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Status report on bycatch of tuna gillnet operations in Pakistan

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Introduction

Tuna fishing by local fishing boats is an important component of the fisheries of Pakistan, as it supports substantially large population of fishermen in this important gillnet fisheries. It is estimated that more than 500 fishing boats are exclusively engaged in coastal and offshore tuna fisheries. Gillnets boats used to land their entire catch in wet salted form which used to be exported to Sri Lanka, however, now the trend is completely changed. Most of these boats now deliver their catch directly or indirectly to tuna canneries in Iran. Small quantities are, however, still landed in wet salted form which is destined to Sri Lanka.

Eight species of tuna are known from Pakistan which includes yellowfin, longtail, skipjack, kawakawa and frigate tuna which are caught in commercial quantities. Bullet tuna and stripped bonitos are comparatively rare whereas bigeye tuna is known only through a few specimens only. In addition to tuna, a number of other species are caught in gillnets. These included billfishes, dolphinfish, sharks and sickle pomfret. Seerfish, narrow barred Spanish mackerel and wahoo are observed in bycatch of vessels operating in neretic waters, however, these are seldom caught in tuna gillnet vessels operating in offshore waters. Turtles, dolphins, porpoises and whales are also caught in the gillnets fishing boats.

Fishing Boats

Pakistani tuna fleet consists entirely of locally made wooden boats. A recent 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 between 15 to 20 m whereas those operating from Balochistan range between 10 to 15 m. There are about 30 large boats (ranging between 20 to 30 m LOA) which have on board freezing facilities and have dual registration in Pakistan and Iran. These boats mostly ply from Iranian fish harbours but also sometime venture in Pakistani waters and offload part of their catch at Karachi or Gwader.

Fishing Gears

Surface gillnetting using polyamide nets are used for catching tuna in Pakistan. It has stretched mesh size ranging between 13 cm to 17 cm (average 15 cm) with a hanging ratio of 0.5. The length of gillnet varies between 4.83 km and 11.27 km. The breath of the net was reported to be 14 m. It was informed by the fishermen that there are a number of larger fishing boats being operated from Karachi and Gwadar (Balochistan) which may have a length of 20 km or even more. Some of those boats which have dual registration in Iran and Pakistan may have gillnets of more than 25 km with a depth of 45 m and may have trammel arrangements. There are variation in the length and specification of net. If targeting small tuna in shallow waters smaller mesh net is used.

Fishing Grounds

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

The fishing boats from towns and cities along Balochistan operates within a radius of 40 to 50 km, however, boats based in Karachi have wider area of operation; some of the operating 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 beyond Pakistan territory. The most important destination for these tuna gillneters used to be Somali water and a few boats used to operate in Omani and Yemeni waters. Because of Somali piracy, now rarely tuna boat from Pakistan operates in these waters. There have been instances when Pakistani boats were apprehended by Somali pirates and using these boats as base for attacking other commercial vessel. Last such event was reported to have taken place in November, 2011.

Because of Somali piracy issue, some of the tuna fishing boats which have dual registration in Iran and Pakistan and have onboard freezing facilities are now operating in southern Indian Ocean even upto Madagascar.

Bycatch Composition

Bycatch of tuna boats depend on the area of operation. In neritic waters, the bycatch consists predominantly of Talang queenfish (*Scomberoides commersonianus*) followed by kingfish (*Scomberomorus commerson*), barracuda (*Sphyraena sp.*), dolphinfish (*Coryphaena hippurus*), Indo-Pacific sailfish (*Istiophorus platypterus*), thresher shark (*Alopias superciliosus*), silky shark (*Carcharhinus falciformis*), other requiem sharks and mantas.

Bycatch of tuna gillnetting in offshore deep waters consists mainly of Indo-Pacific sailfish (*Istiophorus platypterus*), black marlin (*Makaria indica*), striped marlin (*Tetrapturus audax*), dolphinfish (*Coryphaena hippurus*), threshers (*Alopias superciliosus*) and mako (*Isurus oxyrinchus*). The data of bycatch of gillnet fishing is no recorded separately therefore, it is apparently not possible to determine any historical change in their catches.

In a recent study (Moazzam, 2012) it was observed that Talang queenfish is most dominating species in bycatch in fishing boats operating from Karachi (Fig. 1a) whereas barracuda seems to be dominating along Balochistan coast (Fig. 1b). It is worth mentioning that Iranian boats procure Talang Queenfish from boats operating from Balochistan, therefore, it is hardly

represented in the bycatch in Balochistan. Composition of the bycatch at Gwader (Fig. 2a), Pasni (2b) and Sur Bundar (Fig. 3) does not differ much. Dolphinfish and sailfish are also found in reasonable quantities at these three fish landing centers.

Length frequency of bycatch species:

Length frequency of the dominating bycatch species has recently been started. The study is being continued to collect month-wise size frequency data which can be used to generate population parameter based on various statistical tools. The size ranges and dominant size class of the some of the bycatch species is given in Table-I and depicted in Fig. 4-7.

Table-I. The size ranges and dominant size class of the some of the bycatch species

Species	Size Range (in cm)	Dominant Size Class (in cm)
Talang queenfish	15-175	84-106
Narrow-barred Spanish mackerel	50-217	92-112
Dolphinfish	41-208	80-103
Silky shark	35-100	35-45
Spot-tail shark	58-156	80-90
Indo-pacific sailfish	108-324	201-231
Bigeye trevally	36-98	54-62

Ecologically Important Bycatch Species

Gillnet is considered to be a passive and indiscriminate gear which not only entangle desired target species but also catch large quantities of non-target species. In addition to target species that is tuna a number of species of ecological significance frequently get entrapped in such gillnet. These include sharks, rays, mantas, marine birds, turtles, dolphins, porpoises and whales. Although no accurate estimate of quantities of these species is available, however, some of the information regarding these species is collected.

Sharks:

Sharks are important bycatch of tuna gillnet operations because a number of shark species inhabits pelagic ecosystem. A list of species which are found in by catch in Pakistan is given in Table-II. Among sharks, bigeye thresher shark (*Alopias superciliosus*), silky shark (*Carcharhinus falciformis*), shorfin mako (*Isurus oxyrinchus*) and oceanic white-tip shark (*Carcharhinus longimanus*) seems to be frequent occurrence in gillnet catches. Bigeye thresher and shortfin mako are the most abundant.

Table-II. List of shark species found in gillnets along Pakistan coast.

Family	Species	Common Name

Echinorhinidae	*Echinorhinus brucus* (Bonnaterre, 1788)	Bramble shark
Heterodontidae	*Heterodontus ramalheira* (Smith, 1949	Whitespotted bullhead shark
Stegostomatidae	*Stegostoma fasciatum* (Hermann, 1783)	Zebra shark
Gingymostomatidae	*Nebrius ferrugineus* (Lesson, 1830)	Tawny nurse shark
Rhicodontidae	*Rhincodon typus* (Smith, 1828)	Whale shark
Pseudocarcharidae	*Pseudocarcharias kamoharai* (Matsubara, 1936)	Crocodile shark
Alopiidae	*Alopias pelgicus* (Nakamura, 1936)	Pelagic thresher
	Alopias superciliosus (Lowe, 1839)	Bigeye thresher
	Alopias vulpinus (Bonnaterre, 1788)	Thintail thresher
Laminidae	*Isurus oxyrinchus* Rafinesque, 1810	Shortfin mako
	Isurus paucus Guitart, 1966	Longfin mako
Triakidae	*Hypogaleus hyugaensis* (Miyosi, 1939)	Blacktip tope
	Iago omanensis (Norman, 1939)	Bigeye houndshark
	Mustelus mosis Hemprich & Ehrenberg, 1899	Arabian smoothhound
Hemigaleidae	*Chaenogaleus macrostoma* (Bleeker, 1852)	Hooktooth shark
	Hemipristis elongatus (Klunzinger, 1871)	Snaggletooth shark
Caracharinidae	*Carcharhinus albimarginatus* (Ruppell, 1837)	Silvertip shark
	Carcharhinus amblyrhynchoides (Whitley, 1934)	Graceful shark
	Carcharhinus amblyrhynchos (Bleeker, 1856)	Grey reef shark
	Carcharhinus amboinensis (Muller & Henle, 1839)	Pigeye shark
	Carcharhinus brevipinna (Muller & Henle, 1839)	Spinner shark
	Carcharhinus dussumieri (Muller & Henle, 1839)	Whitecheek shark
	Carcharhinus falciformis (Muler & Henle, 1839)	Silky shark
	Carcharhinus leucas (Muller & Henle, 1839)	Bull shark
	Carcharhinus limbatus (Muller & Henle, 1839)	Blacktip shark
	Carcharhinus longimanus (Poey, 1861)	Oceanic whitetip shark
	Carcharhinus macloti (Muller & Henle, 1839)	Hardnose shark
	Carcharhinus melanopterus (Quoy & Gaimard, 1824)	Blacktip reef shark
	Carcharhinus obscurus (LeSueur, 1818)	Dusky shark
	Carcahrhinus plumbeus (Nardo, 1827)	Sandbar shark
	Carcharhinus sealei (Pietschmann, 1916)	Blackspot shark
	Carcharhinus sorrah (Muller & Henle, 1839)	Spottail shark
	Galeocerdo cuvier (Peron & LeSueur, 1822)	Tiger shark
	Lamiopsis temmincki (Muller & Henle, 1839)	Broadfin shark
	Loxodon macrorhinus Muller & Henle, 1839	Sliteye shark
	Negaprion acutidens (Ruppell, 1837)	Sicklefin lemon shark
	Prionace glauca (Linnaeus, 1758)	Blue shark
	Triaenodon obesus (Ruppell, 1837)	White reef shark
Sphyrnidae	*Eusphyra blochii* (Cuvier, 1816)	Winghead shark
	Sphyrna lewini (Griffith & Smith, 1834)	Scalloped hammerhead
	Sphyrna mokarran (Ruppell, 1837)	Great hammerhead
	Sphyrna tudes (Valenciennes, 1822)	Smalleye hammerhead
	Sphyrna zygaena (Linnaeus, 1758)	Smooth hammerhead

Although annual statistical landings of sharks caught by tuna gillnet boats is not separately recorded, however, it is estimated that about 55 % of the total shark landings is originated from tuna gillnet boats. Sharks landings of past 10 years in given in Table-III which indicates a noticeable decrease in shark landings.

Table-III Shark landings of Pakistan

Area	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Sindh	15,111	14,100	11,274	9,199	7,611	5,111	4,721	2,911	2,540	2,170
Balochistan	7,357	4,597	4,257	3,009	3,049	3,378	1,257	3,006	2,214	2,490
EEZ	3	-	2	42	21	-	74	-	-	-
Total	22,471	18,697	15,533	12,250	10,681	8,489	6,052	5,917	4,754	4,660

Rays:

Although 47 species of rays and guitarfishes are reported from Pakistan. Of these only 14 species are found as bycatch of tuna gillnet operations. Ginat manta, pygmy devil ray, spine-tail mobula and common stingray were observed to be of common occurrence. No data on landings of rays is available.

Family	Species	Common Names
Dasytidae	*Dasyatis kuhlii* (Muller & Henle, 1841)	Bluespotted stingray
	Dasyatis pastinaca (Linnaeus, 1758)	Common stingray
Myliobatidae	*Aetobatus flagellum* (Bloch & Schneider, 1801)	Longheaded eagle ray
	Aetobatus narinari (Euphrasen, 1795)	Spotted eagle ray
	Aetobatus ocellatus (Kuhl, 1823)	Eagle ray
	Aetomylaeus nichofii (Bloch & Schneider, 1801)	Banded eagle ray
	Manta ehrenbergii (Muller & Henle,1841)	Giant manta
	Mobula diabola (Shaw, 1804)	Devil ray
	Mobula eregoodootenkee (Garman, 1913)	Pygmy devil ray
	Mobula japonica (Muller & Henle, 1841)	Spinetail mobula
	Mobula thurstoni (Lloyd, 1908)	Smoothtail mobula
	Myliobatis aquila Smith, 1935	Common eagle ray
	Rhinoptera adspersa Muller & Henle, 1841	Rough cownose ray
	Rhinoptera javanica Muller & Henle, 1841	Javanese cownose ray

Whale Shark:

Whale sharks (*Rhincodon typus*) are frequently observed in coastal areas of Pakistan. It is found both in coastal and offshore waters and reported to bask in the area between Churna Island and Ras Malan. According to the information collected during the Rapid Assessment Survey about 2 to 5 whale sharks entangled in tuna gillnets every year. Fishermen do not release entangled whale shark and bring it to beach or to landing centers and take out its liver. Oil is extracted from liver and used for smearing the fishing vessels hull to make is smooth and prevention against boring and fouling animals. Meat is also sold for production of fish meal.

Marine Birds:
No marine bird was found to be caught in gillnets by Pakistani boats. A detailed investigation reported that a single specimen of flesh-footed shearwater (*Puffinus carneipes*) got entangled in the gillnet during heaving process which was captured live by fishermen and released later on.

Turtle:

Mainly green turtle (*Chelonia mydas*) was reported to entangled in the gillnet especially if is deployed in coastal waters for catching tuna. Frequency of turtle entanglement is more common in off Karachi area and in Jiwani to Pasni areas. According to fishermen, in most cases the turtle was found to be alive and entangled only on the upper part of the gillnet thus able to surface and breath. Since it is considered to be bad omen to kill a turtle, therefore, all entangled turtles are immediately released. It is estimated that about 15 to 25 turtles are entangled in fishing nets every month especially during winter months with reported mortality to be about 2 to 3.

Dolphins and Porpoises:

Dolphins seem to be more frequent in getting entangled in tuna gillnets. Indo-pacific humpback dolphin are more frequently entangled in gillnets placed in coastal waters where rarely a few black finless porpoises are also reported to be entangled. Spinner dolphin, pantropical spotted dolphin and bottlenose dolphins seems to entangle in tuna gillnets deployed in offshore waters. Other species of dolphins occurring in Pakistan are also prone for entanglement in gillnets. According to fishermen, most of dolphins entangled in gillnet die immediately. Since dolphins are considered sacred by fishermen, therefore, live dolphins are immediately released and those dead are thrown back. Although it is not possible to accurately estimate the number of dolphins killed every year in tuna gillnet fisheries of Pakistan but based on limited information collected recently (Moazzam, 2012) it is estimated that 25- 35 dolphins are killed every month.

Whales:

Baleen whales especially humpback and sei whales are reported to get entangled in tuna gillnets but such events are of rare occurrence. According to the information recently collected 1 to 2 whales are entangled every year and in most cases fishermen try to release the entangled whales, however, sometime entangled whale die. In survey of dead whales beached along the coast of Pakistan since 2008, three whales were observed to have net entanglement. Two of these were humpback whale and third was a sei whale.

Conservation of Threatened/Ecological Important Species in Gillnet Operations

Although Pakistan is a member of IOTC but there is no programme in place for reduction in bycatch in gillnet operations. United Nations General Assembly (UNGA) Resolution 46/215 calls for a global moratorium on large-scale high seas driftnet fishing. However, most of the Pakistani vessels are interacting more frequently with highly migratory species, such as

discarded driftnets have serious detrimental effects on these species of concern and the marine environment. IOTC therefore, prohibit the use of large-scale driftnets on the high seas in the IOTC area through Resolution 09/05. Pakistani fishing vessels involved in catching tuna use gillnets with length varing between 4.83 km and 11.27 km in boats based in Sindh and 1.2 km to 6.5 km in Balochistan. Some of these vessels even operate in area beyond EEZ of Pakistan. This is in contravention of IOTC Resolution 09/05 and also UNGA Resolution 46/2 15.

An analysis of various Pakistani legislation pertaining to fisheries and related field was made which revealed that none of the Pakistan legislation takes into account management of tuna resources or exploitation. There is neither restriction on construction of boats for any general or aimed fisheries nor limit/size or mesh size of the gillnets has given in any federal or provincial fisheries laws. Under federal fisheries regulation i.e. Exclusive Fishing Zone (Regulation of Fishing) Act, 1975, there is a provision for making legislation for restricting use of any gear or put a ban on catching any species. However, no legislation is in existence for tuna gillnet fisheries.

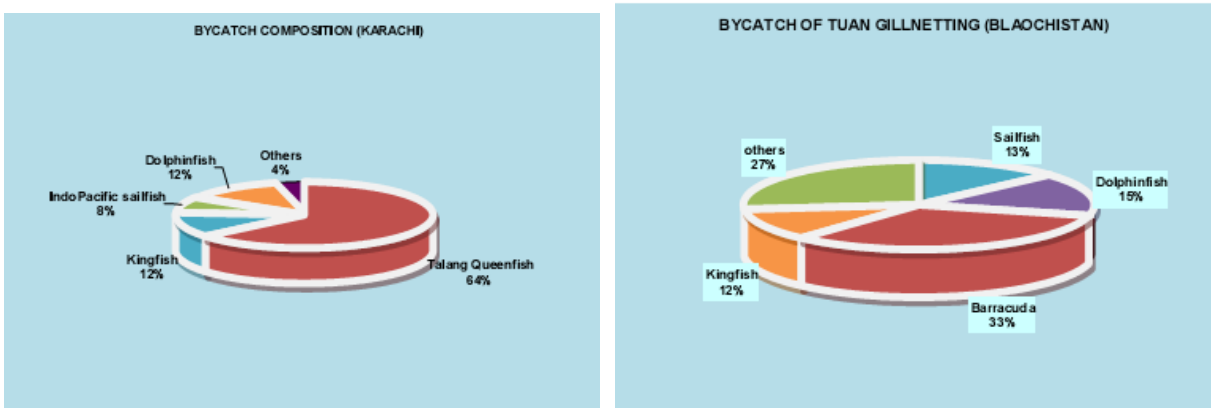
Coastal fisheries in Pakistan are governed and managed by provincial governments of two maritime provinces i.e. Sindh and Balochistan. For this purpose, both Provincial governments have enacted legislations namely Sind Fisheries Ordinance, 1980 and Baluchistan Fisheries Ordinance, 1970 and rules made thereunder. Some Amendments have also been made in these ordinances and rules. These legislation describes procedures for operation of the fishing boats, licensing regimes and various punitive actions for violations of the provisions of these legislations. These legislations also do not take into consideration any aspects of tuna fisheries, bycatch or incidental catches in fishing operations. Under provincial wildlife legislations i.e.

Sind Wildlife Protection Ordinance, 1972 and Baluchistan Wildlife Protection Ordinance, 1974, catching of marine turtles of the genera *Dermochelys, Chelonia, Caretta* and *Eretomochelys* i.e., all leatherback, green or hawksbill, loggerhead and tortoise-shell turtles is banned. There is also no regulation putting restriction on incidental or deliberate catching of dolphins, porpoises, whales and any marine birds.

Matters pertaining to CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) are now governed by Ministry of Climate Change. In compliance to CITES, Government of Pakistan can restrict catching of any protected and endangered species for purpose of trade. However, no tuna related matter has ever been placed on any of list lists.

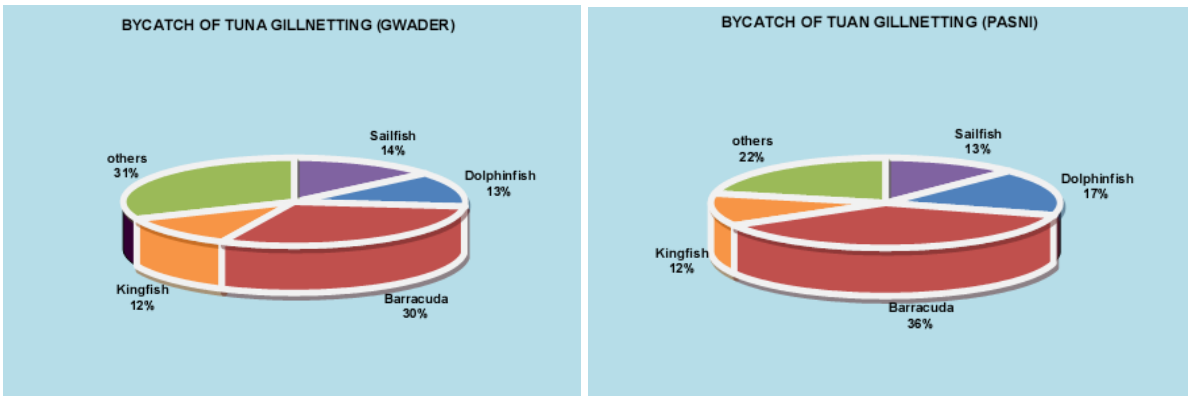
There is also neither restriction on construction of boat for any general or aimed fisheries nor limit the mesh size or length of the gillnets or longline under any federal or provincial fisheries laws. It is evident that there is no existing legislation has any specific provision for management of tuna or bycatch issues. However, under the auspices of both federal and provincial fisheries acts/rules, provision exists for restricting or limiting the catch of any specific species that may be

included in First Schedule of these legislations. These provisions thus can be employed to give legislative covers to tuna fisheries through enactment and notification of the new rules under these fisheries regulations. WWF-Pakistan has decided to initiate a programme to modify local gillnet boats to use handline, longline and possibly pole and line for catching tuna instead of gillnetting.



(a) (b)

Fig. 1. Bycatch composition (a) Karachi (b) Balochistan coast (Moazzam, 2012)



(a) (b)

Fig. 2. Bycatch composition at (a) Gwader (b) Pasni (Moazzam, 2012)

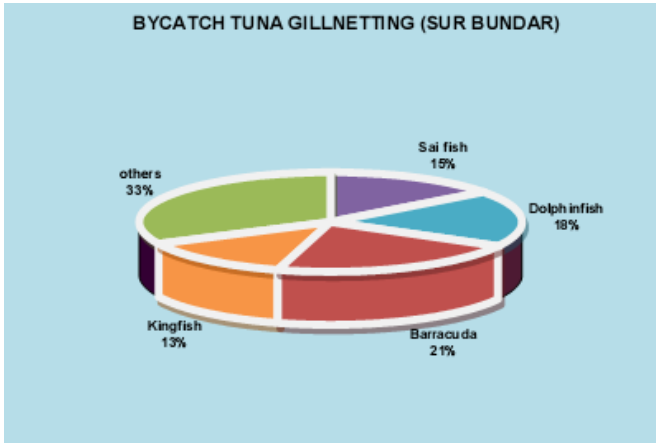


Fig. 3. Bycatch composition in Sur Bandar area (Moazzam, 2012)

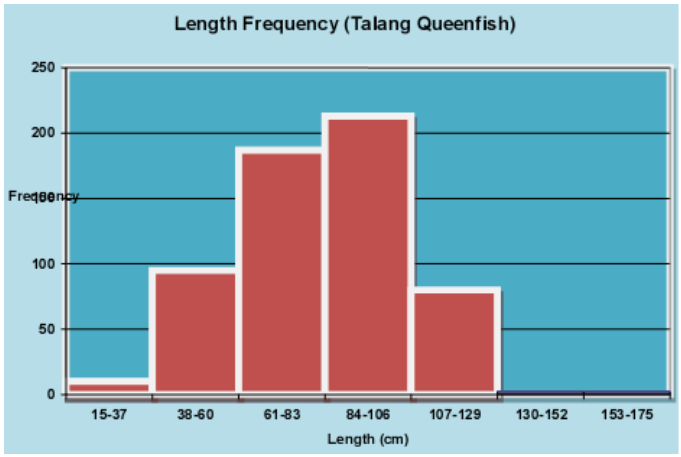
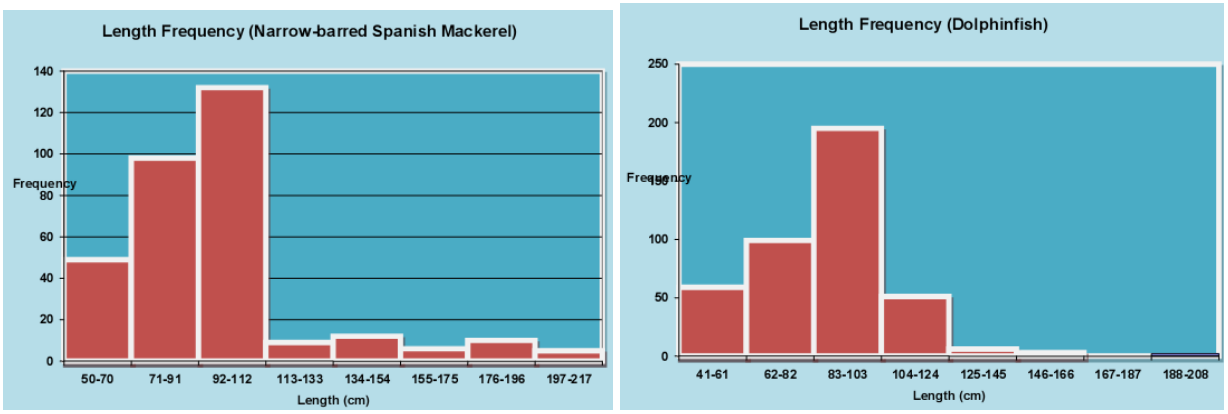
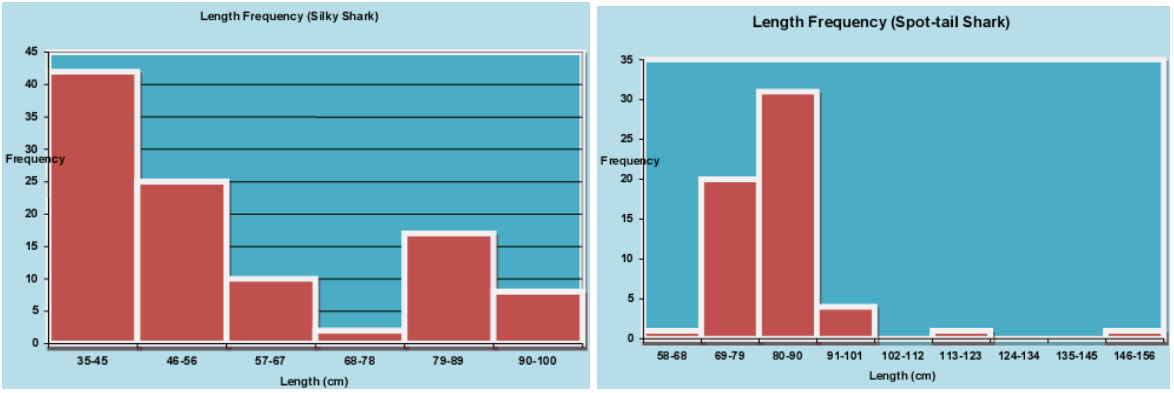


Fig. 4. Size frequency of Talang queenfish (Moazzam, 2012)



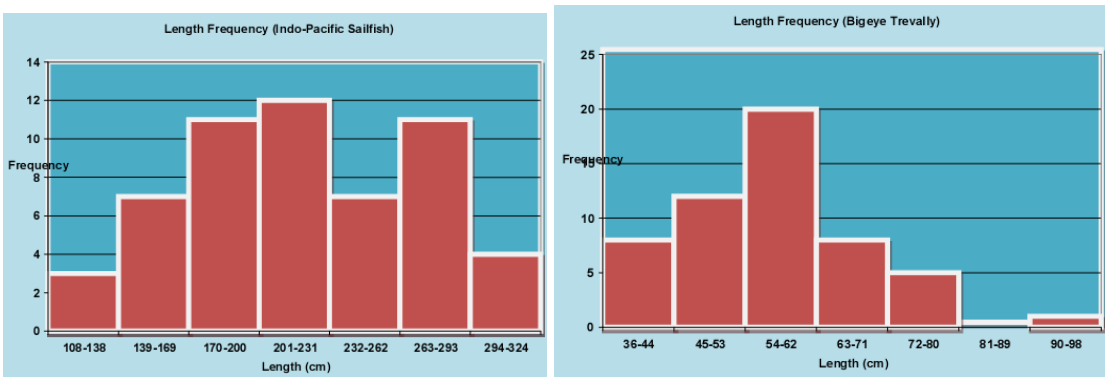
(a) (b)

Fig. 5. Size frequency of (a) Narrow-barred Spanish Mackerel and (b) Dolphinfish (Moazzam, 2011)



(a) (b)

Fig. 6. Size frequency of (a) Silky Shark and (b) Spot-tail Shark (Moazzam, 2012)



(a) (b)

Fig. 7. Size frequency of (a) Indo-Pacific Sailfish and (b) Bigeye trevally (Moazzam, 2012)