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# Landing Trends, Species Composition and Percentage Composition of Sharks and Rays in Chittagong and Cox's Bazar, Bangladesh

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***Abstract* – The study was conducted from April, 2006 to June, 2010 on landing trends, species composition and percent contribution of sharks and rays by weight using the catch records of Marine Fisheries Survey Management Unit, Chittagong from two landing centers Fishery ghat, Chittagong and BFDC ghat, Cox's Bazar. This study identified 27 species in total representing 11 species of shark (04 families) and 16 species of ray (09 families). The highest landing volume (134 MT) and contribution (76%) to total catch for the whole sampling period was found from *Scoliodon laticaudus* followed by *Rhizoprionodon acutus* (108 MT or 55%), *Carcharhinus melanopterus* (75 MT or 38%), *Sphyrna zygaena* (49 MT or 26%), *Chiloscyllium indicum* (38 MT or 20%), *Eusphyra blochii* (22 MT or 11%) *Galeocerdo cuvier* (21 MT or 10%) and other (03 MT or 2%). Species which occurred least were placed in the 'other' category comprising *Carcharhinus amblyrhynchos*, *Stegostoma fasciatum*, *Carcharhinus leucas* and *C. falcifomis.* Among rays, the landing volume and resultant percent contribution to overall catch found highest from *Himantura uarnak* (219 MT, 120%), followed by *Himantura walga* (158 MT or 60%), *Himantura bleekeri* (68 MT or 34%), *Rhinobatos granulatus* (29 MT or 18%), *Gymnura micrura* (12 MT or 7%) *Mobula diabolus* (11 MT or 5%), *Rhynchobatus djiddensis* (10 MT or 5%), *Aetomylaeus nichofi* (9 MT or 4%), *Rhinoptera javanica* (8 MT or 4%) and *Narcine timlei* (7 MT or 4%) and other species with least occurrence (5 MT or 4%). Species in other category consisted of *Gymnura poecilura, Rhina ancylostoma, Himatura gerrardi, Anoxypristis cuspidata, Himantura undulata and Taeniura. Sps.* Landing of different species were found to vary from month to month and year to year throughout the sampling period. To make absolute comment regarding these trends of occurrence, base line biological information together with long term catch record for size distribution was needed which could not be work out from the present data set. However, total landing of sharks and rays were found to be on slight decline.**

***Keywords* – Shark, Ray, Species Composition, Elasmobranches Fishery, Landing Trend, Catch Data, Abundance, Percent Contribution.**

## I. INTRODUCTION

Bangladesh has a long coastline of 714 km and comprising an Exclusive Economic Zone (EEZ) of 164,000 sq. km. About 44 percent of our EEZ consists of continental shelf providing a rich resource of coastal fisheries. In Bangladesh economy, fisheries sector plays a significant role through generating employment and providing major source of animal protein for the population. Shark fishery is largely artisanal, multi gear and multispecies fishery in Bangladesh which occurs from the coasts to the edges of the EEZ. Sharks and rays come mostly as by catch but in recent years, some shark targeted boats are introduced. The contribution of sharks and rays is only 1% of our total marine landings. There are a range of gears to harvest sharks but caught by shark net (modified gill net) and rays are mainly caught by hook and lines. Besides, rays are also harvested as incidental catch by set bag net and trammel net. In addition, large number of small size rays (juveniles or just born) and sharks caught by shrimp trawl net remains unreported.

Traditionally, elasmobranches have never been highly prized fish product. Their economic value ranks low among marine commercial fisheries. For example, in the Taiwanese gill net fisheries of the central Western Pacific, shark trunk prices attain only 20% and 60 % of those of Tunas and Mackerels respectively (Millington, 1981). The only valued elasmobranches product is shark fin for oriental soup, a commodity which recently has attained a considerable increase in demand (Cook, 1990). In our country, shark fins and ray skin are usually processed for export market and the meat part is sold for local consumption mostly to the tribal community. However, fins of small sized shark have no export value and therefore sold as raw meat or in dried condition.

Recently, number of shark fishing boats, fishing days and export trade have been expanding rapidly which gives some cause of alarm. Moreover, catch of small size or juvenile sharks and rays has increased with the decrease of large size sharks reminding us that the stock may be undergoing overexploitation (Halder, 2010). In Bangladesh, landing of shark is not reported by species but by groups i.e. sharks and rays in yearly statistical report by the Department of Fisheries. Species wise catch data is very important to know the catch composition, pattern of

occurrence and to identify the species under threat. Sharks are widely recognized as being vulnerable to over fishing because they grow slowly, are late to mature and produce relatively few young. As a result, they are susceptible to over fishing and slow to recover. Therefore, there has been a realization that the stocks may be overfished and some management initiatives are required. In the present study, effort has been made to determine the landing trends, species composition and percent contribution of sharks and rays from April 2006 to June 2010 in the coasts of Chittagong and Cox's Bazar. It is expected that the statistical interpretation would rightly focus on the status of the resources and contribute towards any national management plan for shark fishery of this country.

## II. Materials and Methods

### *Sampling Stations*

The study was under taken for about 04 years starting from April 2006 up to June 2010 at two fish landing centers i.e. BFDC ghat of Cox's Bazar district and Fishery ghat of Chittagong district situated at the south-eastern part of the Bay of Bengal. These two landing centers were selected because the major landing of shark and ray is done here and the wholesale and retail market is also located in these two places.

### *Data collection and statistical analysis*

Species wise landing data were recorded both at landing stations and on board commercial fishing vessels. Data were collected from four field visits per month i.e. new-moon, full-moon, first quarter and last quarter. The species were preserved in 5% formalin just after collection from the landing centers and then sorted in the laboratory of Marine Fisheries Survey Management Unit (MFSMU), Chittagong, Bangladesh. Species were identified to the lowest possible taxonomic position by consulting the following resources: Rahman *et al.* (2009), Albert *et al.* (2007), Kazunari *et al*. (2007), Raje *et al.* (2007), Ramon (1994), Quddus *et al.* (1988), FAO (1984), Munro (1982), Day (1978) and Hussain (1972).

Sampling was performed through interviews with the Arartdar (assemblers), boat owners and fishermen of the boat. Information was collected on trip duration per month, number of fishing days and fishing effort. The length (total length for shark and disc width length for ray) and weight of the fishes were measured directly by using balance and measuring tape. The percentage contributions of shark and ray species were calculated by weight. The species wise weight was measured in kilogram and then it was converted into metric tons (MT). Data processing and analysis was done by MS Excel.

## III. Result

### *Description of boats and gears*

Sharks and rays usually come as the commercial catch of artisanal mechanized fishing boats. In Cox's Bazar and Chittagong, about 50-60 boats are engaged for fishing which are typical open hulled wooden boats of 5-7 meters long with engines of 45-65/75 Hp. Each boat carries 17-18 fishermen and their active fishing days last for 15-18 days depending on the volume of the catch. The main gears include shark net (gill net), set bag net (ESBN and MSBN), long lines and trammel net. Shark nets are large mesh gill net made of thread no.4 and having length, depth and mesh size of 1500-3000 m, 10-15 m and 450 mm respectively. Long lines are mainly used for rays consist of a nylon monofilament mainline of 2 to 3 mm in diameter hung in a sagging curve between surface float. The branch lines with a length of 5-12 m descend from the main line, each terminating in a single baited 'J' hook. The number of hooks ranges from 800-6000 and hook size varies from No.6-11. Frozen squids (*Loligo spp.)* and cuttle fish (*Sepia spp.)* and sardines (*Sardinella spp*.) are commonly used as bait. Both long lines and gill nets are shot in the evening and their retrieval begins after midnight.

### *Total landing and Species composition*

A total of 11 species of sharks (04 families) and 16 species of rays (09 families) were identified from the present study (Table 1). According to total landing, the most common and widely distributed shark species were found as *Scolioden laticaudus, Rhizoprionodon acutus, Carcharhinus melanopterus, Sphyrna zygaena* and *Chiloscyllum indicum* (Fig. 1). The relatively common species were *Eusphyrna blochii* and *Galeocerdo cuvier* while the least common or rare shark species in the catch were *Carcharhinus amblyrhynchos*, *Stegostoma fasciatum*, *Carcharhinus leucas* and *C. falcifomis*. Likewise, the most abundant ray species were found as *Himantura uarnak, H. walga, H. bleekeri* and *Rhinobatos granulatus*. The relatively common ray species in the catch were *Gymnura micrura, Mobula diabolus*, *Rhynchobatus djiddensis*, *Aetomylaeus nichofi*, *Rhinoptera javanica* and *Narcine timlei* (Fig. 2). The species with least occurrence throughout the sampling period were *Gymnura poecilura*, *Rhina ancylostoma*, *Himatura gerrardi*, *Anoxypristis cuspidata*, *Himantura undulata and Taeniura. Sps.* Fig. 3 shows year wise total landings of sharks and rays during the sampling period and it appears to be on slight decline.

### *Average size of species*

In the present investigation, an attempt had been made to record the size of different shark and ray species but it did not cover all. However, the average size of the dominant shark species were found as follows: *Scoliodon laticaudus* (average size of 50-52 cm and 0.15-0.2 kg), *Rhizoprionodon acutus* (52-90 cm and <1.5 kg), *Carcharhinus melanopterus* (68 cm and 1.53 kg), *Sphyrna zygaena* (55-75 cm and 1.5-2.5 kg), *Chiloscyllium indicum* (22-33 cm and 0.15-1.5 kg), *Eusphyrna blochii* (>60 cm and 1.5-2 kg) and *Galeocerdo cuvier* (54-77 cm and 2-15 kg). The average size of the dominant ray species were found as follows: *Himantura uarnak* (average disc width 92 cm and weight 56 kg), *Himantura walga* (28 cm and 0.15-15 kg), *Himantura bleekeri* (92 cm) and *Rhinobatos granulatus* (up to 107 cm and 2-2.5 kg).

### *Percent contribution of species*

Species wise percent contribution to total landings during the sampling period is shown in table 1. Among sharks, the greatest contribution (76%) came from *Scoliodon laticaudus* (Fig. 4) followed by *Rhizoprionodon*

*acutus* (55%), *Carcharhinus melanopterus* (38%), *Sphyrna zygaena* (26%), *Chiloscyllium indicum* (20%), *Eusphyrna blochii* (11%), *Galeocerdo cuvier* (10%) and other (2%). Similarly, Fig. 5 shows that among rays, the major contribution was from *Himantura uarnak* (120%) followed by *Himantura walga* (60%), *Himantura bleekeri* (34%), *Rhinobatos granulatus* (18%), *Gymnura micrura* (7%), *Mobula diabolus* (11 MT, 5%), *Rhynchobatus djiddensis* (10 MT, 5%), *Aetomylaeus nichofi* (09 MT, 4%), *Rhinoptera javanica* (08 MT, 4%) and *Narcine timlei* (07 MT, 4%) and other species with least occurrence (08 MT, 4%). Species which were rare in the catch or constituted very low proportion are placed in 'other' category.

### *Landing trend of different species*

The landing patterns of the shark and ray species most commonly found in this study are presented below:

During April-June/2006, the highest and lowest percentage composition of *Scoliodon laticaudus* was 46.41% and 6.37% in the month of May and June/06 respectively. In 2006-07, the dominant percentage was 48.30% in the month of August/06 and the lowest was 1.49% in February/07. During 2007-2008, the highest and lowest percentages were 26.20% in May/08 and 1.38% in June/08 respectively. In 2008-09, the maximum and minimum percentages were 53.67% and 3.31% during December/08 and October/08. During 2009-2010, the highest percentage was 63.89% in September/09 and the lowest was 4.34% in May/2010 respectively (Fig. 6). During April-June/2006, the highest percentage composition of *Rhizoprionodon acutus* was 50.80% and lowest was 3.75% in the month of April/06 and June/06 respectively. During 2006-2007, the highest and lowest percentages were 27.25% and 0.41% in July/06 and January/07 respectively. In the period 2007-2008, the maximum percentage was 46.29% in the month of September/07 and the minimum was 2.71% in January/08. During 2008-09, the dominant and lowest catches were 25.35% and 0.85% in March/09 and September/08 respectively. In the year 2009-2010, the maximum and minimum percentages were 15.07% and 0.22% in the month of August/09 and May/10 respectively (Fig. 7).

During April-June/2006, the landing of *Carcharhinus melanopterus* species was zero. In 2006 to 2007, the highest and lowest percentage compositions were 21.75% and 1.14% in the month of June/07 and January/07 respectively. During 07-08, the maximum abundance was 28.84% in the month of August/07 and minimum was 2.14% in September/07. In 2008-09, the dominant and lowest catches were 35.65% and 0.49% in the month of April/09 and December/08 respectively. During 2009-10, the highest percentage was 52.24% in the month of May/10 and lowest was 0.66% in October/09 (Fig. 8). During April-June/2006, the percentage composition of *Sphyrna zygaena* was 0.33% only in the month June/06. In 2006-07, the highest and lowest percentages were 7.67% and 0.68% in the month of June/07 and March/07 respectively. During 2008-2009, the maximum catch percentage was 14.09% in the month of February/09 and minimum was 2.51% in March/09. In 2009-2010, the dominant and lowest percentages were 21.35% and 1.42% in the month of March/10 and October/09 respectively (Fig. 9).

During April-June/2006, the percentage compositions of *Chiloscyllium indicum* were 4.95% and 2.78% in the month of June/06 and May/06 respectively. In the year 2006-07, the highest and lowest percentages were 27.32% and 0.10% in May/07 and August/06 respectively. During 2007-08, the maximum catch percentage was 12.23% in the month of April/08 and the minimum was 0.61% in September/07. In 2008-09, the dominant catch was 14.41% in February/09 and the lowest in the month of May/09 was 0.53%. During 2009-10, the maximum and minimum catch percentages were 11.31% and 0.21% in the month of June/10 and February/10 respectively (Fig. 10).

During April-June/2006, the percentage compositions of *Himantura uarnak* catch were 83.21% and 13.41% in the month of June/06 and May/06 respectively. In 2006-07, the highest percentage was 65.44% in March/06 and the lowest was 5.57% in the month of February/07. During 2007-08, the maximum and minimum landings were 25.49% and 0.04% in the month of December/07 and September/07 respectively. In 2008-09, the dominant catch was 27.35% in the month of January/09 and the lowest was 0.53% in December/08. During 2009-10, the highest and lowest percentage compositions were 18.30% and 0.23% in the month of February/10 and June/10 respectively (Fig. 11). The percentage composition of *Himantura walga* landing was absent during April-June/2006. In 2006-07, the dominant and lowest compositions were 60.66% and 0.22% in the month of February/07 and October/06 respectively. During 2007-08, the maximum catch percentage was 29.65% in September/07 and the minimum was 5.34% in the month of April/08. In 2008-09, the dominant percentage composition was 11.12% in the month of June/09 and the lowest was 0.62% in July/08. During 2009-10, the highest and lowest catch percent were 16.93% and 0.33% in the month of July/09 and November/09 respectively (Fig. 12).

During April-June/2006, the percentage composition of *Himantura bleekeri* was totally absent. In 2006-07, the highest catch percentage was 17.07% in February/07 and the lowest was 0.08% in April/07. During 07-08, the maximum and minimum landings were 34.87% and 0.48% in the month of October/07 and April/08 respectively. In 2008-09, the dominant percentage was 55.99% in the month of September/08 and the lowest was 2.23% in November/07. During 2009-10, the highest and lowest percentage compositions were 34.66% and 0.21% in the month of October/09 and February/10 respectively (Fig. 13). During April-June/2006, the percentage compositions of *Rhibobatos granulatus* were 16.29% and 0.27% in the month of May/06 and June/06 respectively. In the year 2006-07, the maximum percentage was 7.97% in November/06 and the minimum was 0.19% in the month of September/06. During 2007-08, the dominant and lowest percentages were 24.01% and 0.60% in the month of June/08 and April/08 respectively. In 2008-09, the highest percentage was 7.97% in the month of

November/08 and lowest was 0.36% in June/09. During 2009-10, the maximum and minimum percentage compositions were 36.91% and 0.20% in the month of April/10 and June/10 respectively (Fig. 14).

## IV. DISCUSSION

From the survey report by White *et al.* (1985), it appears that maximum number of sharks and rays are distributed and harvested between 10-50 meter depth zones of the Bay of Bengal. In the present study, major landings came from the artisanal mechanized boats, so it can be predicted that most sharks and rays were caught within 40 meter depth. It should be noted that shark target fishing has been developed for the last 5-10 years mainly by using hooks and lines during winter months. During 2007- 2008, about 53% of total shark and ray 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 i.e. 5% (Fisheries Statistical Yearbook of Bangladesh, DoF, 2009).

In the present investigation, 11 species of shark and 16 species of ray were identified (Table 1). The number of shark and ray species in Bangladesh reported by different authors varies. According to IUCN (2000), the total number is 56, while Rahman *et al*. (2009), Roy *et al.* (2007), Quddus *et al.* (1988), Day (1978) and Hussain (1970) mentioned the number as 51, 22, 21, 63 and 56 respectively. For proper identification of species, publication of detail species profile in vernacular language is very important (Halder, 2010). Besides, the scientific names and even family names of many Chondrichthyes species has been changed which needs to be upgraded to avoid mistakes. Cantor (1849) published a catalogue, which outlines the taxonomy of 28 species of sharks and rays in Malaysian waters, while Scott (1959) described some 294 marine fishes, out of which 25 are sharks and rays. Ahmad *et al.* (1999) believed at least 12 families of sharks (comprising around 48 species) and 11 families of rays (41 species) inhabit in Malaysian waters. About 70 species of sharks occur in Indian seas within which about 22 species have only limited occurrence and value; around 12 are moderately abundant though not frequently caught and only 06 are major species in the fishery (Hanfee, 1998).

Halder (2010) showed that the average weight of sharks in Bangladesh ranged from 0.11 to 9.02 kg following the data of Roy *et al.* (2007) and commented that comparatively smaller sizes of sharks are caught here. In the present investigation, dominance of smaller size sharks was also observed which is due to the fact that 76% of the overall catch constituted by *S. laticaudus* (Fig. 4) having average size between 50-52 cm in total length and 0.15-0.2 kg in weight. Since, pelagic requiem sharks (e.g. *Carcharhinus Sps.*) of larger size 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 rare in the catch. Further study on species size distribution through time and area need to be done to understand the issue of overexploitation. The country annual catch of sharks and rays in 2006-07, 2007-08, 2008-09 and 2009-10 were 4790 MT, 4767 MT, 3933 MT and 4033MT respectively (Fisheries Statistical Yearbook of Bangladesh,DoF, 2010). In the present study, the total landings in Chittagong and Cox's Bazar for the consecutive years were found as 342 MT, 188 MT, 181 MT and 172 MT respectively (Fig. 3), which corresponds to the slightly declining trend of the total country catch. However, to understand the actual trend in shark catches, no less than 15-20 years data set is required, nevertheless, the present findings has at least provided some initial ideas.

According to landing volume and contribution to overall catch, *Scoliodon laticaudus* was found to be the most common shark followed by *Rhizoprionodon acutus* (Fig. e 4) which is in agreement with the findings in Indian seas by Hanfee, (1998). He reported that among the requiem sharks, *Carcharhinus sorrah, C. limbatus* and *C. melanopterus* and the hammerhead shark *Sphyrna lewini* are common but in present study only *C. melanopterus* were common. He found that other sharks which occur moderately in the catches are the grey sharks, *C. macloti, C. hemiodon, C. dussumieri, C. Sealei, Loxodon macrorhinus* and *Rhizoprionodon oligolinx* but none of these were found to occur in the present study. Further, the tiger shark (*Galeocerdo cuvier*) and the hammerhead shark *Eusphyra blochii* were relatively common in the catches of sampling time which also agree with the findings of Hanfee. No similar work in the Bay of Bengal is available to compare with the present findings. However, the least common species in the catch gives cause for some concern and requires investigation on their population status. It should be noted that changes in species contribution takes long time and require many years data to draw conclusion. Further, there may be other factors like changes in fishing effort and fishing practices having significant influence on catch. Catches in the exploratory surveys by the government of Indian tuna long liners showing that the Pelagic sharks constitute 42% in the Arabian Sea, 36% in the Bay of Bengal, 43% in the Andaman Sea and 31% in equatorial areas. However, there has been no organized industrial fishing for the pelagic sharks till now (Devadoss, 1997). Sivasubramaniam (1987) summarizes data from fisheries survey of Indian tuna research cruises off the south west coast of India during 1983-1986. These results indicate the catch rates of 17.6 sharks/1000 hooks. James and Pillai (1987) review additional research cruise result from areas of the south east Arabian Sea, Andaman Sea, Western Bay of Bengal and the equatorial region of Indian Ocean. They found the percentage contribution of sharks to the total catch average as 39.8%.

In Bangladesh, shark fishing is done throughout the year but the main season is November to March and a peak was found in June (Roy *et al.*, 2007). In the present study, catch compositions varied from month to month of a sampling year (Fig 6 to Fig. 14). To interpret these patterns of occurrence, baseline biological information (such as life cycle, size composition, breeding behavior, food and feeding habit, age at birth, age of maturity, fecundity, growth, habitat, migration etc.) is needed.

Besides, size class distribution was not possible to work out from the catch data which has an important bearing on the trends in occurrence. Pepperell (1992) analyzed the records of shark captures from 1961 to 1990 by game fish anglers off south-eastern Australia. He found interesting changes in size distribution of the catch that have occurred for blue, hammerhead, grey nurse, mako, tiger and white sharks caught over the past three decades. It should be mentioned that MFSMU of Chittagong started to record species wise catch data of elasmobranches since 2005 for the landing stations in Chittagong and Cox's Bazar while such record is not available for the landing centers at south west part of Bangladesh. 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.

James (1973) elaborated the occurrence of some shark and ray species off the east coast of India. He reported that *S. laticaudus* breeds round the year, therefore dominates the catch which is in agreement with present findings (Fig. 6). He found that *C. melanopterus* was quite common in the catch from April- July which matches the present findings but several peaks in other months were also recorded (Fig. 8) and this may be due to variation of different sites. He recorded gravid female of *S. zygaena* in February, March, May and October. Information on berried female of this species is absent in this study, however, Fig. 9 shows peak abundance in January, March and July while moderate catch in August, October onwards and this may be indirectly related to new recruitment. The differences in appearance or assemblage of a species can be attributed to a number of factors such as territorial habitat, reproduction, change in weather parameters, seasonal migrations and availability of food and different methods of sampling.

## V. Conclusion

In the present study, a brief image on the status of shark fishery in Bangladesh has been represented. On the basis of major findings some limitations and necessary measures are detailed as below:

Key features (such as nostrils, gill slits, mouth position, various lengths, body coloration etc.) used to make distinctions between different species of sharks and rays are so close that it often makes confusion. Therefore, detail species profile needs to be developed with local names, valid scientific names, pictures and status in IUCN red list. Further, for easy and correct identification at field level, guide book and training on taxonomy need to be provided for the data collectors. In absence of long term data record (both species and area wise), it becomes difficult to make absolute comment on changes in species composition over time and area, landing pattern, abundance, size distribution and vulnerability of a species. Existing data recording system is not so consistent and accessible to all stakeholders. At present, detail catch data on shark and ray fishes is maintained from MFSMU, Chittagong which should be extended to the south western coastal districts as well. In this regard, the capacity of MFSMU, Chittagong needs to be strengthened. Information on biological aspects, population parameters (e.g. growth rate, mortality, exploitation rate, recruitment pattern, maximum sustainable yield, biomass etc.), fishing effort (e.g. fish days, gear, mesh size, fishing depth etc.) and impacts of environmental changes on shark fishery are still very limited to interpret catch data. Therefore, accumulation of data and information together with need based research is of prior importance. Shark fishery although has a minor contribution to the total catch, its potential to the economy and biodiversity of our country is noteworthy. Therefore, a National Plan of Action (NPOA) for sustainable management and development of the fishery is an urgent need.

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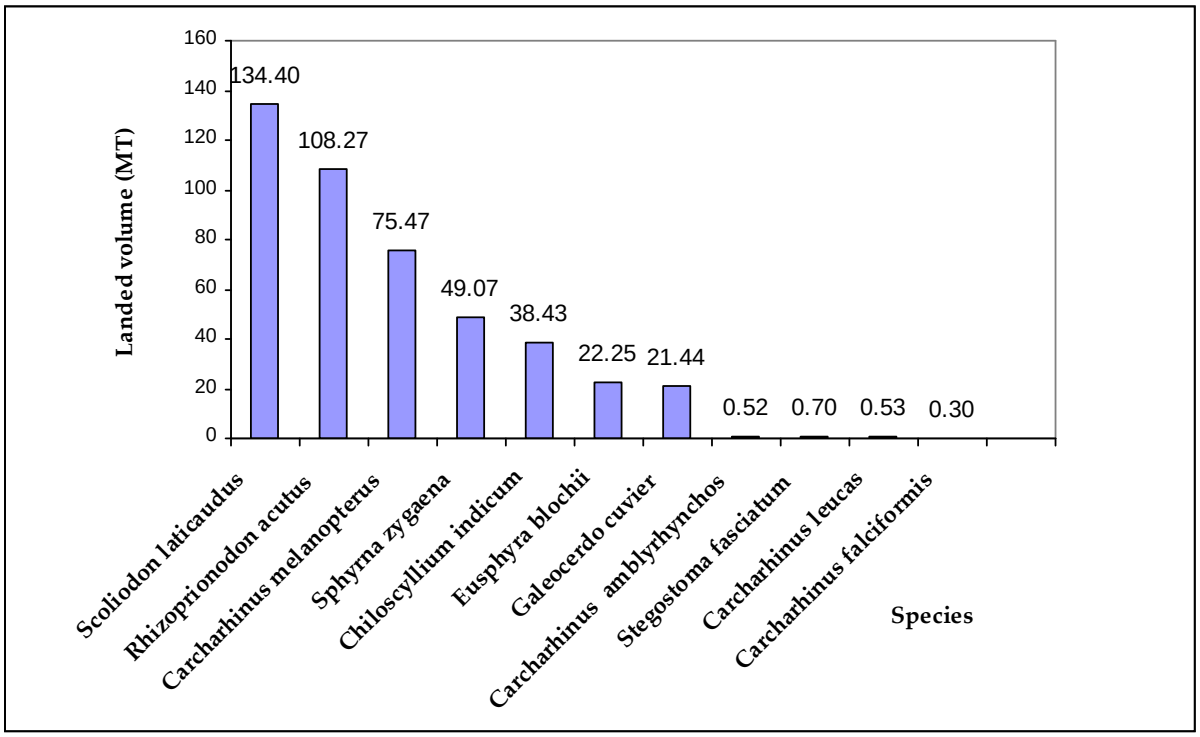


Fig.1. Total landing of Shark species in Chittagong and Cox's Bazar from April 2006 to June 2010

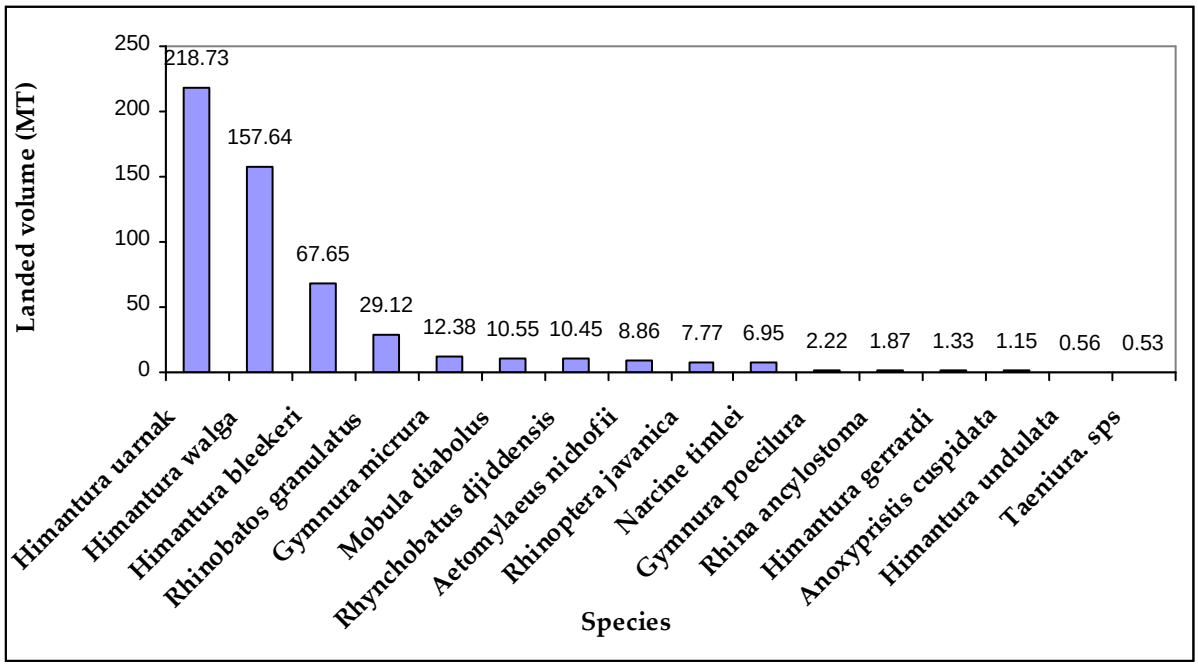


Fig.2. Total landing of Ray species in Chittagong and Cox's Bazar from April 2006 to June 2010

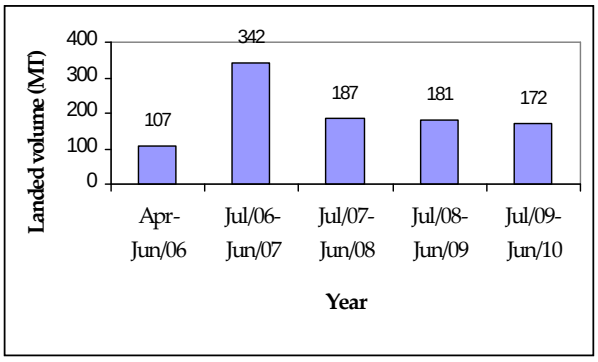


Fig.3. Total landing of Shark and Ray in Chittagong and Cox's Bazar from April 2006 to June 2010

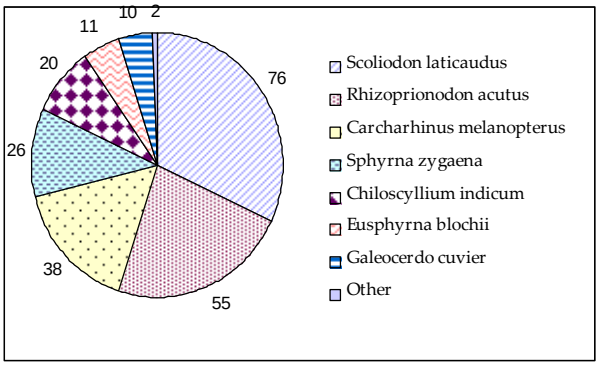


Fig.4. Percent contribution of Shark species in Chittagong and Cox's Bazar from April 2006 to June 2010

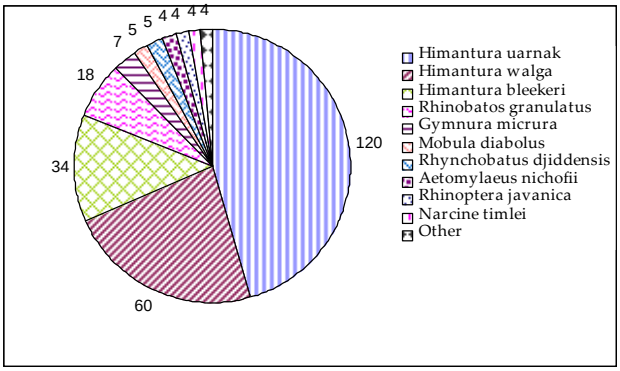


Fig.5. Percent contribution of Ray species in Chittagong and Cox's Bazar from April 2006 to June 2010

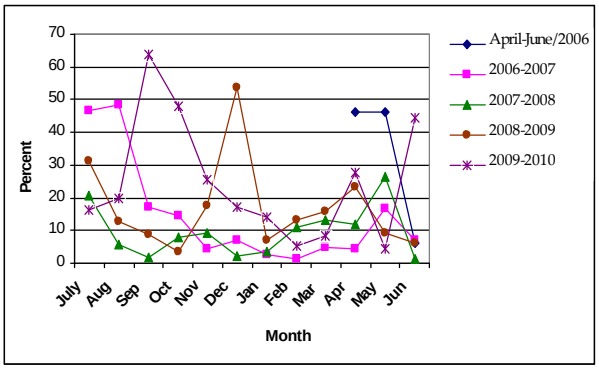


Fig.6. Percent contribution of *Scoliodon laticaudus* in Chittagong and Cox's Bazar from April 2006 to June 2010

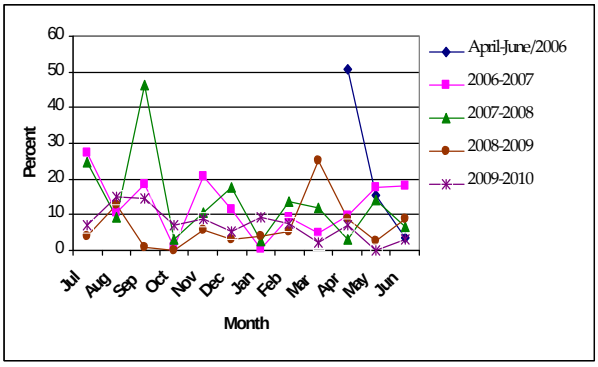


Fig.7. Percent contribution of *Rhizoprionodon acutus* in Chittagong and Cox's Bazar from April 2006 to June 2010

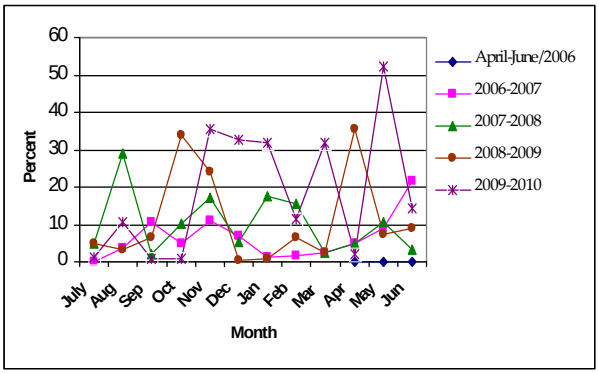


Fig.8. Percent contribution of *Carcharhinus melanopterus* in Chittagong and Cox's Bazar from April 2006 to June 2010

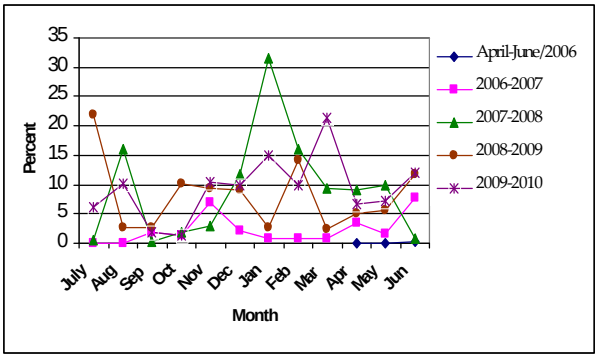


Fig.9. Percent contribution of *Sphyrna zygaena* in Chittagong and Cox's Bazar from April 2006 to June 2010

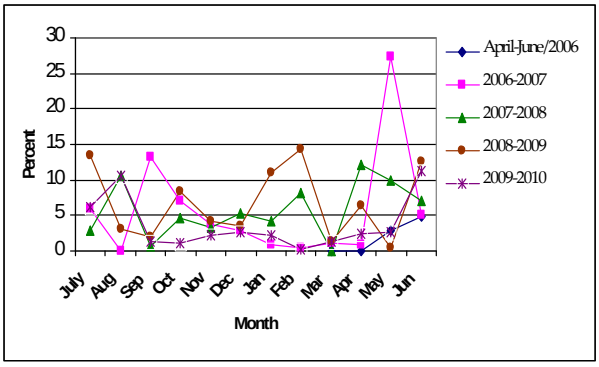


Fig.10. Percent contribution of *Chiloscyllium indicum* in Chittagong and Cox's Bazar from April 2006 to June 2010

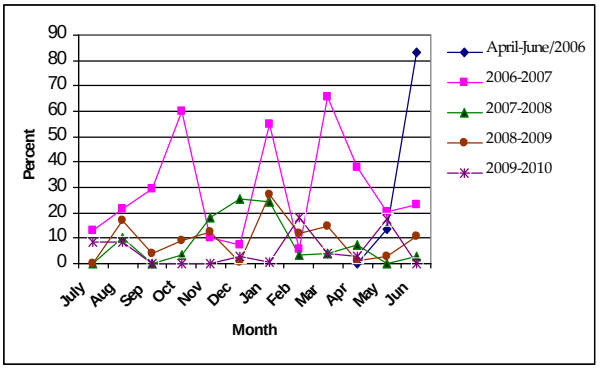


Fig.11. Percent contribution of *Himantura uarnak* in Chittagong and Cox's Bazar from April 2006 to June 2010

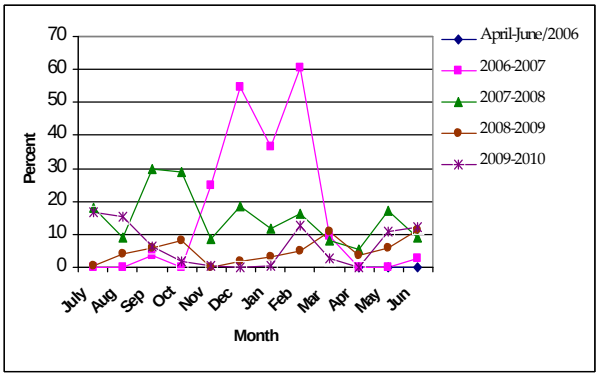


Fig.12. Percent contribution of *Himantura walga* in Chittagong and Cox's Bazar from April 2006 to June 2010

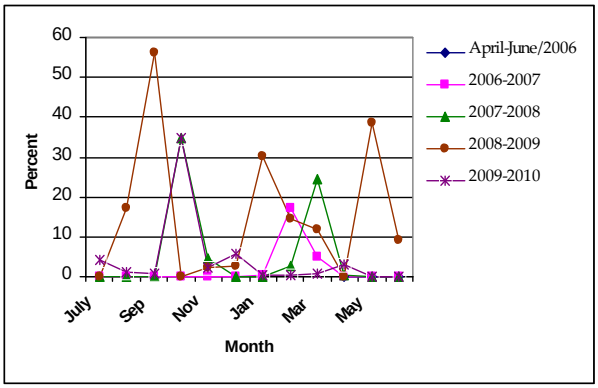


Fig.13. Percent contribution of *Himantura bleekeri* in Chittagong and Cox's Bazar from April 2006 to June 2010

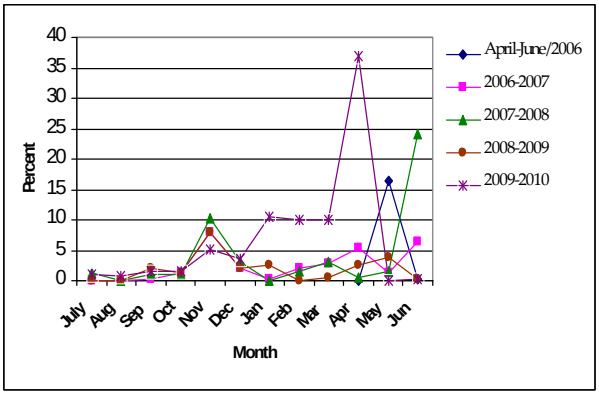


Fig.14. Percent contribution of *Rhinobatos granulatus* in Chittagong and Cox's Bazar from April 2006 to June 2010

Table 1: Total landing and percent contribution of sharks and rays in Chittagong and Cox's Bazar district from April 2006 to June 2010

| S. No | Species name | English name | April/2006 - June/2006 | | July/2006- June/2007 | | July/2007 -June/2008 | | July/2008- June/2009 | | July/2009 - June/2010 | | Total Landing (MT) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Landing (MT) | % contribution | Landing (MT) | % contribution | Landing (MT) | % contribution | Landing (MT) | % contribution | Landing (MT) | % contribution | |
| A. | SHARKS | | | | | | | | | | | | |
| 1. | Scoliodon laticaudus | Yellow dog shark | 16.835 | 15.71 | 22.037 | 6.45 | 18.340 | 9.77 | 33.271 | 18.39 | 43.914 | 25.49 | 134.397 |
| 2. | Rhizoprionodon acutus | Sharp nosed shark (milk shark) | 9.030 | 8.42 | 30.992 | 9.07 | 42.294 | 22.52 | 13.340 | 7.37 | 12.614 | 7.32 | 108.27 |
| 3. | Carcharhinus melanopterus | Black shark | | | 16.209 | 4.74 | 14.094 | 7.51 | 12.646 | 6.99 | 32.525 | 18.88 | 75.474 |
| 4. | Sphyrna zygaena | Round headed hammerhead shark | 0.275 | 0.26 | 6.612 | 1.94 | 13.086 | 6.97 | 11.854 | 6.55 | 17.242 | 10.01 | 49.069 |
| 5. | Chiloscyllium indicum | Ridge back cat shark | 4.597 | 4.29 | 11.874 | 3.48 | 7.157 | 3.81 | 9.892 | 5.47 | 4.911 | 2.85 | 38.431 |
| 6. | Eusphyrna blochii | Arrow headed hammerhead shark | 0.449 | 0.42 | 4.636 | 1.36 | 8.202 | 4.37 | 6.114 | 3.38 | 2.852 | 1.66 | 22.253 |
| 7. | Galeocerdo cuvier | Tiger shark | 0.170 | 0.16 | 7.007 | 2.05 | 5.081 | 2.71 | 4.091 | 2.26 | 5.093 | 2.96 | 21.442 |
| 8. | Carcharhinus amblyrhynchos | Grey shark | | | | | 0.708 | 0.38 | | | 0.515 | 0.30 | 1.223 |
| 9. | Stegostoma fasciatum | Zebra shark | 0.206 | 0.19 | 0.050 | 0.01 | 0.392 | 0.21 | 0.050 | 0.03 | 0.003 | 0.001 | 0.701 |
| 10. | Carcharhinus leucas | Bull shark | | | | | | | | | 0.527 | 0.31 | 0.527 |
| 11. | Carcharhinus falciformis | Silky shark | | | | | 0.304 | 0.16 | | | | | 0.304 |
| B. | RAYS | | | | | | | | | | | | |
| 12. | Himantura uarnak | Honeycomb whip ray | 70.950 | 66.20 | 106.873 | 31.28 | 14.535 | 7.74 | 18.638 | 10.30 | 7.737 | 4.49 | 218.733 |
| 13. | Himantura walga | Scaly sting ray | | | 103.042 | 30.16 | 35.643 | 18.98 | 9.566 | 5.028 | 9.392 | 5.45 | 157.643 |
| 14. | Himantura bleekeri | Whiptail sting ray | | | 15.139 | 4.43 | 8.657 | 4.61 | 35.452 | 19.60 | 8.400 | 4.88 | 67.648 |
| 15. | Rhinobatos granulatus | Granulated shovel nose ray | 3.330 | 3.11 | 8.198 | 2.40 | 1.372 | 2.99 | 3.786 | 2.09 | 12.431 | 7.22 | 29.117 |
| 16. | Gymnura micrura | Short tail butterfly ray | 0.270 | 0.25 | 0.154 | 0.05 | 0.830 | 0.44 | 4.508 | 2.49 | 6.620 | 3.84 | 12.382 |
| 17. | Mobula diabolus | Leaser Devil ray (Bat ray) | 0.165 | 0.15 | 2.001 | 0.59 | 2.415 | 1.29 | 4.977 | 2.75 | 0.993 | 0.58 | 10.551 |
| 18. | Rhynchobatus djiddensis | White spotted shovel nose ray | 0.375 | 0.35 | 2.394 | 0.70 | 5.616 | 3.00 | 1.803 | 1.00 | 0.260 | 0.15 | 10.448 |
| 19. | Aetomylaeus nichofii | Nieuhof's eagle ray | | | 1.335 | 0.39 | 6.608 | 3.53 | 0.855 | 0.47 | 0.066 | 0.04 | 8.864 |
| 20. | Rhinoptera javanica | Javanese cow ray | | | 0.933 | 0.27 | 0.154 | 0.08 | 2.850 | 1.58 | 3.832 | 2.22 | 7.769 |
| 21. | Narcine timlei | Spotted electric ray | | | 1.815 | 0.53 | 0.494 | 0.47 | 4.044 | 2.24 | 0.597 | 0.35 | 6.95 |
| 22. | Gymnura poecilura | Long tail butterfly ray | | | | | | 0.08 | 1.845 | 1.02 | 0.374 | 0.22 | 2.219 |
| 23. | Rhina ancylostoma | Bow mouthed guitar fish (shark ray) | 0.530 | 0.49 | 0.175 | 0.05 | 0.928 | 0.26 | | | 0.240 | 0.14 | 1.873 |
| 24. | Himantura gerrardi | White spotted whip ray | | | | | | | 1.333 | 0.74 | | | 1.333 |
| 25. | Anoxypristis cuspidata | Knife tooth saw fish | | | 0.220 | 0.06 | 0.883 | | | | 0.042 | 0.02 | 1.145 |
| 26. | Himantura undulata | Leopard whip ray | | | | | | | | | 0.560 | 0.33 | 0.560 |
| 27. | Taeniura. sps | Fantail ray | | | | | | | | | 0.526 | 0.31 | 0.526 |
| | Total | | 107.182 | | 341.696 | | 187.793 | | 180.915 | | 172.266 | | 989.852 |