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By-catch of tuna gillnet fisheries of Pakistan: A serious threat to non-target, endangered and threatened species

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Original Article

Abstract

Tuna gillnet fishery of Pakistan employs more than 500 fishing boats that operate in offshore waters. In addition to tuna, gillnet also catches large quantities of by-catch fish species including billfishes, pelagic sharks, dolphin fishes as well as marine turtles and cetaceans, which are protected species. High by-catch of these non-target animals affects their population in the area. The paper provides information on by-catch and suggests measures that can be adopted as alternate fishing methods to minimize mortality of endangered and threatened cetaceans and turtles.

Keywords: *Tuna gillnet by-catch, enmeshment, mortality, cetaceans, sharks, turtles, whale shark.*

Introduction

Gillnet is the main fishing gear used for catching tuna and other large pelagic fishes in many countries of the world including Pakistan (IOTC, 2013). This net is considered to be an indiscriminate fishing gear which enmeshes not only target species (tuna) but also a large number of non-target animals (Tregenza *et al*., 1997; Tregenza and Collett, 1998; Lewison *et al*., 2004; Gillet, 2011). The non-target species (by-catch) includes some species which are considered protected or threatened such as cetaceans and turtles, and therefore, there is a general concern among conservationists about use of these indiscriminate nets (Lewison *et al*., 2004).

Tuna fishing in Pakistan is based on large gillnets used onboard about 500 vessels which are dedicatedly engaged in catching large pelagic fishes (Moazzam, 2012). Information on species composition and mortality of these important fishes is not documented. In this paper an attempt is made to present data on by-catch of tuna gillnetting operations and to suggest measures that can be adopted as alternate fishing methods to minimize mortality of endangered and threatened species.

Material and methods

For making a review of the fishing practices, landings and disposal of the catch, information was obtained from published literature, statistical data and government archives. In addition, monitoring of by-catch through landings data at the major fish landing centers in Karachi as well as by posting a few observers onboard tuna gillnetters was initiated in 2012. The paper presents quantitative data on tuna landings, by-catch composition including frequency and seasonality, areas of fishing and some biological information on by-

catch species. Data were collected from the landing centres intermittently since September 2011 and through observer programme from October, 2012 to September, 2013. No tuna gillnet operation was carried out during July and August, 2013.

Results

Historically, tuna gillnetting represents an important fishery in Pakistan. Fishing vessels from Pakistan operated not only in the coastal and offshore waters of Pakistan but also in the high seas including the waters of Somalia which is considered to be a rich fishing ground for tuna and tuna-like species. Tuna and other by-catch fish species are not consumed in Pakistan but the catches are exported in salted and dried form to Sri Lanka for centuries. However, in the last 10 years, it has been transported to neighboring countries in chilled form and only small quantities are exported in salted and dried form to Sri Lanka.

Fishing boats

The Pakistani tuna fleet consists entirely of locally made wooden boats. A study (Moazzam, 2012) carried out in two maritime provinces i.e. Sindh and Balochistan revealed that most of the boats operating from Karachi (Sindh) range from 15 to 25 m LOA (Fig. 1) whereas, those operating from Balochistan range from 10 to 15 m (Fig. 2). There are about 65 large boats (ranging from 20 to 30 m LOA) engaged in fishing trips of more than two months in comparatively deeper waters and have onboard freezing facilities.

Tuna fishing vessels are equipped with a hydraulic net hauling device as well as navigation equipments such as GPS and fish finders. Fish is stored in 6-8 insulated compartments each having a capacity of about 1 to 1.5 tonnes (t). In most tuna fishing vessels, the catch is stored with crushed block ice. The smaller tuna fishing vessels do not carry any communication equipment; however, a few larger vessels may have VHF and shortwave radios.

Fig. 2. Smaller tuna fishing boat (12.5 m) at Jiwani, Balochistan.

Fishing gears

Surface gillnetting using polyamide nets (Fig. 3) is used for catching tunas in Pakistan. It has stretched mesh size ranging between 13 cm and 17 cm (average: 15 cm) with a hanging ratio of 0.5 (Fig. 3 inset). The length of gillnet varies between 4.83 km and 11.27 km. The breadth of the net was reported to be 14 m. There are a few larger fishing boats operated from Karachi and Gwadar, which may have a gillnet of about 20 km length. There are variations in the length and specification between the nets. When targeting small tuna in neritic waters, nets with smaller mesh size are used. In almost all cases, tuna gillnets are set in the evening and hauled in the early morning.

Fig. 1. Larger tuna fishing boat (23 m) at high seas.

Fig. 3. Polyamide gillnet stored on board tuna fishing vessel at Karachi. Inset: stretched mesh.

Fishing grounds

Fishing boats engaged in tuna fisheries are mainly based in Karachi and Gwadar. A few tuna fishing boats are based in other coastal towns of Pasni, Sur and Pushukan (Balochistan). There used to be a substantially large tuna fleet which operated from Ormara and Jiwani in Balochistan but because of the diversion to Indian mackerel fishing, tuna gillnet operation from these towns has practically stopped.

The fishing boats from towns and cities along Balochistan operate within a radius of 40 to 50 km. However, boats based in Karachi have wider area of operation; some of them operate as far as 400 miles from the base station. Larger fishing boats also operate in high seas i.e. beyond the Exclusive Economic Zone of Pakistan. Previously about 150 to 200 large boats based mainly in Karachi, Gwadar and Jiwani used to catch tuna from areas beyond Pakistan territory mainly in Somali waters. Because of piracy issues, only a few tuna boats from Pakistan now operate in Somali waters.

Tuna landings and catch composition

Tuna is an important fishery in Pakistan contributing about 40,000 t annually (Fig. 4). Tuna landings in 2000 was recorded as 22,000 t which steadily increased to 40,900 t in 2010. A slight decrease was noticed in 2011 when it reached 39,300 t. Eight species of tuna are known from Pakistan, of which only five species i.e. yellowfin (*Thunnus albacares*), longtail (*Thunnus tonggol*), skipjack (*Katsuwonus pelamis*), kawakawa (*Euthynnus affinis*) and frigate (*Auxis thazard*) are caught in commercial quantities. Bigeye tuna (*Thunnus obesus*) is of rare occurrence in Pakistan and known from only a few specimens. Bullet tuna (*Auxis rochei*) and striped bonitos (*Sarda orientalis*) are also not common in Pakistan.

Analysis of landings data from Karachi Fish Harbour for four years i.e. from 2008 to 2011 indicated that catch composition of fishing boats operating in the neritic waters differs substantially from those operating in offshore waters of Pakistan. Those operating in neritic waters predominantly caught long tail tuna (59%) and kawakawa (29%), with frigate (8%), yellowfin (2%) and skipjack tunas (2%) caught in smaller quantities (Fig. 5). In offshore operations, the skipjack tuna contributed 83%, followed by yellowfin tuna (12%). Contribution of all other species was about 5% (Fig. 6). Seasonal variation in overall species composition was noticed both in neritic and offshore waters.

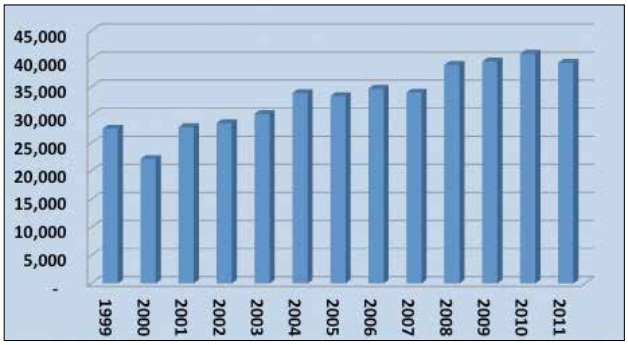

Fig. 4. Tuna landings (in tons) in Pakistan.

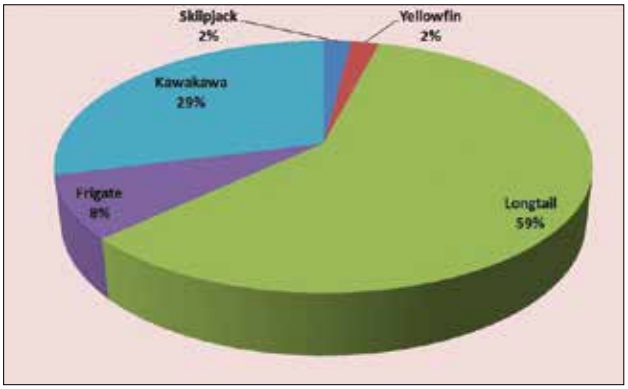

Fig. 5. Species composition in coastal tuna fisheries.

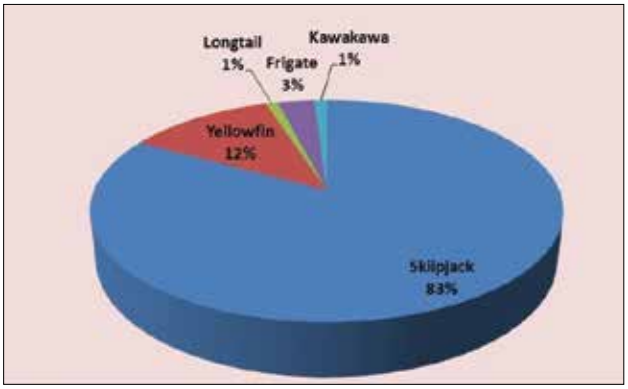

Fig. 6. Species composition in offshore tuna fisheries.

By-catch composition of gillnetters

Finfish

In addition to tuna, a number of other fish species of commercial importance were caught by vessels operating in both neritic and offshore waters. In the neritic waters, the by-catch consisted predominantly of talang queenfish (*Scomberoides commersonnianus*) followed by kingfish (*Scomberomorus commerson*), barracuda (*Sphyraena* spp.), dolphin fish (*Coryphaena hippurus*), Indo-Pacific sailfish (*Istiophorus platypterus*), thresher shark (*Alopias superciliosus*), silky shark (*Carcharhinus falciformis*), other requiem sharks and mantas. By-catch of tuna gillnetting in offshore deep waters consisted mainly of Indo-Pacific sailfish, marlin (*Makaria*

indica), striped marlin (*Tetrapturus audax*), dolphin fish, thresher sharks and mako sharks (*Isurus oxyrinchus*). The data on by-catch of gillnet fishing was not recorded separately and therefore, it was not possible todetermine any historical trend in the catches.

Recent studies on the catches by four observers posted on tuna gillnetters showed that tuna species contributed about 67% to the total catch followed by other teleosts (23 %) and sharks and rays (9%) (Fig. 7). Turtles contributed about 0.6% and cetaceans about 0.4% to the total catch. The study further revealed that among teleosts, talang queenfish is the most dominant species in the by-catch (Fig. 8) whereas kingfish and dolphin fish each contributed 12%. Indo-Pacific sailfish contributed about 8% whereas other species contributed about 4%. It may, however, be pointed out that there was a marked seasonality in the composition of by-catch and data for an average annual catch is presented here.

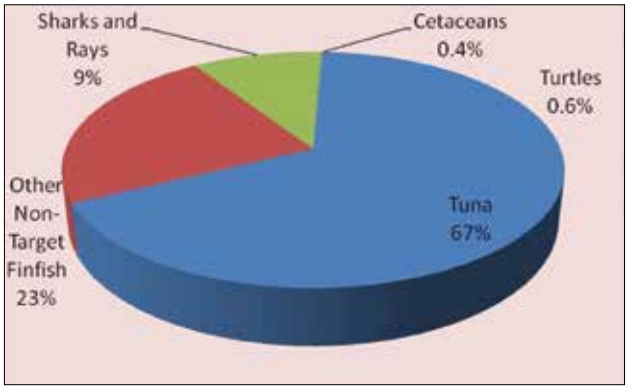

Fig. 7. Tuna and by-catch composition of tuna gillnet operation.

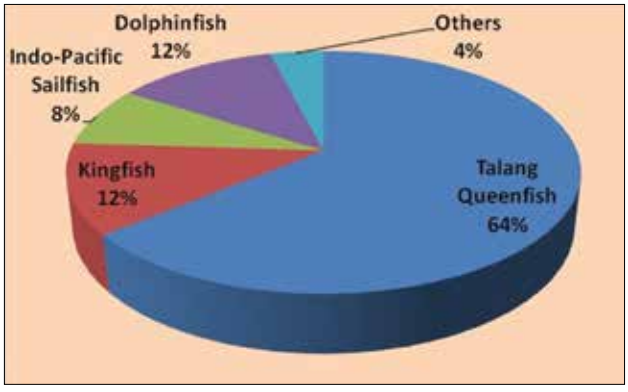

Fig. 8. Finfish (excluding sharks) by-catch of tuna gillnet operation.

During the study, 25 species of sharks were observed. Bigeye thresher (*Alopias superciliosus*), shortfin mako (*Isurus oxyrinchus*), silky shark (*Carcharhinus falciformis*), oceanic whitetip shark (*Carcharhinus longimanus*), scalloped hammerhead (*Sphyrna lewini*) and great hammerhead (*Sphyrna mokarran*) were dominant in the catch. The most dominant species of shark was shortfin mako followed by bigeye thresher (Fig. 9) and silky shark whereas other species were comparatively rare in occurrence.

Fig. 9. Bigeye thresher shark (*Alopias superciliosus*) entrapped in tuna gillnet.

Whale shark (*Rhincodon typus*) was frequently observed in the coastal and offshore waters of Pakistan. It was previously reported that about 2 to 5 whale sharks got entangled in tuna gillnet every year (Moazzam, 2012). However, the data collected by the observers indicated that frequency of their enmeshment in the tuna gillnet was at least 4 times higher than previously reported. During a period of about 1 year, five whale sharks were enmeshed in four vessels, of which one died whereas other four were successfully released by the fishermen.

The study revealed that 10 species of rays were frequently found as by-catch. Pelagic stingray (*Pteroplatytrygon violacea*), bluespotted stingray (*Dasyatis kuhlii*), longheaded eagle ray (*Aetobatus flagellum*), Chilean devil ray (*Mobula tarapacana*), spinetail mobula (*Mobula japonica*), pygmy devil ray (*Mobula eregoodootenkee*) and Javanese cownose ray (*Rhinoptera javanica*) were represented in the catches of tuna gillnet. Of

these, pelagic stingray, spinetail mobula and Chilean devil ray were noticed more frequently than other species.

Marine birds

No marine bird was found to be caught in gillnets during the study period. Enquiries showed that a single specimen of flesh-footed shearwater (*Puffinus carneipes*) got entangled in the gillnet during heaving process which was captured live and released by fishermen.

Turtles

Five species of marine turtles i.e. green turtle (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) are reported from Pakistan. During the study, only three species were observed to have enmeshed i.e. olive ridley (Fig. 10), green turtle and hawksbill. On an average, in each fishing trip 1-2 green turtles and 3 to 8 olive ridley turtles were entangled in tuna gillnets. Only about 3 to 5 % mortality of turtles was recorded. Most turtles were observed to be alive in the gillnets and in most cases fishermen released the enmeshed turtles. It is most interesting

Fig. 10. Olive ridley turtle (*Lepidochelys olivacea*) entrapped in tuna gillnet.

that no nesting of olive ridley turtle was observed in Pakistan during the last ten years but there is a large population of this species in the offshore waters. Hawksbill turtle was observed at least on three occasions during the study whereas one report of leatherback turtle was also recorded. Loggerhead turtle has not been found in the by-catch so far.

Dolphins

Dolphins seem to be frequently entangled in tuna gillnets (Fig. 11). Spinner dolphin (*Stenella longirostris*), pantropical

Fig. 11. Striped dolphin (*Stenella coeruleoalba*) entrapped in tuna gillnet.

spotted dolphin (*Stenella attenuata*), striped dolphin (*Stenella coeruleoalba*) and bottlenose dolphins (*Tursiops truncates* and *T. aduncus*) were observed to get entangled in tuna gillnets. Although it is not possible to accurately estimate the number of dolphins killed every year in tuna gillnet operation, Moazzam (2012) estimated that 25- 35 dolphins are killed every month in gillnet operation. The present study reveals that on an average each tuna gillnet entraps about 60 dolphins annually and with a tuna fleet of about 500, the mortality of dolphins could reach about 30,000 annually. This, however, needs further studies to verify. Almost all dolphins enmeshed in the tuna gillnet operation die and are discarded.

Whales

Baleen whales including blue whale (*Balaenoptera musculus*), sei whales (*Balaenoptera edeni*) and Arabian humpback (*Megaptera novaeangliae*) were reported to get entangled in tuna gillnets but such events are very rare. According to recent information, 1 to 2 whales are entangled every year and in

Fig. 12. Bryde'swhales *(Balaenoptera brydei)* entrapped in tuna gillnet and beached in Gwader (Photo Courtesy Abdul Rahim).

most cases fishermen try to release the entangled whales, but, the entangled whales die in some instances. In a survey of dead whales beached along the coast of Pakistan since 2008, three whales were observed to have nets entangled. Two of these were humpback whale and the third was a Bryde's whale (Fig. 12). Toothed whales do occur in Pakistan but only one such whale i.e. dwarf sperm whale (*Kogia sima*) was entangled in gillnet and died.

Discussion

Tuna gillnetting is an important fishery for Pakistan which annually contributes about 40,000 t of tuna in addition to large quantities of other teleosts and sharks as by-catch. In addition to commercially important species, gillnet operations in coastal and offshore waters catch large number of non-target species such as turtles and cetaceans. This is considered as a serious threat to these non-target species and some protection measures need to be taken up. In order to control the mortality of non-target species, it is suggested to divert the gillnet fleet to other modes of fishing such as long lining which is known for causing comparatively lower mortality to non-target species. Indian Ocean Tuna Commission and United Nations General Assembly resolutions warrant length of gillnet to be limited to 2.5 km. Reduction of the length of gillnets being used in Pakistan (presently >10 km) can also help in reducing the entrapment and mortality of non-target species. Use of techniques such as pingers and lights attached to the gillnets, which are known to deter or reduce entrapment of vulnerable species may also be attempted.

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