Socio-economic aspects of offshore tuna fishery of Pakistan with special reference to its role in the livelihood conditions of hinterland communities

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Abstract

Tuna fishing is one of the oldest economic activities along Pakistan's coast. There is a fleet of about 700 tuna gillnet vessels that operate in Pakistan. These fishing vessels used to be manned by fishermen from the coastal villages of Pakistan; however, since the 1980's fishermen from the hinterland province of Khyber Pakhtunkhwa have replaced most of the crew from the coastal area. Tuna gillnet boats are comparatively more expensive than other types of fishing vessels being used in Pakistan, whereas their operational expenses are comparable to a shrimp/fish trawler. Based on this distribution, the annual income of the fishermen ranges between Rs 300,000 and Rs 600,000 depending on the catch. The annual income of Captain ranges between Rs 2,000,000 to Rs 5,000,000. Some of the fishermen also work on tuna gillnet vessels in the neighbouring country and they earn about 25 to 50 % more than fishermen operating in Pakistan. For most of the period, fishermen remain in the offshore waters, therefore, they do not incur any expenditure. As compared to other trades, the income of tuna gillnet fishermen is almost double. In terms of their living condition, the fishermen working on tuna gillnet vessels are comparatively rich as compared to labourers. Since about 5 % of the population of Malakand District and 2 % of Lower Dir District of the province of Khyber Pakhtunkhwa are working on tuna gillnet vessels, and their earnings are comparatively much higher than any other trade, which is reflected in a better livelihood condition of these fishermen.

Introduction

Tuna fishing is one of the oldest economic activities along Pakistan's coast. Historically, there were large fisheries for at least 200 years, producing salted and dried products that were exported mainly to Sri Lanka. Among the dry seafood, the tuna species was used to fetch the highest prices, therefore, fishermen prefer to engage in catching various tuna species along the coast of Pakistan. The main centres for tuna fisheries along the Pakistan coast were Karachi, Gaddani, Ormara, Pasni, Sur, Gwader, Phushukan, Ganz, and Jiwani. All these population centres are located along the open coastline, therefore, have easy access to offshore waters. For a long the surface gillnet used the only gear used for catching tuna. Fishermen used to carry salt which was used for preservation on board fishing vessels. There used to be many curing yards at each of these landing centres which wet-salted fish from the fishing boats are further processed before export to Sri Lanka.

The processing trend started to change since 1990 when tuna was started barter traded with fuel with neighbouring country both at high seas and along the border. Construction of the coastal road along the Balochistan coast (Makran Coastal Highway) has opened a new avenue, and fish from even the distant places like Karachi could be easily transported to neighbouring country within a few hours. This brought changes in fish handling on board fishing vessels and now all the catch is landed in chilled form. There are some large tuna gillnetters registered in Pakistan that have on-board freezing facilities. Such vessels undertake long fishing trips (more than two months) and land their catch in the neighbouring country in frozen form.

Information about tuna gillnet fisheries of Pakistan is known through the work of Ahmed (1989), Imad (1988), Kazmi *et al.*, (2019), Khan (2016), Moazzam (2011, 2012a-c, 2014, 2018a-b, 2020a-b, 2021a-b, 2022a-b), Moazzam and Ayub (2015, 2017), Moazzam *et al.*, (2016, 2017, 2019a-b, 2020), Nawaz and Moazzam (2014) and Shahid *et al*. (2018). These studies were based mainly on the fisheries statistical data that was published by the Marine Fisheries Department, Government of Pakistan. A Crew-based Observer Programme initiated by WWF-Pakistan since 2012 which was completed in September 2019 but a number of these observers are still providing information which is also incorporated in the studies during 2020 and 2025. However, none of these studies provide any information about the socio-economic conditions of fishermen involved in this fishery.

Fishing Boats

Pakistani tuna fleet consists entirely of about 700 locally made wooden boats (Fig. 1). A census of the fishing boats carried out in December 2011 reveals that most of the boats involved in tuna fishing range between 15 to 25 m (Fig. 2). Almost all tuna fishing boats operating from Karachi have a transom at the stern whereas those which are mainly engaged in catching neritic tuna are mostly double keeled. Tuna boats usually have an inboard engine with 50 hp to 500 hp. Almost all of these boats have a hydraulically operated net hauler, whereas on some smaller boats, nets are hauled manually. Previously, no navigational and communication gadgets were used on these boats, but now most tuna boats carry fish finders, GPS, GPS plotters, and satellite phones. Some boats also have VHF and short-wave radios for communication purposes.

Fig. 1. A typical tuna gillnet vessel of Pakistan

Most of the tuna boats targeting neritic or tropical tunas have a fish hold consisting of 8 compartments, each having a capacity to hold about 1.0 to 1. 5 tons of fish. Ice is carried on fishing trips, and the prime catch is placed with ice. Because of smaller size, some fishing boats that are engaged in catching neritic tuna have fewer fish holds or carry insulated plastic containers (IPC).

(a) (b)

Fig. 2. (a) A large tuna gillnet vessel with on-board freezing; (b) Smaller tuna gillnet vessel

Fishing Gears

Gillnetting made of polyamide are primarily used for catching tuna in Pakistan. The net has stretched mesh size ranging between 13 cm to 17 cm (average 15 cm) with a hanging ratio of 0.5. The length of a typical gillnet may varies between 5 and 10 km. A survey of fishing gear carried out by WWF-Pakistan revealed that nets used in neritic waters had a length ranging between 2.4 and 8.0 km (average 4 km) whereas in those boats operating in the offshore waters had gillnets with lengths ranging from 5.5 to 10.0 km (average 7 km). Both stone and lead weights are used as sinkers, whereas various types of floats are used in the head rope.

Studies carried out by WWF-Pakistan during 2012 and 2017 revealed that tuna gillnetting in Pakistan is marred with high bycatch of non-target species, including cetaceans, turtles, whale sharks, mobulids, sunfish and sea snakes etc. (Moazzam and Nawaz, 2014; Nawaz and Moazzam, 2014). Considering the serious impact of the high bycatch on the marine environment, especially on the marine biodiversity of Pakistan, WWF-Pakistan developed and introduced modifications in the operational arrangement of the gillnets. Minor modifications were made in the net design, which included placement of the net 2 m below the surface which resulted in almost total elimination of the cetacean bycatch and major reduction in entanglement of turtles and other megafauna. Since 2015-16, all tuna gillnets that are operated in offshore waters of Pakistan have adopted this mode of operation, and now, subsurface gillnetting is being used in tuna gillnet fishing in Pakistan.

Fishing Grounds

Fishing boats engaged in tuna fisheries are mainly based in Karachi and Gwadar. Fewer tuna fishing boats are based in Pushukan. There used to be a large tuna fleet which used to be based in Pasni, Ormara and Jiwani, but because of the diversion of this fishing fleet to other fisheries operations, including gillnetting for Indian mackerel in nearshore waters, tuna gillnet operation in these towns has practically stopped. Although about 70 % of the tuna boats used to be operated from Karachi, about 30 % of the fleet was based in Gwadar between 2010 and 2020; however, since 2021, almost the entire tuna fleet has shifted its operation to Gwadar mainly because of higher prevailing prices and availability of cheaper fuel. A major part of the tuna

fleet shifts to Karachi before the onset of the close season (June and July) to Karachi mainly for undertaking annual repair and maintenance.

(a) (b)

Fig. 3. (a) A gillnet being heaved; (b) heaving process of gillnet.

The fishing boats engaged in tuna fishing operates within a radius of 200 to 300 km from their base stations, however, boats based in Karachi and Gwadar have wider areas of operation; as far as 500 km from the base station. The information gathered during a study during 2012 and 2017, revealed that there are 10 major fishing grounds along the Pakistan coast. Of these, off Ghorabari seems to be most preferred location for boats based in Karachi, whereas off Churna Island, off Gaddani, and Malan are also important fishing grounds. Larger tuna vessels operate in offshore waters of the Area beyond National Jurisdiction (ABNJ) and waters in Somalia and Yemen.

Fishing Operations

Major tuna fishing boats undertake voyage of about 25 to 45 days. In comparison those operating in waters offshore waters and having onboard freezing facilities undertake fishing voyage of about 60 to 90 days. Crew size varies from 12 to 20 depending on the size of the fishing vessel. In case of smaller fishing boats (‘horas’ and ‘rachins’) upto 10 fishermen are employed whereas in larger fishing boats, especially those operating in offshore waters, the crew size varies between 15 and 20. Prior to installation of hydraulic winches, the nets used to heaved manually due to which larger crew used to be engaged for such boats.

Fishing Seasons

Tuna is harvested throughout the year; however, because of rough seas during the southwest monsoon (June to September), tuna fishing activities decrease (Fig. 4-5). Almost the entire fleet engaged in tuna fishing observes a close season of two months (June and July) voluntarily. There is strong seasonality in catch quantity and catch composition.

The main fishing seasons of tuna and bycatch species are February to April and from September to November (Fig. 4-5); however, noticeable inter-annual variability was noticed during the last ten years.

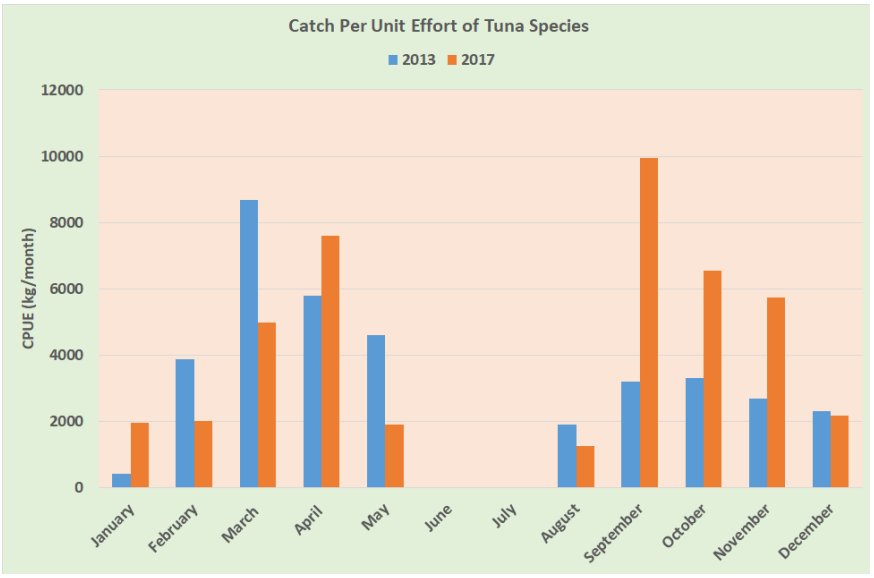

Fig. 4. CPUE of Tuna Species during 2013 and 2017

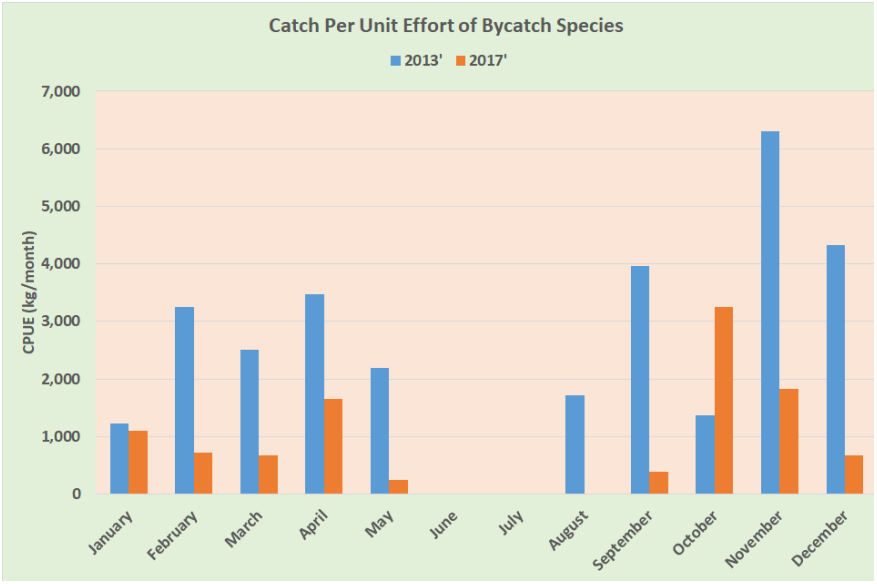

Fig. 5. CPUE of Bycatch Species during 2013 and 2017

Catch Composition

Out of eight species known from Pakistan, only five species, i.e. yellowfin, longtail, skipjack, kawakawa, and frigate tunas, are represented in the commercial catches of the tuna gillnetters. Stripped bonito, bigeye tuna, and bullet tuna are seldom represented in the catch. Analysis of data on landings (2012 and 2017) indicates that the catch composition of fishing boats targeting tuna along in coastal areas of Pakistan differs substantially from those operating in offshore waters of Pakistan.

In 2013 and before that, almost the entire tuna fleet used to be operating in coastal waters and in the nearshore environment on the continental shelf; therefore, the tuna used to contribute about 55 % and bycatch used to contribute about 45 % (Fig. 6). However, after the cessation of Somali Piracy, tuna vessels started their operation in comparatively deeper waters. In

addition, tuna gillnet vessels started using subsurface gillnetting (2 m below the sea surface), which made a major change in the catch composition. Tuna composition was noticed to be about 76 %, whereas bycatch contributed only about 24 % (Fig.6).

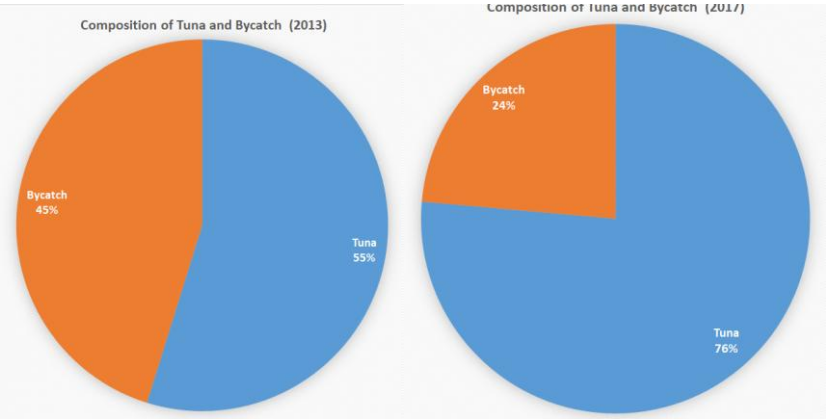

Fig. 6. Tuna and Bycatch during 2013 and 2017

Because of the restriction in the area of operation during the period of Somali Piracy, the catch composition during this period has a noticeable presence of coastal species. The data for 2013 (Fig. 7) indicates that Yellowfin tuna (Fig. 8) contributed 47.97 %, followed by longtail tuna (19.79 %), skipjack (2.16 %), kawakawa (23.97 %), frigate tuna (6.07 %), and bullet tuna (0.33%). It is evident that neritic tunas, including (longtail, kawakawa, frigate, and bullet tunas are dominating in the catch. In contrast, the catch composition during 2017 (Fig. 7) was observed to be dominated by tropical tuna, i.e., yellowfin tuna (63.88 %) and skipjack (10.59 %), followed by longtail (22.31 %), and kawakawa (3.22 %). The disparity in dominance of longtail and kawakawa is primarily on account of Somali Piracy. From 1995 and 2014, there was a major shift in tuna vessel operations, which used to confine to the coastal waters of Pakistan and avoid operation in offshore waters due to the impact of piracy. Due to cessation of this piracy, Pakistani vessels started venturing in offshore waters as well as in ABNJ and waters of Somalia and Yemen, resulting in a decrease of coastal tuna such as kawakawa and frigate tunas in the catches.

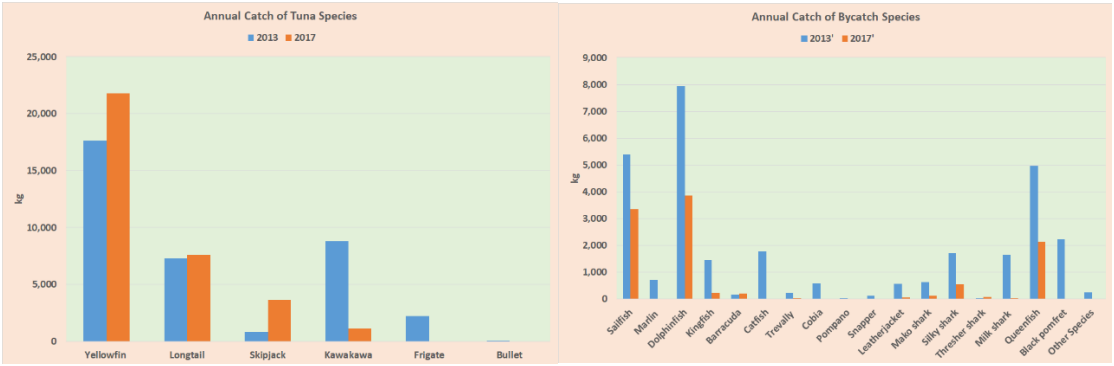

Fig. 7. Changes in tuna and bycatch species during 2013 and 2017

Fishermen

Pakistan has two Maritime Provinces i.e. Sindh and Balochistan whose population living in coastal areas are dependent on fishing and coastal and offshore waters. Tuna fishing operations are traditionally dominated by fishermen from Balochistan because the continental shelf is

narrow and access to fishing grounds is combatively easier than from the Sindh province. Fishermen from Balochistan used to fish in coastal and offshore waters as well as in the waters of Somalia, Yemen, and Oman since centauries; however, fishing in Omani waters discontinued by late 1970's because of improved MCS in Oman.

Fig. 8. Yellowfin is dominating among the tuna species.

Although fishermen from the Sindh used to be operating in offshore waters but there were major tuna fisheries for neritic tuna in the province of Sindh. It was in the 1970s, when labourers from Khyber Pakhtunkhwa (a hinterland Pakistani province near Afghanistan) started working in the fisheries sector, mainly on the harbour activities, including loading, offloading of the fishing vessels and marketing of seafood. These people from Khyber Pakhtunkhwa started working as "khalasi" (labourer) on tuna fishing boats in late 1970's and some of them with few year experience started as "Nakhuda" (Captain) of tuna boats. With the passage of time, now about 80 % of the fishing boats are being operated by the people from Khyber Pakhtunkhwa mainly working as Captain as well as labourers on the tuna boats. Most of tuna gillnet fishermen originates from Malakand District (about 80 %) or from Lowe Dir District (18 %) and remaining from other parts of the Khyber Pakhtunkhwa. The remaining about 13 % are manned by fishermen from Balochistan and 7 % from fishermen of Sindh. In addition, about 75 % of the tuna fishing boats from the neighbouring country are also manned by fishermen from Khyber Pakhtunkhwa.

Economics of Tuna Gillnetting

As compared to other fishing operations such as trawling, bottom-set longlining, and seining being practiced in Pakistan, tuna gillnetting is considered to more remunerative and benignant,

although the initial expenses and operational costs are comparatively much higher. Being a large boat (between 20 and 24m), the cost of construction of new one usually cost Rs 2 to 3 million (1 USD = 280 PKR). The new engine of 350 to 500 hp costs about Rs 40 to 50 million, therefore usually refurbished second-hand engines are installed which usually cost around 20 to 25 million (Table-I). In addition, fabrication of a complete net of polyamide having a length of 7 km usually cost Rs 20 to 25 million. Cost of net haulers and other gadgets amount to Rs 2 million. Therefore, the cost of a new boats with a refurbished engine is 49 to 60 million (Table-I). It may be pointed out that because of high cost of a new engine, almost all new boats have refurbished engines.

Table-I. Cost of construction of a new fishing boat (2025 prices)

Details	Amount	
	PKR	US$
Construction of a new fishing boat (20 to 24 m)	25-30 million	89,000-110,000
New engine (350 to 500 hp)	20-30 million	71,000-110,000
Refurbished engine	2 to 3 million	7,100-11,000
Cost of net (7 km)	20 to 25 million	71,000-89,000
Net haulers and other gadgets	2 million	7,100
Total cost of a new boat with refurbished engine	49 to 60 million	170,000-210,000

Operational Expenses

Depending on the duration of the fishing trip, power (hp) of the engine, and number of crew, the cost of a fishing trip of a tuna gillnet vessel of 20 to 24 m ranges between Rs 2.0 to Rs 3.2 million. Usually, a tuna gillnet undertakes a fishing trip of about 30 to 45 days (Table II). In case of a good catch, the captain may like to extend the fishing trip for either it make a short visit to Karachi or Gwadar and take additional supplies or procure fuel at high seas. The major cost of the operational expenses relates to fuel; therefore, almost the entire tuna fleet has shifted its operation base from Karachi to Gwadar, where cheaper fuel is available, which is mainly transported from neighbouring country through traditional marketing channels. The fuel cost is about 30 to 40 % cheaper in Gwadar as compared to Karachi. Tuna gillnet boats are comparatively more expensive than other types of fishing vessels being used in Pakistan, whereas their operational expenses are comparable to a shrimp/fish trawler.

Table-II. Operational Cost of a Fishing Trip (30 to 45 days) (2025 prices)

Details	Amount	
	PKR	US$
Fuels (Diesel)	1.0 -1.8 million	3,600-6,400
Ice	0.5-0.7 million	1,780-2,500
Water	0.2-0.3 million	715-1,070
Food and Supplies	0.3 to 0.4 million	1,070-1,426
Total Expenses	2.0 -3.2 million	7,165-11,396

Prevailing Prices of Tuna and Tuna-like species

Tuna, tuna-like species, and bycatch species caught during the fishing trips are landed either at Karachi or Gwadar, depending on the base station of the vessel. Almost the entire catch of tuna species, billfishes, and kingfish (narrow-barred Spanish mackerel) is being transported to neighbouring country, though land route or high-seas transshipment. Small tuna species, including kawakawa (small sizes), frigate and bullet tuna, striped bonitos, queenfishes, black pomfrets, dolphinfish, sharks, and other bycatch species are landed either in Gwadar or Karachi for local consumption and export. Table III presents prevailing prices in the local markets at Karachi and Gwadar. Most of the large pelagic species have higher prices in Gwadar as compared to Karachi, whereas prices of queenfishes, black pomfret, dolphinfish, and sharks are comparatively higher in Karachi.

Table –III. Prices Prevailing (2025) in the Karachi and Gwadar Fish Landing centres

Species	Prices/kg	
	Karachi	Gwadar
Yellowfin tuna	250	450
Longtail tuna	230	450
Skipjack	250	450
Sailfish	210	400
Marlin	210	400
Queenfish	550	400
Black pomfret	500	350
Dolphinfish	500	400
Sharks	600	350

Earning from Fishing Operations

Most fishing trips of the tuna gillnet operations last for 30 to 45 days, and usually about 8,000 kg to 20,000 kg of tuna and tuna-like fishes are caught on each fishing trip, usually generating about Rs 2.5 to 6.5 million, however, marked seasonality is observed in the quantity of fish caught. In case if the catch is less than 4,000 kg per trip, then it is considered a failed trip. Usually, 5 to 8 fishing trips are undertaken in a fishing year. Usually, a close season on two months is voluntarily observed; however, if the catches are poor in the month of May, then the fishing operation is closed in the middle of May. Similarly, the fishing operations in most cases do not start at the beginning of August and most vessels start their operation by the middle of August or by the end of August, making the fishing period during in the year to be about 8 to 10 months.

Income of Owner/Captain/Fishermen

Like all other fishing operations, tuna gillnetting is also undertaken on a share-incentive basis. The owner of the vessel and the crew are equal shareholders in the income of each fishing trip. Maintenance of the fishing vessels, gadgets on board, and fishing gear is the responsibility of the owner of the vessel. At the end of each fishing trip, the expenses (including marketing costs such as offloading, sorting, and display) are deducted from the total sale proceeds, and half of the remaining balance is the owner's share. The remaining half is divided into crew, captain, engineer, mate, etc. If there are 15 crew on board a fishing vessel, then the balance (excluding

50 % share of owners of the vessel) is divided into 25 equal shares. Each crew member will get one share. The captain will get 2 ½ or 3 shares, whereas the engineer/driver will get 2 ½ shares. There will be an additional share for the mate (called "Sarang") and the diver (called "dubbi"). In addition, there is 1 share each of engine, fishing gear, and gadgets. To retain the services of a good captain, the owner usually gives an amount equal to 2 or 3 (in rare cases 4) to the captain.

Based on this distribution, the annual income of the fishermen ranges between Rs 300,000 and Rs 600,000 depending on the catch. The annual income of Captain ranges between Rs 2,000,000 to Rs 5,000,000. The fishermen who work on tuna gillnet vessels in the neighbouring country earn about 25 to 50 % more than fishermen operating in Pakistan. Since most of the period, fishermen remain in the offshore waters, therefore, they do not incur any expenditure. As compared to other trades, the income of tuna gillnet fishermen is almost double.

Socioeconomic Impact

In terms of their living condition, the fishermen working on tuna gillnet vessels are comparatively rich as compared to labourers. Since about 5 % of the population of Malakand District and 2 % of Lower Dir District of the province of Khyber Pakhtunkhwa are working on tuna gillnet vessels and their earnings is comparatively much higher than any other trades, which reflects of the improved livelihood conditions of these fishermen. Almost all of the captains of the tuna vessels from Khyber Pakhtunkhwa own a good car and their houses are comparatively good. They maintain livestock and poultry as well as have good facilities in their houses. The crew of the tuna gillnet vessels, if they do not own a car, then they have a motorcycle in their houses. Although most of the captain and crew are not well educated but their children are now getting better education, including some of them studying in engineering and medical colleges, as well as computer and information sciences. Tuna gillnetting, therefore, plays an important role in the improved socio-economic conditions of the hinterland population of Malakand and Lower Dir Districts of Khyber Pakhtunkhwa. As compared, the fishermen engaged in other fishing operations along Sindh and Balochistan coast are still living in coastal villages, and their socio-economic conditions are not as good as those of tuna gillnet fishermen.

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