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Present Yield Status, Percentage Composition and Seasonal Abundance of Shark in Two Geographically Important Zones of Bangladesh

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Abstract

A study was carried out during January-December (2014) in two selected shark landing centers; BFDC Fish harbor, Cox's Bazar and Fishery Ghat fish landing center, Chittagong situated at the North-eastern part of the Bay of Bengal. Data were collected through semi-structured interview, case study, frequent visit to the informants found in and between the trade channels. A total of 9 shark species belonging to 3 families (Carcharhinidae, Hemiscylliidae and Sphyrnidae) were recorded. It was found that sharks were exploited mostly at small sizes (45%) in those landing centers. The highest and lowest yield were found in the month of January and July respectively at Chittagong whereas November and July at Cox's Bazar. The highest and lowest landed number was found in November and July respectively at both the landing centers. Dog shark was the most dominant species followed by Hammerhead shark in terms of yield and landed number at Chittagong and Cox's Bazar contributed 55.794 MT (60% 90) and 17.675 MT (19%) among the total yield and 174,877 (83%) and 25,733(12%) landed number respectively. Yield and landed number of other species contribution altogether were only 21% and 5% respectively of total. Total yield was found 6 folds in Cox's Bazar than that of Chittagong. Abundance reveals that the highest catches of shark were found during October to December (42%) and the lowest catches during January to March (16%). Yield of shark was found to be declining than the previous years and a clear deviation of seasonal abundance is also occurring. As there is no gear size limitation or seasonal restriction in the Fish Act, small sized sharks were found to be caught mostly in those landing centers which may also pose a threat to shark species composition in the Bay of Bengal region, Bangladesh.

Keywords: Shark yield; Bay of Bengal; Percentage contribution; Seasonal abundance; Fish act

Introduction

Sharks are a highly diverse group of fish that evolved over 400 million years ago. These are predominantly marine, oceanic and are widely distributed in the tropical, subtropical and temperate waters of the seas around the world [1]. More than 60% catches were reported from central (tropical) regions, in particular from the Indian Ocean (26%) followed by Western central pacific (14%) and the Eastern Central Atlantic (10%). Total 26 top shark-fishing countries were responsible for 84% of global shark catches [2]. In the Indian Ocean deep sea, there were species of shark-like fishes including 8 orders, 23 families and 46 genera [3]. At least 171 species of elasmobranches, representing 68 genera and 34 families, were recorded from fresh or estuarine waters [4]. In Bay of Bengal there are 11 species of sharks identified [5]. The Bay of Bengal is one of the most heavily fished regions in world's ocean for shark. The major shark hunting grounds of Bangladesh include the coastal waters of Kuakata, Sonar Char, Ruper Char, Fatrar Char, Char Gongmoti and Dublar Char in Patuakhali and Ashar Char, Patharghata Barguna, the Sunderbans, Sandwip, Kutubdia, Moheshkhali, Cox's Bazar and Teknaf [6]. Sharks are harvested as target species mainly by shark net (modified gill net) and hooks and lines and as a by catch in other commercial fishing. A large numbers of small sized juveniles or new born sharks and rays are caught by shrimp and fish trawlers which were not recorded or reported, for small size and low market value and discarded it as a trash [7]. Some 50% of the estimated global catch of chondrichthyans is taken as by-catch, does not appear in official fishery statistics, and is almost much unmanaged. When taken as by-catch, they are often subjected to high fishing mortality. Consequently, some skates, sawfish, and deep-water dogfish have been virtually extirpated from large regions [8]. Recently, number of shark fishing boats, fishing days and export trade have been expanding rapidly in Bangladesh which gives some cause of alarm. Moreover, catch of small sized or juvenile sharks has increased with the decrease of large size sharks reminding us that the stock may be undergoing overexploitation [9]. Some shark species were found frequently in a season which is not found now as before some has entered into the IUCN threatened and endangered list which gives concern about the decrease of species composition because of overexploitation or illegal fishing activities.

In this present study, effort had been made to determine the shark species composition and percentage contribution from January, 2014 to December, 2014 in BFDC Fish harbor, Cox's Bazar and Fishery Ghat fish landing center, Chittagong. The main objective of this study was to find out the landing trends and seasonal abundance of shark from the sustainable yield and conservation point of view in the Bay of Bengal region. It is expected that the statistical interpretation would rightly focus on the status of the shark fisheries and contribute towards any national management plan for shark fishery of Bangladesh in the Bay of Bengal region.

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Materials and Methods

Study site and duration

The field study was conducted from January-December(2014) in two selected shark landing centers, BFDC Fish harbor, Cox's Bazar and Fishery Ghat fish landing center, Chittagong district situated at the North-eastern part of the Bay of Bengal. These two study areas were selected to cover most of the landing centers, retail, and wholesale markets of shark from the Bay of Bengal of Bangladesh region.

Data collection method

Information regarding harvesting procedure, trip duration per month, auction procedure, harvesting gears and vehicles were collected at both landing stations through formal face to face interview of boat owners/divers of commercial fishing vessels, fishermen, retailers and buyers. Collected information was verified by the key informants. Photos were captured by a digital camera. The length and weight of the fishes were measured directly by using measuring tape and balance. Missing information were collected through the phone call and verified by the respective officers.

Month wise data regarding total yield and landed numbers of each shark species, number of fishing days were collected from Fishery officials of the Marine Fishery Wing (Department of Fisheries), Cox's Bazar and the Marine Fisheries Survey Management Unit, Chittagong.

Statistical analysis

The species wise weight was measured in kilogram and then it was converted into metric tons (MT). Statistical software MS Excel (version 2013) was used for data analyzing.

Results

Species composition

A total 9 species of sharks recorded from this study which was Dog shark (*Scoliodon laticaudus*), Hammerhead shark (*Sphyrna lewini*), Milk shark (*Rhizoprionodon acutus*), Tiger shark (*Galeocerdo cuvier*), Silky shark (*Carcharhinus falciformis*), Ridge back cat shark (*Chiloscyllium indicum*), Black tip reef shark (*Carcharhinus melanopterus*), Bull shark (*Carcharhinus leucas*) and Spot tail shark (*Carcharhinus sorrah*).

Size abundance

Major findings from this study were that the highest mean length was found in Bull shark (151.67 ± 7.92 cm) followed by Black tip reef shark (116.25 ± 2.27 cm) and Silky shark (102.19 ± 6.29 cm) whereas the lean was found in Ridge back cat shark (46.02 ± 2.98 cm) (Table 1). The highest mean weight was found in Bull shark (29.20 ± 4.34 kg) and the lean in Ridge back cat shark (0.36 ± 0.11 kg) (Table 1). Big sized sharks were caught rarely in Chittagong only.

Sharks were mostly caught at small sizes (45%) as shown in (Figure 1) Large sized sharks were caught in a very small amount (22%).

Harvesting depth, vehicles and gears

Sharks were harvested by the Chittagong and Cox's Bazar, Kutubdia, Moheshkhali, Cox's Bazar and Teknaf coasts. The usual harvesting depth was 10-50 m. Shark nets were widely used mainly for harvesting target species of shark like Dog shark, Milk shark, and Hammerhead shark. Sharks were exploited as by catch of Lakkha net in both Chittagong and Cox's Bazar. Gill nets, Set net bag, Trammel net were also used for exploitation. Anchors as well as hooks and lines were found to be used only in Cox's Bazar. These were operated by wooden mechanized boats.

Shark species	Mean length (cm) ± SD	Mean weight (kg) ±SD
Silky shark	102.19 ±6.29	9.25 ± 3.12
Dog shark	50.87 ±2.18	0.60 ± 0.19
Spot tail shark	55.75 ± 2.20	0.91 ± 0.27
Black tip reef shark	116.25 ± 2.27	4.53 ± 0.92
Bull shark	151.67 ±7.92	29.20 ± 4.34
Tiger shark	70.21 ±2.13	4.14 ± 1.11
Hammerhead shark	70.36 ±1.68	2.30 ± 0.54
Ridge back cat shark	46.02 ±2.98	0.36 ± 0.11
Milk shark	58.67 ±5.00	0.85 ± 0.25

*SD=Standard Deviation.
Table 1: Species wise mean length and weight (±SD) of shark.

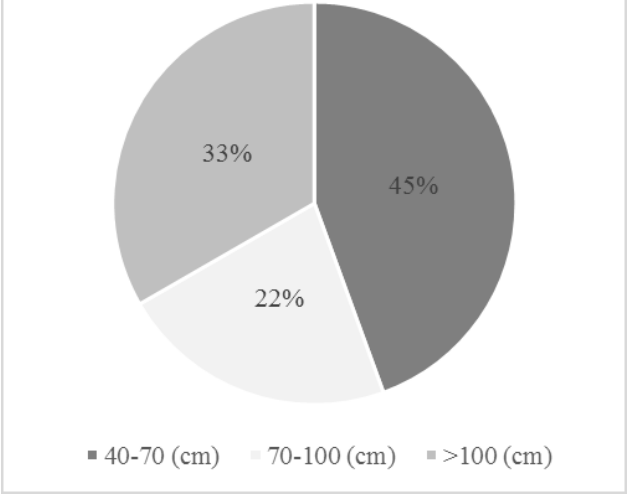

Figure 1: Percentage of shark size abundance.

Total yield and landed number

During the study period, the highest yield was recorded 2.37 MT in January and landed number was 5,200 in November in Chittagong. Total yield and landed number were found 12.824 MT and 23,245 respectively.

In Cox's Bazar, the yield and landed number was found to be the highest in November and no catch was recorded in July. Total yield and landed number were found 80.34 MT and 188,407 respectively (Figures 2 and 3).

According to the landing data, Dog shark was found to be the most dominant species followed by Hammerhead shark in terms of yield in both Chittagong and Cox's Bazar. Dog shark yield was found 5.696 and 50.098 MT in Chittagong and Cox's Bazar respectively. The lowest yield was found in Black tip reef shark (1.807 MT). Milk shark was found to be landed only in Chittagong whereas Spot tail shark in Cox's Bazar. Total yield was found much higher in Cox's Bazar (80.34 MT) than Chittagong (12.824 MT) (Figure 4).

The landed number of Dog shark was found to be the most dominant followed by Hammerhead shark in both Chittagong and Cox's Bazar than the other shark species (Figure 5). During the study period, the highest landed number was found in Dog shark species (153,696) in Cox's Bazar and the lean in Ridge back cat shark (9) in Chittagong.

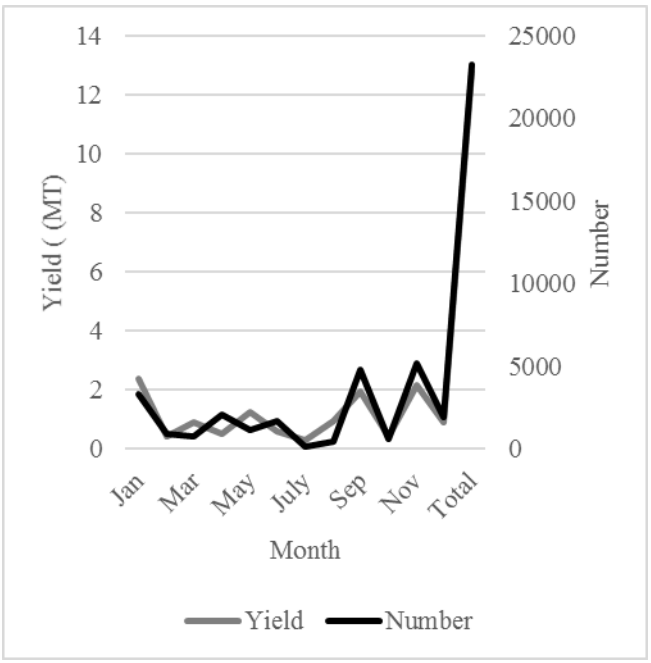

Figure 2: Month wise yield and landed number in Chittagong.

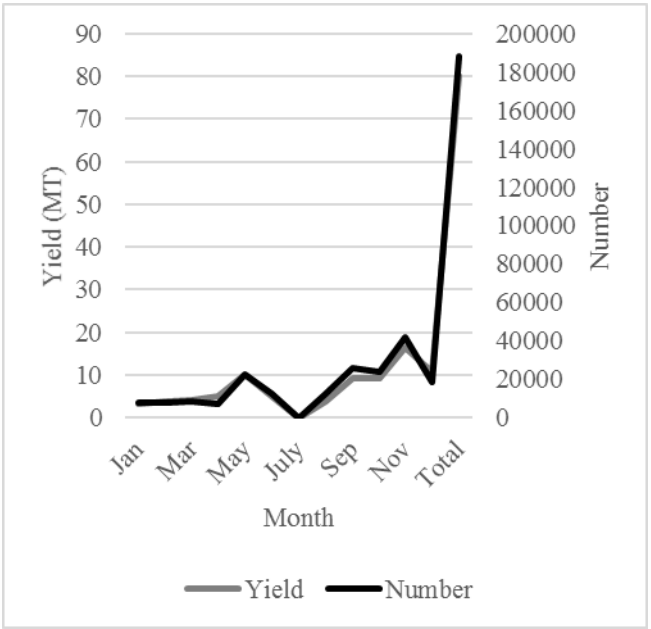

Figure 3: Month wise yield and landed number in Cox's Bazar.

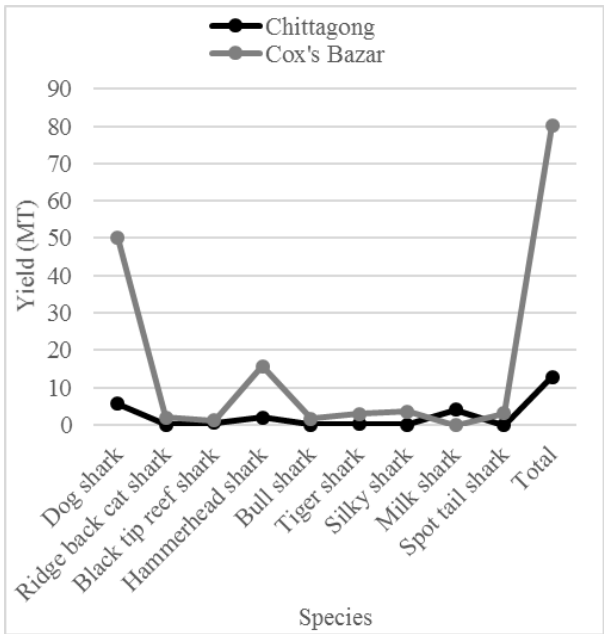

Figure 4: Species wise comparison of total yield between Chittagong and Cox's Bazar.

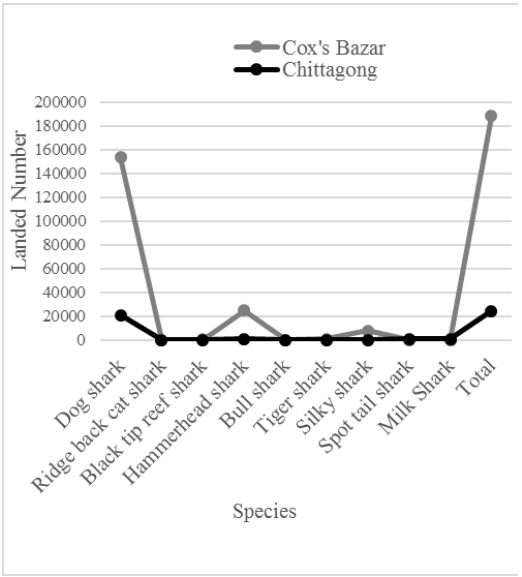

Figure 5: Species wise comparison of total landing between Chittagong and Cox's Bazar.

Percentage contribution

Among the recorded shark species, greatest contribution came from the Dog shark (60%) in total yield followed by Hammerhead shark (19%) in both landing centers. Yield of other shark species altogether was found only 21% (Figure 6).

The highest percentage contributor shark species in total landed number was found in Dog shark (83%) followed by the Hammerhead shark (12%). Landed number of other shark species altogether was found only 5% (Figure 7).

Cox's Bazar contributes the highest shark yield (86%) between the two selected shark-landing centers (Figure 8). Total yield was found 6 folds in Cox's Bazar than that of Chittagong.

From the seasonal abundance data the highest abundance of shark was found during October to December (42%) and the lowest during

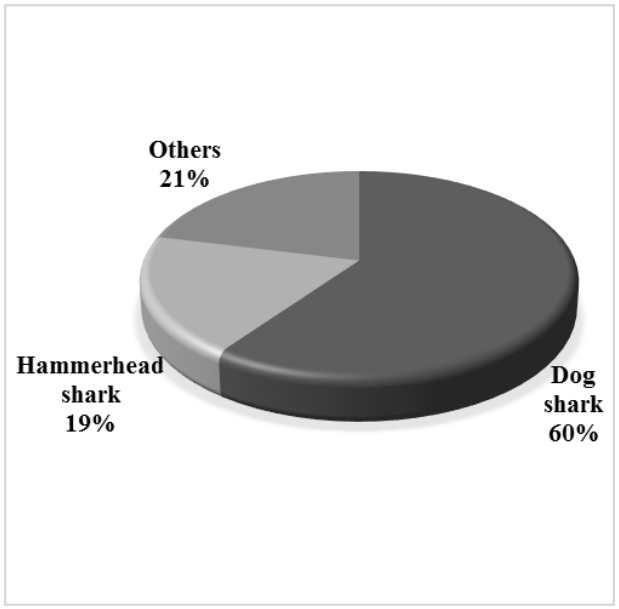

Figure 6: Percentage contribution of shark species in total yield.

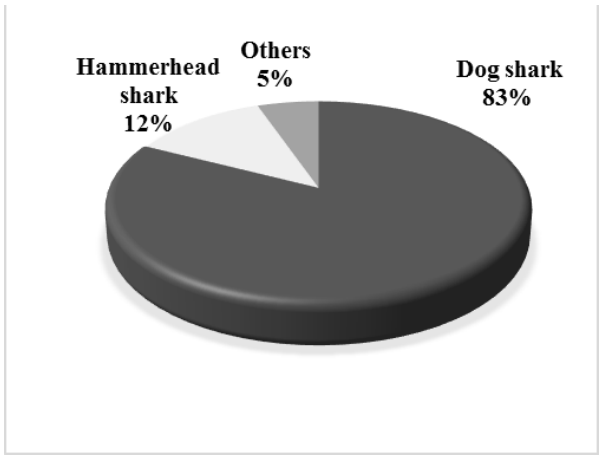

Figure 7: Percentage contribution of shark species in total landed number.

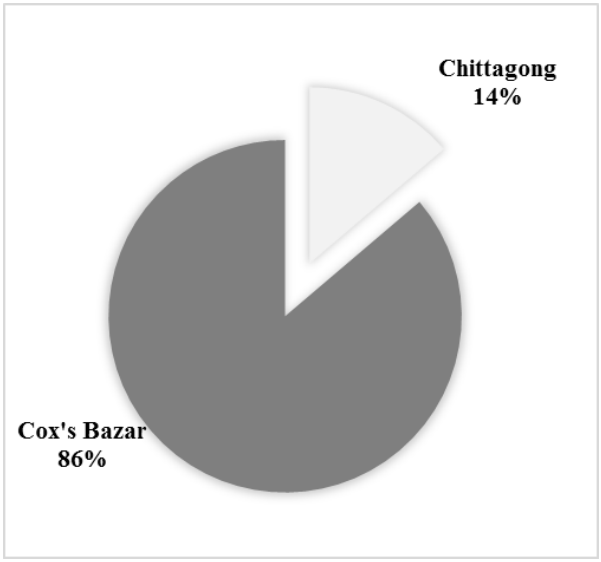

Figure 8: Comparison of shark catch contribution percentage between Chittagong and Cox's Bazar.

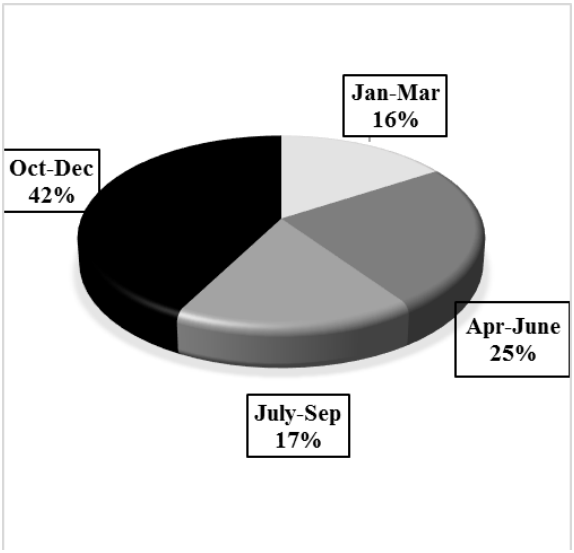

Figure 9: Seasonal abundance of shark in Chittagong and Cox's Bazar.

January-March (16%) (Figure 9).

Fishing season

The total harvesting and fishing days from both Chittagong and Cox's Bazar were 93.164 MT and 193 days respectively. The highest harvesting was found in the month of November (18.56 MT). In the month of July, no fishing was done in Cox's Bazar (Figure 10).

Discussion

The number of shark species in Bangladesh reported by different authors varies in different times [10] recorded 10 species of sharks belonging to 3 families. According to [11] the total number is 56, while [1,7,12-15] mentioned the number as 51, 22, 36, 21, 63 and 56 respectively. There is a clear indication of declining shark species composition from the previous years.

In the present study, dominance of smaller size shark was observed as maximum harvesting came from Dog shark. The mean size and mean weight of Dog shark was found 50.87 ± 2.18 cm and 0.60 ± 0.19 kg which was different to the observation of [16] having average size between 50-52 cm in total length and 0.15-0.2 kg in weight. It might create threats to Dog shark population due to overexploitation in the near future. Since, larger size sharks are mostly common in offshore water which is beyond the reach of our artisanal fishermen, it is more likely that sharks more than 100 kg are less common in the catch.

Dog shark was found to be the top listed shark in respect to the total landing 55.794 MT and contribution (60%) to overall catch at both landing centers which agree with the work of [17] who showed that the highest landing (134 MT) and contribution (76%) to total catch for the whole sampling period was found from Dog shark [1] found that

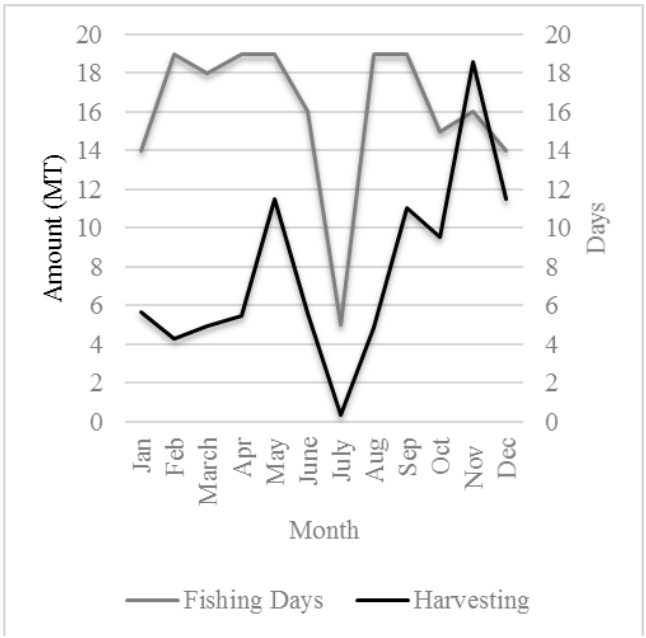

Figure 10: Peak season of shark harvest in 2014.

mostly small sized sharks were caught because of gear limitations. For a number of species shifts in length compositions to smaller sizes have been attributed to over exploitation [18]. Further study need to be done on species size distribution through time and area to understand the issue of overexploitation.

In the present investigation, it was found that sharks were mainly caught by Hooks and lines, Gill nets, Set net bag, Trammel net and Shark nets [16] noted in their study that shark target fishing has been developed for the last 5-10 years mainly by using hooks and lines during winter months. In their study they included that during 2007-2008 about 53% of total shark landings were caught by gill net (shark net) followed by hook and lines (34%) and trammel net (8%) and the minimal catch was from set bag net (5%). They also predicted that most sharks were caught 10-40 meter depth as major landings came from mechanized boats. This was one of major causes of smaller size shark catches.

Total yield and landed number in the year of 2014 was 93.16 MT and 211,652 respectively from two landing centers which was lower comparing with 136.45 MT yield and 449,133 landed number found by [17]. Catch records clearly reflect declining trends. The highest and the lowest landing were in the month of July and November (2014) respectively which was different from the study of [16] who showed the highest landing was found in the month of October 2011 and lowest in the month of January 2012.

During the study, it was observed that some shark species were abundant and some were less abundant in the fish landing centers in Chittagong and Cox's Bazar districts [16] found the most common and widely distributed two shark species were *Scoliodon laticaudus* and *Sphyrna lewini* which were also common in the present study. They also found five relatively common species which were *Rhizoprionodon acutus, Chiloscyllium indicum, Galeocerdo cuvier, Carcharhinus melanopterus,* and *Carcharhinus falciformis* but in the present study *Rhizoprionodon acutus, Galeocerdo cuvier*, and *Carcharhinus falciformis* were relatively common though not frequently caught. They showed rarely found species were *Rhizoprionodon oligolinx, Carcharhinus leucas and Carcharhinus sorrah though Chiloscyllium indicum, Carcharhinus leucas, Carcharhinus melanopterus, Carcharhinus sorrah* were rare in the present study and *Rhizoprionodon oligolinx* was totally uncommon [17] stated that the least common species in the catch gives cause for some concern and requires investigation on their population status. They also noted that changes in species contribution takes long time and require many years' data to draw conclusion and there may be other factors like changes in fishing effort and fishing practices having significant influence on catch.

There were some shark species that were available at least 5-10 years ago, but now they are not available and some are vulnerable. Totally absent Milk shark in Cox's Bazar and spot tail shark in Chittagong might be due to their late maturity, highly mobile and migratory characters; and harvesting of small sizes did not possible to renew the stock quickly like other shark species.

From the study, Shark abundance was found to be the highest during October to December, and lowest during January-March whereas [6] found the peak during January-March and lowest during July-September in their study during (2003-2013) conducted in those landing centers. There was a clear indication of change in shark seasonal abundance which might be due to the large exploitation of Dog shark during October to December than the previous years. Besides, many species of sharks and rays are highly seasonal and erratic in their occurrence i.e., vary over geographical locations, therefore, country wide and regional catch record is very important to track changes in elasmobranches diversity [16].

In the present study, catch compositions varied from month to month of the sampling year [7]. Stated that shark fishing was done throughout the year but the main season was November to March and a peak was found in June, in the present study it was found October to December and a peak in November. Similar study of [9] showed that the main shark fishing season was November to March and a peak was found in July where in the present study no fishing was found to be done in July due to heavy rainfall.

Increased number of active fishing days and new fishing techniques indicated that all shark species were in high fishing pressure. Many shark populations have declined where they were once common due to increased human pressure.

Conclusion

Sharks were mainly harvested by shark nets and hooks and lines as target species. But as by catch some new borne juveniles harvested by shrimp and fish trawler were discarded as a trash for very small size and low market value and not recorded. Catch record clearly reflects declining trends and bulk of the catch were small sized due to overfishing and lack of gear size limitation. A clear deviation in shark seasonal abundance was observed. Decreasing in shark species composition was also found which might pose serious threats to shark population and total yield. Steps should be taken to ensure maximum sustainable yield and conservation through the inclusion of shark in the Fish Act restricting overexploitation or illegal exploitation.

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