *et al.,* 2008). The phases of the moon generate different tidal patterns and other environmental cues during a 29 lunar day month period. Local communities have adopted a number of terminologies to describe the tidal phases or fishing time relative to the moon.

These tidal phases are locally known as; *bamvua* - the days of large spring tides bracketing the new or full moon lasting 3-4 days from days 29-3 and 15-18 of the Islamic calendar; *Msindizo* - the period between lunar days 8-10 and 21-23 when the tidal range is smallest, fishers often take break from fishing during period of the month. *Maji ya jioni* falls between days 5-7 and 18-20 and is associated with *bamvua* and *msindizo* during which good tides suitable for fishing occur in the late afternoon (*jioni*). *Maji ya asubuhi* occurs between days 11-13 and 24-27 of the Islamic calendar when neap tides develop into spring tides with good tides for fishing occurring early in the morning. The moon calendar emphasizes certain repetitive biological and ecological processes (e.g. fish spawning, aggregation, and feeding habits) that can be validated by fishermen's own observations. There are reports of fishers exploiting spawning aggregations of reef fishes in Kenya, mainly from fishers' knowledge studies and validated through various ways (Samoilys et al 2006, Robinson et al 2008, Maina et al. in prep). However, validated of spawning aggregations of pelagic fish are non-existent. Targeted fishing of spawning aggregations can lead to dramatic decline of the species. Therefore, knowledge about timing and locations of spawning aggregations is critical for management.

7. ANNUAL FISHERY CATCHES

Artisanal fisheries

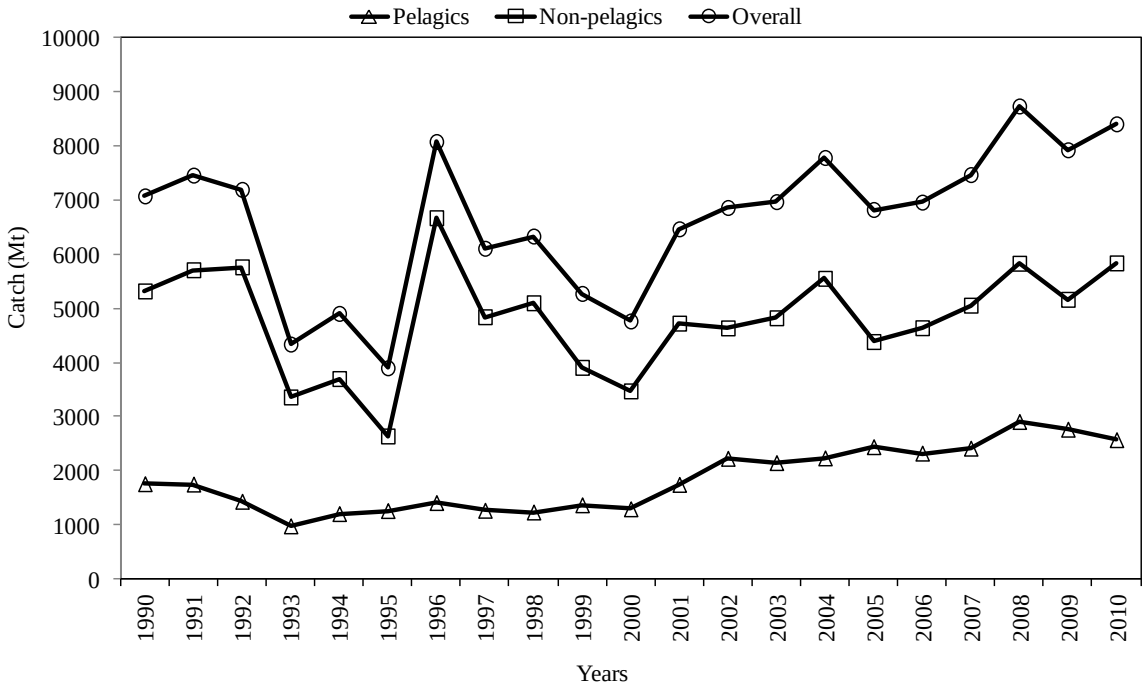


Figure 7. Annual catches from the marine artisanal fisheries over the last ten years (Data source: Fisheries department catch data).

The annual production for Kenya's marine fisheries has remained fairly between 4,336 mt to 8,736 mt (mean 6743 ± 265.09 mt - SE) over the last two decades from 1990, Y = 95.442x + 5692.7, R^2 = 0.24 (Figure 7). The pelagic fishery over the same period accounted for 27.0% of the landings, with catches oscillating between 977 mt to 2,096 mt (mean 1,843 ± 128.40 mt - SE), increasing steadily by 78 mt annually (Y = 77.946x + 985.47, R^2 = 0.68). The annual pelagic fish production during 1978–1981 period fluctuated between 997 mt to 1,150 mt. The proportion of pelagic fish recorded for 1990 – 2010 in this study is higher than the 18% reported by Wakwabi *et al*. (2003) which also indicated that 80% of the total marine products come from shallow coastal waters and reefs, and about 20% from off-shore fishing.

A decline in production mostly for non-pelagic fish was recorded from 1991 to 1995 and from 1997 to 2000 periods; the latter could partly be attributed to the 1997/1998 El-Nino event and the tribal clashes that occurred at the coast during that period. Tuna exports were also severely curtailed in 2001 by EU SPS conditions which led to temporary closure of the factory for several months, thought catches seems to have remained stable. Acquisition of efficient fishing gears such as ringnets, recovery of habitats and fish species after the El-Nino phenomenon, and improved data collection have contributed to the 76.5% increase in artisanal catches from year 2000 to 2010 (figure 7). Ringnets are among the most productive gears contributing 77% of the landed catch Vanga with a mean catch per unit effort of 11.9 kg/Fisher/day. In Shimoni, ringnet landings constitute 4% of the total fish landings and 9% in Gazi with an average of 9.4 kg/fisher/trip. Throughout the Eastern Pacific from Canada to Chile, catches of small and medium

pelagic, demersals and other species were also negatively affected by the El-Nino event (FAO 1998). The growth in the production of the pelagic fishery vis - avis t he overall production can be gauged from figure 7.

The recorded marine artisanal fisheries production is low considering that Kenya has a 640km coastline, a 200 nautical miles of EEZ (230,000km^2) and is said to be located within the richest tuna belt in the Indian Ocean. The marine capture fisheries potential is largely unknown but is estimated at 125 000 mt, excluding EEZ fishery (FAO, 1981). The inshore waters are reported to have a potential to yield ~20,000 mt per year (Odero 1984), while FAO (1990) reported annual marine catch from reef areas might be closer to 12,000 mt. The bulk of marine catch is landed by artisanal fishermen using simple gears and vessels while the country's EEZ is exploited by Distant Waters Fishing (DWF) Fleet which target mainly tuna. The catches from DWF fleets operating in the country's EEZ are landed and processed at local fish processing establishments while some is landed and transshipped from the same facilities (see section 8).

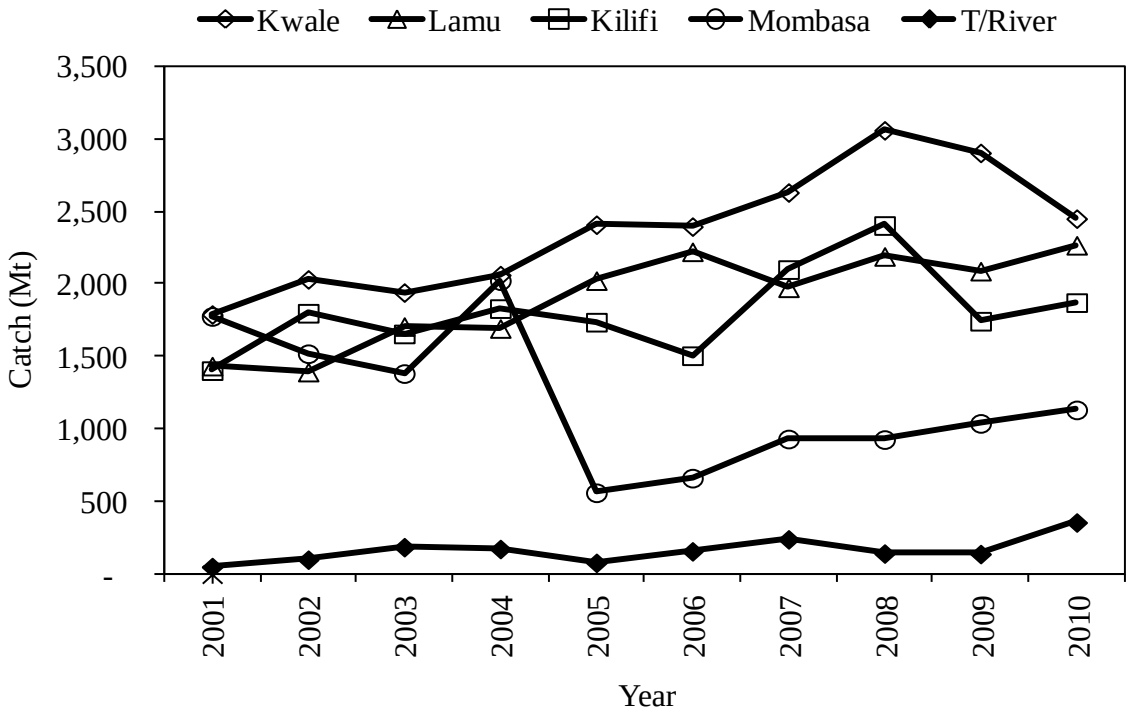


Figure 8. Trends and distribution of artisanal marine fishery landings by county along the Kenya's coast.

County- wise contribution to the artisanal marine fisheries landing indicates that Kwale, Lamu and Kilifi Counties contributed 82% of the 2001-2010 landings (figure 8). Kwale County recorded the highest annual catches ranging from 1,792 mt in 2001 and 3,062 mt in 2010, mean 2,370 ± 417 517 mt – (figure 8). Lamu and Kilifi counties recorded high annual catches, slightly over 1, 390 mt throughout the same period. Mombasa county landings include fish transported by boats from neighboring counties for better prices. Rich inshore marine fishing grounds are found in and around Lamu Archipelago, Ungwana Bay, North Kenya Bank, Malindi Bank and on the south coast around Majoreini and Vanga. The northern banks are much productive because of being located within an upwelling region created by the meeting of the southern flowing 'Somali

Current' with the north flowing 'East African Current' during the northern monsoon season (November to March).

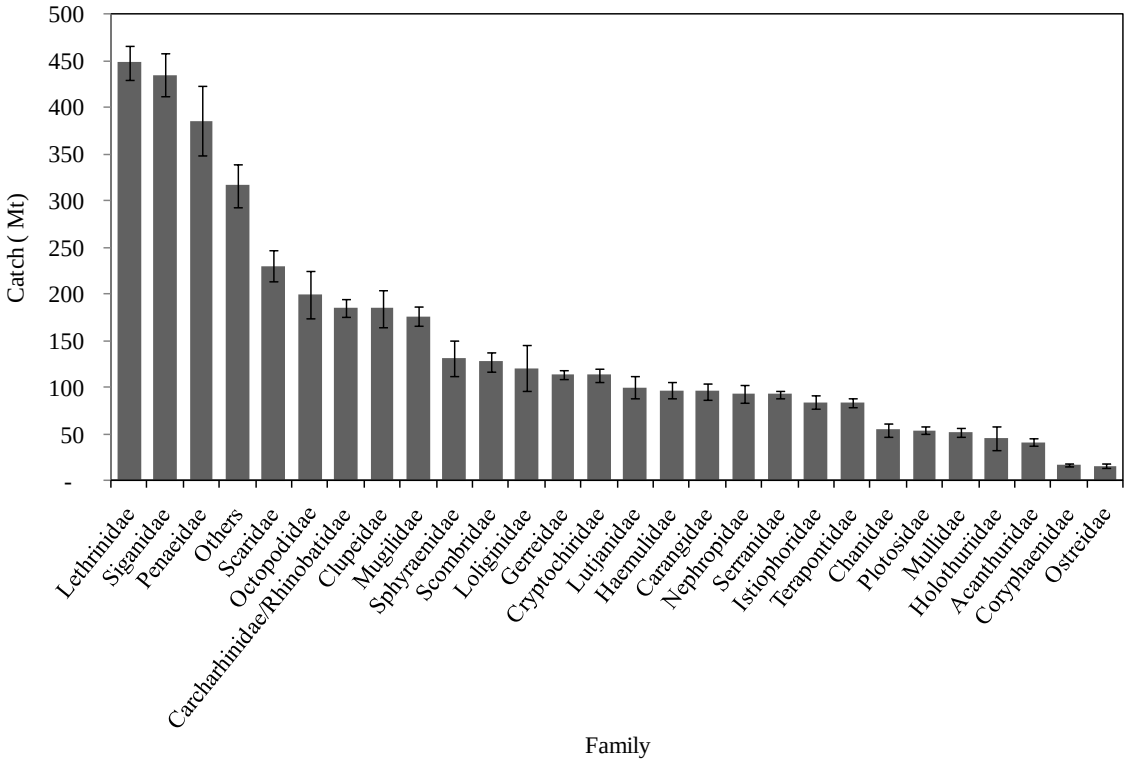


Figure 9. Average marine artisanal fisheries catch by family for the last 20 years: 1990 - 2010. Catches recorded as 'unaccounted for' and 'mixed/others' was combined and categorised as "Others". (Data source: FiD)

The main marine fishery products are demersal, pelagic, sharks and rays, crustaceans, molluscs, echinoderms and deep sea/big-game fish. The demersal fish were the most dominant (>38%) with Lethrinidae, Siganidae, and Scaridae being the dominant families recording an annual mean of 448 mt, 435 mt and 230 mt respectively, over a 20 year period (figure 9). The mean catch for the pelagic families Carcharidae/Rhinobatidae, Clupeidae, Sphyrainidae and Scombridae ranged from 127 mt to 185 mt. The annual production from 1990 to 2010 by family is shown in figure 10 with a maximum production of 829 mt in 1996 for family Lethrinidae and minimum 53 mt for Sphyrainidae in 1992.

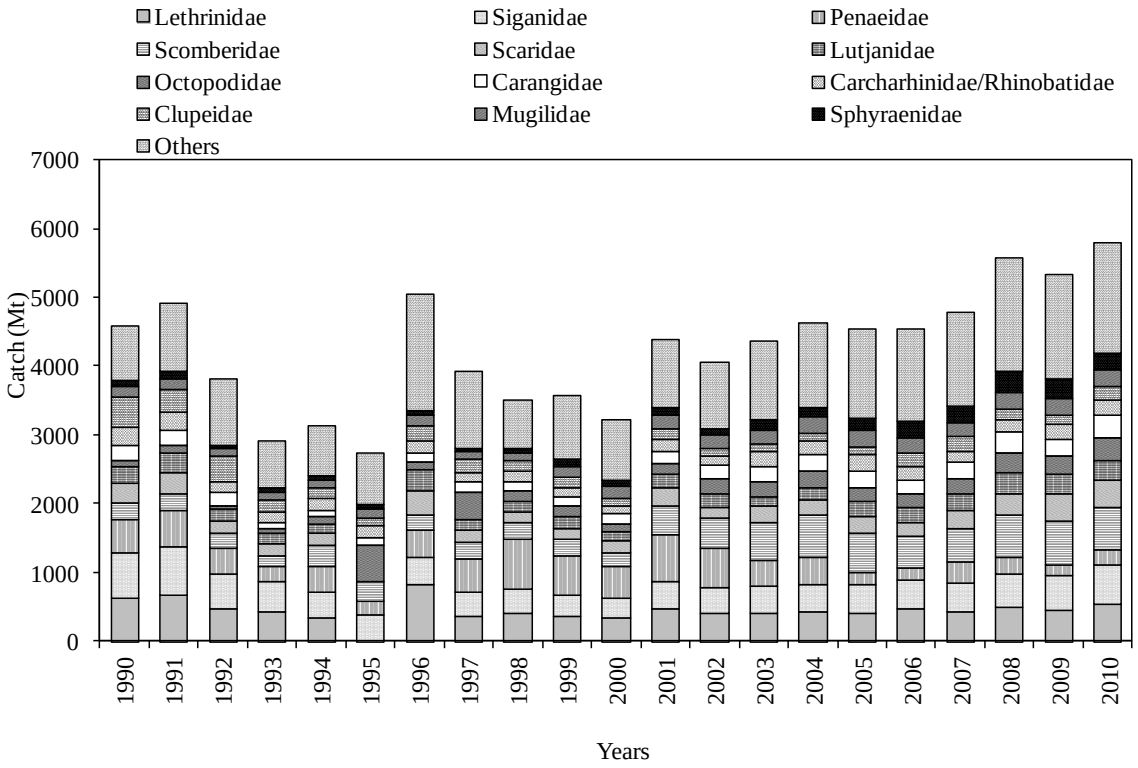


Figure 10. Annual catch production for main pelagic fisheries and other fisheries by family along the Kenyan coast (Data source: FiD).
Families contributing less than 2% to the 20yrs catch are categorized as "others" (Architeuthidae, Gerreidae, Cryptochiridae, Haemulidae, Nephropidae, Serranidae, Istiophoridae, Terapontidae, Acanthuridae, Chanidae, Plotosidae, Mullidae, Holothuriidae, Coryphaenidae, Ostreidae). Catches recorded as 'unaccounted for' and 'mixedfish/others' (36.0% of the total landing) could not be categorized into family level and therefore are not included in the graph.

Annual yield from the small and medium pelagic fisheries over the last 20 years ranged from 429 mt -1,290mt and 347mt – 1,357 mt respectively (Figure 11). The small and medium pelagic fisheries comprised 85.4% of the pelagic fishery and recorded increased production (> 47%) from year 2000 (500 mt) to 2010 (1000 mt). The Small pelagic fishery comprised mainly of sardines, herrings, anchovies and mackerel from in the inshore waters and exploited primarily by gillnets.

The quantity and value of major small and medium pelagic fish groups recorded between 1990 - 1999 from artisanal marine fisheries is shown in figure 16 and table 9. Most of the small pelagic fish are recorded in the catch landings as mixed-pelagics. The mixed pelagics comprise a significant portion of the artisanal pelagic catch recording an annual average of 222.19 ± 19 mt (figure 16 and table 9). Of all the small and medium pelagic fisheries recorded in the artisanal marine fisheries landings, a declining trend was only recorded for sardines, from 439 mt in 1990 to less than 150 mt annually for the most part of the last decade, $Y = -8.2421x + 274.96$, $R^2 = 0.33$ (figure 16). Catches of the highly valuable bonitos/tunas, cavalla jacks, little mackerels and barracudas ranged between 125 mt and 172 mt annually, each group.

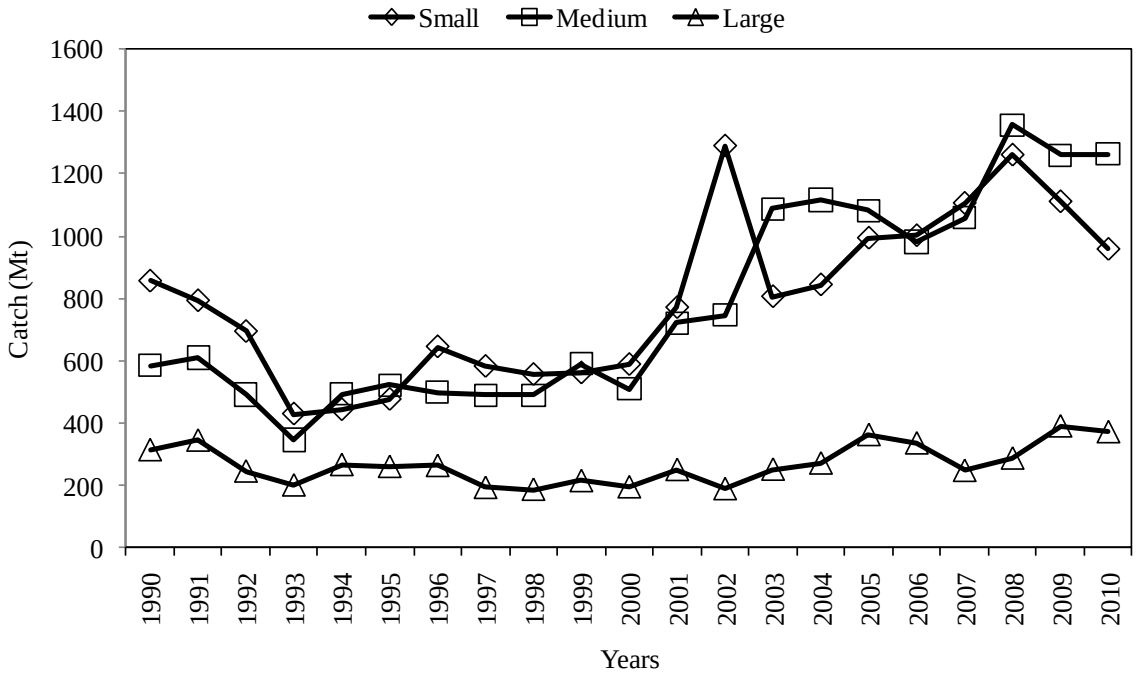


Figure 11. Annual yield of marine artisanal small, medium and large pelagic fishery, 2001 to 2010. Small pelagic fishery = 43.3%, medium pelagic fishery = 42.1% and large pelagic fishery = 14.6%. (Data source: FiD).

Recreational/sport fisheries

The proposed fisheries and development bill (Nov 2011) defines recreational fishing as "non-commercial fishing by an individual for leisure or relaxation". Kenya's sport fishing industry is well known within the WIO region for its prominence in big-game fishing. The commonly used methods of sport fishing along the Kenya's coast include; trolling (offshore), fly-fishing (shallow waters or open waters), bottom fishing (5-50m deep using baited hooks), drift fishing (>50m depth) and spearfishing. Collection of sport fishing data by Kenya's fisheries department started in the 1940s, but it was until 2006 when computerization of the historical data was started with support from the Indian Ocean Tuna Commission and the Overseas Fishery Cooperation Foundation (IOTC-OFCF) (Ndegwa 2011). This was to enhance the data collection and processing systems for the Tuna resources in the Indian Ocean, capturing into a database the historical sport fishing information stored by various clubs. Despite the efforts, the sport fishery statistical records still need further improvement to avoid under reporting. The fishery recorded an annual catch mean of 206 ± 14.01 mt (± SE) from 1993 to 2006, with maximum catches of 318 mt in 2009 and a minimum of 94 mt in 2006 (figure 12). The sport fishery landings increased by 129% from 90 mt in 1984 (de Sousa, 1988).

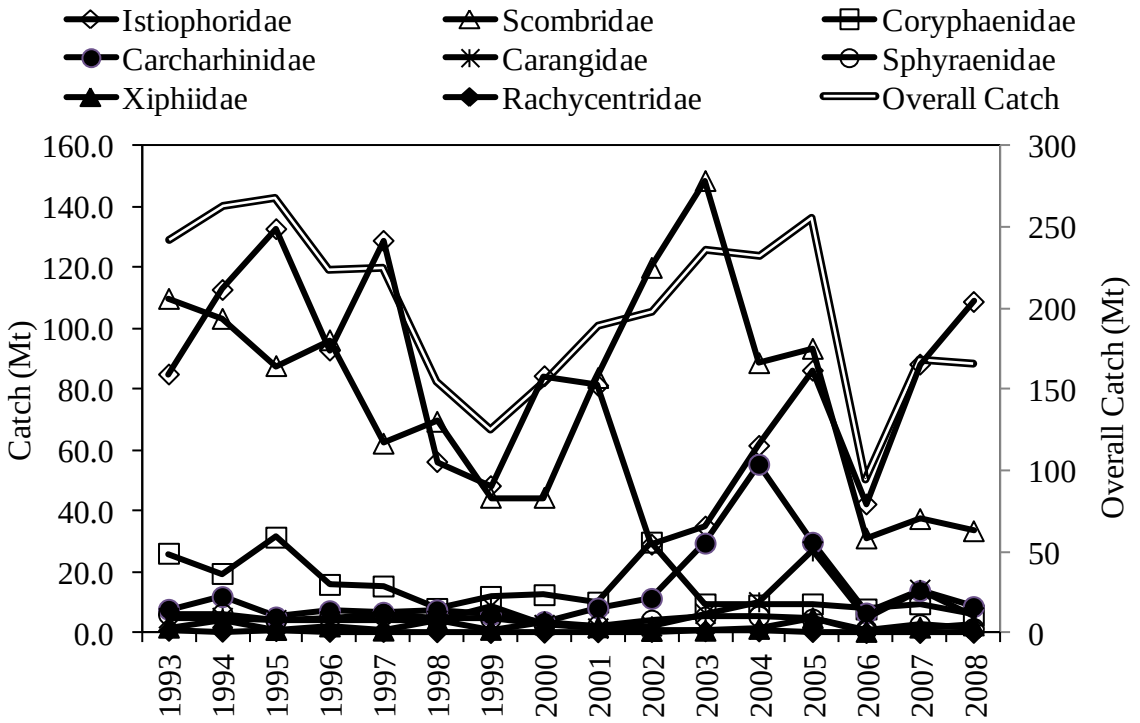


Figure 12. Trends in sport fishery landings by family, 1993-2008. Total catch annual average = 206 ± 14.01 mt (SE), maximum = 318 mt, minimum = 94 mt.

Sport fishing is most pronounced during the calmer north east monsoon season (August - April); mainly targeting the big games such as bill fish, sail fish and sword fish (Ndegwa and Sigana 2010, figure 12). Sport fishery catches are dominated by large pelagic fish families such as Istiophoridae (Sailfish) and medium pelagic Scombridae such as Tuna/Bonitos, Kingfish, and small mackerels among other families (figure 12).

Catches of some key sport fishery pelagic fish are shown on figure 13. Wahoo, Dolphin fish (Dorado or felusi), and Kawakawa (little tunas) recorded the highest catches at Malindi sports club, > 2mt annually. Kawakawa are the most abundant of the three nerritic tuna species caught in the Kenyan waters (Ndegwa 2011). Wahoo are reportedly common in the month of September while December onwards is season for marlin (black, blue, striped) (Habib 2005). The early season is generally characterized by large schools of yellowfin tuna. The catches of the medium and larger pelagic in Kenya's coastal waters indicates presence of large quantities of species such as tunas (e.g skipjack, yellowfin, dogtooth, and longtail), bonitos, barracudas, wahoos, dolphin fish, mackerels, rainbow runners, cavallas and grunters (Ndegwa and Sigana 2010).

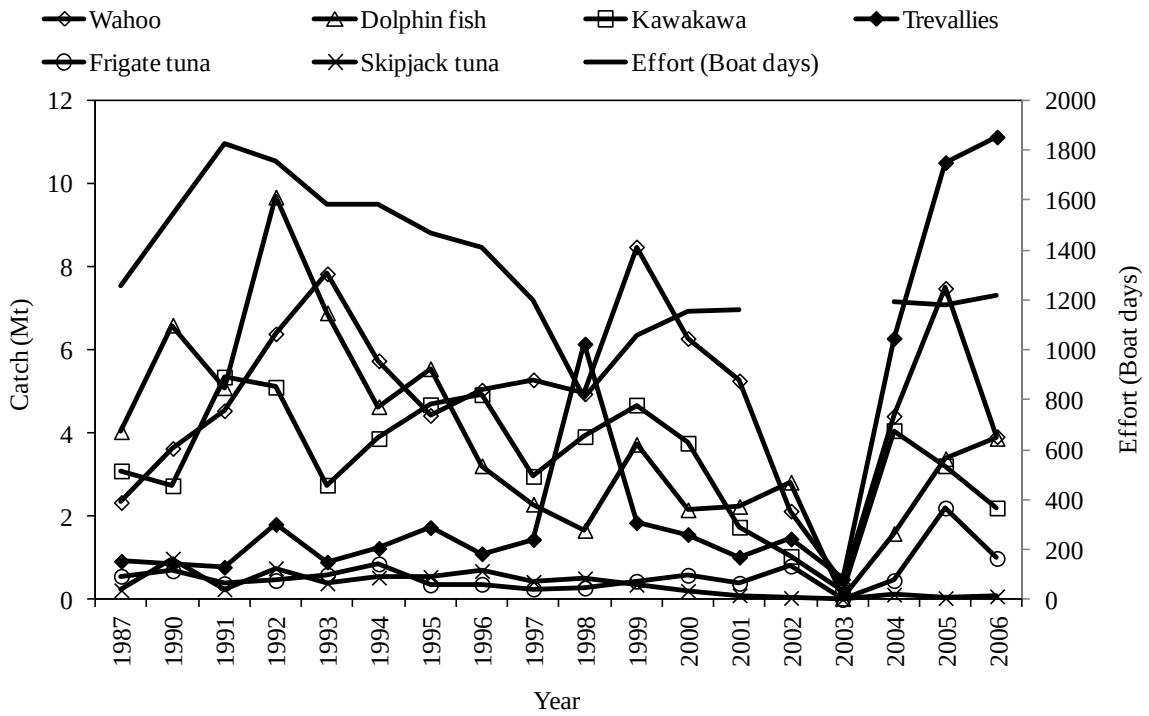


Figure 13. Trends of some key pelagic fish landed by Malindi sports fishing club, Kenya

Malindi-Ngomeni and Watamu in Kilifi County are the most prominent sport fishing grounds recording over 40 mt of catch annually from 1993 to 2009, except in 2006 (figure 13). Shimoni and Pemba Channel, off Shimoni in Kwale County are among the most prominent sport fishing grounds in south coast.

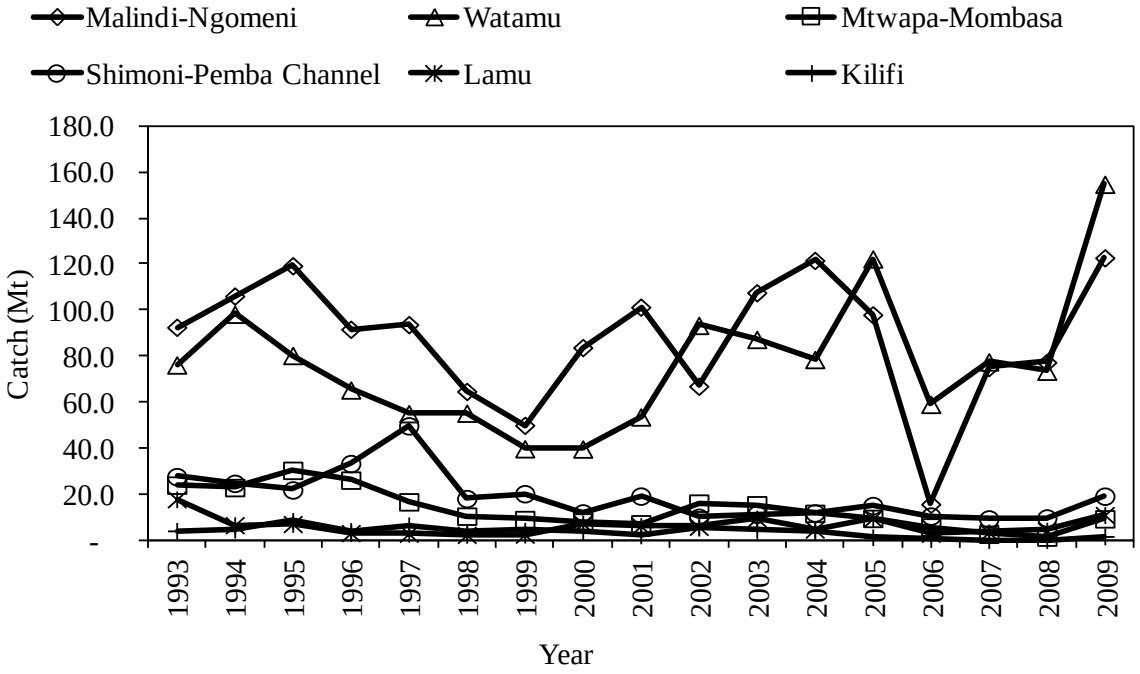


Figure 14. Trends in sport fishery landings of key sport fishing grounds along the Kenya's coast.

8.0 ASSESSMENT OF THE IMPORTANCE OF THE FISHERY IN THE NATIONAL ECONOMY

i. Value of the catches from the fishery

The artisanal marine fishery production has remained between 4,336 mt – 8,736 mt annually over the last 2 decades, valued between 135 million Kshs in 1990 and 737 million Ksh in 2008 (figure 15). The value of the catches has been increasing at a higher rate than the quantity, as seen in the narrowing of the gap between production and value. This is attributed to the increasing demand for fish proteins both for export and domestic market, coupled with improved quality of fisheries produce as a result of strict quality control requirements. Fishers' preference of selling to the hotels, restaurants and retailers in urban centres to maximize prices has also contributed to increased fish value.

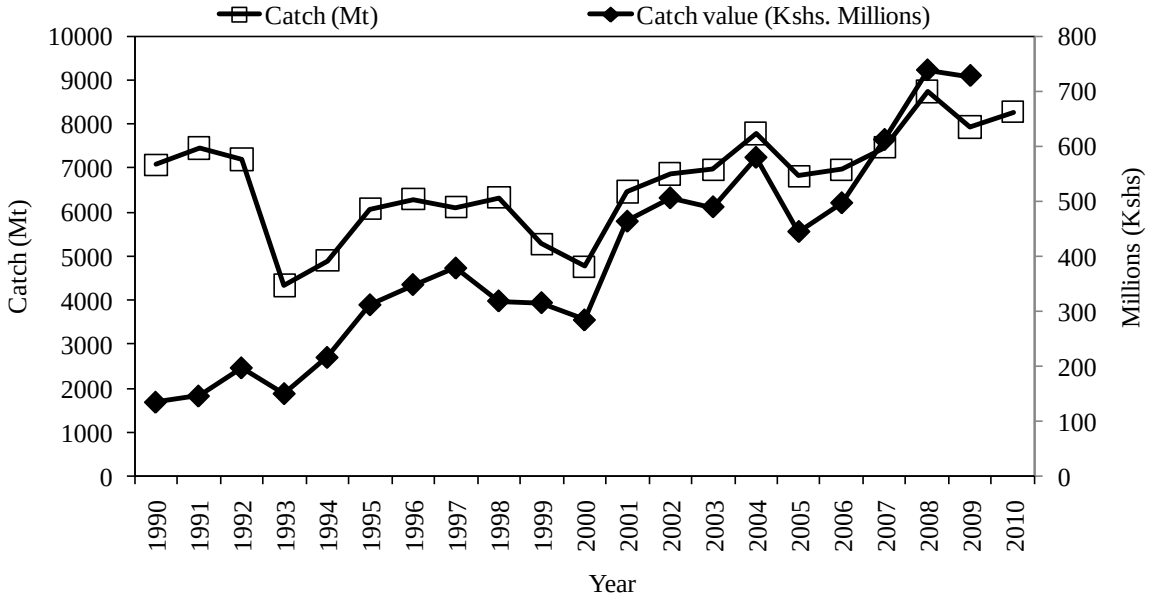


Figure 15. Quantity and value (million K.Shs) of artisanal marine production in Kenya, 1990–2010**.**

The large pelagic fishery recorded the lowest annual catch value compared to the small and medium pelagic fisheries (figure 11). The medium pelagic fishery comprising of mainly the highly valuable bonitos/tunas, cavalla jacks, little mackerels and barracudas (table 9) recorded the highest annual catch value compared to other pelagics. The annual catch value of the small and medium pelagic fisheries from 1990 – 2009 ranged from 7.32 million Kshs – 90.74 million Kshs (mean 35.69 ± 14.60 million Kshs -SE) and 7.56 million Kshs – 107.33 m (mean 42.87 ± 6.88 million Kshs - SE) respectively (figure 11).

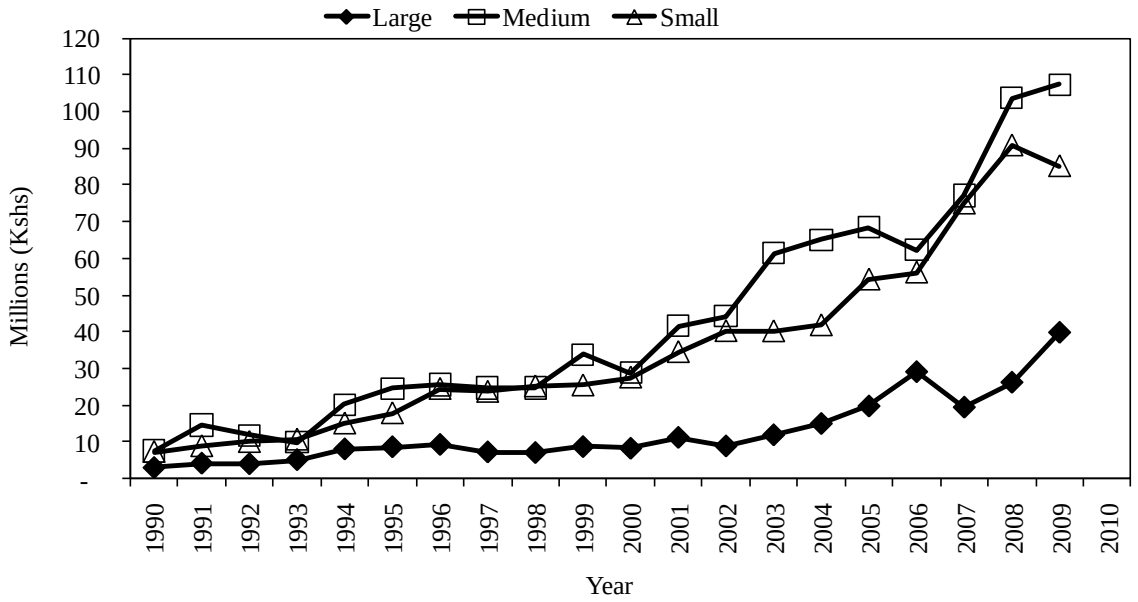


Figure 11. Annual trends of artisanal marine production pelagic fisheries catch value (million Kshs) from 1990 to 2009

Table 9. Annual average of quantity and value of major pelagic fish groups from artisanal marine fisheries, 1990-2009.

Fish group	**Average annual Catch (Mt) ± SE**	**Average annual Value (Ksh. Millions)**
Mixed Pelagics	222.19 ± 31.22	241.44
Sardines	184.00 ± 21.02	109.55
Mullets	172.46 ± 10.89	158.48
Bonitos/Tunas	171.68 ± 23.59	200.99
Cavalla jacks	136.55 ± 10.63	136.55
Little mackerels	128.94 ± 13.61	151.23
Barracudas	125.85 ± 19.75	147.74
Milk fish	53.69 ± 7.75	66.56
Queen fish	49.20 ± 3.51	44.30
Dolphin fish	16.36 ± 1.77	16.75

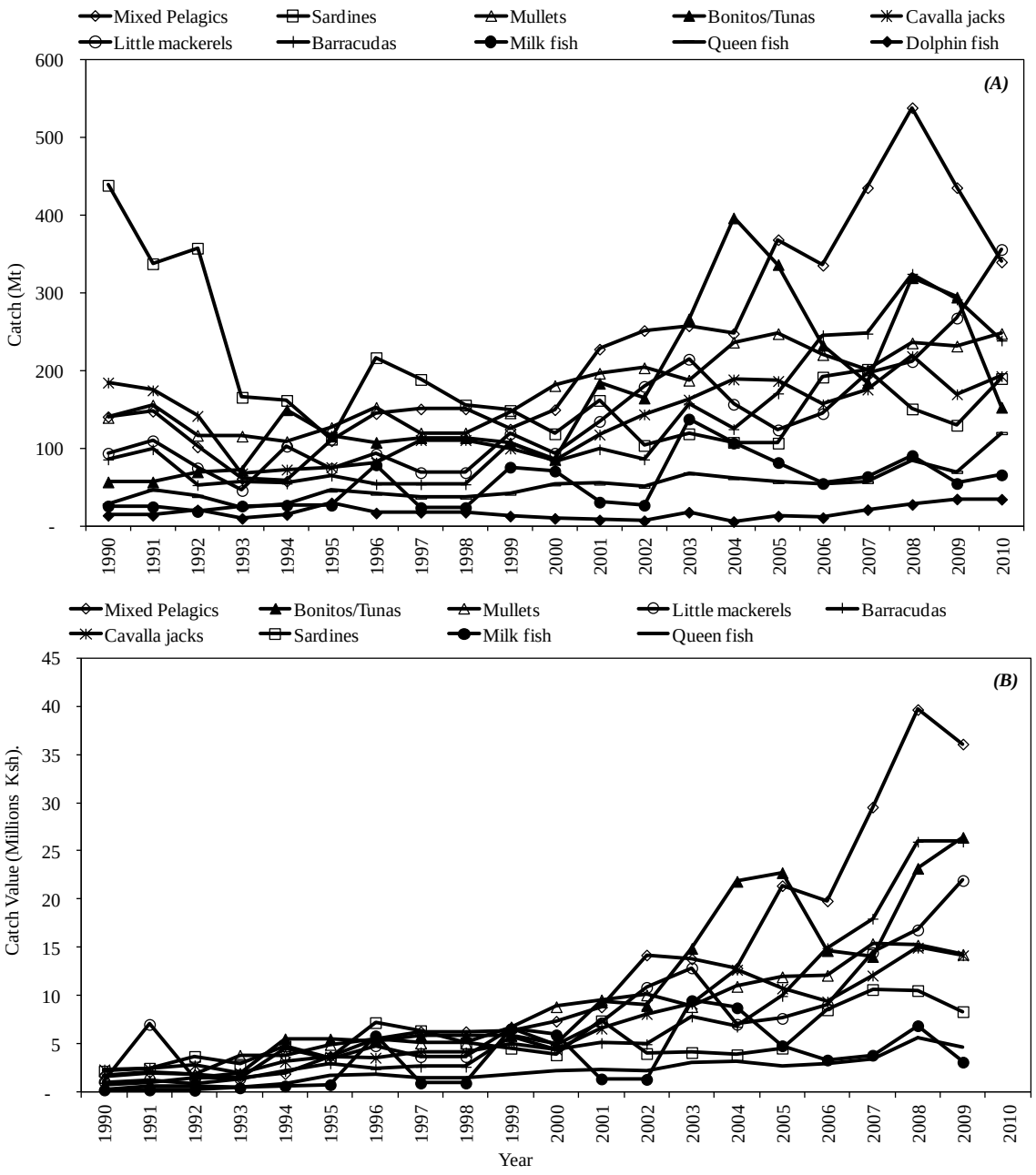


Figure 16. Quantities *(B)* and value *(A)* of pelagic fish groups from marine artisanal landings.

ii. Products and markets

The bulk of marine fisheries catch ends up into the domestic market with high value fish going to the tourist hotels along the coast and in Nairobi. The local demand for marine fisheries was estimated at about 5,000 mt, valued at 400-500 milion K.Sh in 2005 (Mwikya 2005). Pelagic catches are utilized by an intricate of markets ranging from domestic, restaurants, hotels, industrial and exports (table 10). The domestic fish market is however not well defined or organized and involves buying fish at the beach by small scale traders and selling to various open-air markets and fish shops. The fish are sold either dried, fresh or processed for later consumption. Artisanal Fish Processors (AFPs) prepare dried and smoked fish mostly for local

market, while Industrial Fish processors (IFPs) freeze or chill fish for export and to a lesser extent, for consumption in Kenya's urban areas. These companies mainly produce frozen and chilled fish for export to European and other non-European markets (Table 13, 15). Italy and Spain are the key export destinations.

Table 10. The markets utilised by each fishery (√ or Yes)**.**

Fishery name	**Domestic**	**Restaurant**	**Hotel**	**Middleman/ Trader**	**Industrial**	**Export**
Hand line	√	√	√	√		
Longline (droplining/drift longlines)	√	√		√	√	√
Trolling		√	√		√	
Set gillnets	√			√		√
Drift gillnets	√	√	√			
Ringnets	√	√	√	√		
Cast nets	√	√	√			√
Beach and reef seine	√		√	√		
Fence traps	√	√	√	√		
Trawling					√	√

iii. Marine fisheries products exports

Marine fishery products for export are supplied by industrial/factory trawlers (e.g for Shrimps), artisanal fishers (lobsters, mollusks and finfish) and by distant waters fleet (DWF) vessels operating in the south West Indian Ocean (lobsters, mollusks and finfish mainly tunas). Artisanal fishers are supplied with ice and insulated containers by the establishments to keep post harvest losses to a minimum. Various products are processed by the export establishments (see table 13-15). Tuna is usually processed into cooked tuna loins by cooking headed and gutted tuna, and then removing the bones and peeling off the skin and dark muscle from the cooked fillet. The pink-colored fillets are then vacuum packaged in cling film and frozen. Tuna loins in destination markets are used as raw material for processing of products such as bottled tuna flakes, tuna salads, tuna pastes and spreads.

Kenya's marine pelagic fishery exports show a varied pattern (figure 17), which depends more on the product than season. The volumes and value of export follow a similar pattern (figure 17). Trend in monthly quantity and value of exported pelagic fisheries products ranged from 0.1 mt to 1,426 mt valued at 0.3 million Kshs to 3145 million Kshs. Annually, an average of 5,226.33 ± 226.33 mt valued at 629.04 ± 72.63 million Kshs, (± SE) were exported. This includes marine pelagic fishery products supplied by industrial/factory trawlers and distant waters fishing fleet (DWF). The export products mainly comprised of frozen yellowfin, Skipjack and Bigeye tuna loins, frozen Headed and gutted Swordfish, sharks and tuna, dried shark fins and frozen Bonito Loins (table 13 and 14).

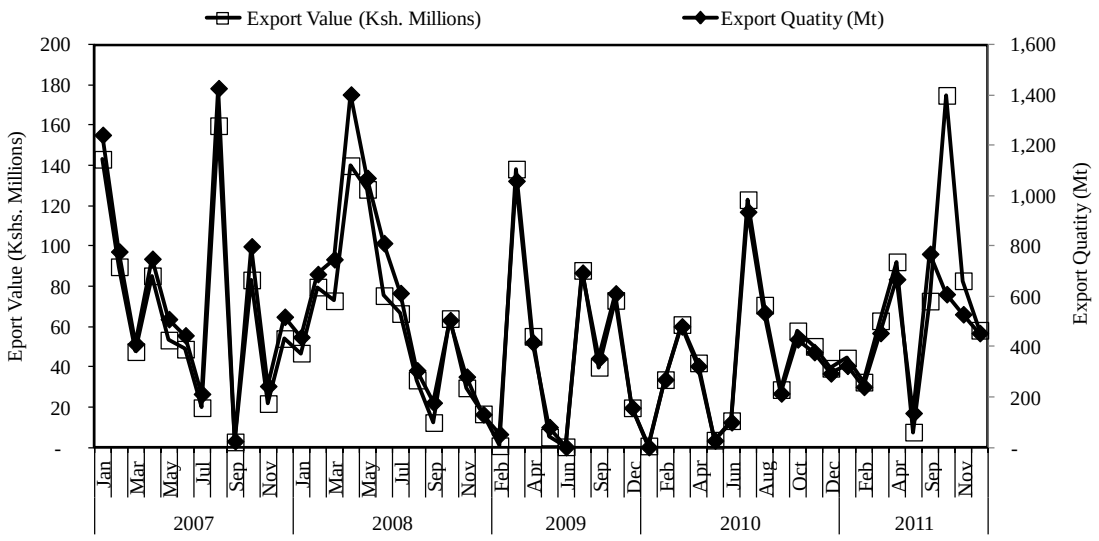


Figure 17. Value and tonnage of marine pelagic fishery export products from 2007-2011. Annual mean: export value = 629.04 ± 72.63 million Kshs, export quantity = 5,226.33 ± 226.33 mt (± SE).

Italy and Spain were the main export destinations for pelagic fishery products during the 2007 - 2011 period (figure 18, table 11 and 13). Kenya fishery quality control conditions and procedures were harmonized with the EU quality control systems since January 2004 allowing exportation to any EU states (Mwikya 2005). The Kenya Fish Processors and Exporters Association (AFIPEK) ensure members adhere to the industry's Code of Practice.

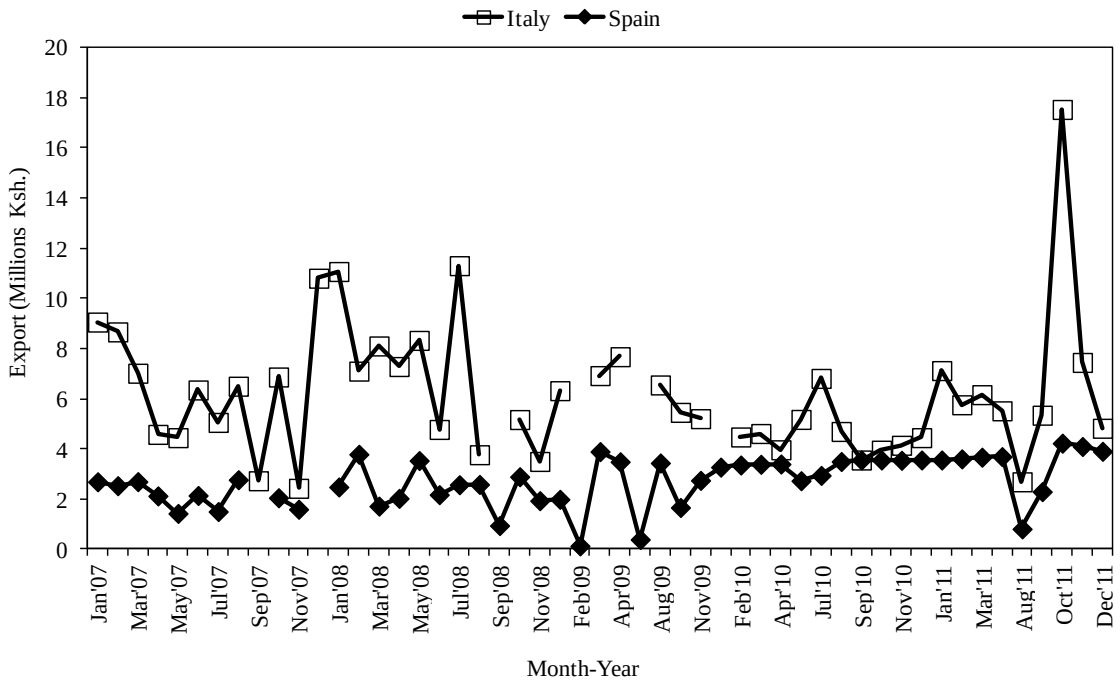


Figure 18. Trend in monthly value of marine pelagic fisheries export products for two major export destinations

Table 11. Quantity and value of marine fisheries export products from 2007 to 2011.

Year	Export Destination	Value (Ksh Millions)	Quantity (Mt)
2007	Italy	667.91	5961.92
	Spain	140.73	1396.81
2008	Italy	475.84	4382.90
	Spain	289.11	2788.56
2009	Spain	265.06	2196.49
	Italy	154.44	1229.68
	China	0.47	2.00
2010	Italy	328.72	2512.79
	Spain	186.86	1436.49
	Portugal	3.43	26.73
	China	4.79	13.00
	Singapore	0.10	0.05
2011	Italy	529.84	3404.68
	Spain	96.28	776.15
	China	1.62	3.40
Total		**3,145.21**	**26,131.66**

The export products mainly comprised of large pelagic fishery (85.9%) with other fisheries mainly comprising of invertebrates contributing 14.1% (table12).

Table 12. The contribution (%) of pelagic fisheries to marine fisheries exports, mean tonnage and value over the last five years.

Pelagic fishery type	**%**		**Mean (2007-2011)** ± SD	
	Quantity	**Value**	**Mt**	**Millions (Ksh)**
Large Pelagics	85.9	75.2	36.77 ± 40.09	4.35 ± 4.31
Medium Pelagics	1.1	1.0	10.25 ± 11.33	1.22 ± 1.22
Others	13.0	23.9	8.70 ± 7.99	2.14 ± 2.14
Total			25.39 ± 34.20	3.40 ± 3.40

The bulk of marine pelagic fisheries products from Kenya over the last five years ended up to three main destinations; Italy and Spain (Table 13). Other destinations include Portugal, Singapore, Netherlands and China, the later importing 18.5 mt of dried shark fins valued at Millions Ksh.s 6.89. Cooked frozen yellowfin loins and cooked frozen skipjack loins were the main fishery export products accounting for 89.6% of marine fisheries products exported over the last 5 years (table 13). Some fish is sold fresh while a significant proportion is processed for later consumption. Artisanal Fish Processors (AFPs) prepare dried and smoked fish mostly for local market, while Industrial Fish processors (IFPs) freeze or chill fish for export and consumption in Kenya's urban areas.

Table 13. Marine fishery export products by destination for Kenya over a five year period, 2007-201**1.**

Export Destination	**Italy**		**Spain**		**Others**		**Overall**		
Products / Qty / Value	*Mt*	*Mil. Ksh*	*Mt*	*Mil. Ksh*	*Mt*	*Mil Ksh*	*Mt*	*Mil. Ksh*	*% (Qty)*
Frozen Yellow fin Loins	15,008.04	1,862.90	4,476.67	557.97			19,484.71	2,420.87	74.6
Frozen Skipjack Loins	24,83.93	293.87	1,421.40	181.50	26.73	3.43	39,32.06	478.80	15.0
Frozen Bigeye Loins			1,071.97	128.34			1,071.97	128.34	4.1
Frozen H&G Swordfish			688.77	67.70			688.77	67.70	2.6
Frozen H&G Sharks			713.96	25.11			713.96	25.11	2.7
Dried Shark Fins					18.458	6.98	18.46	6.98	0.1
Frozen H&G Tuna			90.60	6.76			90.60	6.76	0.3
Frozen Bonito Loins			56.42	6.07			56.42	6.07	0.2
Other Products			74.71	4.58	0.01		74.72	4.58	0.3
Total Exports	17,491.97	2,156.76	8,594.50	978.04	45.198	10.41	26,131.67	3,145.21	
Proportion by Destination %)	66.9	68.6	32.9	31.1	0.2	0.3			

iv. Marine fisheries import products

The monthly trend in quantity and value of marine pelagic fishery products imported over a five year period indicates an increase in the value of products from year 2010 (figure 19). Highest monthly imports were recorded in July 2009, 565 mt valued at 14.4 Kshs. Million. An annual mean of 3,993.2 mt of pelagic fishery products imports valued at 102.2 Kshs. Million were recorded over the five year period.

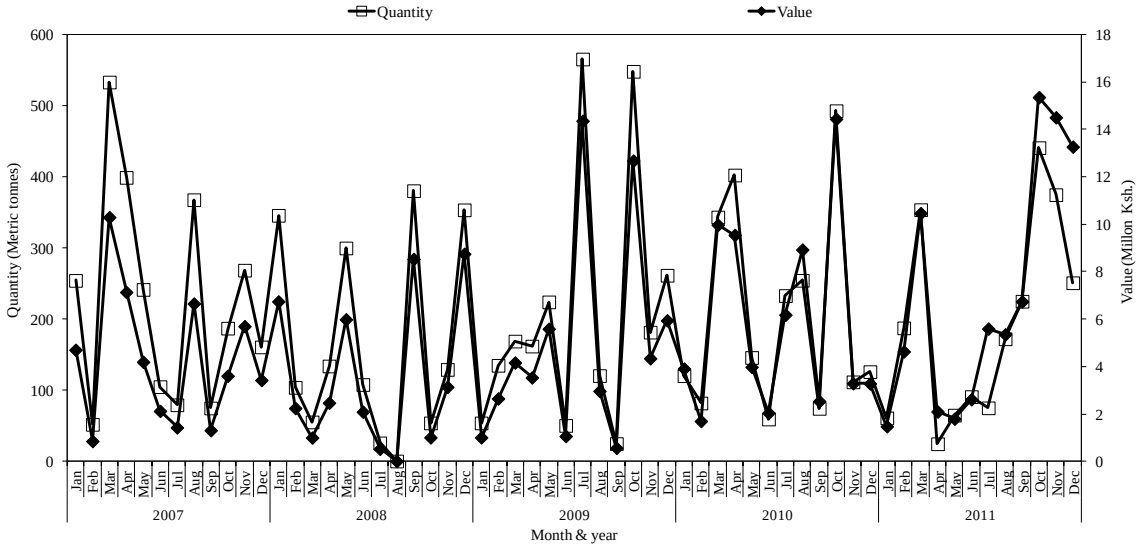


Figure 19. Time series of imported marine fishery pelagic fishery products, 2007-2011.

The marine fisheries imports products from 2007 to 2011 comprised mainly of medium and small pelagic fisheries which accounted for 56.1% and 29.1% of the total tonnage respectively. The small pelagic fishery imports (mt) declined by 55.4% to 529 mt in 2007 over the five year period (figure 19-20). The main countries of origin for imported marine fishery products were Japan (22.4%) Korea (20.2%) and India (12.7) largely exporting frozen mackerels and sardines to Kenya. These imports are mainly from the distant waters fishing fleet (DWF) operating in the south West Indian Ocean and offloading at the Kenyan port where the fishery products are further processed for export by local establishments. The establishments also facilitate the transhipment of some unprocessed marine fishery products to European processing companies from foreign-flagged vessels.

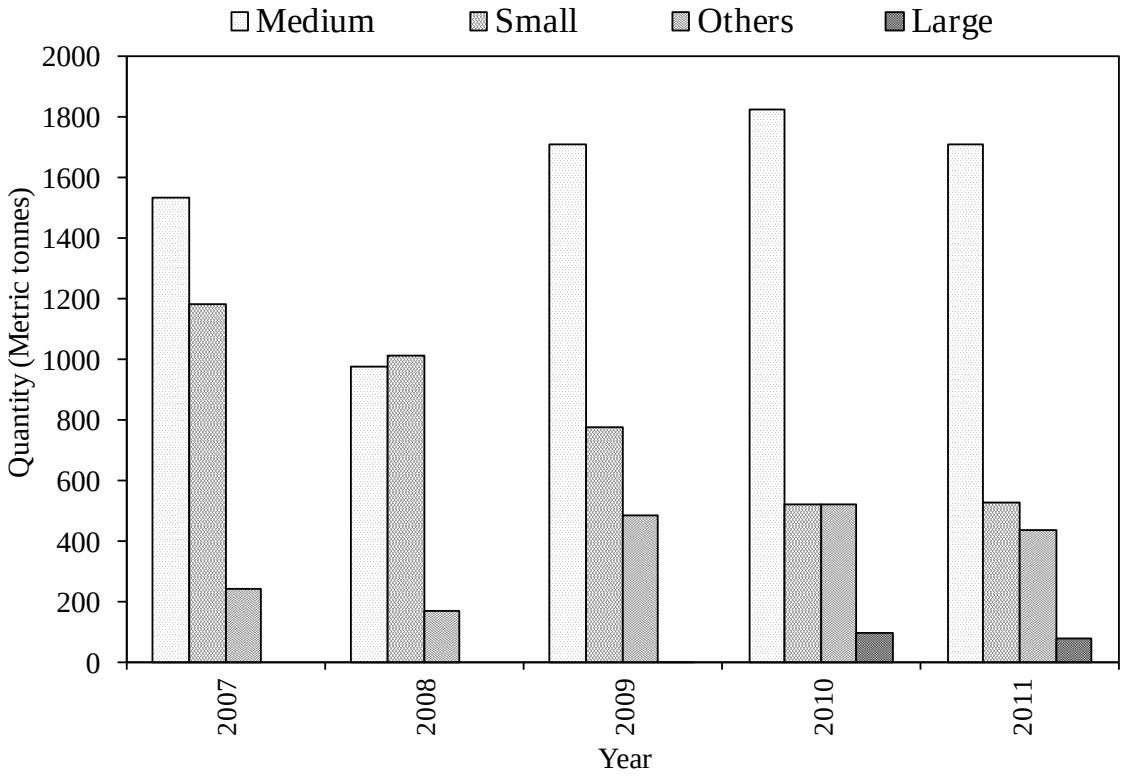


Figure 20. Quatity of imported small and medium pelagic fisheries products from 2007-2011. Medium pelagic = 56.1%, small pelagic = 29.1%, large pelagic = 1.3% and other fisheries such as crustaceans and demersals = 13.3%.

Table 14. The marine fishery products imported in Kenya, 2007-2011

Year	Products	Quantity (Mt)	Value (Million Ksh)
2007	Frozen Herrings	583.0	10.74
	Frozen Mackerels	1537.4	29.13
	Frozen Sardines	603.5	11.58
2008	Frozen Brazilian Menhaden	0.5	0.01
	Frozen Herrings	610.6	14.63
	Frozen Mackerels	971.5	20.37
	Frozen Sardines	403.0	7.41
	Frozen Yellow Tail Scad	5.0	0.09
2009	Frozen Herrings	96.0	2.43
	Frozen Mackerels	1689.4	41.43
	Frozen Pacific Saury	25.0	0.58
	Frozen Sardines	658.1	13.57
	Frozen Sharks	3.5	0.26
	Frozen Tuna	23.8	0.54
	Salted Sharks	1.0	0.08
2010	Dried Sharks	60.0	1.26
	Frozen Dolphinfish	20.5	0.71
	Frozen Herrings	22.3	0.82
	Frozen Koheru	27.0	0.72
	Frozen Mackerels	1748.9	50.00
	Frozen Sardines	485.0	10.35
	Frozen Sharks	36.9	3.44
	Frozen Tuna	30.6	2.07
2011	Dried Sharks	67.0	1.34
	Fresh Salmon	0.3	0.06
	Frozen Mackerels	1604.7	58.67
	Frozen Sardines	529.0	15.71
	Frozen Sharks	13.7	1.88
	Frozen Tuna	107.4	6.24
	Smoked Salmon	0.1	0.01
Total		11979.5	306.59

v. *Employment of activities in value-addition and linked to the marine fisheries sector*

Nationally, 798,000 Kenyans were, directly or indirectly, supported by the marine fisheries sector in 1995 compared to 720,000 in 1993. In the same year (1995), there were 34,000 fishermen with an estimated 238,000 dependants and about 526,000 other people engaged in the provision of support and ancillary services such as trade in fish inputs, fish handling, processing and marketing. At the Kenyan coast establishment involvement in the marine fisheries sector are highlighted on Table 15. These companies mainly produce frozen and chilled fish for export to European and other non-European markets.

Table 15. Main establishments involved in processing of marine fish and fisheries products. (Source: Ministry of livestock and fisheries development, Mombasa)

Establishment & # of Employees	**Location**	**Raw Product**	**Source of Raw Material**	**Processed Product**	**End Product Destination**
Wananchi Marine Products **(375)**	Liwatoni	-Tuna spp (Bigeye, Skipjack, Yellow fin)	Seychelles, Spain	-Cooked frozen tuna loins	Italy, Spain,
Amco Foods Ltd **(16)**	Shimanzi	-Octopus	Shimoni, Vanga	-Frozen octopus	-Italy, Spain
		-Nile perch	Lake Victoria	-Nile perch fillets	-South Africa, Italy
Crustacean Processors **(20)**	Shimanzi	-Octopus	Shimoni, Vanga	-Frozen Octopus	- Portugal, Italy
Transafrica Fisheries **(22)**	Majengo	-Octopus -Lobster	-Shimoni, Vanga	-Frozen octopus -Frozen whole lobster	-Italy, Malta , Portugal, Greece,
Sea Harvest **(89)**	Mikindani	-Octopus	Kipini, Ukunda , Vanga,	-Frozen octopus	- Portugal, Italy, Spain, France
		-Lobster	Shimoni,Kilifi, Mayungu	-Frozen whole lobster	
Kenya Dry Products **(30)**	Kongowea	Haplochromis spp (Fulu)	Lake Victoria	Dried Fulu	Denmark

9. FISHERY MANAGEMENT MEASURES OR TOOLS CURRENTLY IN USE

Table 16. Set of management measures or tools currently being applied in pelagic fishery sector. "√." indicates existence of the management measure or tool.

Type of Management Tool	Tick	Comments (e.g. when introduced, effectiveness, compliance, etc)
Spatial (area) restrictions and closures such as:		
Marine protected areas where fishing is prohibited	√	Marine parks and reserves exist since 1968 (Table 17). There are 4 marine parks in Kenya where fishing is prohibited, managed by the Kenya Wildlife Service (KWS). Marine parks are well managed with better compliance and effective enforcement compared to reserves.
Nursery area closures	√	No specific areas set aside as nurseries, but are believed to be covered within MPAs.
No-take zones	√	Marine parks are no-take zones where fishing is not allowed.
Marine reserves where fishing is sometimes allowed	√	A total of six reserves exist where only fishing using traditional gears is allowed (Table 17). Use illegal and disallowed fishing methods are common. Enforcement is inadequate.
Co management	√	Through Beach management units (BMUs)
Other temporary areas closures for specific purpose (e.g., spawning aggregations)		There exist no (government) temporary area closures along the Kenyan coast aimed at e.g. protecting spawning aggregation of fish although there is some evidence of targeted fishing of fish spawning aggregations (Maina *et al., in prep*; Samoilys *et al.,* in prep; Robbinson *et al.,* 2008). Local communities' interest in establishment locally managed marine areas is on rise (Table 18).
Temporal restrictions such as:		
Defined fishing season(s)	√	There is no legal specific fishing season in Kenya except for the Prawn trawling.
Defined number of days fishing	√	Prawn Fishery Management Plan 2010 (legal notice no. 20).
Defined number of hours per day fishing		
Defined number of hours fishing	√	Trawling time may be restricted according to the Prawn Fishery Management Plan 2010 (legal notice no. 20).
Gear restrictions such as:		
Engine size restrictions	√	Prawn Fishery Management Plan 2010 (legal notice no. 20).
Gear size restrictions	√	No reference to mesh size restrictions for marine fisheries gillnets in fisheries regulations, except 'seining net with mesh sizes less than 50 mm when diagonally stretched is prohibited fishing gear except for fishing for Rastrineobola (Omena)'..
Gear type restrictions	√	The illegal fishing gears: beach seines, spearguns, spear and harpoon, and some undersize mesh sized gill nets (e.g. mosquito nets), monofilament nets , dynamite and use of scuba gear for fishing lobster and bêche-de-mer.
Size/Age restrictions (i.e., minimum or maximum sizes)		

Type of Management Tool	Tick	Comments (e.g. when introduced, effectiveness, compliance, etc)
Participatory restrictions such as:		
Licenses	√	Having fisherman, vessel, fish processing, and fish traders licence and fish movement permits is mandatory. There are many artisanal fishers who don't comply with these regulations.
Limited entry	√	Fisheries Act 378 Section 6(1), empowers the Director of fisheries to limit the number of persons, vessels, nets, etc. employed in a fishery. The prawn fishery management plan (legal notice no. 20) authorizes the director to limit the number of vessels with a maximum of 300 (GRHP), beyond three nautical miles to a maximum of 4 vessels. Those more than 300(GRHP) beyond five nautical miles may be limited to a maximum of four vessels.
Catch restrictions such as:		
Total allowable catch (TAC) limits	√	There is no specification on allocation of the Total Allowable Catches (TACs). For foreign fishing vessels, the Act implicitly suggests the existence of a form of TAC and ITQ under Section 12(2) (a) and (b) respectively. The Director may issue a licence to a foreign fishing vessel only if there are surplus fishery resources, which may be harvested, indicating the quantity as a condition in the licence.
Vessel catch limits		Applies to foreign fishing vessels, which have to state the tonnage of the allowable catch.
Individual vessel quotas		
Rights- / incentive-adjusting regulations such as:		
Individual effort quotas		
Individual fishing quotas		
Individual transferable quotas		
Individual transferable share quotas		
Group fishing rights (including community development quotas)		
Territorial use rights		
Stock use rights		

10. THE EFFECTIVENESS OF THE CURRENT MANAGEMENT MEASURES IN RELATION TO THE FISHERY

i. Legal measures

The Fisheries Act 1991 empowers the director to impose the following management measures:

a) closed seasons for designated areas, species of fish or methods of fishing;
b) prohibited fishing areas for all or designated species of fish or methods of fishing;
c) limitations on the methods of gear, including mesh sizes of nets, that may be used for fishing;
d) limitations on the amount, size age and other characteristics and species or composition of species, of fish that may be caught, landed or traded;
e) regulate the landing of fish and provide for the management of fish landing areas; and
f) Control of the introduction into, or harvesting or removal from, any Kenya fishery waters of any aquatic plant.

ii. Marine protected areas where fishing is prohibited

Establishment of MPAs was propelled by interests in the tourism industry but has had benefits to fisheries. Marine Protected Areas increase spill over of fish to adjacent fished areas (McClanahan and Kaunda-Arara, 1996; McClanahan and Mangi, 2000; Kaunda-Arara and Rose, 2004). This has led to increase an increase in CPUE in areas closer to the MPA (Kaunda-Arara and Rose, 2004). There is high abundance and species diversity of fish in the marine parks and marine reserves than in open fished areas

Table 17. Nationally gazetted Marine Protected Areas in Kenya (Source: IUCN, 2004)

Site	IUCN Category	Size (Km2)	Date established	Management type
Malindi	II	6.3	1968	Park
Watamu	II	10	1968	Park
Malindi-Watamu	VI	245	1968	Reserve
Kisite	II	28	1978	Park
Mpunguti	VI	11	1978	Reserve
Kiunga	250	1979	1979	Reserve
Mombasa	VI	200	1986	Park
Mombasa	II	10	1986	Reserve
Diani-Chale	VI	75	1995	Reserve

Establishment of MPAs has contributed led to conflicts between stakeholders (Muthiga, 2009), especially between marine resource users and between managers and resource users. KWS is involved in surveillance within the MPAs which reduces fishing within protected areas, but illegal fishing still persists in the marine reserves. Fisher communities that interact more with the KWS have a higher compliance level.

iii. Nursery area closures, no-take zones and marine reserves where fishing is sometimes allowed

Nursery area closures are believed to be within MPAs. Marine Protected Areas in Kenya are considered as no-take zones. Within reserves, only artisanal fishing is allowed. Marine reserves have been noted to have inadequate management have not been successful in sustaining the livelihoods of the local communities (Muthiga, 2009).

iv. Other temporary areas closures for specific purpose

There exists no (government) temporary area closures along the Kenyan coast aimed at protecting spawning aggregation of fish. Information on timing and location of fishing spawning aggregations is insufficient. Recent studies indicate there is targeted fishing of rabbit fish, *Siganus sutor* and exploitation of grouper, *Epinephelus fiscoguttatus* spawning aggregations for dive tourism in south coast Kenya (Maina *et al., in prep*; Samoilys *et al.*, in prep; Robbinson *et al.*, 2008). This could be subjected to management measures in the near future, including gazettment as breeding areas. There are also community initiatives coming up with community marine protected areas (Table 18). Recent developments in marine conservation indicate increasing community initiatives geared towards establishment of community marine reserves, with different forms of management types. These community reserves have been driven by the need to improve the health of the ecosystem, to reduce overexploitation, livelihood development, reduce resource use conflicts, eco-tourism and habitat, and species protection. These are positive development and will benefit fisheries.

Table 18. Community marine protected areasconinitiatives along the Kenyan coast (Source: Harrison and Laiser, 2009; Murage et al., 2010; Abunge, 2011; 2011; Samoilys et al., 2011)

Conservation initiative	Year formed	Size (Km^2)	Management intervention
Kuruwitu	2006	0.29	No take zone
Tiwi (Nyari)	2009	0.125	No take zone
Msambweni	In progress	0.46	Gear restriction
Wasini	2008	In progress	Seasonal closure
Kibuyuni	2010	0.275	Gear restriction/no take zone
Mkwiro	In progress	0.155	Gear restriction
Bureni	2010	0.52	No take zone
Kanamai	2011	0.22	No take zone
Mkwakwani/Tradewinds	2009	0.118	Gear restriction
Shimoni	In progress	In progress	Gear restriction
Jimbo	In progress	In progress	Gear restriction
Vanga	In progress	In progress	Gear restriction
Majoreni	In progress	In progress	Gear restriction
Kiweni, Lamu	2010	3	Gear restriction

v. Defined fishing season(s) and hours fishing

The Fisheries Act empowers the director (with approval of the Minister and by notice in the gazette) to declare closed seasons for designated areas, species of fish or methods of fishing. The Prawn fishery management plan (legal notice no. 20) for instance, empowers the director authority to enforce closed season from the 1st November to the 1st April every year for the Malindi, Ungwana Bay and adjoining waters. Closed season in prawn fishery is expected to reduce resource use conflicts. Trawling time may be restricted according to the Prawn fishery management plan 2010 (legal notice no. 20). The draft ringnet fishery management plan (June 2012) proposes fishing from October - April during the day time hours - 6am and 6pm.

vi. Gear size and type restrictions

There is no provision in the Fisheries ACT Cap 378 on gear sizes in marine waters. However, under section 5(1)c, the director is authorized by notice in gazette, to impose limitations on the methods of gear, including mesh sizes of nets, that may be used for fishing. Some of the illegal and destructive fishing gears in use by artisanal fishermen include the beach seines, spearguns, spear and harpoon, and some undersize mesh sized gill nets (e.g. mosquito nets), monofilament nets , dynamite and use of scuba gear for fishing lobster and bêche-de-mer.and (9th

November 2001 Kenya Gazette notice No. 7565 Vol. CIII. No. 69, and The legal notice number 214 of 2003). These gear types are however still being used in certain parts of the Kenyan coast, leading to conflicts among resource users, destruction and overexploitation of fisheries resources. In some areas more than a half of the artisanal fishers use banned fishing gears. Increasing human population and the use of destructive fishing gear have resulted to declining fisheries.

vii. Licenses

In Fisheries Act Section 9(1), "No person shall fish in Kenya fishery waters unless he is a holder of a valid fishing licence, he is an employee of a licensee or he is fishing for his own consumption." Licenses limit the number of fishermen increasing CPUE. Many artisanal fishermen however, lack licenses and are not BMU members making enforcement difficult.

viii. Limited entry

This applies to foreign fishing vessels that must have licenses to operate in Kenyan waters (Fisheries Act 1991 Section 11). According to Section 18 of the Fisheries ACT, foreign fishing vessels are not allowed to access Kenya's territorial waters. They are therefore limited to the EEZ. However, the Kenya government institutional capacity is inadequate to monitor, control and survey its EEZ.

ix. Total allowable catch (TAC) limits and vessel catch limits

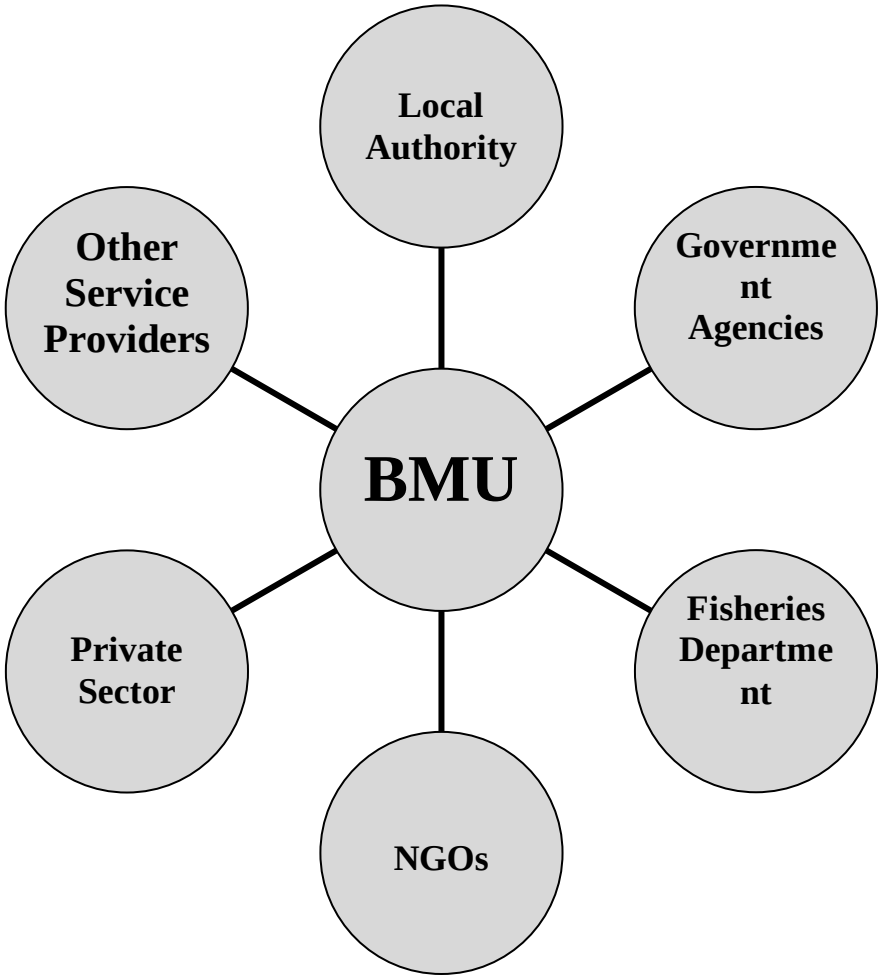
The Prawn fishery management plan (legal notice no. 20) gives the director authority to specify the annual total allowable catch for shallow water prawns based on evaluation of stock assessment and monitoring data. Foreign vessels have TAC limits as provided for by the Fisheries Act 1991. They have to state the tonnage of the allowable catch in the foreign fishing craft license. The institutional capacity of Kenya is however limited to conduct MSC of vessel catch limits for foreign fishing vessels.

x. Co management.

Co-management is a partnership that harnesses the knowledge and capacities of those who have a shared interest in the sustainability of a fishery towards promoting a common end. Co-management can involve all the principal fisheries stakeholders. In fisheries co-management, there are several stakeholders, which fall in the following categories: fisherfolk, private sector, civil society, public sector and development partners. The fisherfolk participate in co-management through their grass root organizations (the BMU). Both rights and responsibilities of stakeholders with respect to the fishery are considerably expanded. The roles of the BMUs are stated as follows; to

(a) Maintain and keep a register of all boat owners and their fishing equipment, fishers and BMU members operating from the beach.
(b) Decide on local markings for identification of fishing gears and outboard engines by licensed fishers;
(c) Participate in vetting of boat owners and fishers for licensing and, in collaboration with government officials, ensure licenses are granted to those registered with the BMU;
(d) Propose bye-laws for endorsement and enforce them;
(e) Identify fish breeding areas on the basis of indigenous knowledge and identify and enforce no fishing in prohibited fishing zones;
(f) Undertake Monitoring, Control and Surveillance in collaboration with the relevant authorities;

(g) Assist in the collection of data for Frame Surveys, catch monitoring and socio-economic investigations, using agreed formats;
(h) Inspect and record visiting boats and give permission to land where appropriate;
(i) Improve sanitation and hygiene at landing sites.
(j) Network with other BMUs to ensure marketing and fair pricing of fish and fish products;
(k) BMU committee should be part of the development organ in their areas of jurisdiction;
(l) Preparation of annual workplans, budgets and financial reports and Formulate funding proposals, and
(m) Prepare development plans and solicit for funding



11. COMPLIANCE OR ENFORCEMENT PROBLEMS

Under section 46 of the Fisheries Management and Development Bill, 2011, the Bill prohibits the use of certain fishing gears and methods. Under section 47, the Bill also prohibits damage, destruction to and interference with fishing gear and vessel.

The Fisheries Management and Development Bill, 2011 allows for the establishment of a Monitoring, Control and Surveillance Unit within the Fisheries Service that will oversee fisheries and fishing activities in Kenyan waters. It also gives the Director-General the responsibility of planning fisheries management and taking fisheries management measures to limit fishing and fishing related activities. The Director-General, for the purpose of MCS, may also establish and operate vessel monitoring systems (VMS) while the fishing vessel is in the fishery waters or, in respect of a Kenya fishing vessel, in areas beyond national jurisdiction. Fishing vessels, both local and foreign are required to have licences in order to operate, except those individuals fishing for non-commercial subsistence.

Compliance and enforcement problems

Along the Kenyan coast, despite the regulations, there have been cases of high fishing effort in near shore fish habitats and use of destructive fishing gears (Mangi and Roberts, 2007) leading to overfishing. Compliance problems are mainly due to:

i. Insufficient awareness and training on fisheries issues
ii. Weak fisher organisations
iii. Insufficient background knowledge about the fishing communities which is essential in fisheries management and development planning
iv. Insufficient application of technical advice to fisheries management
v. Lack of sustained enforcement of fisheries regulations
vi. Difficulties in discouraging overfishing and disposing of acquired illegal gears
vii. Weak stakeholders' participation in fisheries management and enforcement
viii. Lack of participatory monitoring and evaluation of fisheries management and surveillance systems
ix. Insufficient support to alternative income generating activities to fishing
x. Proliferation of migrant fishers especially foreigners
xi. Resource use conflicts amongst stakeholders
xii. Inadequate ownership to the co-management concept in coast.
xiii. Inadequate capacity to conduct MCS

Migrant fishery

Fisher migration is a common feature in the East African coast and occurs both within Kenyan waters and from neighboring countries (Wanyonyi et al. 2011; Crona and Rosendo, 2011; Fulanda et al 2009). The drivers for migration are many but motivated mainly by improved livelihoods through better earnings, savings and increased catches. Fisher migration ranges from circular, seasonal migration to more long-term settlement by migrants though their policy implications have not been given enough attention (Crona and Rosendo, 2011). Fishers migration often occurs during the Northeast monsoon. Migrant fishermen are associated with use of destructive fishing gears and non-compliance to fisheries rules and regulations. On the other hand, migrant fishers assist in introducing new fishing technologies to fishermen and in effect transfer of fishing knowledge and skills.

12.0 NATIONAL OR REGIONAL FORUMS RELEVANT TO MANAGEMENT OF SMALL AND MEDIUM PELAGIC FISHERY

i. Tuna Fisheries Alliance of Kenya (TUFAK)

TUFAK was formed to support Tuna fisheries management in Kenya's EEZ. For a long time, Kenya has never had a forum for tuna discussions, until the year 2011, when the idea of Tuna Alliance of Kenya was put into practice. East Africa Willife Society (EAWLS) and Community Action for Nature Conservation (CANCO) have recently been active promoting a Civil Society Organization/Private Sector Alliance on Tuna Fisheries Management through Tuna Fisheries Alliance of Kenya (TUFAK). The Alliance aims to ensure active involvement of CSOs in the management of tuna resources in the Kenya taking into consideration the regional perspectives. The Alliance has so far has managed to; a) gather support for a CSO consultative workshop on tuna fisheries management in Kenya, b) Facilitate a Tuna taskforce for the drafting of national CSO Tuna Engagement Strategy for Kenya, and c) Prepare, produce and print tuna advocacy and awareness creation materials. TUFAK intends to continue supporting and strengthening the Civil Society Organization and the private Sector on Tuna Fisheries Engagement Network as well as support implementation of key activities on Tuna Engagement Strategy. This is build positive engagement between the network and the government for the sustainable management of the Tuna fishery.

ii. The National Environmental Civil Society Alliance (NECSA)

NECSA is an implementation committee overseeing the quality of the government's rolling out of environmental legislation within the new Constitution. Any advocacy issues on environmental legislation should take advantage of NECSA's existence and approach the issues from both County and National levels. NECSA also collaborates with the Constitutional Implementation Committee (CIC).

iii. Kenya Fish Processors & Exporters Association (AFIPEK)

AFIPEK is a professional Association of the large-scale industrial fish processors in Kenya. AFIPEK target mainly fish products from artisanal fishermen for domestic and export market. AFIPEK's has works towards fostering public recognition and support for the fishery sector, to promote high quality fish and fish products and to advocate for the effective management of Inland and marine fish resources.

iv. The East African community (EAC)

The EAC through Treaty for the Establishment of the East African Community, 2007 Chapter 18; Article 105 of the treaty aims to achieve food security and rational agricultural production within the Community. Chapter 19 Article 114 b (ii) emphasizes the need for common policies and regulations for the conservation, management and development of fisheries resources. Article 10 (1) of the protocol grants free movement of workers who are citizens within their territories. The protocol allows for free movement of goods, services, labour and capital plus the right of establishment and residence. This means that migrant fishers are allowed to move freely between Kenya and Tanzania.

ix. Kenya Coastal Development Project (KCDP)

KCDP is a World Bank sponsored project aimed at promoting an environmentally and socially sustainable utilization of Kenya's coastal and marine resources. The project is poised to help coastal zone communities achieve social and economic wellbeing, improve their standards of living and create wealth by empowering them to identify viable livelihood activities. It has four

components namely: Sustainable Management of Fisheries Resources; Sound Management of Natural Resources; Support of Alternative Livelihoods and Capacity Building, Monitoring and Evaluation, communication and Implementation of the Coastal Village Fund. KCDP implementation is through partnership of the Ministry of Fisheries Development (Fisheries Department and KMFRI), the Ministry of Forestry and Wildlife (KEFRI and KWS), Ministry of Regional Development (CDA), Ministry of Environment and Mineral Resources (NEMA) and the Ministry of Lands (Development of Physical Planning) in collaboration with a number of CBOs, NGOs and the private sector. KMFRI is the lead institution.

v. The Agulhas and Somali Currents Large Marine Ecosystems Programme (ASCLME programme)

The ASCLME programme in the Western Indian Ocean (WIO) is a Global Environmental Facility (GEF) initiative that consists of three inter-linked modules that address fisheries, ocean productivity and the influence of land-based activities on the marine environment. The three modules are the Agulhas and Somali Currents LME project (ASCLME project, UNDP), the WIO-Lab project (UNEP) and the South Western Indian Ocean Fisheries Project (SWIOFP) whose overall goal is to see the West Indian Ocean's marine resources ecologically managed for sustainable use and benefit by the region's riparian countries. The ASCLME project aims define clearly the ecosystem boundaries, understand the major transboundary environmental impacts within these ecosystems (by conducting Transboundary Diagnostic Analyses) and develop Strategic Action Programmes (SAP) for effective management and governance of these ecosystems. The ASCLME Project is capturing essential information relating to the dynamic ocean-atmosphere interface and other interactions that define LMEs, as well as data on fisheries, coastal populations and critical habitats. The Project is building capacity at the national and regional level and helping to create effective strategies for evolving information into policies and governance mechanisms that support the sustainable management of marine and coastal resources

vi. South Western Indian Ocean Fisheries Project (SWIOFP)

The SWIOFP is a 5-year project (2008-2012) that addresses shared, transboundary and migratory fish stocks of nine countries along the WIO countries; South Africa, Mozambique, Tanzania, Kenya, Seychelles, Comores, Madagascar, Mauritius and France. SWIOFP aims to collect relevant information to support regional management of fish stocks and build scientific and fisheries management capacity. It is subdivided into six operational Components: Data and IT, Crustacean fisheries, Demersal fisheries, Pelagic fisheries, Biodiversity issues, and Fisheries management (van der Elst et al. 2009). This document deals with Component 4 of SWIOFP (i.e. pelagic fisheries). All nine SWIOFP countries have significant pelagic fisheries and datasets, and participate actively in this Component.

viii. The Indian Ocean Tuna Commission (IOTC)

IOTC is an intergovernmental organisation mandated to manage tuna and tuna-like species in the Indian Ocean and adjacent seas. It does so by promoting cooperation among its Members to ensure the conservation and optimal utilisation of tuna and tuna-like stocks and encouraging sustainable development of fisheries based on such stocks through proper management.

vii. SMARTFISH

SmartFish is a European Union funded programme financed under the 10th European Development Fund implemented by the Indian Ocean Commission (IOC) in collaboration with Common Market for East and Southern Africa (COMESA), the East Africa Community (EAC) and the Inter-Governmental Authority on Development (IGAD). The programme covers Eastern and Southern Africa and the Indian Ocean Region (ESA-IO). The SMARTFISH project focuses

on fisheries management, fisheries governance, trade, food security, and Monitoring, Control and Surveillance. Eventual beneficiaries of the programme include fishermen, coastal communities, other stakeholder groups and wider populations of ACP states of the ESA-IO region.

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Appendix 1. The biological, ecological, economic and social situation related to the of the pelagic fishery along the Kenyan coast

Goals	Situation	Sources of information	Strengths	Weaknesses	Opportunities	Threats
Biological	-Fish species (table 3) -CPUE <5kg/fisher/day -Reef Fishing pressure 9 – 27 fishers/km^2 -Reef fish Densities 0.04 – 0.07 ha^{-1} $month^{-1}$.	McClanahan and Mangi 2001, Hicks et al. 2009; Samoilys et al. *in prep;* Maina *et al* 2008 -FiD 2008	-Data on reef fisheries available	-Data on pelagic fisheries poor and rarely available to species level; -No fisheries specific management plans except for prawns	-Improve data recording systems -Develop pelagic fisheries management plans -Additional Pelagic fisheries data through regional programmes	-Over-exploitation of shallow nearshore areas -
	Targeted fishing of spawning aggregations	Samoilys *et al.* 2012	Reports recent but for reef fishes	-No enough information for entire coast -Spawning aggregations of pelagic fisheries unknown	Indigenous knowledge on spawning aggregations exist	-Collapse of key fisheries
	High rate of juvenile capture from set gill nets (49%), beach seine (68%), small hooks (56%)	Mangi and Roberts, 2007;McClanahan and Mangi; Samoilys et al. 2011	Studies exist for reef fish species	Biological studies scanty, studies for pelagic species scanty	Conduct biological studies (reproduction, maturity e.t.c.)	
Ecological	MSY not known				More studies needed	Current situation unknown
	Habitat destruction (coral reefs, mangroves, seagrass beds)	Mangi and Roberts, 2007;	Communities wary of MPAs		Education and awareness; Alternative livelihoods; Promote community conservation areas	Evidence of overfishing, use of destructive fishing gears such as beach seines; overlapping mandates of government institutions; weak law enforcement
	No up to date information on stock status		No sufficient and recent stock	Stock assessment reports not recent, insufficient	Conduct stock assessment; take advantage of regional	Stock status unclear

Goals	Situation	Sources of information	Strengths	Weaknesses	Opportunities	Threats
			assessment on pelagic fisheries	capacity	projects	
	Bycatch: turtle, birds, sharks, whales, dolphins	Samoilys et al. 2011	Reduced bycatch	No bycatch data	More studies needed	No information on bycatch
Social	Fisherman vs processor			Fishers have no power to influence price	BMU collection/buying centres at landing site	Fisher management Capacity low, lack of capital
	Fishermen numbers (12077) Fishing crafts numbers excluding foot fishers (2687)	FiD frame survey 2008		Information not updated	Conduct a frame survey	
	Growth rate of the population					
	Fisher associations/groups are weak		Establishment of BMUs	Internal wrangles; Inadequate capacity to implement BMU bylaws by fishers	BMU training; Develop options for greater self governance	Illiteracy; interference from politics; migrant fishers; community commitment; private sector stakeholders not keenly interested
	Fishing male dominated		More women involved in fish trading	Gender imbalanced activity	Encourage women participation	Cultural and Religious hindrances
	Political instability	Post election violence				Terrorism and piracy
Economic	-Dependency on fishing by coastal communities is high, -Low fisher incomes <Ksh 500 per day	FiD Annual statistics	-Demand for fish is high -	-Insufficient economic information on pelagic fisheries -Price fluctuations	-Undertake economic surveys of the pelagic fishery -Improve Marketing strategies	Minimal investment by government towards fisheries development

Goals	Situation	Sources of information	Strengths	Weaknesses	Opportunities	Threats
				-seasonality in fishing		
	Marine artisanal fisheries production (1990-2010) = 4336mt -8736mt, Ksh. 135.2 – 726.7 million. Small pelagic 429 – 1290mt , ksh. 7 – 107 million. - Medium pelagic 347, – 1357mt, Ksh. 7.3 - 90.7 million. Small and medium fisheries (85.4% of the pelagic fishery).	This study (FiD data)		-Data mainly from artisanal fisheries; -catch records not comprehensive; -near-shore fisheries overexploited; -Market network for artisanal fisheries production poor	-Improve data monitoring; -offshore fisheries development -Market demand for fish and fisheries products high in Kenya	Terrorism and piracy; poaching of EEZ fisheries by other countries; MCS system weak;
	Export value to national economy (refer to section 8)	This study				
	Import value from pelagic fisheries: Ksh 306.59 millions = 11979.5 mt	This study				
	Fishing techniques mainly artisanal		Small scale hence low pressure	Risky of under exploitation of deep pelagic species	Support exploitation of pelagic species beyond reef	Destructive fishing methods; exploitation of fish spawning aggregations

Appendix 2. Fisheries facilities available along the Kenyan coast by county.

Facilities	**Years**	Kwale	Mombasa	Kilifi	Tana River	Lamu	**Total**
Cold rooms (working)	2004	0	1	1	0	0	2
	2006	0	1	0	0	0	1
	2008	0	1	1	0	1	3
Cold rooms (non working)	2004	0	1	1	0	1	3
	2006	1	0	0	0	0	1
	2008	0	0	0	0	0	0
Pontoon/jetty	2004	2	2	5	0	6	15
	2006	4	3	3	1	1	12
	2008	2	4	7	0	8	21
Fish stores	2004	0	1	2	0	0	3
	2006	1	2	2	1	1	7
	2008	0	1	2	0	0	3
Landing sites	2004	35	23	26	4	22	110
	2006	31	28	31	3	22	115
	2008	38	29	49	4	21	141
Landing sites with BMUs	2004	19	3	14	2	9	47
	2006	19	16	25	3	7	70
	2008	38	29	49	4	21	141
Landing sites with BMU office	2008	2	2	1	0	0	
Net repair facilities	2004	10	13	19	3	12	57
	2006	15	9	23	3	0	50
	2008	21	17	4	3	9	54
Craft repair facilities	2004	12	12	15	2	13	54
	2006	15	10	19	2	0	46
	2008	17	15	8	2	14	56
Fish Smoking kilns	2008	2	0	2	1	0	5
Fish Drying racks	2008	1	0	1	1	0	4
Engine repair facilities	2008	3	2	3	0	2	10

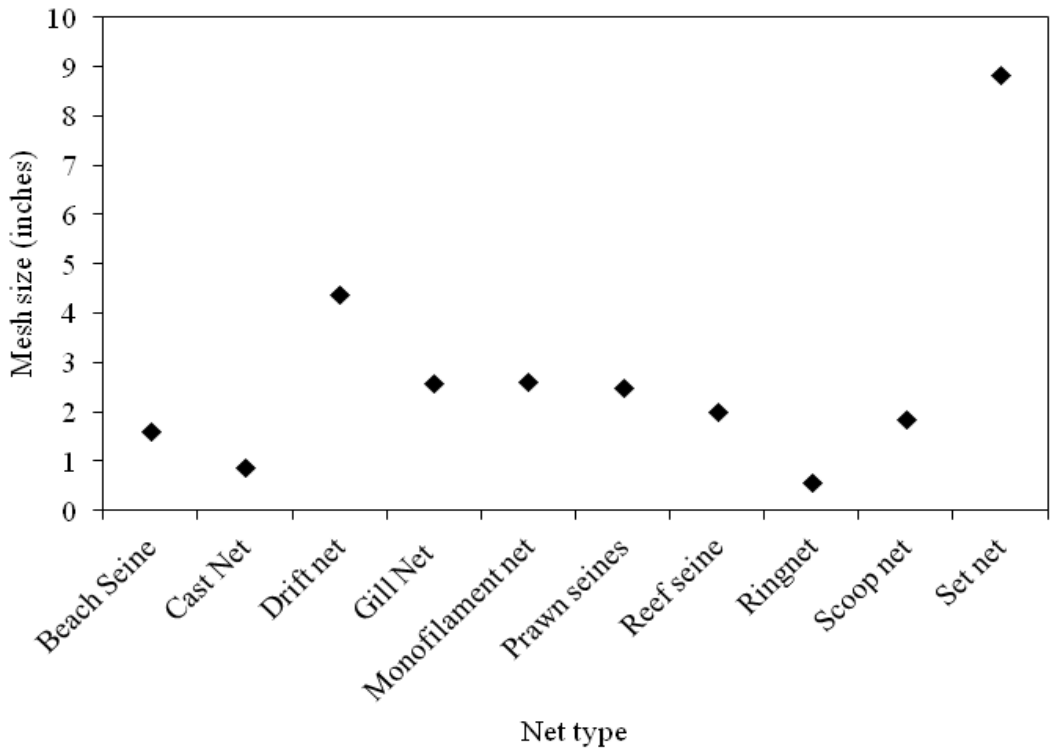
Appendix 3. Coast province staff establishment, ministry of fisheries development

Designation	**PDF**	**Mombasa**	**Kwale**	**Kilifi**	**Malindi**	**Tana River**	**Lamu**	**Taveta**	**Total**
ADF	1		1		1				3
PFO	8	5		2	2	1	3	1	22
FO		4	2	1	1	3	3	2	16
FA		7	11	5	7	6	14	7	57
SDO	1								1
Secretary	2	1	1		1				5
CO		1	1	2	1		1	1	7
Artisans	5		1						6

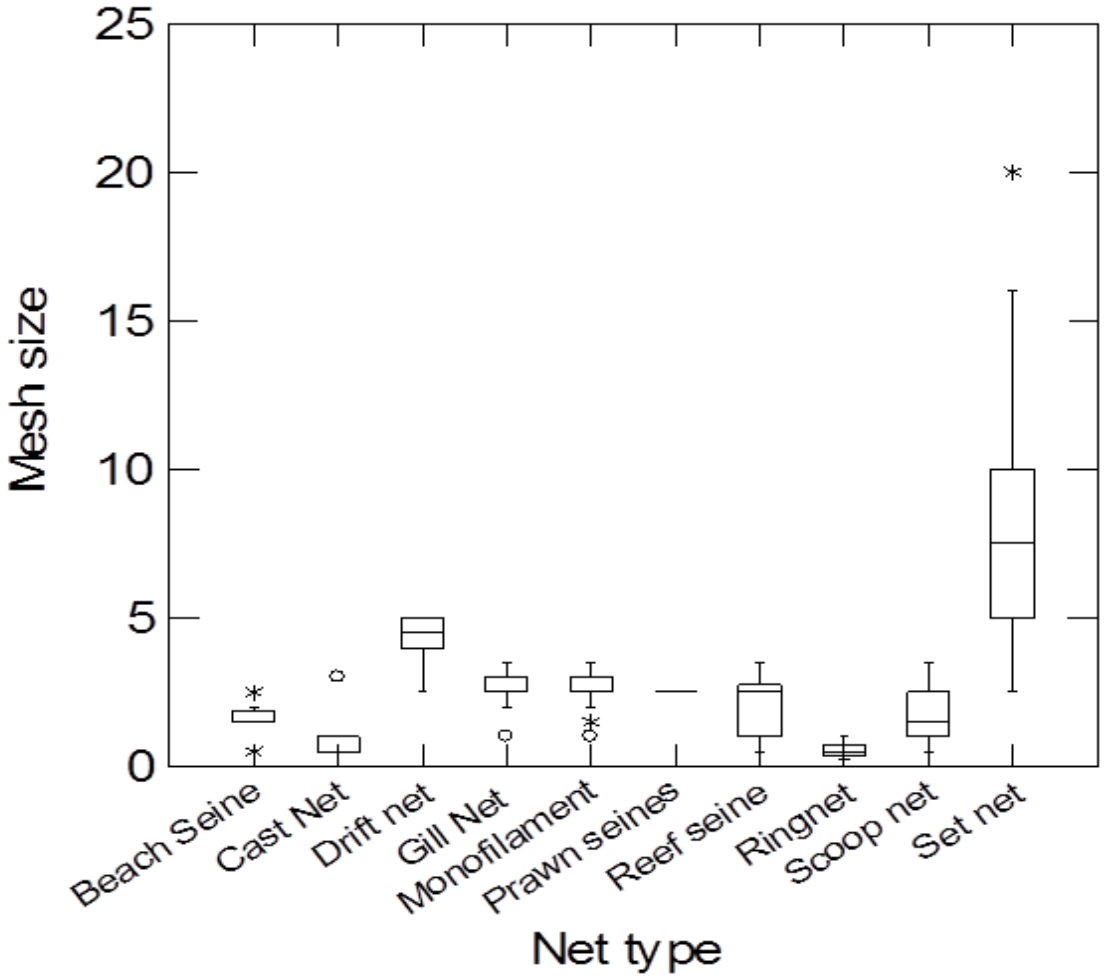
Designation	PDF	Mombasa	Kwale	Kilifi	Malindi	Tana River	Lamu	Taveta	Total
Coxwain					1		1		2
Driver	1	1	1	1	1	1		1	7
SSS	2	2	5	2	3	2	2	1	19
Records Mgt Officer	1								1
Supplies Officer	1				1				2
TOTAL	22	21	23	13	19	13	24	13	148

Appendix 4. Number of ringnets in operation along the Kenyan coast as at January 2012 (Data source: this survey).

Area	Landing point	# nets	# fishermen / vessel	Boat type	Comments
Watamu	Watamu	2	38-40	Mashua	
Vanga	Vanga and Jasini	7	15-50	Mashua	Some operates at Jasini and in Tanzania
Kilifi	Kilifi central	2		Mashua	
Msambweni	Gazi	3	16-20	Mashua	
Shimoni	Bati/Mwazaro	2	15-28	Mashua	Tanzanian vessels



Appendix 5. Average mesh size of different fishing nets used along the Kenya's coast. The "gillnet" category consists of nets used to target reef fishes such as parrot fish, rabbit fish and emperors.



Appendix 6. A box plot of mean mesh size (inches) of fishing nets used along the Kenya's coast. The "gillnet" category consists of nets used to target reef fishes such as parrot fish, rabbit fish and emperors.

Appendix 7. Guidelines used in the development of the baseline report on the development of small and medium pelagic fishery for Kenya's coast.

Through the National Task Group (NTG) of the EAF-Nansen Project, this study on the small and medium pelagic fishery of the Kenya's coast aimed at collating information and analysis addressing the following points:

1. Is there a Management Plan for the fishery?
2. Where there is no management plan, are there stated or de facto objectives for the fishery?
3. What is legal framework within which the fishery is operating?
4. What are the institutional and administrative frameworks for fisheries management in the country?
5. Overview of the fishery and resources exploited
    - 5.1. Details of fishing gear used and areas fished
    - 5.2. Give brief information on the resources exploited.
    - 5.3. Number of fishers and land-based workers by sector. Indicate full-time and part-time.
    - 5.4. Provide information on direct interactions with other fisheries e.g. competing for same target species, target species taken as bycatch in another fishery, bycatch in this fishery affecting another fishery, etc.
6. Available scientific and traditional knowledge on the resources
    - 6.1. Brief biology of the major fish species
    - 6.2. Geographical distribution of the species
    - 6.3. Estimated status of the stocks (especially over the last 5 years).
    - 6.4. Provide information on any direct interactions with the ecosystem (impact on sea bottom, pollution caused by the fishery, affects of coastal zone development or land-based pollution, etc).
    - **6.5.** Summarise the traditional knowledge about the fishery and the resources exploited.
7. Annual catches from the earliest time available (by species or lowest available taxonomic group where landings are multispecies).
8. Assessment of the importance of the fishery in the national economy
    - 8.1. Value of the catches from the fishery per year for the last 5 years (by species or lowest available taxonomic group where landings are multispecies). Also add time series of market prices for the landings.
    - 8.2. Products, markets and quantitative assessment of the value and employment of activities in value-addition and linked to the sector.
9. Full set of management measures/primary management tools currently being used in the fishery/sector including those indicated in table below. *Please indicate use with a "√."* and comment on the status of implement (track record of the management option):

Type of Management Tool	**Tick**
Spatial (area) restrictions and closures such as:	
o Marine protected areas where fishing is prohibited	
o Nursery area closures	
o No-take zones	
o Marine reserves where fishing is sometimes allowed	
o Other temporary areas closures for specific purpose (e.g., spawning aggregations)	

Temporal restrictions such as:	
o Defined fishing season(s)	
o Defined number of days fishing	
o Defined number of hours per day fishing	
o defined number of hours fishing	
Gear restrictions such as:	
o Engine size restrictions	
o Gear size restrictions	
o Gear type restrictions	
Size/Age restrictions (i.e., minimum or maximum sizes)	
Participatory restrictions such as:	
o Licenses	
o Limited entry	
Catch restrictions such as:	
o Total allowable catch (TAC) limits	
o Vessel catch limits	
o Individual vessel quotas	
Rights- / incentive-adjusting regulations such as:	
o Individual effort quotas	
o Individual fishing quotas	
o Individual transferable quotas	
o Individual transferable share quotas	
o Group fishing rights (including community development quotas)	
o Territorial use rights	
o Stock use rights	

10. From the table above, assess the effectiveness of the current management measures in relation to the fishery itself, including effectiveness in ensuring sustainable utilisation. "Effectiveness" may be in terms of better status of the stocks (increasing cpue), decreasing conflicts, increasing value, level of compliance, etc. It is important to note that in the State of World Fisheries and Aquaculture (SOFIA) FAO defines fisheries governance as "the sum total of the legal, social, economic and political arrangements used to manage fisheries".
11. Any compliance or enforcement problems being experienced in the fishery, and any complaints or dissatisfaction amongst fishers/rights holders. You need to consider scientific monitoring (e.g. of catches against permitted exploitation) as well as MCS (monitoring, Control and Surveillance).
12. Is there a national or regional forum for discussions on management of this or other resource? If yes, please give a short description of the forum (nature, frequency, subject of discussions, outcomes, etc.)
13. Any other comments relevant to current management of the fishery and the way forward for the introduction of EAF.