Species composition of elasmobranchs in the surface and subsurface gillnet operation in the Northern Arabian Sea

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Abstract

Sharks form important part of bycatch of the tuna gillnet operations in Pakistan. WWF-Pakistan introduced subsurface gillnetting in 2014 in which gillnet are placed 1.4 to 2 m below the sea surface. Fishing fleet engaged in tuna gillnetting adopted subsurface gillnetting and by January 2016 entire tuna fleet was converted in subsurface gillnetting. Catch of endangered, threatened and protected (ETP) species such as dolphins and sea turtles were observed to be much lower in subsurface gillnet as compared to surface operations. Sharks are among the other ETP species whose catches were dropped in subsurface gillnet as compared to surface operations. . It was observed that overall shark catches were 15.06 % lower in the subsurface gillnet operation as compared to surface placement of gillnets. A marked seasonality was observed in case of dominating species including mako and silky shark. Catches of mako sharks was observed to be about 8.65 % higher in subsurface gillnets as compared to surface gillnets.

Introduction

Sharks are considered as an important bycatch group of tuna gillnet fishing in Pakistan and other part of the Arabian Sea (Koya, 2018; Shahifar, 2018, Khan, 2013; Moazzam, 2013; Shahid *et al.*, 2015, 2016). In Pakistan, gillnets consisting of monofilament and multifilament are used for catching tuna and tuna like species. Monofilament net is mainly used for catching neritic tuna in coastal waters whereas multifilament nylon nets are used for catching longtail tuna (*Thunnus tonggol*), yellowfin tuna (*Thunnus albacares*) and skipjack tuna (*Katsuwonus pelamis*) in the offshore waters. There are about 700 tuna gillnetters based mainly in Karachi along Sindh Coast and Gwadar along Balochistan Coast.

A number of shark species were observed to be entangled in the tuna gillnets which is dominated by silky shark, mako shark, thresher sharks, hammerhead sharks and oceanic white tip sharks (Khan *et al.*, 2013, Moazzam, 2012; Shahid, 2012; Shahid *et al*., 2015, 2016). Pakistani tuna fleet used to use pelagic gillnet which is deployed on the sea surface and known to be marred with high catches of endangered, threatened and protected (ETP) species including cetaceans, sea turtles and sharks. WWF-Pakistan introduced subsurface gillnetting in 2014 and by 2016 entire gillnet fleet is converted to

this mode of fishing which resulted in major decrease in catches of ETP species. Present paper deals with the species composition of sharks in surface and subsurface gillnet operations.

Materials and Methods

The information reported by observers under WWF-Pakistan crew based programme (Moazzam, 2019) was analyzed. The data of average shark catches for 2013 was compared with data for the year 2018. Data for 2014 was not used in the study because conversion of fishing fleet to subsurface gillnet was started in December 2014, therefore data for 2014 was not appropriate for analysis. The data for 2018 was used in the analysis presented in this study because by 2018 the fleet is fully adjusted to subsurface gillnetting. In 2013, crew based observers were placed on only 4 tuna gillnet vessels, therefore, average data of the four vessels was used is in this study. Although observers were posted on 85 tuna gillnet vessels during 2018, but average of only 30 vessels were analyzed for present study.

Results and Discussions

Information about tuna gillnet fisheries of Pakistan is known through the work of Khan (2016), Moazzam (2011, 2012a-c, 2014, 2017, 2018a-b), Moazzam and Ayub (2015, 2017), Moazzam *et al.*, (2016, 2017) and Nawaz and Moazzam (2014). These studies were based mainly on the fisheries statistical data being published by Marine Fisheries Department, Government of Pakistan and also on information collected through the Crew-based Observer Programme initiated by WWF-Pakistan in 2012.

The surface tuna gillnets were observed to entangle a large number of ETP species including sea turtles, dolphins, mobulids, sea snakes, whale sharks, sunfishes and requiem sharks. While exploring various options that may help in reducing bycatch of ETP species, it was decided to conduct experiment on using subsurface gillnetting which is locally known as “”Teelo”. Results of subsurface fishing prompted tuna gillnet fishermen to switch over to subsurface fishing to catch more longtail, yellowfin and skipjack. By January 2016 entire tuna gillnet fleet of Pakistan shifted to subsurface gillnetting.

The study revealed that sharks are commonly caught by tuna gillnet vessels as bycatch (Moazzam, 2012; Shahid, 2012; Shahid *et al*., 2015, 2016). The dominating among shark species caught by tuna gillnetters are silky shark, mako shark, threshar shark, hammerhead shark and oceanic whitetip shark. A number of requiem and other sharks are also caught in the gillnet species but these are of rare occurrence.

Shark Catches

With the introduction of subsurface gillnetting, it was noticed that the catches of all major group of ETP species including cetaceans, sea turtles and sharks are noticeably reduced. Shahid et al., (2018) reported major reduction in catches of pelagic shark, however, no details of involved species was provided. Present study revealed that on average there was 15.06 % decrease in the catches of sharks in subsurface gillnet as compared to catches of surface gillnets. Month-wise changes in the catches of sharks is given in Fig. 1 which reveals that the catches of shark were higher in surface gillnets during January, March, April, September, November and December whereas the catches of sharks were higher in subsurface gillnets during three month (February, May and October). Tuna gillnet operations are stopped during June to August, due to voluntary close season, therefore, no data for these three months is available.

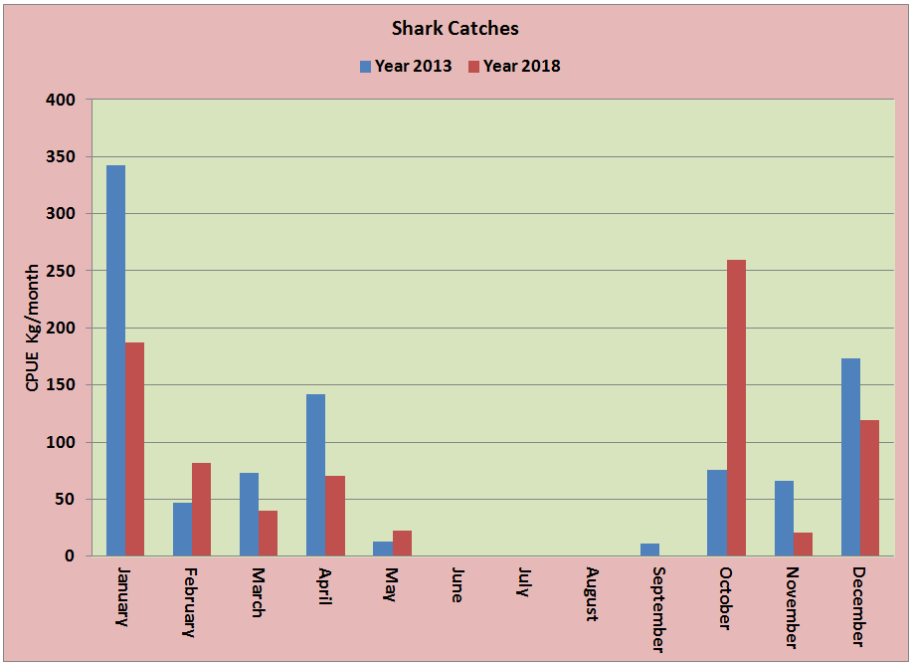

Fig. 1. Average Shark catches in year 2013 (surface gill) and year 2018 (subsurface gillnet)

Species Composition

Silky shark (*Carcharhinus falciformis*) was observed to be most dominating shark species in the bycatch of tuna gillnet operations. Overall the catches of silky sharks were about 28.44 % higher in surface gear as compared to subsurface gillnetting. Present study revealed that in the months of January, February, March, November and December the catches of silky sharks are higher in surface gillnetting whereas in the months of April and October the catches of silky shark were higher in subsurface gear

(Fig. 2). No silky shark was observed in catches of surface or subsurface gear gillnet in September.

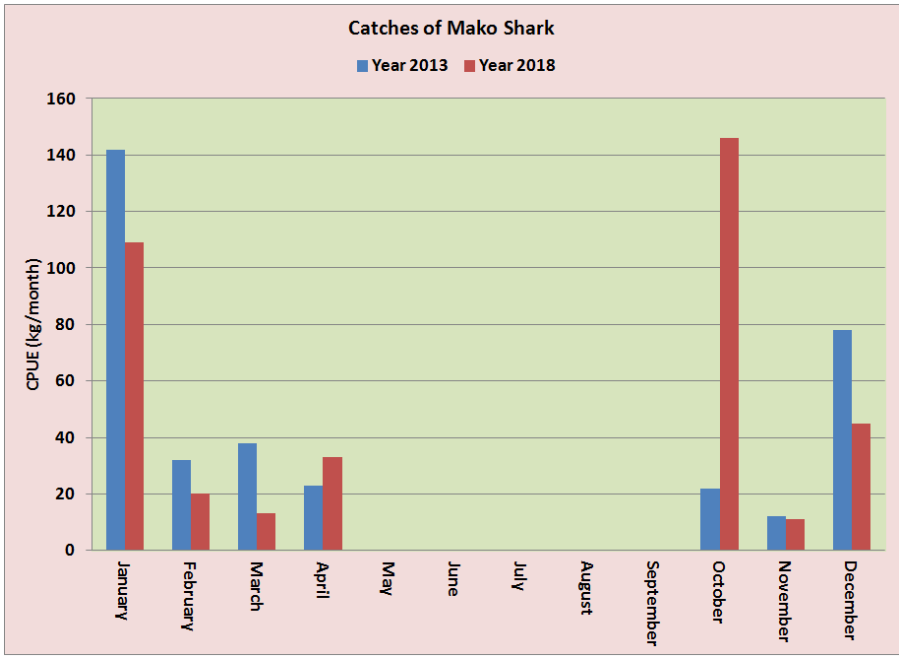

Fig. 2. Average Mako Shark catches in year 2013 (surface gill) and year 2018 (subsurface gillnet)

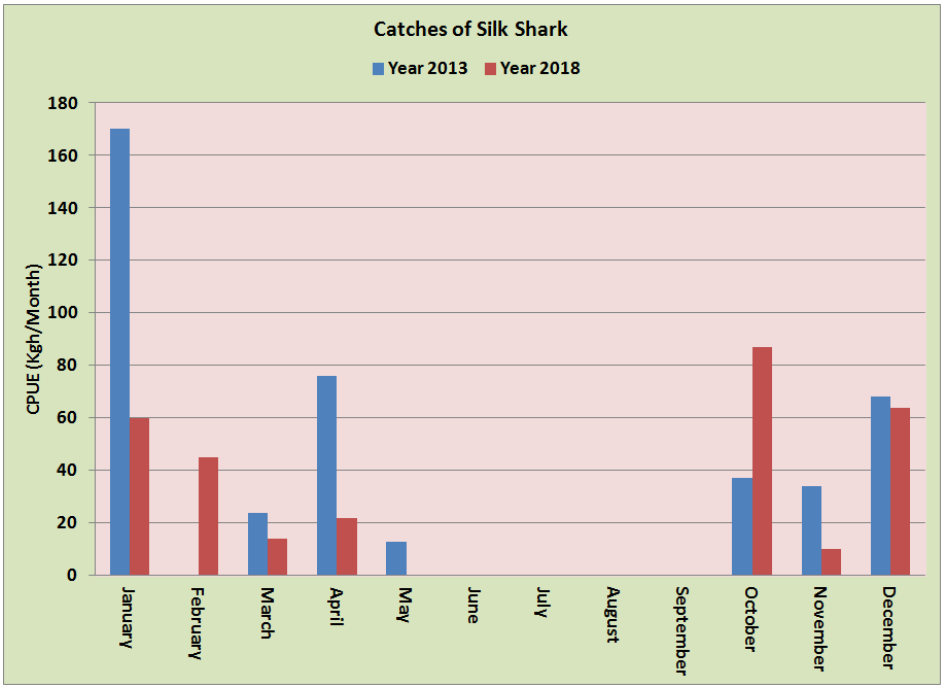

Fig. 3. Average Silky Shark catches in year 2013 (surface gill) and year 2018 (subsurface gillnet)

Mako shark (*Isurus oxyrinchus*) is the second most dominating sharks in the catches of tuna gillnet operations. Overall the catches of mako sharks were about 8.65 % higher in subsurface gear as compared to surface gillnetting. Present study revealed that in the months of January, March. April, May, November and December the catches of mako sharks are higher in surface gillnetting whereas in the month of October the catches of mako shark were higher in subsurface gear (Fig. 2). No mako shark was observed in catches of surface gillnet in February. This is the only species whose catches were higher in subsurface gear as compared to surface operation.

A number of other shark species were also found as bycatch of tuna gillnet operations in coastal and offshore waters of Pakistan. These includes pelagic thresher (*Alopias pelagicus*), bigeye thresher (*Alopias superciliosus*), oceanic whitetip shark (*Carcharhinus longimanus*), scalloped hammerhead (*Sphyrna lewini*), great hammerhead (*Sphyrna mokarran*), tiger shark (*Galeocerdo cuvier*), whitetip reef shark (*Triaenodon obesus*), blacktip reef shark (*Carcharhinus melanopterus*), graceful shark (*Carcharhinus amblyrhynchoides*), pigeye shark (*Carcharhinus amboinensis*), bull shark (*Carcharhinus leucas*), spottail shark (*Carcharhinus sorrah*), and longfin mako(*Isurus paucus*). Among these shark species, pelagic thresher was observed to be most dominating followed by scalloped hammerhead, great hammerhead, tiger shark, whitetip reef shark and oceanic whitetip shark. Other species are rarely encountered

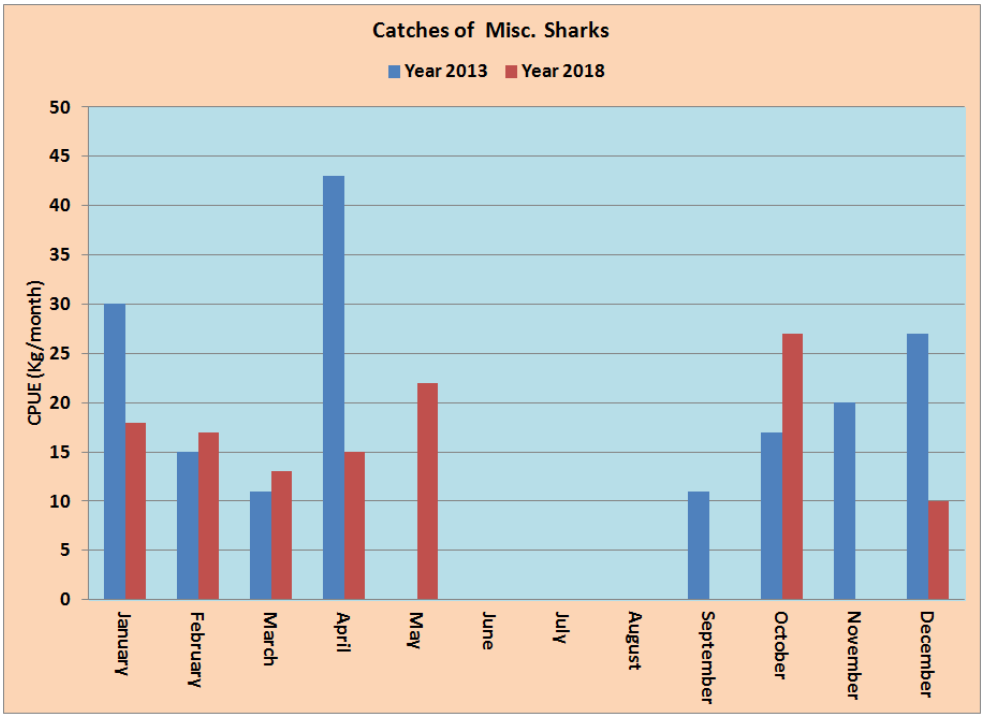

Fig. 4. Average Miscellaneous Shark Species catches in year 2013 (surface gill) and year 2018 (subsurface gillnet)

Because of the limited number of each species encountered in the catches, therefore, their catches data is pooled (Fig. 3). Overall the catches of miscellaneous sharks were about 29.89 % higher in surface gear as compared to subsurface gillnetting. The data, further indicates that in the surface gillnet, shark species are dominating in the month of January, April and December whereas in subsurface gear miscellaneous sharks were dominating in February, March and April. None of species pooled under miscellaneous shark were found in the month of May in surface gear and in September and November in subsurface gear. Some of the species dominating in the bycatch of tuna gillnet operation are illustrated in Fig. 5-10.

Fig. 5. Silky sharks (*Carcharhinus falciformis*)

Fig. 6. Mako shark (*Isurus oxyrinchus*)

Fig. 7. Scalloped hammerhead (*Sphyrna lewini*)

Fig.8. A giant tiger shark (*Galeocerdo cuvier*)

Fig. 9. Pelagic thresher (*Alopias pelagicus*)

Fig. 10. Oceanic whitetip shark (*Carcharhinus longimanus*),

Conclusions

Adoption of subsurface gillnet operation by Pakistani fishermen since 2014 has shown promising results as catches of ETP species such as dolphins and sea turtles were observed to be much lower in subsurface gillnet than in surface operations. Sharks are among the ETP species whose catches were dropped in subsurface gillnet. It was observed that overall shark catches were 15.06 % lower in the subsurface gillnet operation as compared to surface placement of gillnets. A marked seasonality was observed in case of dominating species including mako and silky shark. Catches of mako sharks was observed to be about 8.65 % higher in subsurface gillnets as compared to surface gillnets. This is the only species whose catches were observed to be higher whereas catch of silky and miscellaneous shark were observed to be 28.44 % and 29.89 % lower in subsurface gears respectively. A detailed analysis of the catches of shark species is underway with the aim to study the impact of subsurface gillnet operations on individual shark species on seasonal basis and depending on areas of operation.

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