Improving Artisanal Tuna Data Collection and Reporting: *Success, Challenges, and Lessons Learnt from Electronic Pilot Data Collection in Kenya*

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Executive summary

This paper looks at the implementation of electronic data collection system introduced to monitor artisanal tuna fishery data collection and reporting. The objective of developing the system was to improve artisanal data collection and reporting in Kenya. The Kenya Fisheries Service in collaboration with County governments and World Wide Fund for Nature (WWF) initiated a six-month pilot study from June to December 2018. Thirteen (13) landing sites were selected in three (3) different riparian counties from the overall catch assessment survey sites with tuna volumes landed at each site as one of the secondary criteria. Twenty six (26) data collections, two from each landing site, drawn from the Beach Management Units (BMUs) Kenya Marine and Fisheries Research Institute (KMFRI) and County fisheries staff. Training was conducted to the data recorders included sampling techniques, species identification and the use of the mobile application to collect and submit the data to the central database.

A standardized data collection protocol was used and uploaded to the mobile application. Overall catch and effort and length data for individual tuna species has been collected for a period of three (3) months and currently in the process of analysis. Weights for species group/family or individual species weight(kg) was measured using electronic weighing balances to the nearest (0.1g) for small individuals while lengths taken using measuring boards. Each landing site was given one a mobile phone and data recording hard books. A synopsis on the current status of implementation indicate improvement in data recording and reporting but still some challenges especially on species identification, data capture and its integration to the overall database.

Rationale of the mobile data pilot study

Kenya has a well-developing fishery extending along the entire length of the Kenyan coastal shoreline. The main fishing target species command high prices in local and world markets and are one of the most valuable fisheries resources exploited by local artisanal fishers. Securing the sustainability of these valuable resource and the livelihoods that depend on it is of primary importance. Tuna fisheries has been one of the key fisheries of high value but data poor as records are general and not to species level. The Kenya Fisheries Service (KeFS) in 2013-2016 introduced Catch assessment survey (CAS) with results showing high production of 20,000-24,000 tons compared to the annual production that fluctuated 7000-9000 tons for many years. However this was not without challenges, especially the loss of data and the delayed submission of data records and entry. A mobile data collection application was developed to enable online data collection and reporting and reduce challenges of data entry and loss of data in some instances. The use of the mobile application was tested, CAS form updated and the aggregate hosted at the Fisheries data and Information Management system database integrated Fisheries data and information management system database.

Objectives of the mobile data study

The main objective of the pilot study was to determine the applicability and the use of mobile application in data collection and reporting towards enhancing artisanal fisheries management. The specific objectives included

i. Finalization on the Design of the Data Collection e-Form(s) and field trials
ii. Capacity building of data collectors in sampling and species identification
iii. Pilot mobile data collection targeting artisanal tuna fisheries data and aggregate the data to a database for further analysis and reporting
iv. Make recommendations for improvement and up scaling the use of the e data collection

Survey design

The Survey design was based on selected landing sites from the existing Catch Assessment Survey (CAS) within four counties as well as tuna landing sites. Thirteen (13) landing sites were selected for the pilot study with ten (10) targeted for tuna species. These sites were

representative of the tuna species caught in the artisanal tune fishery with different gear-vessel categories were considered within the selected sites.

Two (2) data collectors per each landing site were trained equipped with an android phone, measuring boards and weigh scale to the nearest 0.1g. The revised CAS sampling protocol was used during the sampling. Data was captured and submitted real time. The data collectors were expected to take photos of species that could not be identified during the sampling.

Sampling locations

The sampling location for the pilot study are shown in figure 1

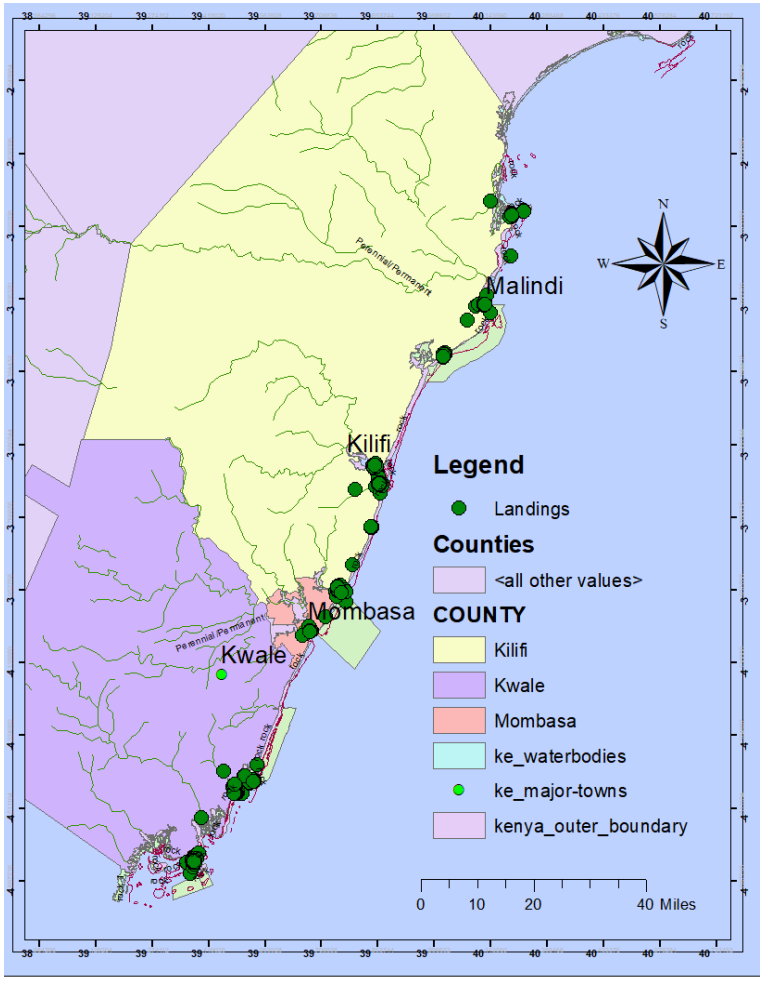

Figure 1. Map showing the sampling locations

Different institutions participated in the data collection pilot study drawn from County governments (Kwale, Mombasa, Kilifi and Lamu), Kenya Fisheries Service (KeFS), Kenya

Marine and Fisheries Research Institute (KMFRI) and the Beach Management Units (BMU) – (Table 1)

Table 1. Landing sites selected for pilot study and institutions distribution of enumerators

No	*County*	*Landing Site*	*Target Species*	*Distribution of Enumerators*			
				KeFS	**KMFRI**	**County Fisheries**	**BMU**
1	Kwale	Shimoni	++		+		+
2	Kwale	Mkunguni	++		+		+
3	Kwale	Gazi*	++		+	+	
4	Mombasa	Old town	++	+		+	
5	Kilifi	Mtwapa*	++	+		+	
6	Kilifi	Kuruwitu*	+			+	+
7	Kilifi	Takaungu	+			+	+
8	Kilifi	Kilifi Central*	+			+	+
9	Kilifi	Watamu	++			+	+
10	Kilifi	Malindi	++			+	+
11	Kilifi	Ngomeni	++			+	+
12	Lamu	Shella*	+++			+	
13	Lamu	Kiwayuu*	+++				+

*+ No specified target ++; Specified target tuna and tuna like species; +++ Specified Target tuna and tuna like species; * Landing sites based on tuna landings and not part of the 24 CAS landing sites; +Highlights institution involved in data collection*

Sampling period and timeframes

Sampling period was mainly during the day although night landing of fish was noted especially during the North East Monsoon (NEM) season hence enumerators were

encouraged to sample as many vessels during the calm weather season. Since the target was tuna and tuna like species vessel gear type only applied in the actual sampling which was based on the total number of fishing crafts per landing site with at least 30% of each vessel gear type category by the end of the 10 sampling period.

The sampling days were selected randomly every month guided by the tide cycles with exception of Fridays and Sundays when most of the fishers are not fishing based on the religions.

Pilot study Preliminary results

1. **Spatial distribution of tuna catches**

A total of 3,520 vessels have been sampled from June to October 2018. Total fish landed within the period is estimated at 72,880.35kg (72.8 tons). Tuna and tuna like species amount to 11,726.975kg (11.7 tons) tablexxx. Most tuna species are caught in Kilifi County with over 10 tons.

Table 2: Showing catch summary for mobile data

County	**No. of landing sites**	**Vessels sampled**	**Total catch landed (Kg)**	**Catch sampled (Kg)**	**Tuna and Tuna like catch (Kg)**
Kilifi	7	2,245	47,014.77	24,359.12	10,401.42
Kwale	3	1,204	23,084.703	8242.3	1,172.657
Mombasa	1	71	2,730.89	1,951.7	152.9
Total	**11**	**3,520**	**72,830.35**	**34,553.119**	**11,726.975**

Tuna and tuna like species are more reported from handline and trolling lines with over 50% caught using handline. Over 10.3 tons (89 %) of the tuna was caught from the north part of Kenya (Figure 2) Kilifi county landings were highest with 10. 4 tons followed by Kwale (1.17 tons) and Mombasa with and 0.152. tons. Watamu pilot sites had the highest tuna catch of 5.234 tons while 3.562 tons.

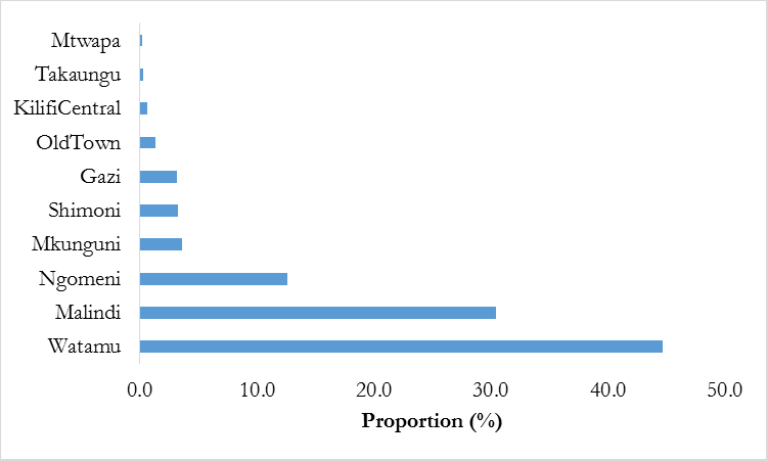

Figure 2: Distribution of tuna and tuna like catches along the pilot sites

2. Species composition and length frequency distribution

Data collected in all the landing sites between June and July 2018 was pooled cleaned and analyzed for species composition and relative abundance. The species composition and length frequency distribution were determined. In particular, species in the data were classified as;

- All the *nguru* were classified as Kingfish, the data was pooled and analysed as a single data set of one species even when though there is likely that there are two kingfish species
- All the *sulisuli* were classified as Sail fish, the data was pooled and analysed as a single data set of one species
- All the *Thannus albacares* were classified as Yellowfin tuna, the data was pooled from all sites and analysed as a single data

In cases where only a single sample of a species was encountered, it was not include in the graphical output of the results but it was noted in the results section.

Species composition

Table xx below shows the species composition of the encountered Tuna and Tuna-like species in all the landing sites sampled

Table 2. Species composition of tuna and tuna like data pooped from all sites (June October 2018)

Common Name	Scientific names	Weight (kg)	Proportion (%)

Kingfish	Scomberomorus spp	5,082.28	43.3
Yellowfin tuna	Thunnus albacares	4,603.65	39.3
Wahoo	Acanthocybium solandri	1,064.31	9.1
Indian mackerel	Rastrelliger kanagurta	307.93	2.6
Bonitos	Sarda orientalis	282.87	2.4
Kawakawa	Euthynnus affinis	159.72	1.4
Frigate tuna	Auxis thazard	154.26	1.3
Narrow–barred Spanish mackerel	Scomberomorus commerson	51.83	0.4
Bullet tuna	Auxis rochei	19.51	0.2
Kanadi kingfish	Scomberomorus plurilineatus	0.62	0.0
	Total	**11,726.98**	**100.0**

Length frequency distribution

Length frequency distribution of Tuna and Tuna-like species in all the landing sites under the piloting phase of the mobile phone data collection project

A total of 12 Tuna and Tuna-like species were encountered in the pilot sites sampled. The kingfish was not identified to species level given the two species available in Kenyan waters. Only a few individuals of *Scomberomorus commerson, Scomberomorus plurilineatus,* sword fish and marlins. The length frequency distribution of the most common Tuna and Tuna-like species encountered in pilot sites are indicated in figure 3. In cases where the data is very

limited (below a sample size of 9), the actual data is presented next to or below the length frequency distribution graph of that species.

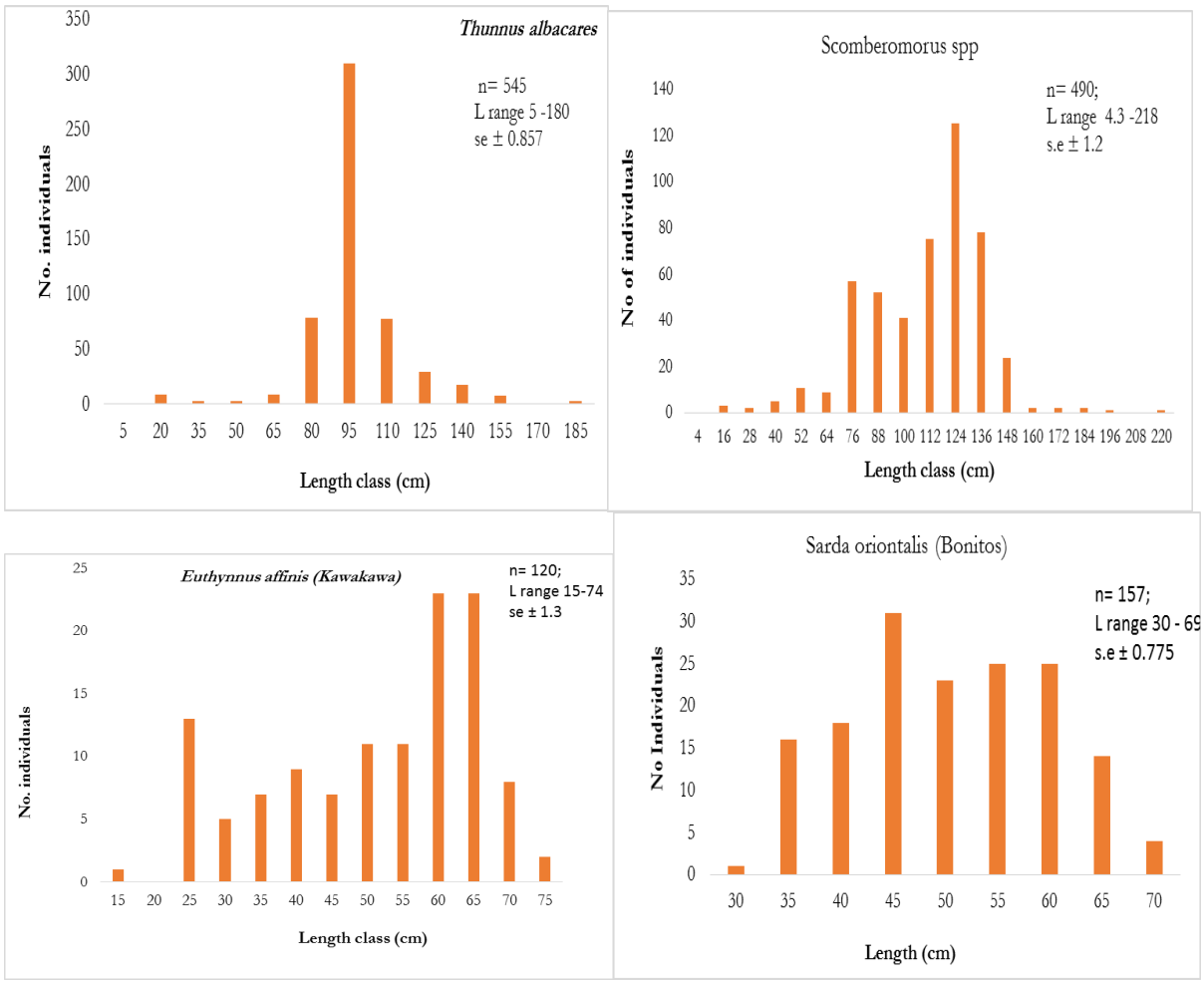

Figure 3: Length distribution for tuna and tuna like species

Most of the yellowfin tuna were above 90cm but individuals <20 cm were also reported. Comparing to previous length data there is an indication of improved data quality.

Evaluation of the electronic data collection

Success of the electronic data collection

1. Data captured and submitted in real time making it easy to correct any mistakes.
2. Preliminary analysis conducted for two months data indicated that data captured is of good quality. Frequent monitoring and communication to the data collection has improved the data quality.
3. The mobile application has capability to capture photos and therefore through the electronic data capture species photos to develop species catalogues and improve on species data reporting
4. The system reduces data loss since the data collectors do not have to keep any filled data forms in their premises for later date submission as it was during manual program.
5. The electronic data collection is faster and the time taken in the process of data collection and submission of once in a month to almost immediately within every sampling day.
6. The data can also be requested anytime when needed. The checks in the system was also pointed as a major tool to prevent errors in the data recorded.
7. Compared to the previous manual data collection the use of mobile was reliable. The manual one was unreliable in since some data collectors were suspected to be presenting unreal data. The supervision was not easy since the data used to be submitted once in a month and to detect errors may take long and noted only during data cleaning after several months.

Challenges

There are challenges associated with the pilot;

1. Sampling at night during the NEM is restricted as the data collectors are not able to cover day and night landings hence the possibility of not capturing important data
2. Data collectors not able to identify to species level and use of names in different languages making it difficult to identify the two kingfish species

3. Linking mobile data to frame survey data for estimation of total catch
4. Data submitted in different tables

Lessons learnt from the pilot

1. Frequent feedback as part of capacity building for data collectors
2. Increased cooperation from fishers due to involvement of the BMU data collectors and regular trainings/workshops during the pilot period.
3. Training of data collectors has improved their ability to collect accurate and reliable data accurately data.
4. The need to develop a catalogue of the species using the names used by the fishers to enhance species identification
5. Reduced time in data cleaning and quality checks due to close monitoring

Recommendation

- The data is generally of good quality, however, data collectors still need to be extra careful when entering the collected data in the mobile phones.
- Since it is a piloting phase, focusing on priority species is desirable. While the data collected will be less, it will be of much higher quality. The species composition per landing site together with other available data, can be useful in identifying the priority species.
- Continuous checks and monitoring improves the quality of the submitted data as subsequent problems are detected and intervention measures put in place This is much easier than trouble-shooting huge sets of data.
- Providing the data collectors with the overall species identification checklist as well as landing-site specific checklist. While this will improve accuracy in species identification, it will also standardize entry of both local and scientific names of species
- The database creates unique recourse identifier (URI) but there was a need to create CAS IDs for the tables, using a query on data aggregation from boat and gear to family/species level. The group managed to create one table, which was an improvement by merging the previous different tables.

- It was noted that local names varied at the family/species level, and thus there was need to introduce queries necessary for the database. Also, a species list was needed and to be introduced as a widget with scientific and common names of all species.
- Upscale the use of the mobile application to the sportfishing database to improve reporting

- Kenya received support while testing the CAS methodology and the training on IOTC sport fishing database. The need to enhance the linkages between the different datasets and reporting is important hence the request for further support to the current mobile data collection and reporting. Species identification is still a challenge that Kenya needs support.

[iii] Mobile data pilot study in Kenya