Preliminary assessment of shark bycatch from Kenya's nascent industrial tuna fisheries

By

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ABSTRACT

The offshore tuna fisheries in Kenya are still nascent, with two longliners in operation from 2016 after a lull of about 6 years. These longliners are normally targeting tuna, swordfish, marlin and sharks. However, sharks are as well caught as by-catch, regardless of the target fishery. Major problems with compliance exist in this fishery, as the lack of constant deployment of scientific observers hinders adequate biological data collection.

In order to assess the shark bycatch in the tuna longline fisheries of Kenya, data provided by the skippers from the logbooks and recorded as catch from one longliner fishing vessel (FV. Shang Jyi) from the period of July 2017 to September 2017 was used.

Preliminary results indicate general substantial catches of sharks at 10.9%, with the hammerhead sharks (*Sphyrna lewini*) constituting 6.5%, blue sharks (*P. glauca*) 3.1%, and blacktip sharks (*Carcharhinus melanopterus*) at 1.2%. Hammerhead sharks were predominantly caught in the months of July, August and September, but none was caught in October and November. The Blue sharks were predominantly caught in November while the blacktips were mainly caught in October. This clearly points to a species-specific segregation which could have been due to seasonality and lunar periodicity effects, or differing fishing locations. However, more data is required for conclusive recommendations.

Key words: *Bycatch, sharks, longline hooks, mitigation*

1. Introduction

The management of Indian Ocean tunas (with the exception of the Southern Bluefin tuna) is under the responsibility of the Indian Ocean Tuna Commission (IOTC). Under the provisions of UNCLOS and of its Fish Stocks Agreement, all Parties fishing for tunas in this ocean are obliged to adhere to this commission and to implement its decisions. Its mandate includes the collection of official statistics and the organisation of scientific sessions dealing inter alia with stock assessment and issues related to the management of the tuna stocks.

The IOTC has developed a number of resolutions related to reporting of data on bycatch in Indian Ocean tuna fisheries. Resolution 17/05 (which superseded Resolution 05/05) calls on CPCs to annually report catches of sharks, requests the Scientific Committee to provide preliminary advice on the status of key shark species and propose a research plan for comprehensive assessment of these stocks of sharks, calls on CPCs to undertake research to identify ways to make fishing gear more selective, calls for full utilization of captured sharks, and provides a number of guidelines regarding shark finning. It also requires that the total weight of shark fins on board not exceed 5 percent of the weight of sharks on board, and encourages the live release of all sharks taken incidentally to other targeted species. It further directs the IOTC Working Party on Ecosystems and Bycatch (IOTC WPEB) to establish the Terms of Reference for the Commission to establish a long term-project on sharks in IOTC, with the aim to ensure the collection of data required for performing reliable stock assessments for key shark species.

The management of bycatch and byproduct species like sharks caught in the IOTC area of competence requires different types of research, survey, and monitoring information than currently adopted for high value target tuna species. However, it is generally not practical to collect the extensive data required for a full stock assessment of individual species; and there are far too many species to address.

Furthermore, the IOTC Resolution 12/01 directs the Commission to consider major uncertainties, including the uncertainty about the status of the stocks relative to reference points, uncertainty about biological, environmental and socio-economic events and the effects of fishing activities on non-target and associated or dependent species. This therefore means that, occasionally, management decisions need to be made long before the required data sets for a full assessment can be collected.

Because of the comparatively low biological productivity of chondrichthyan species (sharks, rays and holocephalans), their populations can be depleted in a shorter period than it takes to collect sufficiently long time-series of data to undertake reliable stock assessments. Alternative rapid assessment methods are therefore required (Walker et al., 2008).

Sharks form an important part of the marine fishery catch in Kenya. Kenya's small scale fishery targeting sharks comprises artisanal fishers utilizing canoes, outriggers or wooden boats powered either by oars, long sticks, sails or engines (Fulanda *et al.*, 2011; Munga *et al.*, 2014). Small scale fishing gear including handlines, seine nets, monofilament nets used inshore and offshore areas also land sharks and rays as by-catch.

The semi-industrial prawn fishery in Malindi-Ungwana Bay also catches sharks and rays as by-catch, most of which are discarded (Oddenyo *et al*., 2016). In Mombasa, the semi-commercial longline fishery targets mostly thresher sharks, *Alopii sp*. and mako sharks, *Isurus sp.* (Kiilu and Ndegwa, 2013). The species catch composition constitutes mako sharks, *Isurus* spp. and blue sharks, *Prionace glauca* (Marshall, 1997, Wekesa, 2012,· Kiilu and Ndegwa, 2013). Other species include scalloped hammerhead, *Sphyrna lewini*, grey reef shark, *Carcharhinus amblyrhynchos*, blacktip reef shark, *Carcharhinus melanopterus* and silky shark, *Carcharhinus falciformis*.

2. Objectives of the study

The main objective of this assessment was to provide initial information on the performance of Kenya's nascent offshore fishing fleet in terms of capture of sharks as bycatch, using catch report data from one longliner fishing vessel.

The specific objectives were to:

1) Categorize the bycatch species of sharks taken in the fishing vessel in 2016 and 2017 in terms of numbers and weights.
2) Determine the species composition of the sharks caught by the fishing vessel over the same period.
3) Outline the various uncertainties associated with such types of data sources based on the challenges encountered.

3. Materials and Methods

3.1. Fishery description

Kenya’s offshore tuna fishery comprises mainly locally flagged and several foreign licensed fishing vessels from Distant Water Fishing Nations (DWFN), targeting the highly migratory tuna and tuna-like species which migrate through the Kenyan EEZ. Presently the local fishing fleet comprise of 2 longliners, while the DWFN fleets mainly comprise of a varying number of purse seiners and longliners operating under a fishing licensing scheme. There is also a fleet of 8-10 semi-industrial longline vessels operated by small scale fishers. Substantial amounts of shark catches have been recorded as by-catch in these industrial fisheries, especially from catch declaration and regional observer reports.

3.2. Catch reporting and legal framework

Kenya’s repealed Fisheries Act CAP 378 of 1989 required foreign fishing vessels to apply for a fishing licence under regulation 6 whereby the fishing plan of the vessel had to be provided. This plan was to outline the area of fishing, the exact number of fishing crafts, estimated times for arrival and departure, proposed duration of fishing plan and outline of the calls into the Kenya ports during the duration of the plan. Before the enactment of the new Fisheries Management and Development Act No. 35 of 2016, the foreign fishing vessels had no obligations to land, trans-ship or declare catches in the country. This arrangement limited the country’s benefits from its EEZ fisheries, especially from reporting and value addition activities associated with the value chains in trans-shipment, landing and processing or even from trade in by-catch. It was also a major gap in data collection and comparison of by-catch declarations.

3.3. Data collection and analysis

In this study we used sample data from a Kenyan flagged longline offshore fishing vessel (FV. Shang Jyi, Call sign 5ZZM) operating from the Mombasa port in the years 2016/2017. The vessel is classified as an industrial fishing vessel under Kenyan law, the total length being 33.56m.

One part of the fishing expedition was done in Kenya’s EEZ in 2016 (Fig. 2), with fishing carried out for 9 months between April and December. On the other part, fishing was conducted for 3 months in July, August and September in 2017 in the high seas off north of Mauritius EEZ, and the southern parts of the Indian Ocean below the 25˚S latitude, where the shortest fishing distance from St. Denis in the Reunion was determined to be about 233nm (Fig. 3; red line).

The fishing equipment was routinely inspected prior to all fishing expeditions, and the fishing gear onboard the fishing vessel was ascertained (see Fig. 1).

From the log-book records of the skipper, the number of hooks used in every deployment when sharks were captured, the species composition and total number of shark pieces captured, and the total weight were determined.

Figure 1: Types of hooks and line weights used in the sampled fishing vessel in 2016 and 2017

4. Preliminary results

During the observation period in 2016 of 151 days of fishing, 538 pieces of sharks were recorded as captured, translating to about 4 recorded sharks per day. In terms of numbers the hammerhead shark, *Sphyrna lewini*, was predominantly caught in both fishing zones (at 45.7% in Kenya's EEZ and 47.4% in the southern Indian Ocean) followed by the blacktip sharks, *Carcharhinus melanopterus* at 27.1% in Kenya's EEZ and Blue shark, *Prionace glauca* at 33.1% in the southern Indian Ocean. Mako sharks, *Isurus spp* (0.2%) and blacktip sharks, *C. melanopterus* (19.5%) were least captured in both zones respectively (Table 1 and 2).

However, in terms of total weight (kg) Tiger sharks, *Galeocerdo cuvier* (at 29.1%) were more higher than Blacktip sharks, *C. melanopterus* (at 23.3%) in Kenya's EEZ (Table 1).

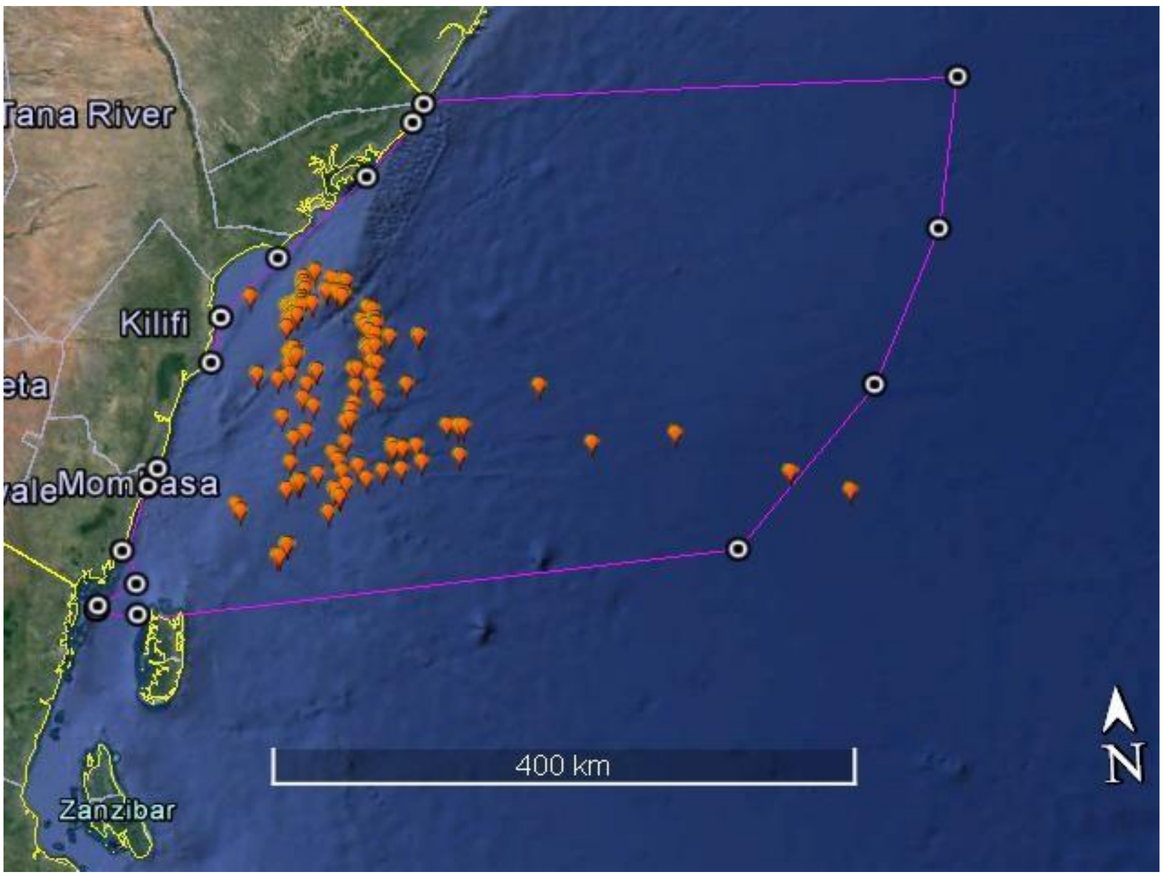

Figure 2: The fishing area in Kenya's EEZ by the Kenyan flagged longliner FV. Shang Jyi between April and December, 2016

Table 1: Species composition and catch rates of sharks captured by a Kenyan flagged longline fishing vessel in 2016 in Kenya's EEZ.

Family	Shark species	Total Pieces	%-age	Total Weight (Kg)	%-age	Number of Hooks	Catch rates (No. of Pieces per hook)
Carcharhinidae	Blacktip shark (C*archarhinus melanopterus*)	146	27.1	4637	23.3	91308	0.0016
	Tiger sharks (*Galeocerdo cuvier*)	131	24.3	5776	29.1	90192	0.0015
Sphyrnidae	Hammerhead shark (*Sphyrna lewini*)	246	45.7	8843	44.5	83963	0.0029
Lamnidae	Mako sharks (*Isurus spp*.)	1	0.2	40	0.2	1500	0.0007
	Sharks (Unidentified)	14	2.6	572	2.9	4500	0.0031
Total		**538**		**19868**			**0.0020**

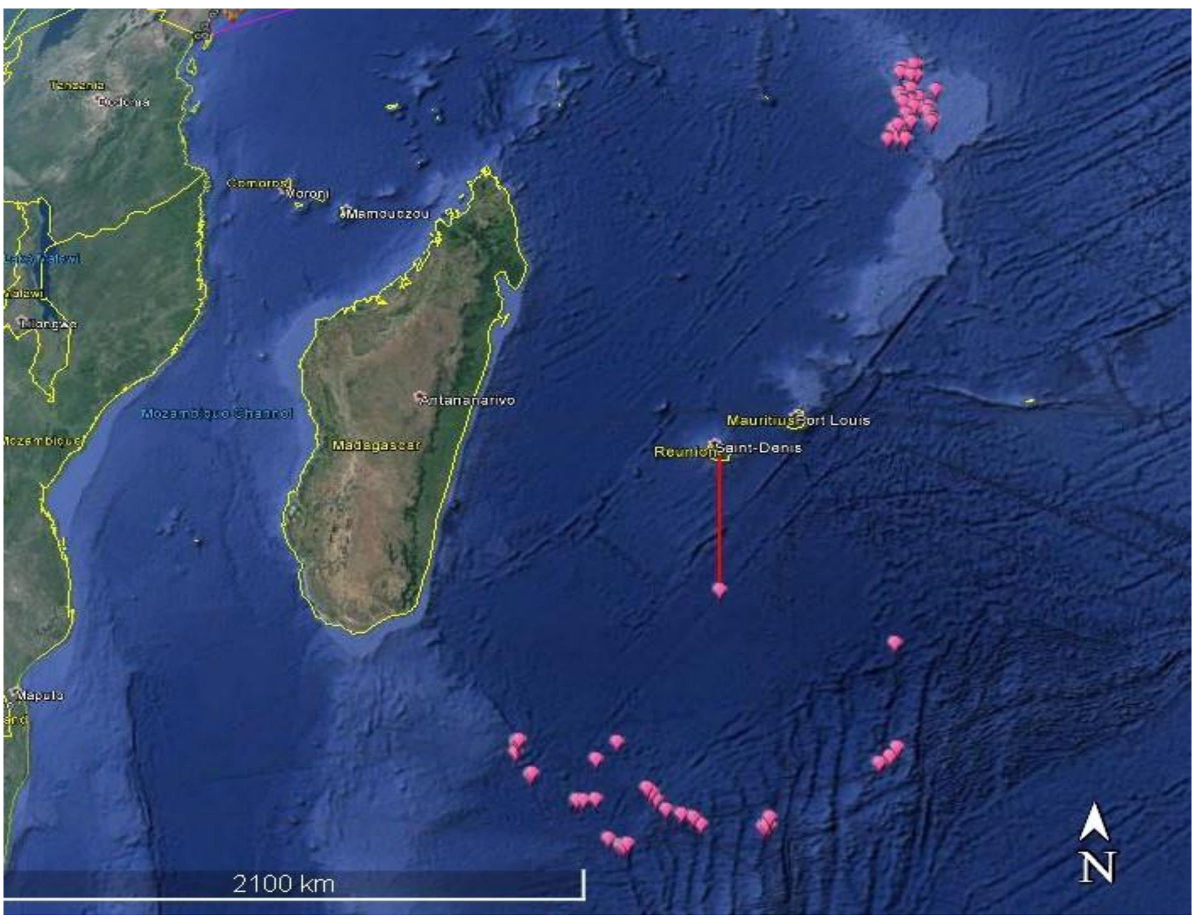

Figure 3: The fishing area in the high seas off north of Mauritius EEZ and southern Indian Ocean by the Kenyan flagged longliner FV. Shang Jyi between July and September, 2017.

Table 2: Species composition and catch rates of sharks captured in a Kenyan flagged longline fishing vessels in 2017 in the southern Indian Ocean.

Family	Species	Total Pieces	%-age	Total Weight (Kg)	%-age	Number of Hooks	Catch rates (No. of pieces per hook)
Carcharhinidae	Blacktip shark (C*archarhinus melanopterus*)	56	19.5	624	11.2	31530	0.0018
	Blue shark (*Prionace glauca*)	95	33.1	1600	28.7	77820	0.0012
Sphyrinidae	Hammerhead shark (*Sphyrna lewini*)	136	47.4	3354	60.1	97350	0.0014
Total		**287**		**5578**			**0.0014**

Evidently there was an observed difference in the diversity of sharks recorded from the fishing areas, with the Kenyan EEZ recording a higher diversity in terms of both family and species representativeness (Table 1 and 2).

5. Discussion

Despite the major ecological importance of sharks in coastal Kenya, many aspects have not yet been studied comprehensively. In particular there is a lack of information on size selectivity of hook and line gear, catch composition, catch rates and factors which affect these, and gear overlap, fishery interactions and competition. Little is known concerning the total amount of long-line gear in use, since there is no regional or national legislation limiting hook and line gear. This legal gap might have adverse effects on sharks that are frequently caught either as bycatch or in directed fishing.

Catch rates, species composition and size selectivity in hook-and-line fisheries are influenced by a number of variables (Bjordal and Løkkeborg, 1996). These include: hook size and design (Forster, 1973; Anon., 1983; Skeide et al., 1986; Bjordal and Løkkeborg, 1996), fishing strategy (Bjordal and Løkkeborg, 1996), bait and bait size (Moreno et al., 1992; Bjordal and Løkkeborg, 1996), and the use of accessories, e.g. swivels and floats (Bjordal and Løkkeborg, 1996). No attempt was made to factor in any of these variables in this study due to limitations in data.

In the present assessment, there were reporting and taxonomic uncertainties in terms of total catch recorded and species identification. A substantial number of shark specimens from Kenya's EEZ (14 pieces weighing 572 kg; Table 1) were reported as unidentified. No sharks are recorded as having been discarded, though this is reportedly a common practice in longline fisheries.

No species of sharks were identified to be at risk as per IUCN red list, or caught against the provisions of the IOTC conservation and management measures, or against national law. Though this depicts a level of compliance, it is not clear whether there were recording gaps and discards.

Long-lines have a number of characteristics that are highly favourable in terms of the rational use and management of living resources (Erzini et al. 1998). These include the minimal capture of undersized fish, essentially no harmful effects in terms of the environment, low energy costs, low discard rates, and the capture of a high quality product (Erzini et al., 1998). This study is part of ongoing assessment on the longline fisheries of Kenyan flagged fishing vessels, which will hopefully contribute to the improved management, landing and utilization of bycacth species, which are increasingly growing scarcer due to unsustainable fishing.

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