

Full Length Research Paper

Exploitation, trade, conservation and management of shark fishery in the Bay of Bengal of Bangladesh region

Roy Bikram Jit^{1*}, Nripendra Kumar Singha¹, Gaziur Rhaman¹ and Fukrul Alam²

¹Marine Fisheries Survey Management Unit, C.G.O building-2, 6th floor, Agrabad, Chittagong, Bangladesh.

²Matshya Bhaban, Dhaka, Bangladesh.

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This study was conducted during July, 2003 to June, 2013 about landing volumes of shark fishery (sharks and rays) in artisanal and industrial fishing sector only in group-wise not in species wise. In these periods, in artisanal fisheries gill nets (shark nets), set bag nets, long lines and trammel nets exploiting data were analyzed. But from 2012-2013 periods in industrial fisheries, this study started the recording and keeping of harvesting data of sharks and rays by trawl fishing in group wise. During 2012-2013, total sharks and rays landing volume contributes only 0.85% (5017 MT) of the total marine fish production of Bangladesh. During 2010-2011 to 2012-2013, no sharks and rays product items were traded from Bangladesh due to international market ban. But from 2003-2004 to 2009-2010 period, sharks and rays products with fish maws were exported to the Myanmar, India, Singapore, Thailand, Hong Kong, China, USA and other countries. Dried and iced sliced meat of shark and rays, its sun-dried hide, bones, fins, tails, teeth and shark liver oil were all sold to local consumers, but only sets of fins (2 pectoral, 2 pelvic, 1 dorsal, 2 anal and 1 caudal fin) and skins were exported to the foreign markets, which has been stopped now. In the year 2009-2010, a total of 955 MT of sharks and rays product (with fish maws) were exported and a total of USD 1.60 million were earned (app.). For the conservation and management of shark fishery, there is need for the National Plan of Action, which was exploited in the MSY and which helped to ban critically endangered sharks and rays species. Appropriate law must be set up in the Fish Act (at present Fish Act has no forms of restriction for harvesting sharks, while Forestry Act restricts it in Sundarbans area) for sustainable harvesting and conservation of the elasmobranchs. Such law should include the number of boats (motorized- and non-motorized) and industrial trawlers that could be allowed to harvest sharks from a particular area, to include the particular season and the allowable limit of harvests; in every case, proper ways of fishing methods should strictly be followed. Coastal areas around Saint Martin's Island and Sundarbans proposed by the Bay of Bengal should be declared as Marine Protected Area as most sharks use these areas as their nursing grounds.

Key words: Trade, conservation, management, fish act, forest act.

INTRODUCTION

Bangladesh is situated at the northern end of the Bay of Bengal between latitude 20.34 and 26.38 North and longitude 88.01 and 92.41 East. There is a total of 166,000 km² water area including EEZ. In this area, there are 53 species of shark, skates and rays (Hussain, 1969).

Fisheries are also important sources of employment in the region. In the artisanal sector at least 500,000 fishermen and 57,863 vessels are employed in the Bay of

Bengal of Bangladesh region. The industrial sector includes at least 225 industrial fishing vessels (DoF, 2013-2014). Artisanal fishermen use a range of gear

*Corresponding author. E-mail: jitroy1964@yahoo.com. Tel: 00 88 01815509464; Fax: 00 88 031 724206.

including gill net (shark net) set bag net, trammel net, hook and lines and others gears. Sharks are harvested by different fish trawls, shark nets (modified long mesh drift gill net), hooks and lines and sometimes by trammel nets. Rays are mainly exploited by shrimp trawl, hooks and lines and incidentally by the set bag net also. Bangladesh's major shark hunting grounds include the coastal waters of Kuakata, Sonar Char, Ruper Char, Fatrar Char and Char Gongmoti in Patuakhali; Dublar Char in Khulna; Ashar Char, Patharghata, Barguna and the Sunderbans; Sandwip in Chittagong; Kutubdia, Moheshkhali and Elephant point in Teknaf, Cox's Bazar.

There are a few small scale sharks processing plant which are operating seasonally for the irregular supply of sharks and rays. Shark processing is carried out as a cottage industry which is mostly by the fisher folk communities and by different stakeholders (Roy, 2008). To export 955 MT of sharks and rays items (fins, skins, small dry fish, teeth, jaws, liver oil, tail, etc.) during 2009-2010 had been playing an important role (approximately USD 0.16 million.) in our economy. No shark products were exported from Bangladesh in 2010 and 2011 due to international ban, but some items were smuggled in the Myanmar in IUU method. In Bangladesh sharks, skates and rays are exploited commercially and which are harvested in industrial and artisanal fisheries. Although shark fishing is seasonal, harvest starts from November and continue up to May. The peak harvesting periods are in December to January. At present, about 80-120 numbers of mechanized boats are engaged directly in shark and ray fishing.

Additionally, elasmobranchs have not been a highly priced fishery product. Their economic value ranks low among marine commercial fisheries, for example, in the Taiwanese gill net fisheries of the central waters pacific, shark (trunks) prices attain only 20% and 60% of those of tunas and mackerels (both whole) respectively (Millington, 1981). The only highly prized elasmobranch product is shark fin for oriental soup, a commodity for which there has recently been a considerable increase in demand (Cook, 1990). Small size of shark and ray is used to produce fish meal and fertilizer if markets of human consumption are not available (Compagno, 1984).

They are typically slow growing and long lived and mature at a late age, with their low fecundity resulting in a low reproductive potential for most of the species. Recoveries of population numbers from severe depletions (caused either by natural phenomena or a human action) should take many years for the majority of elasmobranchs (Bonfil, 1994). Fisheries for elasmobranchs have not increased in the same way because of other fisheries worldwide. Due to the low market value of these fishes and relatively low abundance, Compagno (1990) indicates that in terms of commercial catches and according to FAO statistics, cartilaginous fishes are a minor group which contributed an average of 0.8% of the total world fishery landings

during 1947-1985. However, bony fishes such as clupeids, gaboids and scombroids accounted for 24.6%, 13.9% and 6.5% respectively.

In Bangladesh, shark fishery (sharks, skates and rays) was introduced as a single fishery, which was exploited by fishers for trade and which contributed about 0.85% of the total marine fish production during July 2012 to June 2013. In the year 2012-2013, it has been estimated that the landing volumes of sharks and rays were 5017 MT (DoF, 2012-2013).

MATERIALS AND METHODS

Landing data about the shark fisheries (sharks and rays) were collected from the Statistical Year Book of Bangladesh, Department of Fisheries and Livestock, Bangladesh, during July, 2003 to June, 2013 and analyzed. In our marine fishery sector, we started recording the sharks and rays harvesting data from trawl fishing during July 2012 to the present time, but artisanal data were recorded from previous times. All sharks and rays data were collected only in group wise and not in species wise, in industrial and artisanal fishing sector. Statistical software excel were used for data analyses.

RESULTS

Gear wise exploitation

Sharks and rays are exploited mainly in the artisanal sector by different gears (gill net-shark net, set bag net, long line and trammel net) and in the industrial sector by different trawl fishing methods which were unreported during the last decay. From the fiscal year, harvesting of sharks and rays in trawl fisheries have been reported only in group wise. During 2012-2013, a total of 5017 MT of sharks and rays were landed of which 1885 MT (37.57%) was gotten by gill net fishing, 430 MT (8.57%) by set bag net, 2031 MT (40.48%) by long line, 125 MT (2.49%) by trammel net, and 546 MT (10.88%) by the rest types of net which was in trawl fishing also. In the year 2011-2012, gill net contributed 38.29% (1480 MT), followed by 14.23% (550 MT), 44.58% (1723 MT) and 2.90% (112 MT) which were contributed by set bag net, long line and trammel net fishing respectively. During 2010-2011, a total of 4205 MT were exploited by gill net (1666 MT or 39.62%), set bag net (609 MT or 14.48%), long line (1841 MT or 43.78%) and trammel net (89 MT or 2.22%). In 2009-2010, no shark net (gill net) fishing was observed but 1863 MT (46.19%) was exploited by set bag net followed by 2021 MT (50.11%) and 149 MT (3.70%) which were by long line and trammel net respectively. During 2008-2009, a total of 3933 MT catch was recorded by set bag net (1863 MT or 47.37%), long line (1921 MT or 48.84%) and from trammel net fishing (149 MT or 3.79%) also, no gill net fishing was observed. In the year 2007-2008, gill net fishing contributed 2538

Table 1. Gear wise exploitation of shark fishery during last 10 years.

Year	Gear wise landing (MT)				Total landing (MT)
	Gill net fishing	Set bag net fishing	Long line fishing	Trammel net fishing	
2012-2013	1885	430	2031	125	5017 (546 MT in trawl fishing)
2011-2012	1480	550	1723	112	3865
2010-2011	1666	609	1841	89	4205
2009-2010	0	1863	2021	149	4033
2008-2009	0	1863	1921	149	3933
2007-2008	2538	232	1634	363	4767
2006-2007	2439	258	1810	283	4790
2005-2006	2442	211	1706	89	4448
2004-2005	2245	178	1570	92	4085
2003-2004	2073	175	2601	97	4946

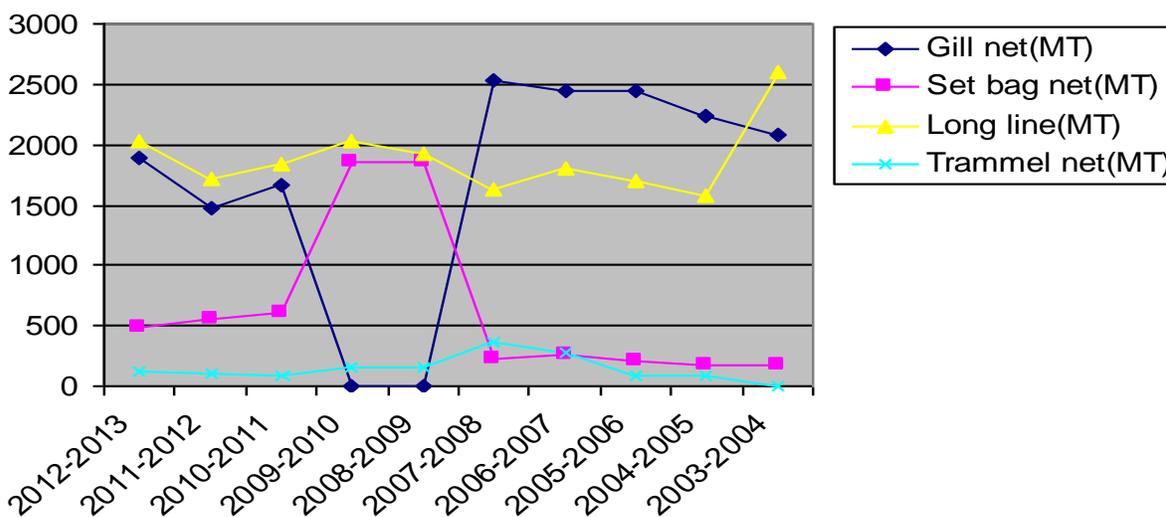


Figure 1. Gear wise total landing of shark fishery during the last 10 years.

MT (53.24%) followed by 232 MT (4.87%), 1634 MT (34.28%) and 363 MT (7.61%) were set bag net, long line and trammel net fishing respectively. During 2006-2007, landing volume was 4790 MT on which gill net contributes 2439 MT (50.92%), set bag net 258 MT (5.39%), long line 1810 MT (37.79%) and trammel net 283 MT (5.91%). In 2005-2006 period, gill net fishing contributed 2442 MT (54.90%) followed by set bag net, long line and trammel net fishing which were 211 MT (4.74%), 1706 MT (38.36%) and 89 MT (2.00%) respectively. In the year 2004-2005, a total of 4085 MT was recorded of which gill net contributed 2245 MT (54.96%), set bag net contributed 178 MT (4.36%), long line contributed 1570 MT (38.43%) and trammel net contributed 92 MT (2.25%). During 2003-2004, gill net fishing contributed 2073 MT (41.91%) followed by set bag net, long line and trammel net fishing volumes which

were 175 MT (3.54%), 2601 MT (52.59%) and 97 MT (1.96%) respectively (Table 1, Figures 1 and 2).

Percentage contribution

During 2012-2013, total landed sharks and rays volumes were 5017 MT which contributed only 0.85% of the total country production of marine catch (588,988 MT) followed by 3865 MT (0.67%), 4205 MT (0.77%), 4033 MT (0.78%), 3933 MT (0.76%), 4767 MT (0.96%), 4790 MT (0.98%), 4448 MT (0.93%), 4085 MT (0.86%) and 4946 MT (1.09%) which were of the total marine catch during 2011-2012 (578,620 MT), 2010-2011 (546333 MT), 2009-2010 (517282 MT), 2008-2009 (514644 MT), 2007-2008 (497573 MT), 2006-2007 (487438 MT), 2005-2006 (479810 MT), 2004-2005 (474597 MT) and 2003-2004 (455207 MT) respectively (Table 2 and Figure 5).

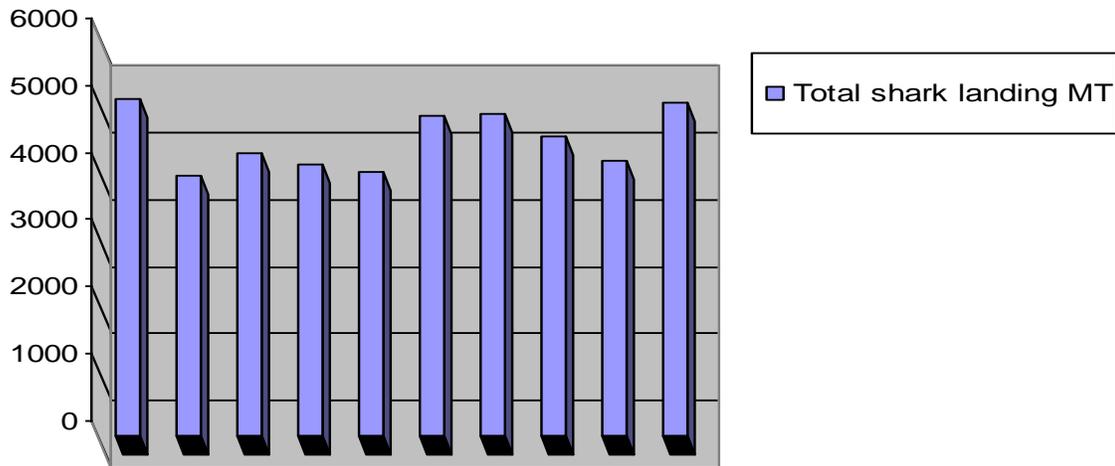


Figure 2. Total landing (MT) of shark during the last 10 years.

Table 2. Percentage contributions (%) of shark fishery during 10 years.

Year	Total shark landing MT	Total fish landing MT	% contribution
2012-2013	5017	588988	0.85
2011-2012	3865	578620	0.67
2010-2011	4205	546333	0.77
2009-2010	4033	517282	0.78
2008-2009	3933	514644	0.76
2007-2008	4767	497573	0.96
2006-2007	4790	487438	0.98
2005-2006	4448	479810	0.93
2004-2005	4085	474597	0.86
2003-2004	4946	455207	1.07

Export volumes and income

From Bangladesh, sharks and rays' products (fins, skin, teeth, liver oil, etc.) were exported up to the 2009-2010 periods in the international market mainly China, Korea, Hong Kong and Singapore. During 2010-2011 to 2012-2013, no shark products were exported from Bangladesh due to banning of shark catch and trade in different countries. In the 2009-2010 period, sharks and rays products, with fish maws exporting volumes was 955 MT followed by 276 MT, 266 MT, 244 MT, 78 MT, 1 MT and 4 MT which were in the period of 2008-2009, 2007-2008, 2006-2007, 2005-2006, 2004-2005 and 2003-2004 respectively (Table 3 and Figure 3).

In the year 2009-2010, a total of USD 1.06 million (app.) was earned from the export items followed by USD 0.22 million, USD 0.23 million, USD 0.52 million, USD 0.10 million, USD 0.05 million and USD 0.19 million which were earned during 2008-2009, 2007-2008, 2006-2007, 2005-2006, 2004-2005 and 2003-2004 respectively

(Table 3 and Figure 4).

DISCUSSION

Sharks are mainly caught by artisanal fishery with drift gill nets, used for catching Hilsa and Indian salmon, set bag nets, long lines and trammel nets within 10-80 m depth ranges. Mostly small sized sharks and rays are caught because of gear limitations. Seasonal abundance reveals that shark harvesting gains momentum in the October-December period and peaks during January-March, while catch gradually falls after that (April-June) with the lowest catches during July-September. Percentage of size abundance revealed that sharks are mostly caught at small sizes (>30 cm), while skates and rays were caught at bigger (>50 cm) sizes (BOBLME, 2014). In the early 1990-2000, catches were around 5000-6000 MT (about 1-1.5% of the total marine catch), while in the mid-2000s catches were little over 4,000 MT (0.8-0.9% of the total marine catch) and it declined to 3933 MT and 3865 MT

Table 3. Export volumes (MT) of shark product (with fish maws) and earning value (in million US dollar) during the last 10 years.

Year	Quantity (MT)	Value (in million US dollar)	Remarks
2012-2013	0	0	1 US dollar = 79 taka (app.)
2011-2012	0	0	
2010-2011	0	0	
2009-2010	955	1.60	
2008-2009	276	0.22	
2007-2008	266	0.23	
2006-2007	244	0.52	
2005-2006	78	0.10	
2004-2005	01	0.05	
2003-2004	04	0.19	

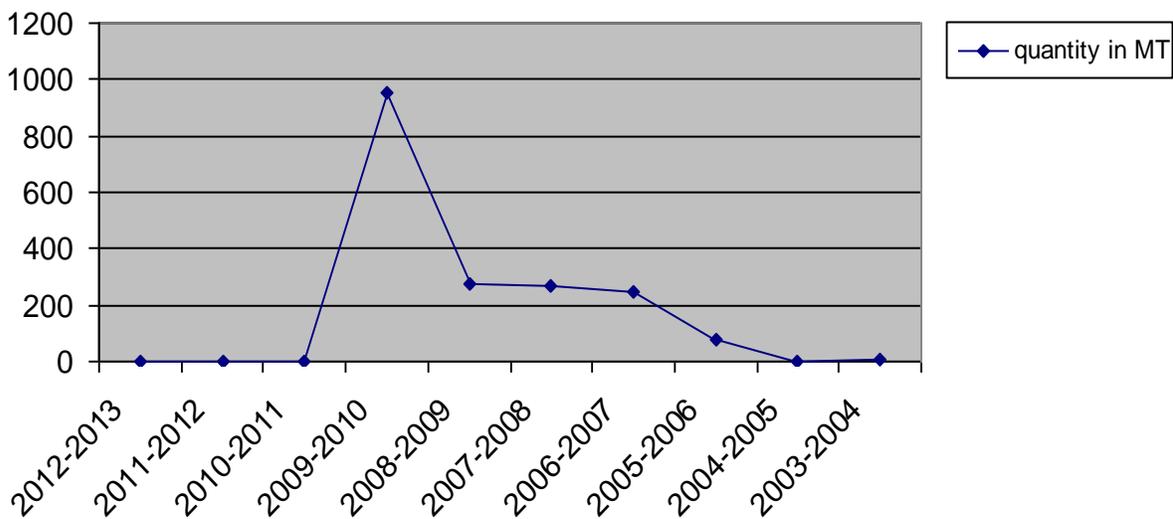


Figure 3. Total export volume of shark product (MT) during the last 10 years.

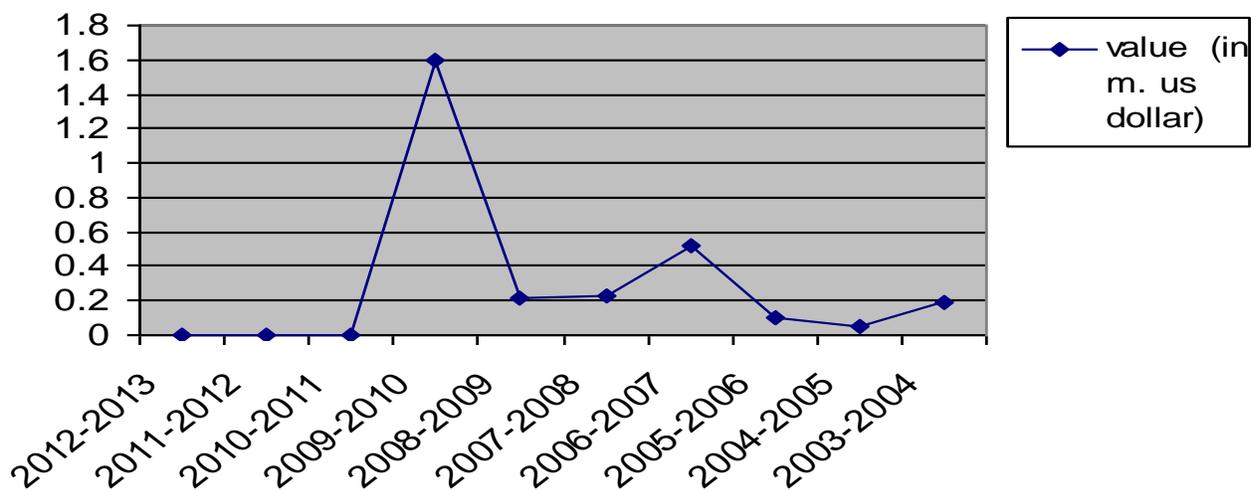


Figure 4. Total export earning of shark product during the last 10 years.

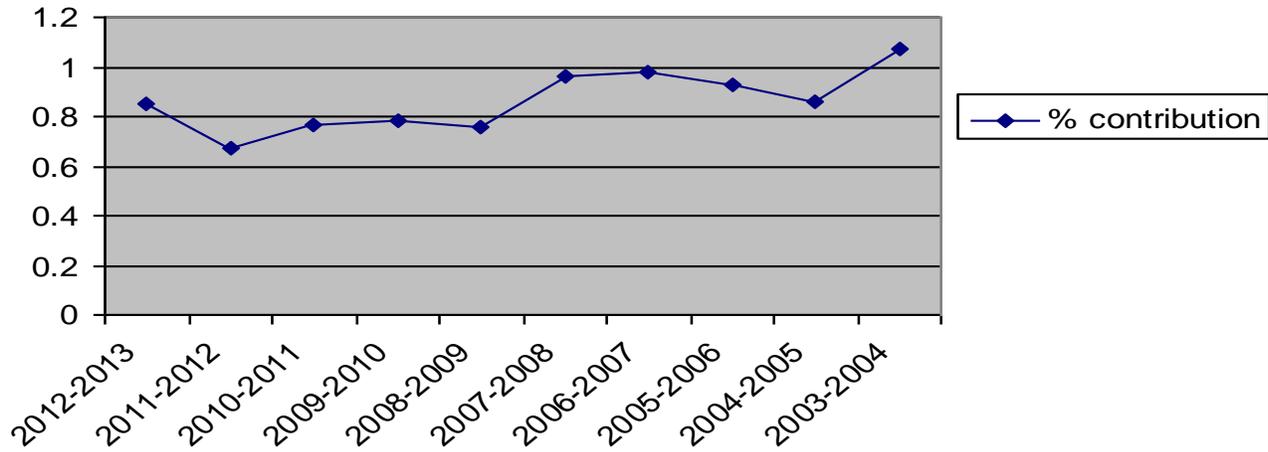


Figure 5. % contribution of sharks and rays landing in the total marine production.

per year during 2008-2009 and 2011-2012 (only 0.76% and 0.67% of the total marine catch) respectively. Catch records clearly reflect declining trend and bulk of the catch is small sized ones. The contribution of sharks and rays to the total annual marine fish landing volumes in Bangladesh declined from 1.07% in 2003-2004 to 0.85% in 2012-2013.

Sharks are caught mainly by pelagic gill net boats fishing as far as Somalia, the Yemen and Oman are concerned, although small quantities are also landed by bottom gill netters working in coastal areas of Pakistan. Around 93% of the shark catches which comes through long line fishing for sharks, rays and other species in Pakistan are described by Pardo (1991). Sharks catches are incidental to the fisheries in India (Appukittan, 1988.) and are mainly taken with long lines, which vary in design by region and are also taken by trawlers using disco nets off Ratangiri (Maharashtra), with bottom set gill nets in Proto Novo (Tamil Nadu) and by shrimp trawlers of Karalla (Devaraj, 1988). Pajot (1980) reports 26.62% of the total catch weight from large mesh small scale drift nets off Sri-Lanka, consisting of sharks and rays.

Zhou (1990) provides some information confirming the existence of fisheries for sharks and rays in the Peoples Republic of China and gives some details. Sharks and rays are caught using drift nets, set gill nets and long lines (there are more than 3.5 million gill nets used in China). Taiwan has one of the world's most important elasmobranchs fisheries oriented mainly towards sharks. Elasmobranchs comprised 3.5% of the total catches in Taiwan from 1987-1991. Large sharks constitute the majority of the catches, approximately 81% of the total elasmobranchs.

Most of the Taiwanese shark catches are taken by large-scale fisheries, particularly with long liners. According to SEAFDEC (1993) data, for sharks, large-scale long lines and hook and lines accounted for 62% of the catches while gill nets and other trawls accounted for

less than 20% each. Only 5% of the shark catch came from small-scale gill net fisheries and less than 1% from traps and long lines. For rays, other trawls were the most important large scale gear with 23% of the catch, but gear classified as large-scale others took 58%. Gill nets took to 7% of the small-scale catch. The remaining 11% of ray catches was taken using small-scale gill nets and traps.

Philippine's elasmobranchs catches were of minor importance before the late 1970s and although variable, from 1987-1991 they compromised only 0.8% of the total national catches. SEAFDEC data show rays to be slightly more important than sharks in the catches representing an average of 53% of the elasmobranch yields during 1977-1991. Philippine catches account for 2.63% of the world wide elasmobranchs catch. In Philippines, for large scale fishery purse seines, trawls, hook and line in small scale fisheries, other trawl, gill/drift net, hook/long line, trap and others were used for elasmobranch fishery.

The elasmobranchs fisheries of the ex-USSR were important, and they contributed 0.11% of the total catches for 1987-1991. The elasmobranchs fisheries of Malaysian comprise only 2.46% of the world catch of this group. Elasmobranchs currently represent 2.2% of the total catch of Malaysia. SEAFDEC data indicate that from 1976-1991, the rays represented on average 60% of the elasmobranchs catch and sharks represented the remaining 40%.

Statistics for the elasmobranchs fisheries of Indonesia were not recorded before 1971. Indonesia fisheries represent 10.18% of the world's elasmobranchs catch. Despite this, elasmobranchs are of only moderate importance in Indonesia, contributing 2.41% to Indonesian landings during 1987-1991.

In Thailand, purse seines, trawl, and hook and line were used for large scale activity but in small scale activity, gill/drift net and hook/long line were used for elasmobranch fishery.

According to the report of Prado and Drew (1991) in Pakistan, 93% shark catch comes from long line fish, but in our marine territory long line fishing contributes 40.48%, and other maximum catches (37.57%) come from gill nets (shark nets) during 2012-2013. In India, sharks were caught incidentally mainly by long lines and of trawlers using disco nets (Appukittan, 1988) with bottom set gill nets and shrimp trawlers (Devaraj, 1988). In the Bay of Bengal of Bangladesh region, gill nets, long lines, set bag nets and trammel nets were used for shark fishery which are maximally related to the reports of Appukittan (1988) and Devaraj (1988). According to the Pajot (1980) report, in Sri-Lanka, sharks and rays consist of 26.62% from large mesh small scale drift nets, but in our catch, shark fishery contributes less than 1.0% which is not related. In the Peoples Republic of China, sharks and rays are caught using drift nets, set gill nets and long lines but in our sharks and rays catch use gill nets, set bag nets, long lines and trammel nets which are most of them related to the Zhou (1990) report. According to the SEAFDEC data of Malaysia, Indonesia, Philippines and Taiwan, during 1977-1991, it was analyzed that maximum catch comes from long lines (37-38% and contributes less than 3% of the total marine catch, but our 10 landing data show that sharks and rays catch contributes less than 1% except for the 2003-2004 period.

Trade

Trade of sharks and shark products evinced an increase since 1980s due mainly to the increased utilization of shark meat for domestic consumption along with the reduction of tariff rates on the import of shark fins, etc., by countries such as China. Further, the escalating cost of traditional food fishes made the underutilized sharks relatively cheap sources of protein. The shark fishery assumed a lucrative one in view of the great demand for their fins and flesh. The major products for trade from sharks are: fins and fin rays; meat; liver oil, liver and fish meal; cartilage; skin and jaws (Hanfee, 1997).

'Shark liver' is a rich source of vitamins A and D and was in great demand during Second World War. Large sharks (Tiger sharks, Hammerhead sharks and Black fin sharks) are the commercially important species, which yield liver oil with high vitamin content. The shark liver oil factory was functioning in 1854 at Calicut (Kerala), before the industry was faced with the problems of introduction of synthetic vitamin A. At present, there is only one shark liver oil factory at Kakkinada. This factory converts refined oil into capsules of vitamin A and D. One kg of refined oil produces 10,000 capsules, which sell at a retail price of Rs. 50-70 per 1000 capsules. Oil is extracted crudely at some places in an unorganized manner and is used as a preservative for boats (Hanfee, 1997).

The largest market for shark liver oil is Japan where it

is used by the cosmetic industry. Germany is also using shark liver oil in the textile, leather, paints and varnish industries. Stearin and liver meal are the byproducts from liver oil. Stearin is used in the manufacturing of candles, soaps and paints, whereas liver meal is used in poultry feed. 'Cartilage' is an occasional demand for 'shark bone' which is powdered and made into tablets (*source*: GIFT), the price of which ranges from US\$ 15-20/kg. It is reported to have anti-cancer properties. 'Skins of the sharks' are processed into good quality leather. In India, there is an unorganized trade for shark jaws as curios. The teeth are also used as beads in artificial jewellery (Pillai, 2000).

Sharks are being harvested and traded in Bangladesh since time immemorial. Unfortunately there is no comprehensive study or any report on the status of the shark fishery in Bangladesh. Sharks and rays are commercially important to be abundant. They are an important and valuable item in the international market. There are a few small scale sharks processing plant operating in Bangladesh. Sharks processing is carried out as a cottage industry mostly by the fisher folk communities and by the different stakeholders; only few species of sharks and rays are locally consumed as a table food. Shark meat and fins are in great deuce and prices. Generally, sharks are not eaten by the common people in this country but are consumed by some Hindu and Tribal people. In every year, sharks fins, dorsal view of ray's skin, teeth, jaws, meat (as dried form) and liver oil are exported from Bangladesh.

Trades in shark have shown continuous increases only in the local markets, but in the international market, there is a ban placed on it. As with catch data, lack of product specification by species by- product type creates problems for meaningful analysis of trade in shark products. Shark fining bans can contribute to conservation and management of sharks by reducing the incentive to target sharks or retain fins. Where sharks are taken in non-target fisheries, fining bans may simply result in the discarding of the entire shark and therefore may not reduce overall mortality and may increase waste since even the fins are not used.

There is no reason to speculate that shark catch data will not undergo the same deficiencies. In addition, given that much shark catch is taken as by-catch, which has not traditionally been the focus of data collection processes, accurate species identification is a well recognized problem in the collection of shark catch data, in that the data may be even less accurate than those for other species.

The commercial value of many shark species is derived from their fins rather than their meat. In our country, the fishermen carry the shark's full body with the fins intact and sell them to the whole seller (aratder) in the landing centers. After buying they cut down the fins from the body and dry it for exportation as a pair; other body parts are sold as raw (meat) to the retailer or consumers. But now,

a day's shark fins are not bought for a reasonable price due to the undemanding of sharks exporting countries. Not only is fining wasteful but it renders attempts to identify the catch of sharks by species largely impossible and exacerbates the lack of species specific catch data.

Dried and iced sliced meat of shark, its sun-dried hide, bones, fins, tails, teeth and shark liver oil are all sold to local consumers, and nothing is discarded. Shark hunting season spans through October and March each year. In Kuakata, different species of sharks were being dried, processed and sold at local kitchen markets. Cox's Bazaar sharks were regularly caught by fishermen using nets and sold off to Sandwip, Kutubdia, Moheshkhali and Teknaf in Chittagong by Cox's Bazaar fishermen. In these areas, the price of iced and sliced dry shark varied from Tk 500 to Tk 5,000 per kg, whereas shark bones, fins, tails and teeth were sold for Tk 15,000 to Tk 40,000 per kg. In Kuakata-Alipur, fishermen catch sharks using fishing nets; when sharks are netted with other fish, the fishermen sell everything they get. In Bangladesh each year about four to five thousand tons of sharks are caught by fishermen (Haroon, 2011). Only 10 to 20% of shark body parts are exported through the legal channels, while the rest are smuggled to Myanmar, India, Singapore, Thailand, Hong Kong, China, USA and other countries.

As sharks and rays are the targeted species though, they are harvested as a by-catch with the commercially other important species. They are brought back as a whole to the landing center and sold at a reasonable price, but the shark fins, skin, dorsal view of ray's skin, teeth and liver oil are better priced (Roy, 2008).

Conservation and management

Adequate conservation and management of shark populations is becoming increasingly important on a global scale, especially because many species are exceptionally vulnerable to over fishing. Yet, reported catch statistics for sharks are incomplete and mortality estimates have not been available for sharks as a group. Here, the global catch and mortality of sharks from reported and unreported landings show that discards and shark fining are being estimated at 1.44 million metric tons for the year 2000 and at only slightly less amount in 2010 (1.41 million tons). Based on an analysis of average shark weights, this translates into a total annual mortality estimate of about 100 million sharks in 2000 and about 97 million sharks in 2010, with a total range of possible values between 63 and 273 million sharks per year (Worm et al., 2012).

To review and discern the status and potentialities of shark fisheries in Bangladesh, a national workshop on Shark fisheries in the Bay of Bengal, Bangladesh: status and potentialities, was organized to support the BOBLME project in Cox's Bazar on 27 November 2010. In Bangladesh, it is not a targeted fishery, rather a by-catch

of Hilsa and Indian salmon fishery. In fact there is yet no ordinance and rules about shark management and conservation. In last August 2009, a server "Management plan for shark fisheries" was held at Maldives, India, and Bangladesh. In that enquirer, it was decided that the management plan for shark (NPOA-shark) will be submitted. Under the project BOBLME, National Plan of Action for shark was held as at 21 May 2014 in the Department of Fisheries (DOF), Dhaka - as per the decision made on the plan that was submitted and which awaits Government approval.

In 1999, FAO adopted the International Plan of Action (IPOA-sharks) for the conservation and management of sharks and has mandated all the states that catch sharks to voluntarily prepare a NPOA-shark and Shark Assessment Report (SAR) for the conservation and management of sharks. In the absence of any legislation (regulations or catch limitations in the Fish Act), except for Forest Act and any management plan, the sharks are overexploited indiscriminately. As a result, the catch volumes are gradually falling and smaller sizes are caught mostly.

Through the Committee on Fisheries (COFI) of the FAO, all member countries agreed to better manage shark populations in their EEZ by endorsing the IPOA-sharks report. Although the deadline for submission of the NPOA-sharks report was in 2001, as of June 2010 only 12 of some 37 shark-fishing countries had submitted NPOA-sharks. The regional BOBLME project have a plan to conserve sharks' biodiversity and stocks in the Bay of Bengal (BoB), and also develop and exert efforts for the implementation of NPOA-shark in the BOBLME region. BOBLME is also committed to formulate a RPOA-shark for the BOBLME region integrating the 8 NPOAs-shark. Of the 8 member countries, 2 (Indonesia and Malaysia) have already published (but not fully implemented) their NPOA-sharks, 3 (Maldives, Myanmar and Thailand) have drafted NPOA-sharks and these need to be finalized, endorsed and adopted, and 3 (Bangladesh, India and Sri Lanka) are yet to formulate their NPOA-sharks, although some preparatory work was done during the 2009-2012 period.

Regional BOBLME project did validation of available information on shark fisheries of member countries; prepare work plans and proposals to develop and implement National Plan of Action (NPOAs-shark), including identification of targeted research/studies and identification of support required, plus recommendations towards the formulation of a Regional Plan of Action (RPOA-shark). The BOBLME has taken the lead in assisting and capacity building of the member countries to address the remaining gaps and issues, raise awareness and improve compliance, implement measures to improve knowledge on shark taxonomy, and initiate work towards regional synthesis of NPOAs (a framework for RPOA) (BOBLME, 2014). It was reported by Dey (2012) that the wildlife law of 2012 banned shark

hunting from the Sundarbans area.

Rules and regulations of the fisheries management under the forest (wildlife) law, 2012

In Sundarban areas, 18 canals were under permanent fishing ban, and three wildlife sanctuaries were under permanent fishing ban as well. Some of these sundarban areas are as follows:

- Sundarbans ES: Compartment no. 4, 5, 6 and part of 7 with an area of about 31,227 ha. Its head quarter is situated at Katka.
- Sundarbans SS: Compartment no. 43 and 44 with an area of about 36,970 ha. Its head quarter is situated at Nilkomol.
- Sundarbans WS: Compartment no. 53, 54 and 55 with an area of about 71,502 ha. Its head quarter is situated at Notabeki.

It was observed that there is no regulation or clear indication about the shark fisheries under the Department of Fisheries or Forest Act. So, for proper shark management, there is need for clear instruction about those species harvested in the times when the banning regulations about critically endangered sharks and rays were under the IUCN (International Union for Conservation of Nature) Red List (2000), and highly migratory 7 shark species were under the CMS (Convention on the Conservation of Migratory Species of Wild Animals).

Conclusion

As a target species, sharks and rays are a valuable commercial species in industrial and artisanal fisheries in that they are mainly caught by shark nets, hook and lines, and sometimes exploited in trammel nets, set bag net and different fish and shrimp trawls also. But sometimes, some new born juveniles are harvested by shrimp and fish trawls which were not recorded or reported for very small size and low market value species and as such they are discarded as a trash. Shark meat, guts and oil are mainly utilized in domestic market, whereas only shark teeth, jaws, fins and skin are exported to the international market in dried and smoked form. And in case of rays, only meat and tail are used in the local market by some Hindu and Tribal people, while shark dorsal view of skin are exported in dried form to China, Korea, Hong Kong, Singapore, UAE and Dubai. From different information and landing data gathered, it was observed that the CPUE of sharks and rays gradually decreased, but total landing sometimes increased. Due to over fishing, small sizes of sharks and rays are captured in huge numbers which are of great threat to shark fishery in Bangladesh. In this sector, many people get protein supply for their livelihood. For sustainable

management, there is need to implement NPoA- sharks, prepared by the BOBLME, to protect endangered shark and ray species and MSY of shark fishery of the Bay of Bengal of our marine territory.

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