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Performance Assessment of Tuna Longline Fishing in Lakshadweep Sea, India

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Abstract

Experimental tuna longline operations were carried out in the Lakshadweep Sea on board modified Pablo boats which are originally used for pole and line fishing for skipjack tuna (*Katsuwonus pelamis*). Catch composition, size frequency and CPUE of the tuna longline operations were analyzed. Sharks, tuna, sailfishes and miscellaneous fishes were the catch. Shark contributed 67.6% of the overall catch followed by tuna (18.7%). Hooking rate of tuna was 4.6 1000^{-1} hooks compared to (16, 3.4 and 2.2 for sharks, sailfishes and miscellaneous fishes, respectively). Silky sharks (*Carcharhinus falciformes*) alone contributed 89.9% to the total shark catch. Overall hooking rate was better during evening compared to morning. There was no significant difference in the overall catch rate between pre-monsoon and post-monsoon operations.

Keywords: Longline, tuna, sharks, Lakshadweep, bycatch

Introduction

Longlines are considered as an effective fishing method to catch sparsely distributed large carnivorous fishes. This method was perfected by Japanese fishermen in 1930s (Shapiro, 1948). Longlines usually target yellowfin tuna, swordfishes, bluefin tuna and bigeye tuna. The main tuna species caught in the Indian Ocean are yellowfin tuna (*Thunnus albacares*) and skipjack tuna (*Katsuwonus pelamis*) (Pillai & Satheeshkumar, 2012).

Tuna aggregations are influenced by water currents, moon phases and temperature gradients and they inhabit continental slopes, sea mounts, sea basins and sea canyons (Morato et al., 2010). Previous studies reported that, tuna longlines can be operated round the year in the Indian Ocean (Somvanshi & Varghese, 2007). Hooking rate was found to be high during pre-monsoon and monsoon seasons in the Arabian Sea whereas it was found to be high during monsoon and post monsoon periods in the Bay of Bengal waters (Somvanshi & Varghese, 2007).

Total tuna landing in India including Lakshadweep Islands during 2013-14 was estimated as 85 291 t and 7 196 t, respectively. *Katsuwonus pelamis* (51%) was the major tuna species landed in Lakshadweep waters followed by *Thunnus albacares* and *Euthynnus affinis* (41.5 and 4.8% respectively) (Anon, 2014). Potential tuna resources in Lakshadweep waters were estimated as 50 000 t indicating scope for further expansion of the tuna fishery (Pillai et al., 2006). This study was the various factors influencing hooking rate in longline fishing operations carried out onboard modified Pablo at Lakhadweep Islands the objective of this study was to elucidate the different factors that influence hooking rate in longline operations.

Materials and Methods

Experiments were carried out using three Pablo boats (L_{OA}. 7.6-8.5m) which were modified for longlining around Agatti Island, Lakshadweep (10° 38 - 11° 07 N and 72° 01 - 73°18 E) from 16 November 2009 to 23 April 2011. Pablo boats were provided with a stainless steel (Grade IS 304) hand-operated winch for hauling the line, a guide pulley in the forward port side for guiding the mainline and a PUF (polyurethane foam) insulated fibreglass

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reinforced plastic (FRP) box for storing the catch and the bait. An FRP bin was also provided with stainless steel rings for storing the branchlines. Mainline and branchlines were made of polyamide monofilament of 3 and 1.8 mm diameter, respectively. High density polyethelene (HDPE) of 22.5 m long was used as floatline. Each basket consist of five Japanese tuna hooks (3.4 sun) with 10° offset. The depth of operation of the hooks was regulated by adjusting the length of the floatline. Fishing operations were mostly carried out during dawn and dusk at a depth range of 35-100 m and data from 370 fishing operations were used in this study. Duration of the soaking time ranged from 1 to 7 h, depending mainly on weather conditions. Shooting and hauling time was approximately 1.30 and 2 h, respectively. The baits used for the fishing opeartions were *Rastrelliger kanagurta*, *Sardinella longiceps* and *Amblygaster clupeoides*. Catch rate was expressed as catch per 1000 hooks.

Results and Discussion

The details of the fishes caught in the longline gear are given in Table 1. Total of 219 fishes weighing 6324 kg were caught during the fishing operations (148 sharks, 41 tunas, 14 sailfishes and 16 miscellaneous fishes). Sharks represented the highest percentage of all fishes caught (67.6%), followed by tunas (18.7%), miscellaneous (7.3%) and sailfishes (6.4%). *Carcharinus falciformis* was the dominant species among all shark species caught (89.9%). Yellowfin tunas contributed 18.3% of the total catch.

Hooking rate reported for shark was 16, followed by tuna (4.6), sailfish (3.4) and miscellaneous fishes (2.2), respectively (Fig.1). Hooking rate observed

Table 1. Species composition of tuna longline fishing in Lakshadweep Sea

Scientific name	Common name	Number of fishes caught	Total length (cm)	Weight (kg)	Conservation status*	Population trend*
Tuna						
Thunnus albacares	Yelowfin tuna	40	15-147	3-40	Near threatened	Decreasing
Gymnosarda unicolor	Dogtooth tuna	1	140	27.5	Near threatened	Decreasing
Sharks						
Carcharhinus falciformis	Silky shark	133	50-243	5-98	Near threatened	Decreasing
Carcharhinus amblyrhynchos	Grey reef shark	7	114-210	16-41	Near threatened	Unknown
Galeocerdo cuvier	Tiger shark	4	183-213	31-74	Near threatened	Unknown
Alopias pelagicus	Thresher shark	2	240-276	50-55	Vulnerable	Decreasing
Negaprion acutidens	Sicklefin lemon shark	1	256	105	Vulnerable	Decreasing
Sphyrna lewini	Scalloped hammer head shark	1	320	130	Endangered	Decreasing
Sailfish						
Istiophorus platypterus	Sailfish	14	50-288	1-44	Least concern	Unknown
Miscellaneous fishes						
Aprion virescens	Green jobfish	5	0.3-95	1-9	Not assessed	Not assessed
Caranx spp	Carangids	2	29	5		
Epinephelus polylepis	Small scaled grouper	1	No data	4	Near threatened	Decreasing
Lutjanus gibbus	Humpback red snapper	8	61-68	2-6		

*IUCN (2012)

for different species was significantly different (x^2= 9.867, p<0.05, *df*=3).

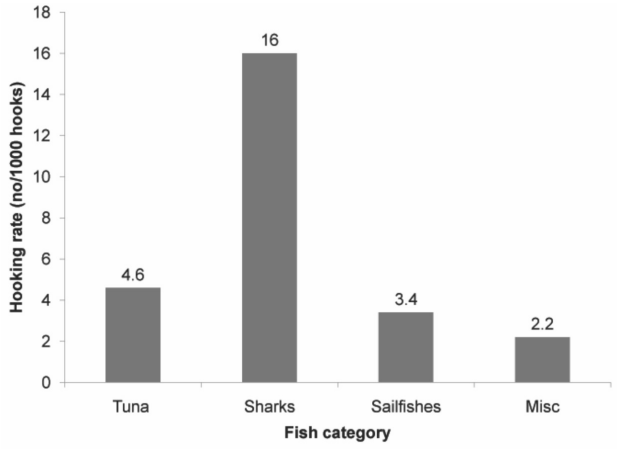

Fig. 1. Group-wise hooking rate in the longline fishing in Lakshadweep waters (values expressed as number 1000^{-1} hooks)

Size of silky shark, *C. falciformis* ranged from 50 to 275 cm. About 40% of the shark had a length of 150 to 175 cm, followed by 175 to 200 cm (26.6%). Weight of the sharks ranged from 5 to 100 kg with an average of 33.56 kg. Silky sharks (*C. falciformis)* are considered as one of the major groups contributing to the elasmobranch bycatch in longline fishing (Harrington et al., 2005; Gilman et al., 2007).

Though length of the yellowfin tuna ranged from 15 to 147 cm, about 70% of them were in the length class of 70 to 130 cm. Length of the sailfish (*Istiophorus platypterus*) ranged from 50 to 288 cm and the weight ranged from 1 to 44 kg.

The overall hooking rate was better in the evening (17) compared to morning hours (9) (Fig. 2). Hooking rate reported for tuna in the morning and evening was found to be 1.6 and 3, respectively (Fig. 3). Shark catch reported during morning and evening was 6.3 and 9.7 respectively. Hooking rate for sailfishes in the morning and evening was found to be 0.4 and 3. Hooking rate of the fishes in the miscellaneous category was 0.7 and 1.5 for morning and evening hours, respectively. Ward et al. (2004) observed that both targeted catch and bycatch were found to be high during evening. There was no significant difference in the species-wise hooking rate between morning and evening hours.

Month-wise variation in the overall hooking rate showed that highest overall hooking rate was recorded during the month of October 2010 (33.3) and lowest during December 2009 (1.1) (Fig. 4). High overall hooking rate was reported during the year 2010-11 (33.3) against the lowest hooking rate in 2009-10 (12.2). There was no fishing during May to September 2009 due to unfavourable conditions during monsoon.

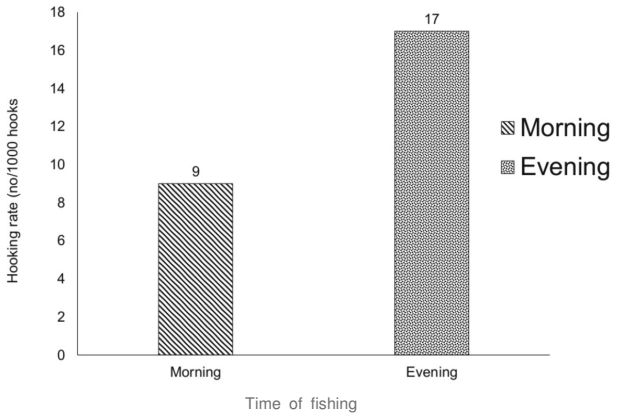

Fig. 2. Overall hooking rate in morning and evening hours

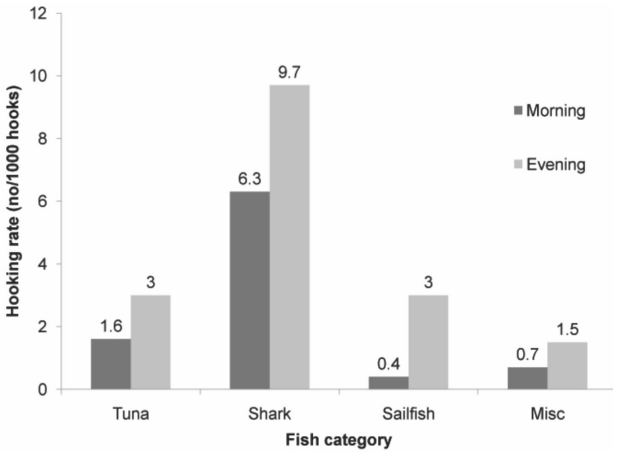

Fig. 3. Species wise hooking rate in morning and evening hours

Hooking rate of tunas ranged from 0 to 13.33 and the highest hooking rate was during October 2010 (13.33). The hooking rate of sharks ranged from 1.14 to 14.67 and highest hooking rate was during December 2010. The hooking rate of sailfish ranged from 0 to 6.67 and the hooking rate of the miscellaneous group of fishes ranged from 0 to 3.7.

There was significant difference in the hooking rate between months (p<0.05) and between types of

fishes ($p<0.01$). There is no significant difference in species composition between pre and post-monsoon seasons ($p>0.05$).

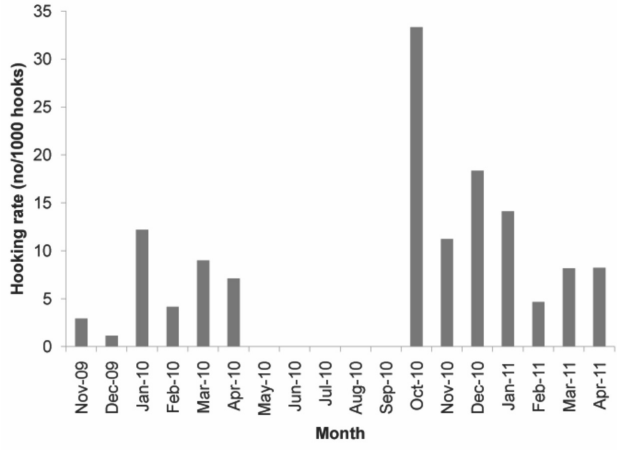

Fig. 4. Month-wise overall catch rate observed during the longline fishing

Lutjanus spp. contributed 44.4% (40.3 kg) to the miscellaneous group of fishes followed by *Aprion virescens, Epinephelus polylepis* and *Caranx* spp. The small scale grouper (*E. polylepis*) comes under the 'decreasing' status as per the IUCN Red List (IUCN, 2012). These species were mainly caught when the longline was deployed near the coral ridges. Spatial variation of the longline catch composition has not been studied since the fishing area was limited to a small geographic area.

The present study was an attempt to study the possibilities of tuna longline fishing in the Agatti Island in Lakshadweep Sea. Shark bycatch is considered as a serious issue in the longline fishing operations (Morgan & Carlson, 2010). Shark bycatch and discard rate from the tuna longline fleets are reported to be very high (20-40%) in the world oceans (Huang & Liu, 2010; Kelleher, 2005). High shark catch up to 58% was reported in Indian waters, targeting tuna (John & Neelakandan, 2004). In the present study, overall hooking rate of sharks was significantly high. Among the 6 shark species caught, 3 species of sharks belonged to the 'near threatened', 2 species to 'vulnerable' and 1 species to 'endangered category' under the IUCN Red List (IUCN, 2012). Shark catches were found to be maximum at shallow hooks, first branchlines on either side of the longline catenary.

The present study showed poor tuna catch and is comparable with the earlier reports by Somvanshi & Varghese (2007) and Zhu et al. (2011). Recent reports reveal that there is a drastic decline in the catch of major oceanic tunas from Indian Ocean and other world oceans (IOTC 2010; 2011).

Results of this study suggest that tuna longlining cannot be considered as an alternative fishing method for catching yellowfin tuna in the present depth range in Lakshadweep waters due to high shark catches. In addition, caution is to be exercised, as the dominant shark species landed *C. falciformis*, is included in the 'near threatened' category as per the IUCN Red List. The study also indicates that tuna long lining is not suitable for operations in the shallow depths in and around Lakshadweep Islands. There is a possibility for diversification of fishing activities to farther and deeper waters around Lakshadweep Islands to harvest yellowfin tunas as there is good potential of yellow fin tuna in the Islands.

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