Present status of threatened and conserved species entanglement in multiday tuna fishery in Sri Lanka

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Abstract

Sri Lanka is one of the oldest and most important tuna producing island nations in the Indian Ocean. Multiday fishing crafts in Sri Lanka are mainly operated targeting tuna and tuna like species and this is a multi-gear, multi-species fishery. Certain threatened and conserved species are protected in Sri Lanka by the existing law notably oceanic white tip shark, three species of thresher sharks, whale shark, marine mammals and turtles. It has been reported that accidental catching of above species to fishing gears frequently operate in tuna fishery such as gillnets, longline and ring net. The present study was undertaken with the aim of studying the present status of threatened and conserved species recorded in tuna fishery for improving the conservation and management of them. Log book data of Sri Lanka tuna fishery operated during 2016 to 2018 with multiday fishing vessels in EEZ of Sri Lanka and high seas were used for this audit. A total of 4014 recodes of incidental catches of threatened and conserved species were reported of which 73.1% were caught to gillnets16.0% were caught to longline and 10.9% were caught to ring nets. However, for all gear, the live release rate of incidental catch was around 90% and zero mortality was recorded for ring nets. When comparing three consecutive years, entangling of conserved shark species especially thresher sharks to fishing gear was considerably higher in 2018 and probably this may be due to the enhancement of thresher population after imposing a total ban on thresher sharks in 2012. Moreover, total turtle entanglement in all the gears was 3351 of which gillnet was the highest (80.6%). However, around 87% of sea turtles were released in live. Furthermore, Green turtle was the utmost among turtle by-catch recodes. A total of 672 and 945 Green turtles were recorded in 2017 and 2018 respectively. Among them, 89.5 % was reported in gillnets followed by longline (8.2 %). Occasional dolphin catches were also recorded mostly for gill nets. The results revealed that gill net is responsible for catching protected species than other gears. Further, the records indicate that a slight increasing trend in the total entanglement with the highest number of

2327 reported in 2018. However, 88% of them were released in live. The slight increase of recorded catch of threatened and conserved species could be mainly attributed to the improved logbook fisheries data collection system in Sri Lanka.

Key words: incidental catch, fisheries log book, Sri Lanka

Introduction

Due to the selectivity of the fishing gear, incidental catches of protected species are recorded. Fishing gear is a major threat to populations of many species such as sea turtles (Pinedo and Polacheck, 2004; Peckham et al., 2007), sharks (Guyomard et al., 2019), marine mammals (Xu et al., 2019) and sea birds (Huang, 2015). Most of the fishing gears commonly use i.e. gillnets (Shester and Micheli,2011), longlines (Donoso and Dutton, 2010) and encircle nets (Xu et al., 2019) have recorded retaining of other species in addition to the target species. Removing of non-target species from the ecosystem may cause imbalance in the ecosystem functions and which could lead for unhealthy ecosystems. In this context, the assessment and reduction of incidental capture and mortality of non-target species are of extreme importance and a major conservation issue. Understanding this issue, Sri Lanka have identified several threatened species (marine mammals, sea turtles and five shark species) for conservation by the laws and regulations to prevent their landings. Though the populations of these species are in critical status, the number of studies are still remaining limited including their interaction with the fishing gear. In this paper, we analyzed the incidental catch records of sea turtles, protected sharks and marine mammals which were entangled for longlines, gillnets and ringnets in Sri Lanka. The data were obtained from logbooks of Sri Lankan multiday fishing crafts operated in Exclusive Economic Zone (EEZ) and the High Seas. The main objective of the study was to investigate the present status of the incidental catch of such species in Sri Lanka multiday tuna fishery.

Methodology

Log book data of Sri Lanka multiday tuna fishery for the period of 2016 to 2018 was used for this study. The data, which are recorded by the skipper and confirmed by the fisheries officers at the arrival ports, were directly extracted from the logbooks. The data extracted were processed according to the IOTC data submission formats. Here, attention was made on protected shark species, seabirds, marine turtles and marine mammals. Under these categories all the available data were processed according to IOTC formats. Total number of entanglements in longlines, gillnets and ringnets were calculated accordingly. The fishing effort of coastal fisheries (EEZ) was calculated using the data obtained from port sampling program, while logbook data was used for

estimating the fishing effort in high seas. It was calculated in monthly strata by gear and species. In the case of longline fishery, effort was processed for 5 degree grid, while one degree grid was used for surface fisheries, viz. gillnet and ringnet. In order to get an absolute value of entanglements in different fishing gear, number of animals entangled per 100 fishing trips were considered. In addition, the yearly incidental catch status of sea turtles, sharks and marine mammals were explored.

Results

The target fish species of tuna fishery of Sri Lanka are mainly, Yellowfin tuna (*Thunnus albacares*), Bigeye tuna (*Thunnus obsesus*), Skipjack tuna (*Katsuwonus pelamis*), Kawakawa (*Enthynnus affinis*), Frigate tuna (*Auxis thazard*) and Bullet tuna (*Auxis rochei*). However, the study revealed that some interactions of threatened and conserved sharks (Oceanic whitetip shark, three species of thresher sharks, whale shark), marine mammals, sea turtles (Green turtle, Loggerhead turtle, Hawksbill turtle, Olive Ridley turtle, Leatherback turtle) in longline, gillnet and ringnet fisheries. It has been shown a gradual increase of entanglements during the three consecutive years 2016-2018 (Fig. 1). Furthermore, over the three-year period, a total of 4014 recodes of incidental catches of threatened and conserved species were reported of which 2935 (73.1%) were caught to gillnets, 641 animals (16.0%) were caught to longline and 438 (10.9%) were caught to ringnets. However, for all gears, the live release rate of incidental catch was around 90% and zero mortality was moreover recorded for ring nets (Fig. 1).

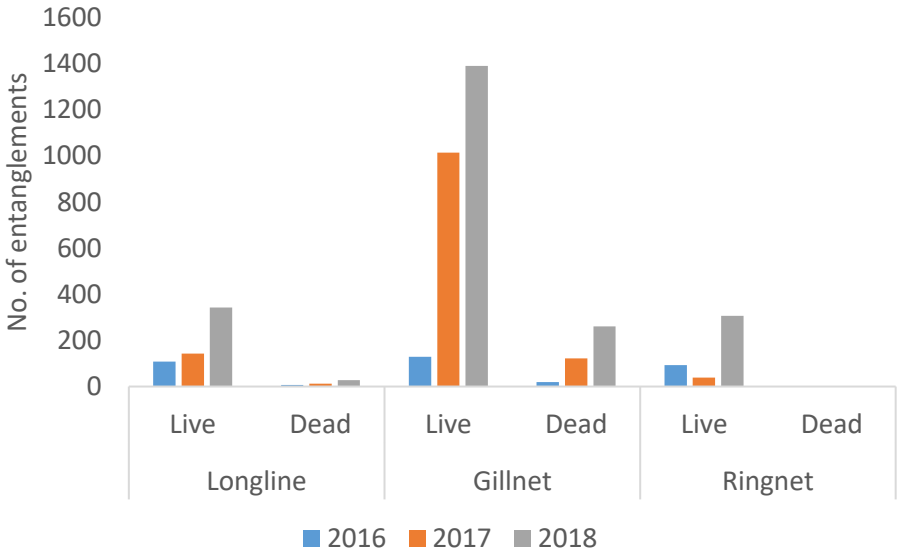

Figure 1: Total number of entanglements of threatened and conserved species in longline, gillnet and ringnet fisheries

During the study period, longlines were responsible for highest fishing effort followed by gillnets and ringnets. Although, the number of trips in longline fishery was higher, the number of records

with incidental catchers were lower with respect to gillnets and gillnets seems to be the most vulnerable fishing gear for catching protected species. When considering the number of records per unit effort (ie. number of entanglements per 100 fishing trips), it showed that the highest number of entanglements per unit effort was also higher in gillnet fishery especially in 2017 (Fig. 2). Since most of the entanglements were released in live, it would be important to know which gear was responsible for highest mortality of considered species. Figure 3 shows that, number of mortalities caused by 100 trips by each gear where gillnets were the highest number followed by longlines and ringnets with zero mortalities respectively.

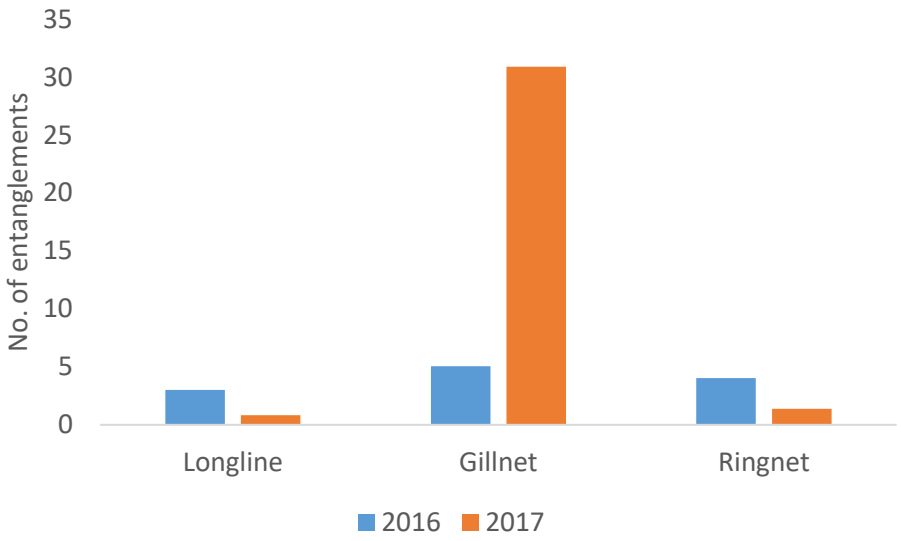

Figure 2: Total number of entanglements of threatened and conserved species in longline, gillnet and ringnet fisheries per 100 fishing trips

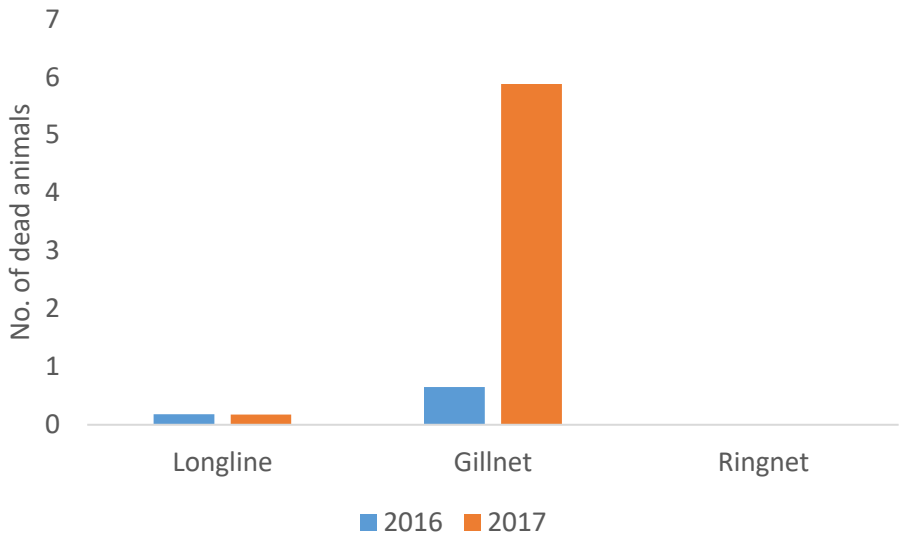

Figure 3: Number of dead releases of threatened and conserved species in longline, gillnet and ringnet fisheries per 100 fishing trips

When considering the species groups, total turtle entanglement in all the gears in 2016 to 2018 was 3351 of which gillnet was the highest (80.6%) (Fig. 4). However, around 87% of sea turtles were released in live. Furthermore, Green turtle was the utmost among turtle incidental catches followed by the Olive Ridley turtles (Fig. 5). A total of 672 and 945 Green turtles were recorded in 2017 and 2018 respectively. Among them, 89.5 % was reported in gillnets followed by longline (8.2 %) (Fig. 5).

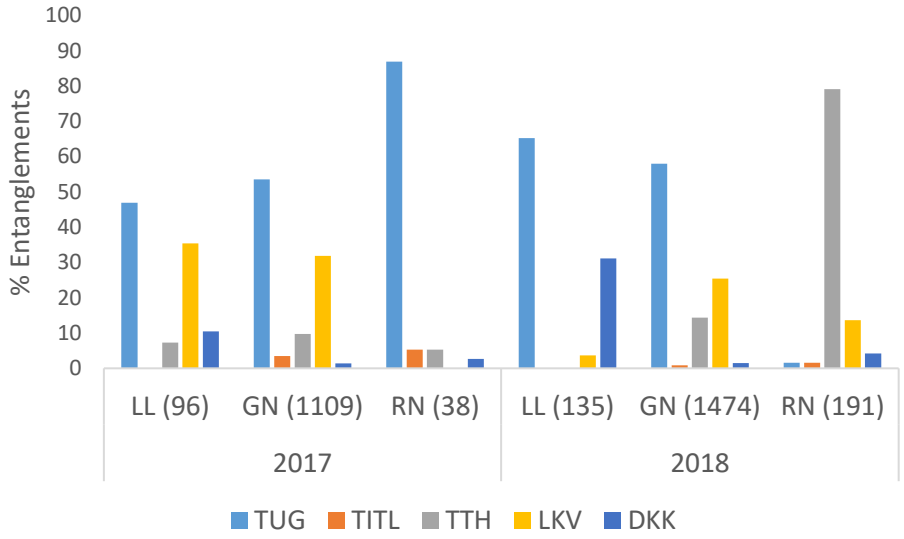

Fig 4: Percentage of turtle species entangled in longlines (LL), gillnets (GN) and ringnets (RN) in 2017 and 2018. TUG: Green Turtle, TITL: Loggerhead Turtle, TTH: Hawksbill Turtle, LKV: Olive Ridley Turtle, DKK: Leatherback Turtle (total number of turtles encountered in different fishing gear was given in parentheses)

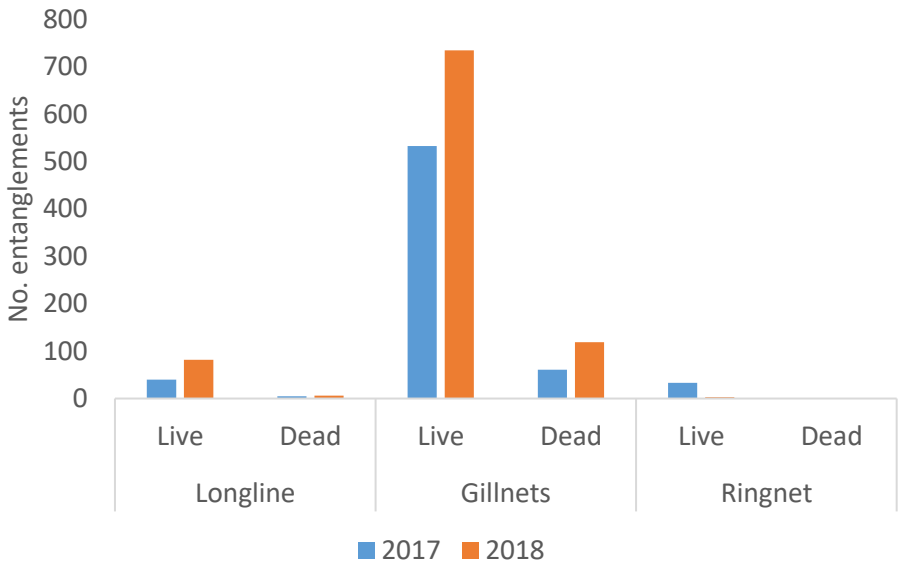

Figure 5: Entanglement of Green Turtles in different fishing gears in 2017 and 2018

Though longlines retained more conserved sharks, moralities were mostly caused the gillnets (Table 1). Also, total number of sharks caught to fishing gear in 2018 was considerably higher than 2017. Table 1 also explains that the thresher sharks were the most vulnerable shark species for fishing gear especially for longlines and ringnets. However, 100% of thresher sharks were released in live. Additionally, a higher entanglement rate of oceanic whitetip sharks was recorded in longlines in which majority was released in live (Table 1)

Table 1: Entanglement of shark species in longline, gillnet and ringnet fisheries in 2017 and 2018

Year	Shark Species	Longline		Gillnet		Ringnet	
		Live	Dead	Live	Dead	Live	Dead
2017	Oceanic whitetip	23	-	1	-	1	-
	Thresher	29	-	-	-	-	-
	Whale shark	-	-	1	-	-	-
	Total	**52**	**-**	**2**	**-**	**1**	**-**
2018	Oceanic whitetip	52	8	-	9	-	-
	Thresher	174	-	-	5	115	-
	Whale shark	-	-	3	12	0	-
	Total	**226**	**8**	**3**	**26**	**115**	**0**

In addition to above species, dolphins were also recorded occasionally as incidental catches in all the three gears but most of the times they were released in live except few mortality records in gillnets. There were no any counts for whales retaining in these fishing gears during the concerned period.

Discussion

The present analysis exposed the recent status of the threatened and conserved species entanglement in multiday tuna fishery in Sri Lanka based on the data recorded in log books. The data used here was a merged dataset within EEZ and high seas. A total of 4014 recodes of incidental catches have been recorded during 2016-2018. It was clearly noticed that there was a gradual increase of incidental catch reporting from 2016 to 2018. This might be probably due to either increase of fishing effort of three gears over the period or improving of logbook data reporting or both reasons. In Sri Lanka, fisheries data collection system including logbook data collection has been improved in recent years which is likely reflected in incidental catches reporting too. In addition to these reasons, due to banning of certain protected species (eg. three thresher sharks), higher availability of these species in fishing grounds was observed than before which having the high probability of entanglement in fishing gears.

Among the conserved and protected species considered, turtles were the most interacted group (3351 turtles) with the fishing gear among the three gear types. Considering only the longline fleet in the US Atlantic, Yeung, (2001) estimated the annual catch of turtles at 800-3000. Furthermore, IUU fishing has a serious contribution to turtle entanglements in fishing gear in the Indian Ocean (Riskas et al, 2018). According to the present study, Green turtle was the most susceptible turtle species for the fishing gear. However, Maldeniya and Danushka (2014) reported that Olive Ridley turtle was the frequent entangling species in Sri Lankan gillnet and longline fisheries. According to Yokota et al. (2009), bait type is a key factor in selection of turtle species in longlines and fish baits are very effective in reducing the Loggerhead turtle bycatch in pelagic longline fisheries.

Therefore, bait type also has to be taken into consideration when analyzing the incidental catches of turtles.

In Sri Lanka there are several legal actions have been implemented targeting conservation and management of sharks. Sri Lanka National Plan of Action for the conservation and Management of sharks (SL NPOA-Sharks) was prepared and implemented in 2013 in accordance to the guidelines in the FAO code of conduct for responsible fisheries and International Plan of Action for the conservation and management of sharks (IPOA-sharks). SL NPOA- sharks suggested a number of management and conservation measures to be implemented within EEZ of Sri Lanka and high seas. In addition, implementation of the regulation on banning of three species of thresher sharks (*Alopius vulpinus, Alopius superciliosus and Alopius pelagicus*) was done in 2012 (Gazette No.1768/36 dated 27 July2012). Also, the banning of Oceanic white-tip shark (*Carcharhinus Iongimanus*) and the Whale shark (*Rhincodon typus*) in 2015 (Gazette No. 1938/2 of 26 October 2015) has also been impacted to further decline the shark catches in Sri Lankan fisheries (Balawardhana et al., 2013).

The study revealed that the percentage of live release of animals were more than 90%. Even though they have been released live, injuries could be happening due to entanglements (FAO, 2009). This aspect has to be taken into considerations in conservation of these conserved and protected species. Also, the status of the populations protected species has to studied in frequently especially after implementing the laws and regulations. Such studies could explore the effectiveness of implemented laws and it would useful in continuation of protecting these species.

In the recent past, improvement of fisheries data collection systems, implementation of laws and regulations on protected species, adhere to regional management plans and frequent awareness programs for fishing community become positive aspects of protecting conserved species in Sri Lanka.

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