**ABSTRACT**

**2016 Towards improvement of neritic tuna data in artisanal fishery (I. Wafula, S. Ndegwa)**

The State Department of Fisheries (SDF) in Kenya in 2013 started collecting data on Catch Assessment Sampling as an improvement to the previous total enumeration previously undertaken by the department. 22 primary and secondary landing sites were selected where all the catches including neritic tunas were sampled. The paper looks at the results of the first two years of sampling, challenges encountered and proposes ways that can be used to improve on the capture of neritic tuna data. The main challenges were identification to the species level, use of similar local names for several species, wrong data entries and lack of a database. During the second year of sampling, more training was undertaken and the data collectors improved in data capture and better recording. The length frequency data received for each species was now more reliable after the identification and sampling improved. The need for constant training was found necessary to improve the quality of the data reporting. Neritic species identified to species level were *Scomberomorous commerson*, *Scomberomorous plurilineatus*, *Auxis rochei* and *Euthynus affinis*. A sizeable amount of tuna was lamped together as tuna which was hard to identify. Though the first year data had identification problems, 80% of the catch in the second year was identifiable to species level when the use of local languages was harmonized. Closer monitoring of the sampling program and use of local languages are important ingredients in realising more accurate fisheries data.

## INTRODUCTION.

Given that the Agreement for the implementation of the Provisions of the United Nations Convention on the Law of the Sea relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA) encourages coastal States and fishing States on the high seas to collect and share, in a timely manner, complete and accurate data concerning fishing activities on, inter alia, vessel position, catch of target and non-target species and fishing effort.

Noting that the United Nations Food and Agricultural Organization (FAO) Code of Conduct for responsible fisheries. Fishing provides that States should compile fishery-related and other supporting scientific data relating to fish stocks covered by sub regional or regional fisheries management organizations and provide them in a timely manner to the organization.

**GENERAL INFORMATION.**

The fisheries sector in Kenya plays a significant role in employment and income generation. During the year 2013 the sector supported a total of 61,252 people directly as fishermen and 67,883 fish farmers with 69,194 stocked fish ponds. The sector supports about 1.1 million people directly and indirectly, working as fishers, traders, processors, suppliers and merchants of fishing accessories and employees and their dependents. Besides being a rich source of protein especially for riparian communities, the sector is also important for the preservation of culture, national heritage, and recreational purposes.

The Kenyan coastline stretches from Vanga at the Tanzanian border to Kiunga on the Somali border (Figure 1). The coastline of is 640 Km long, the territorial sea and adjacent Exclusive Economic Zone (EEZ) measures some 152,100 $Km^2$. Rich inshore marine fishing grounds are found in and around Malindi Bank, Ungwana Bay, North Kenya Bank and Lamu Archipelago (Figure 1). This area is where the south flowing Somali Current meets the north flowing East African Current during the Northeast Monsoon season (November to March) causing upwelling and enrichment.

Marine artisanal fish production was 9,134 metric tons equivalent of 5.6% of the national production while aquaculture production amounted to 23,501 metric tons contributing 14.4% of the total production in 2013. Artisanal fishing effort consists of multiple gears and crafts of different capacities with varied methods of operation. There are two discernible fishing seasons congruent with the Indian Ocean monsoon seasons. The calm NE monsoon sets in active fishing by most of fishermen while the rough SE monsoon season results in little fishing with most fishermen opting out of the fishery or alternatively restricted in the inshore sheltered creeks and bays.

In the year 2013 artisanal fishing fleet comprised of about 2,913 fishing crafts and 12,915 fishermen (Marine Artisanal Fisheries Frame Survey 2014 report Figure 2), while the semi-industrial fleet had two licensed trawlers. The inshore waters which are fishing grounds for artisanal fishermen are over-exploited are degrading gradually. Great potential exists in the exploitation of the Kenyan EEZ where estimates done in 1975-1980 indicate potential of 100,000 to 150,000 metric tons annually (FAO, 1980) and more recent estimates indicate potential of 300,000 metric ton (Habib 2003). This fishery is currently exploited by Distant Water Fishing Nations (DWFN) upon payment of access fees to the State Department of Fisheries. The State Department has limited capacity for Monitoring, Control and Surveillance (MCS) to ensure compliance with the established fisheries management standards, besides it is possible that vessels could be accessing our EEZ resources without payment of access fees. However the challenge at hand is large and needs a comprehensive approach in order to establish and deploy a national fisheries enforcement unit. A well trained and a disciplined law enforcement unit is

critical toward the management of every fishery particularly when its operation is based on best scientific information.

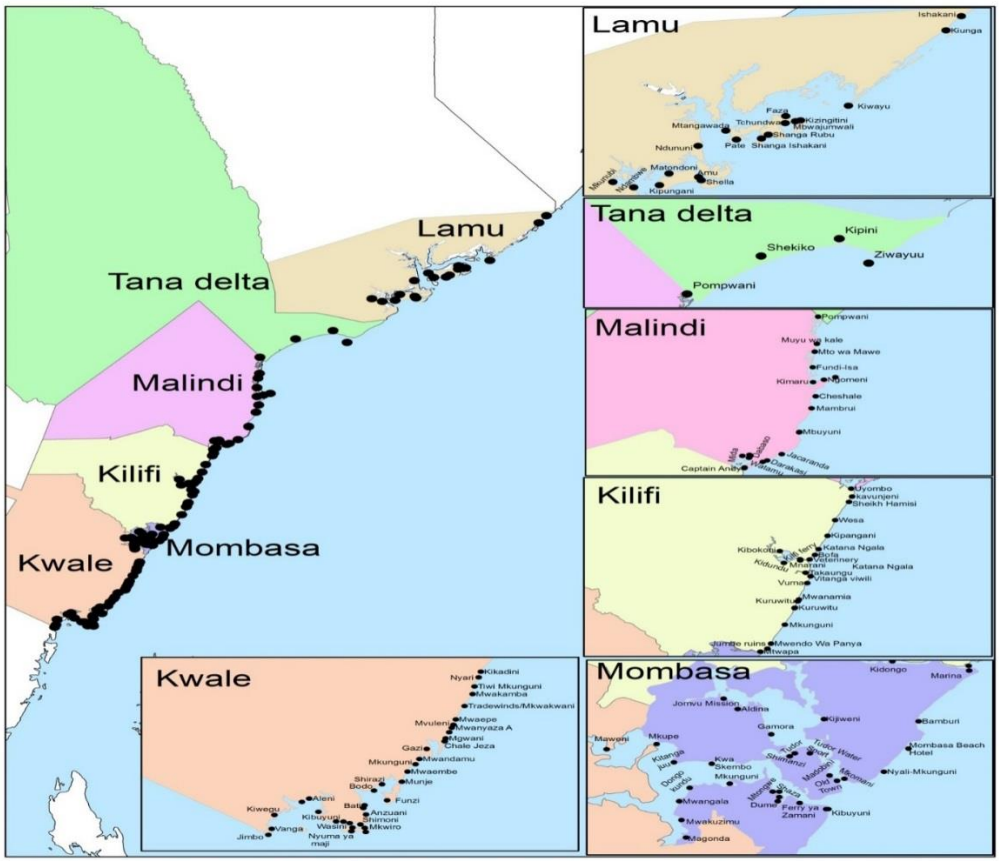


Figure 1: Fish landing sites.

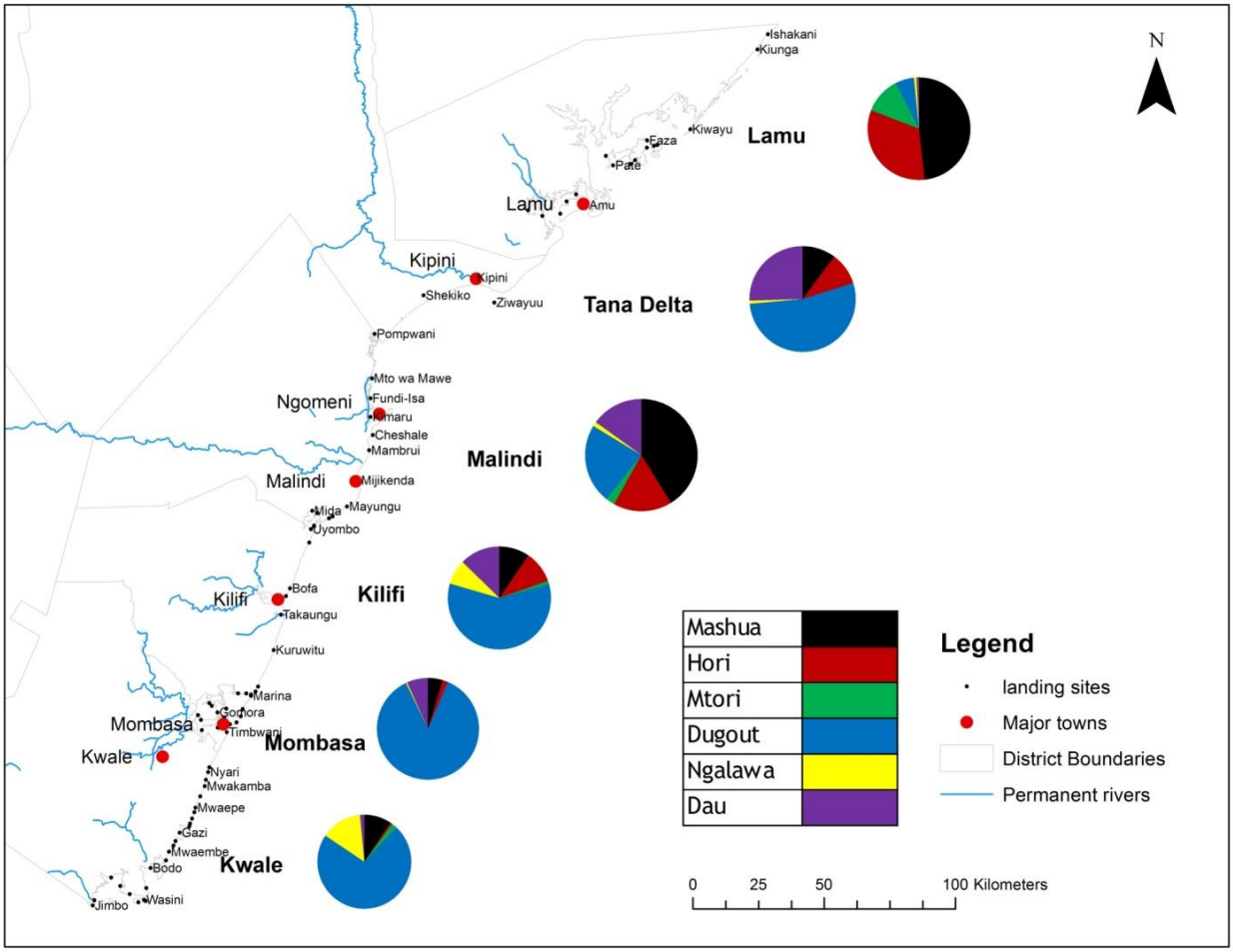


Figure 2: Spatial distribution of fishing crafts

The artisanal fishing activities are affected by Kenya's coastal oceanographic conditions which are caused by changes in the monsoon wind system (UNEP, 1998) that results to seasonal reversal process with NE monsoons between November-March and SE monsoons between May-September. These oceanographic processes cause distinct seasonality in the artisanal fishery, with high catches during the NE monsoon than the SE monsoon. These two seasons are referred to as *Kazi kazi* and Kusi by the locals. During *Kazi kazi* the sea is calm and there is a lot of fishing activities and fish landings are normally high while during Kusi the winds render the sea rough thus unfavorable to fishing trips. Landings from artisanal fishery have been increasing, declining then increasing in cycles while the value of the fish has maintained an upward trend over the years.

## FLEET STRUCTURE:

Artisanal fishing activities are undertaken by about 13,706 fishermen operating about 3,112 crafts (2014 Frame Survey). The most common fishing methods used are gillnets, traditional traps, seine nets, long line hooks, hook and line and others. Fishing in the territorial waters is carried out by 3 trawlers mainly trawling for shrimps.

The artisanal fleet was composed of different vessel types with two being the main target for tuna and tuna-like species. These are the outrigger vessels and Dhows. The main gears targeting tuna were Hand lines, Longlines, Trolling lines, Monofilament nets and Gillnets. The distribution of gears is as shown below. Figure 3.

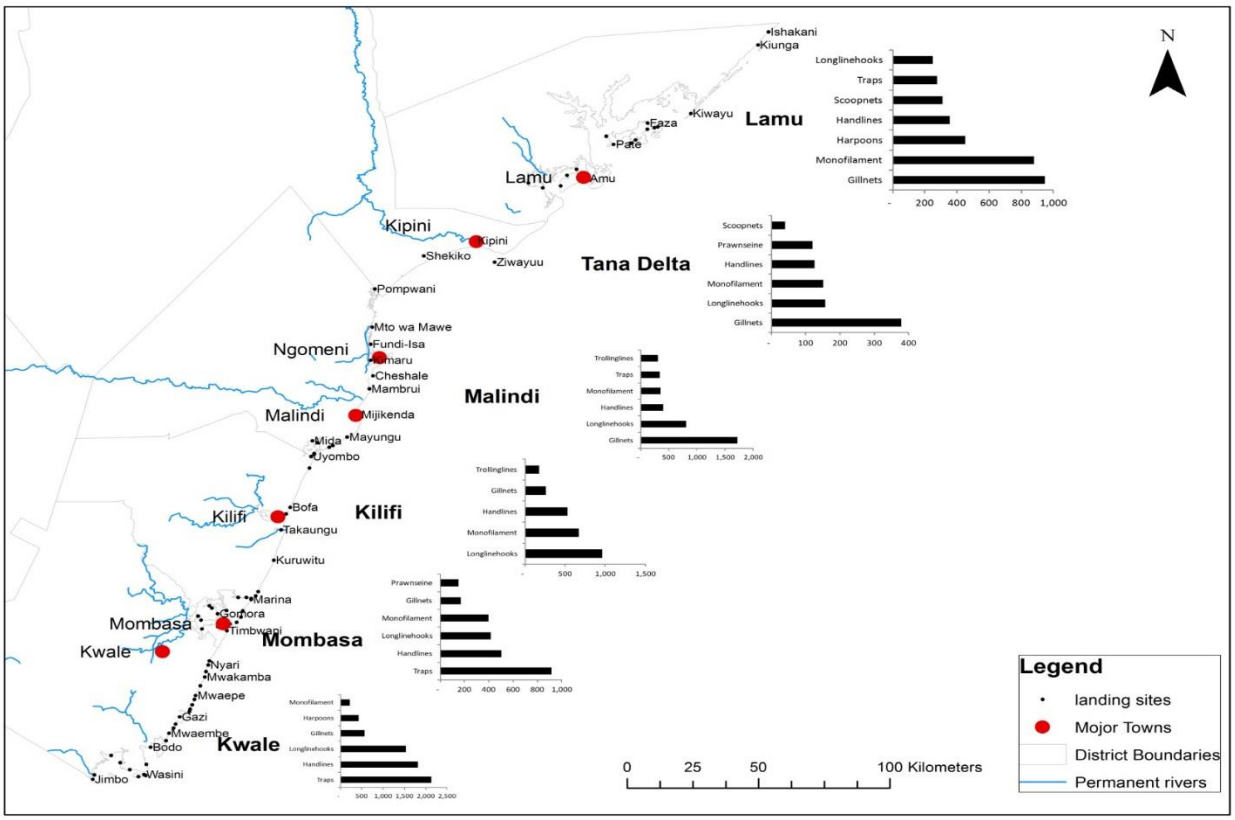


Figure 3: Distribution of fishing gears on the landing sites

From the figure shown above, the highest concentration of longlines is around Kilifi, Mombasa and Kwale. Most gillnets are around Lamu, Tana Delta, and Malindi. In 2013 data collected, most catches were recorded around Mambrui, cheshale. *Garangids* were the most landed. Compared with 2014, there`s significant improvement in the parameters covered during data collection. In 2014, factors such as time out, time in, type of boat used, propulsion mode, and

main gear type used were covered. From the data collected, the Northern Kenya banks has shown that rolling lines are the main gear used to capture *Euthynus affinis*. While in South coast ring net was the main gear used to capture the same species. Ring net was also prominent in the Kilifi County landing sites for the capture of the same species

Previously there has been the problem of data collection for the state Department of fisheries. In most cases data collection was based on the weight provided by fishermen and fish traders. This lead to inaccurate data and inconsistencies being experienced. This problem has improved now with new system of data collection being adopted.
From the 2012 frame survey (Figure. 4.) The frequency with which landing sites are visited indicates a significant improvement in data collection.

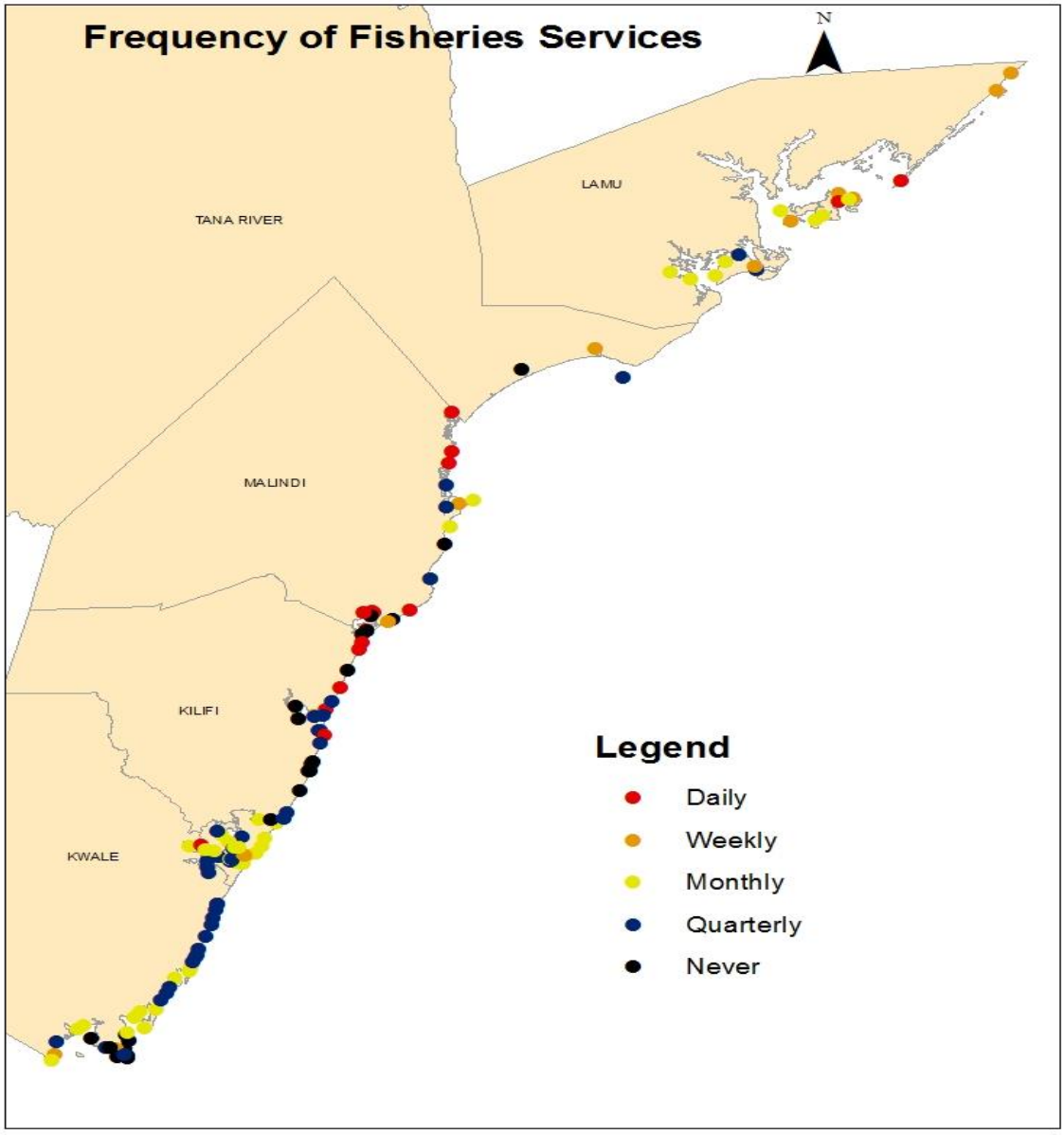


Figure 4: Frequency of fisheries services at landing sites

## ANNUAL CATCHES PER FAMILY

| LANDING_ | DATE | YEAR | MONTH | DATE | BOAT_TYP | BOAT_LEN | BOAT_REG | PROPULSI | MAIN_GE | NUMBER_ | mesh_hoo | NO_OF_FI | TIME_IN | TIME_OUT | AREA_FISH | WEIGHT_K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GAZI | 41906 | 2014 | 9 | 24 | DA | 12 | | OB | GN | 1 | | 4 | 12.40PM | 6.00AM | CHALE | 41.5 |
| GAZI | 41905 | 2014 | 9 | 23 | da | 12 | | OB | rn | 1 | | 22 | 2.00pm | 6.00am | chale | |
| GAZI | 41902 | 2014 | 9 | 20 | da | 12 | | OB | RN | 1 | small | 24 | 1.50pm | 6.00am | kinondo | 57 |
| GAZI | 41902 | 2014 | 9 | 20 | mt | 9 | | ob | rn | 1 | small | 17 | 2.00pm | 5.00am | kinondo | 54 |
| GAZI | 41902 | 2014 | 9 | 20 | da | 12 | | ob | rn | 1 | small | 28 | 2.00pm | 5.00am | kinondo | 106 |
| GAZI | 41898 | 2014 | 9 | 16 | mt | 9 | | ob | rn | 1 | small | 22 | 12.20pm | 6.00am | chale | 63.5 |
| GAZI | 41898 | 2014 | 9 | 16 | da | 12 | | ob | rn | 1 | small | 28 | 12.30pm | 6.00am | chale | 135 |
| GAZI | 41895 | 2014 | 9 | 13 | mt | 9 | | ob | rn | xx | small | 22 | 12.37pm | 5.00am | mwabung | 150 |
| GAZI | 41895 | 2014 | 9 | 13 | mt | 9 | | OB | rn | 1 | small | 17 | 12.43pm | 5.00am | mwabung | 70 |
| GAZI | 41895 | 2014 | 9 | 13 | da | 12 | | ob | rn | 1 | small | 22 | 1.26pm | 6.00am | kinondo | 500 |
| GAZI | 41895 | 2014 | 9 | 13 | da | 12 | | ob | rn | 1 | small | 27 | 1.30pm | 5.45am | kinondo | 720 |

Figure 5: Example of sampling protocol in IOTC area

Table.1.

| YEAR | FAMILY | Sample weight (Kgs) |
|---|---|---|
| 2013 | *Scombridae* | 8551.6 |
| 2014 | *Scombridae* | 5084.45 |
| 2013 | *Carangids* | 10180 |
| 2014 | *Carangids* | 4786.65 |

*Scombridae* shows decline in sample weight from 8,551.6 in 2013 to 5,084.45 kgs. The *carangids* show some improvement due to improved data sampling techniques and increased number of data collectors compared with other years. Large samples were also recorded in the same period. There was enhanced supervision for data collectors after the introduction of catch assessment survey.

## NERITIC TUNA CATCHES

Table.2.Neritic tuna catches from artisanal and recreational fisheries

| Year | Family | Total Weight(Kgs) | |
|---|---|---|---|
| 2014 | *Scombridae* | 1260.67 | |
| 2015 | ,, | 2152.45 | |
| | | | |
| Year | Family | Total Weight (kgs) | |
| 2014 | *Carangidae* | 7344.46 | |
| 2015 | ,, | 8913.83 | |

Catches for both the families show increase in total weights for the two years. This is because of improved sampling techniques and also large samples were collected.

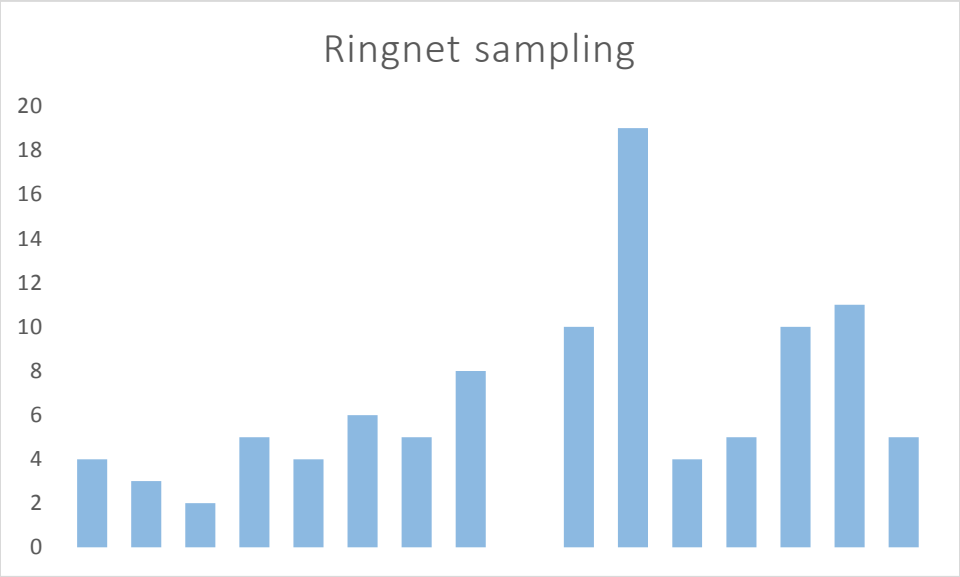


Figure.5. Ring net sampling for 15 days in 2014 (*E. affinis*)

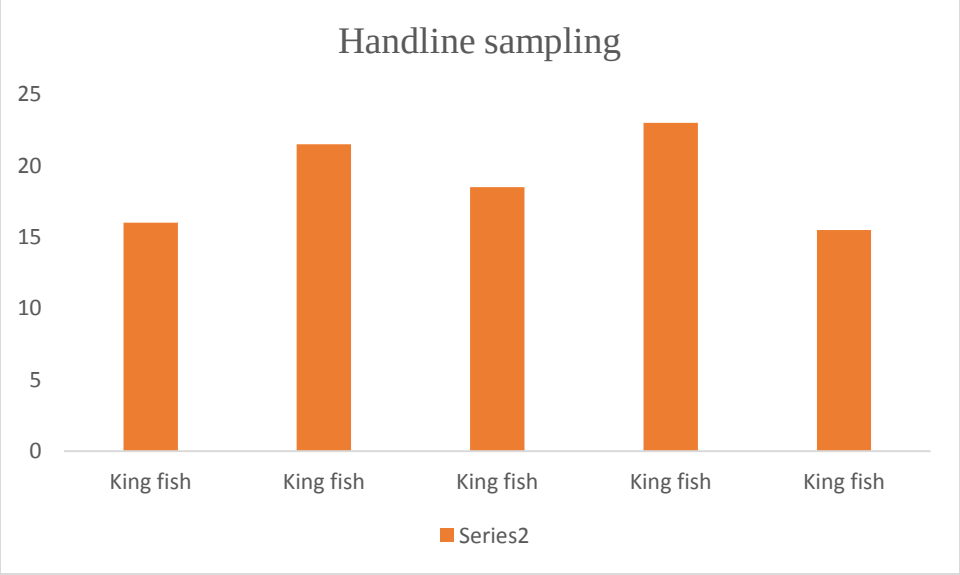


Figure.6. Carangids sampling 2014 for 5days.

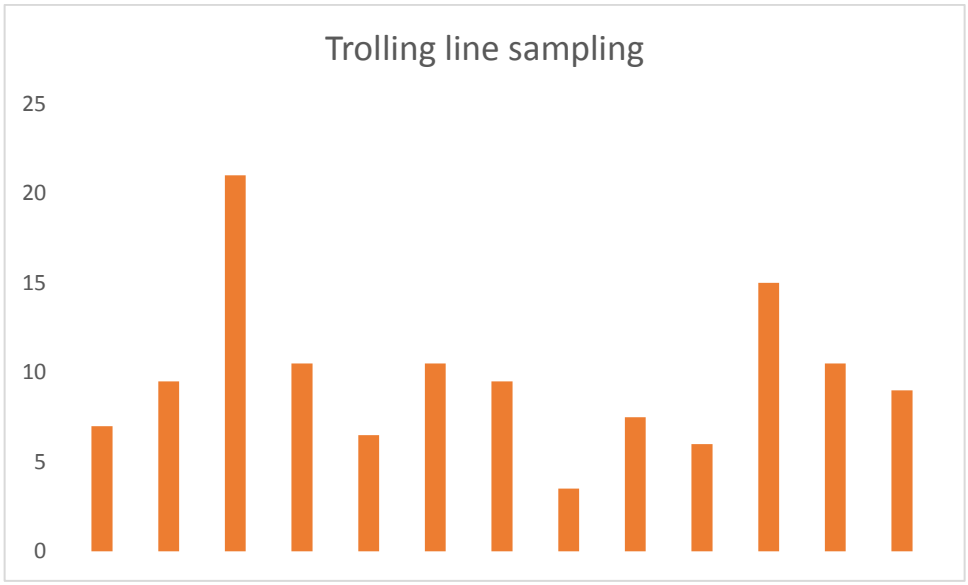


Figure. 7. Kawakawa sampling for 2015 for 13 days.

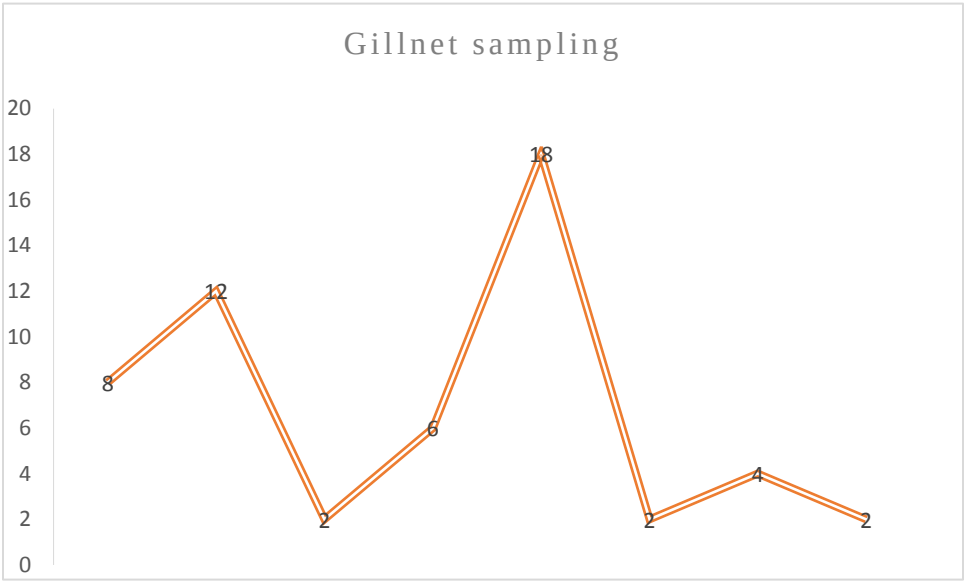


Figure .8. Kingfish sampling 2015 for 8 days.

## CHALLENGES AND SOLUTIONS IN DATA COLLECTION

Most of the challenges experienced in data collection was experienced on the availability and distribution of data collectors along the landing sites. Another challenge was the in-accessibility for some landing sites. Previously data collectors were not trained thus the quality of data collected was very poor. E.g. Fishing area, fishing time, mesh size of gill net or monofilament, number of fishermen and weight were not captured before but are now being captured under CAS. This type of sampling even though not conclusive, one can estimate catch per unit effort (CPUE) with it. Data collectors have also been trained on best practices of data collection. They have also been able to earn some incentives to motivate them. Supervision was also enhanced for the data collectors. The introduction of catch assessment survey in 2013 produced a more scientific and elaborate mode of identifying priority species from among the lambed together families. Neritic tuna was just recorded as tuna without further classification. There was also no database for the species recorded. Incomplete returns or incomplete filling of catch return forms, "cooking" of catch data by the collectors and inadequate supervision of data collectors, wrong identification of species and under declaring of catch. Use of local/indigenous languages required some expertise in translating to English and eventually scientific names. These challenges have been overcome with introduction of CAS .Wrong data leads to wrong assessment of fisheries resources which will eventually lead to collapse of the resources unexpectedly and Misplaced investment leading to over-capitalization of the fishing industry. Estimation of bad fisheries statistics would tarnish the image of the country internationally. This could result in sanctions being taken against the country.e.g. Putting Kenyan vessels on the list of IUU (Illegal, unregulated and unreported) vessels and ban on fish export to the EU countries. Through CAS most of these challenges have been addressed even though not 100%. More improvement is being worked on. Once CAS achieves the desired results, other countries can learn from the Kenyan experiences, right from the initial stages of CAS data collection throughout the evolution to the final stages of data collection which will clearly show Neritic tuna catches in database once established. This will lead to formulation of well informed and structured fisheries management decisions.

## Monitoring control and surveillance patrols

During the year 2015, a deep sea patrol was undertaken by Rv Mtafiti, the general objectives were

- To assess the performance of RV Mtafiti and the equipment for MCS at sea.
- Ensure the absence of IUU fishing vessels in patrol sectors of Kenya Territorial Zone and EEZ and to investigate the zones prioritized during this assignment.

- Inspection of fishing vessels active and transiting the patrol zone. Report all information gathered on the fishing vessels with respect fisheries regulation and measures for fisheries management adopted national and regionally.
- Unclear and incoherent information gathered was to be shared with the IOTC and members of the IOC for further information.

The RV Mtafiti departed from its home port at Mombasa, Kenya on the morning of 11th December 2015. MCS was done collaboratively, through a bridge watch Programme designed to verify licensed vessels and discern information on unlicensed ones in transects while transiting through research survey sampling points as shown in Figure. 9.

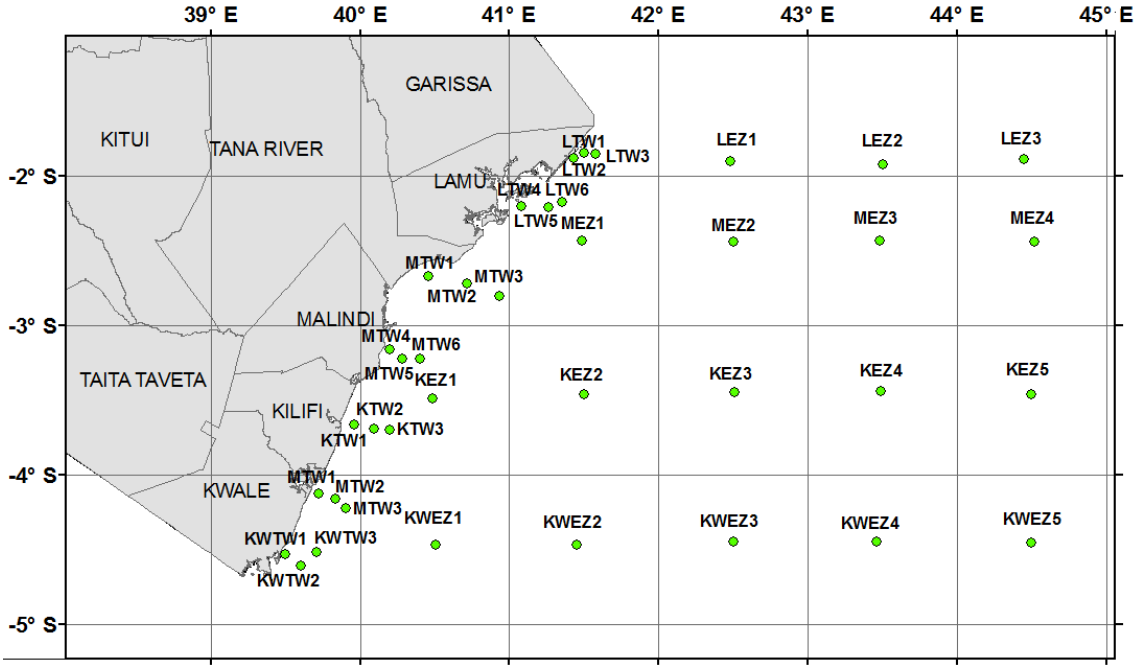


Figure. 9. The Kenya coastline showing the territorial waters, Exclusive Economic Zone.

1. A status report all MCS equipment and the vessel.
    a) The Furuno radar has a range of 120nm, but only clear up to 38nm.
    b) The AIS give details of vessels: Type, IMO.
    c) HF SSB radio system, TRP 7000 okay, however has diminished clarity on large distances. It was recommended that a satellite data and phone system be procured to enable continuous at sea vessel communication and data exchange with Navy base and SDF.
2. The boarding platform available was only suitable for inshore waters. A more robust system is required for offshore operations including elaborate mechanised launching.eg a Rubber Hulled Inflatable Boat (RHIB).
3. The vessel currently may only be able to use one of its two engines at a time. This limits the vessel speed to a maximum of 3.8 knots. However, if the engine pneumatic controller is repaired the vessel may reach a speed of 7-8 knots which will support some MCS activities.
4. The vessel has since undergone dry docking to rectify anomalies indicated.

In general, during the entire 12 days of the survey no IUU`s were sported both in the territorial waters and the Kenyan EEZ.

Table 3. The area, Station labels and coordinates Research Stations Visited by RV Mtafiti during the Mcs cruise.

| | Territorial Water Stations | | | | EEZ stations | | |
|---|---|---|---|---|---|---|---|
| | Station | Long | Latitude | | Station | Long | Latitude |
| KILIFI | KTW1 | 39.959 | -3.668 | KWALE | KWEZ1 | 40.506 | -4.465 |
| | KTW2 | 40.093 | -3.69 | | KWEZ2 | 41.455 | -4.426 |
| | KTW3 | 40.183 | -3.695 | | KWEZ3 | 42.512 | -4.465 |
| MOMBASA | MTW1 | 39.728 | -4.125 | | KWEZ4 | 43.461 | -4.445 |
| | MTW2 | 39.838 | -4.16 | | KWEZ5 | 44.498 | -4.455 |
| | MTW3 | 39.908 | -4.21 | | | | |
| KWALE | KWTW1 | 39.503 | -4.535 | | | | |
| | KWTW2 | 39.598 | -4.615 | | | | |
| | KWTW3 | 39.708 | -4.51 | | | | |
| | | | | | | | |

Figure. 10. Rv. Mtafiti used for Mcs as well as research sampling activities.