International Journal of Pure and Applied Zoology ISSN (Print) : 2320-9577
Volume 2, Issue 2, pp: 150-159, 2014 ISSN (Online): 2320-9585

http://www.ijpaz.com

Research Article

PRESENT STATUS AND SPECIES COMPOSITION OF COMMERCIALLY IMPORTANT FINFISH IN LANDED TRAWL CATCH FROM BANGLADESH MARINE WATERS

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Article History: Received 29th January 2014; Revised 10th May 2014; Accepted 24th May 2014; Published 30th May 2014

ABSTRACT

Trawl Fishery in Bangladesh started in 1972, is mainly engaged in harvesting demersal fish and shrimp, but in recent years government is being sanctioned new modern mid-water trawlers and long liners to encourage pelagic fishing. This paper looks into ways of species composition of commercially important finfish species in landed trawl catch depicting the trend of stock and efforts to provide available information so that fishery biologists, planners and administrators may take an inclusive resource based management plan for keeping sustainability in marine fishery resources. The secondary data of landed trawl catch of fin fish since 1985-86 to 2012-13 in association with close inspection during landing trawl catch was used. There are more than 90 species of fish which have commercial importance. Intense exploitation with high fishing efforts is the present trend of marine fishery resources. Since after industrialization in country's marine fishing sector, three phases is visually demarcated (R^2=0.744). Phase I indicates from 1985-86 to 1999-2000, phase II from 2000-01 to 2009-10 and phase III started from 2010-11. The abundance index (CPUE) was in increasing trend (4.05) at phase I where fishing was almost in a virgin stock and down to 2.18 at phase II. At phase III, the CPUE (R^2=0.20) is being risen to above 4.0 due to added modern and hi-tech vessels into the fishing fleet together with imposed of strict restriction unreported catch. The number of trawlers engaged in fishing was 14 at the initial stage to 31 the beginning of phase II and sharply increased to 152 in 2012-13. Though, there are various category of vessels engaged in trawl fishing in the Bay of Bengal, grossly categorized into wooden body and steel hull. The CPUE of steel hull trawlers were 4 to 6 times greater than that of wooden body trawlers. Catch ceiling or quota may be enacted to prescribe limitation on the total quantity of fish captured for a specific period of time would be a major step to reduce this inequality side by side to maintain sustainable exploration of fishery resources. New surveys and new information on stock (preferably based on catch-effort data) are required to adopt proper management strategy with regard to maintain sustainability of fisheries resources especially before increasing effort.

Keywords: Finfish, Species composition, Trawl catch, Bangladesh marine waters.

INTRODUCTION

Bangladesh is endowed with vast coastal and marine resources along its south edge at the northern end of the Bay of Bengal. The Republic has a 710-km long coastal line extending from the tip of Teknaf in the Southeast to the west coast off Satkhira (Hossain, 2004). The coast as a whole is dominated by soft substrate ecosystems that are biological productive, providing critical ecological habitats like mangroves, algal beds, salt marshes, sandy beach and mudflats (Kabir, 2000). The nation's economic zone extends 320 n. miles out into the sea from the coast line. The total marine water area of Bangladesh is

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164,000-sq. km. of which more than 24,000 sq. km. is shallower than 10 m. depth (Rahman *et al.,* 1995). The marine waters of the Bay of Bengal have great potential for fish production. Marine fisheries constitute of industrial fishery by large trawlers and artisanal fisheries by mechanized and non-mechanized boats. The fisheries sector accounts for 60% of the animal protein intake in Bangladesh. But despite of continuous increase in fish production, it has not been able to cope with the fast-growing population. The country's fish production has increased from 640,000 MT (inland 545,000 mt & marine 95,000 mt) in 1975-76 to 3,061,687 mt (inland 2,683,162 mt. & marine 578,620 mt.) in 2011-12. At present, the marine fisheries sector contributes only 17.74% of the country's total production (DoF, 2013); despite of a sizable marine and brackish water area under the EEZ. The strategic development of this sector has not yet been properly exploited. There are 475 marine fish species reported in the country together with 36 species of shrimps (Hussain, 1971; Shafi and Quddus, 1983). Of the marine species of fishes and shell fishes, more than 90 are commercially important. Hilsa, hair-tail, croaker, grunter, scads, snapper, pomfret, catfish, eel, sea bream, tuna, mackerel, flat fish, Bombay duck and sharks/skates/rays are the major commercial finfish species in Bangladesh (Rahman *et al.,* 1995).

Trawl Fishery started after the liberation of Bangladesh, which commenced from 1972 (Rahman *et al.,* 1995). Vessels range in size from smaller wooden vessels of around 20m in length, to steel-built vessels of 40m to 50m in length. These industrial trawlers are mainly engaged in harvesting demersal fish and shrimp, but in recent years mid-water trawlers have been added to the fleet for fishing small pelagic species, and the government recently sanctioned new modern mid-water trawlers and long liners to encourage pelagic fishing (Uddin *et al.,* 2012).

It is aimed to address the species composition of economically important finfish in landed trawl catch. This paper depicts the trend of marine fish stock and efforts to provide available information so that fishery biologists, planners and administrators may take a comprehensive resource based management plan for keeping sustainability in marine fishery resources.

MATERIALS AND METHODS

Finfish trawlers are of two kinds including wooden body and steel hull engaged in fishing in the EEZ of Bangladesh. All wooden body trawlers have chilling facilities and almost all steel hull trawlers have freezing facilities for preservation of their caught fish. The industrial fishing fleet has a capacity of gross tonnage ranged between 56 to 148MT for wooden body and 251 to 668MT for steel hull trawlers. The overall length is ranged from 18.5 to 26.50 meters for wooden body trawlers and 34 to 54 meters for steel hull trawlers. The engine powers are varied from 420-600 BHP for wooden body and 716-1850 BHP for steel hull, but mostly fall within 500-1000 BHP. These industrial trawlers are mainly engaged in harvesting demersal fish and shrimp, but in recent years mid-water trawlers have been added to the fleet for fishing pelagic species. There is no by catch in true sense as almost all fish caught are brought ashore as alternate use of fishes which are not consumed directly. Discarding of trash fish/by-catch at sea is forbidden by Rule 7 of the Marine Fisheries Rules, 1983 (The Bangladesh Gazette, 1983). The white fish trawlers use mostly high opening bottom trawls from the stern side with 60 mm mesh size at the cod-end. The head-rope length in the fish trawler fleet varies from 18m to 32m. Almost all the trawlers are equipped with modern navigations, communication and fish finding equipments. Trawl fishing has been restricted by ordinance to operate beyond 40 meters depth contour. The smaller wooden trawlers usually sail for 14 days and steel-hull vessels for 30 days in one voyage. They usually complete 5-6 hauls in a day taking 3-3.5 hours per haul. But the number of hauling and fishing days substantially depends on weather, sea worthiness and functioning of trawler itself.

In this article, the catch and effort data since 1985-86 to 2012-13 of finfish trawlers were used during the study period. The catch is in the

form of weight as metric tons and effort is in the form of number of fishing days. CPUE was calculated in the way of how much (MT) fish caught by one vessel in a day (Uddin *et al.*, 2012). Microsoft excel was used for calculating relative abundance of stock of commercially important fish species and catch trend in Bangladesh EEZ of the Bay of Bengal (Figure 1).

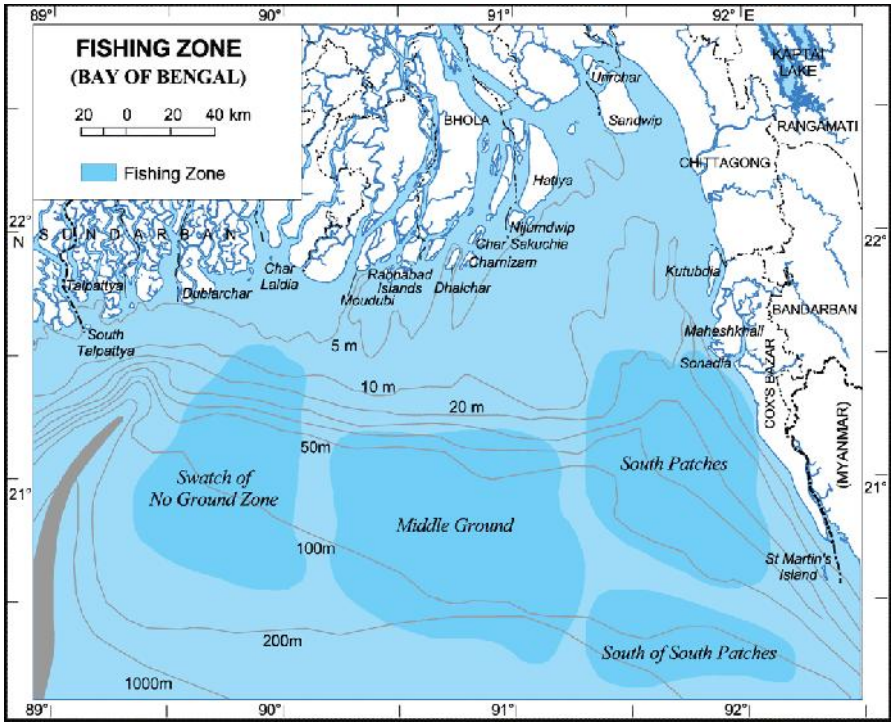

Figure 1. Fishing grounds in Bangladesh marine waters.

RESULTS AND DISCUSSION

Total number of fish trawlers engaged in catching fish and shrimp as by catch (there is no by catch in true sense) were varied from 8 to 152 and fishing days increased as well (Figure 2).

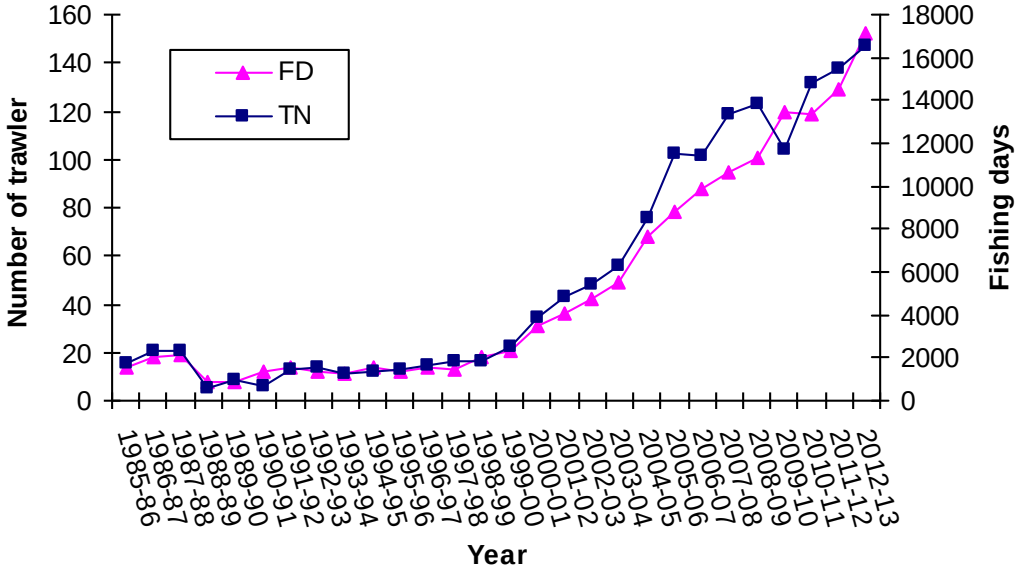

Figure 2. Number of fish trawlers engaged in fishing since 1985-86 to 2012-13. FD-Fishing days and TN-Trawler number. [Source: Marine Fisheries Office (MFO), Dept. of Fisheries (DoF)].

The highest and lowest fishing days was 16585 in the year of 2012-13 and 617 in the year of 1988-89 respectively. There are more than 90 species of finfish which have commercial importance comprising about 15 major groups. Of which, the most common species of fishes are as in table 1 including length.

Table 1. Commercially important fish species (Source: Rahman *et al.*, 1995; Encyclopedia of Flora and fauna of Bangladesh-Marine fishes, 2009 and Fishbase, 2004).

Sl. No.	Scientific name	English name	Local name	Max. length (cm)	Common length (cm)
Ariidae					
1	*Arius spp.* (5-7 species)	Cat fish*	Kata machh	50-60 (SL)	40-50 (SL)
Carangidae					
2	*Parastromateus niger*	Black pomfret*	Hail chanda	75 (TL)	30(TL)
3	*Scomberoides commersonianus*	Talang queenfish	Chapa kori	120 (TL)	90(TL)
4	*Selar boops*	Oxeye scad	Moori	25 (FL)	20(FL)
5	*Megalaspis cordyla*	Hardtail scad*	Kauwa	50 (TL)	20-30(TL)
6	*Carangoides malabaricus*	Malabar cavalla	Malabar moori	60 (FL)	30 (FL)
Chirocentridae					
7	*Chirocentrus dorab*	Wolf-herring*	Karati chela	100 (TL)	40-60(TL)
Clupeidae					
8	*Tenualosa ilisha*	Hilsa shad*	Ilish	75 (TL)	42 (TL)
9	*Ilisha filigera*	Big eye ilisha*	Choukka	30 (TL)	20 (TL)
10	*Sardinella frimbiata*	Sardine*	Kolombo	16(SL)	10-12(SL)
11	*Sardinella melanura*	Sardine*	Chapila/Takhia	15.2 (SL)	10-12(SL)
Congridae					
12	*Conger cinereus*	Indian conger eel*	Kamila	130 (TL)	50 (TL)
13	*Ariosoma anago*	Silvery Conger	Kamila	60 (TL)	60 (TL)
Cynoglossidae					
14	*Cynoglossus spp.* (5-6 species)	Tongue sole	Kukur jeeb	35-45 (TL)	25-30 (TL)
Drepanidae					
15	Drepane longimanna	Sickle fish	Pann machh	40 (FL)	30 (FL)
Engraulidae					
16	*Setipinna taty*	Hairfin anchovy*	Teilla phasa	17 (TL)	12 (TL)
17	*Thryssa mystax*	Moustached thryssa	Phasa	17 (TL)	10 (TL)
18	*Coilia dussumieri*	Pointed tail anchovy	Olua	17 (TL)	10-12 (TL)
Ephippidae					
19	*Ephippus orbis*	Spade fish	Hatir kaan	20 (SL)	15 (SL)
Gerreidae					
20	*Gerres filamentosus*	Silver biddies	Dom machh	25 (TL)	15 (TL)
21	*Pentaprion longimanus*	Silver biddies	Jagiri	13 (TL)	7-11 (TL)
Harpadontidae					
22	*Harpadon nehereus*	Bombay duck*	Loittya machh	45 (TL)	25 (TL)
Leiognathidae					
23	*Leiognathus brevirostris*	Pony fish	Taka chanda	28 (TL)	20 (TL)
Lobotidae					
24	*Lobotes surinamensis*	Triple tail	Samudra koi	110 (TL)	80 (TL)
Lutjanidae					
25	*Lutjanus johni*	Red snapper*	Ranga choukka	70 (TL)	20-30 (TL)
26	*Lutjanus sanguineus*	Blood snapper*	Ranga choukka	45 (TL)	15-20 (TL)
27	*Lutjanus malabaricus*	Malabar red snapper*	Ranga choukka	100 (TL)	50 (TL)

Menidae					
28	*Mene maculata*	Moon fish	Tek chanda	25(TL)	15 (TL)
Mullidae					
29	*Upenus sulphureus*	Goat fish	Sonali Bata	23 (TL)	20 (TL)
30	*Liza spp.* (5-6 species)	Mullet*	Bata	40-50 (TL)	20-25 (TL)
31	*Mugil cephalus*	Grey mullet	Khorul bata	50 (TL)	25-30 (TL)
Nemipteridae					
32	*Nemipterus spp.* (5-6 species)	Threadfin breams, redfish*	Lal mach	18-28 (TL)	17-20 (TL)
33	*Nemipterus japonicus*	Threadfin bream*	Rupban	32(TL)	25(TL)
Plaicephalidae					
34	*Platicephalus indicus*	Flat-head fish	Murbaila	45 (TL)	35(TL)
Priacanthidae					
35	*Priacanthus tayenus*	Purple-spotted big-eye	Pari machh	35 (TL)	25 (TL)
Polinemidae					
36	*Polynemus indicus*	Indian salmon*	Lakhua	145 (TL)	80 (TL)
37	*Polynemus paradiseus*	Paradise threadfin*	Tapsi	30 (TL)	17 (TL)
38	*Eleutheronema tetradactylum*	Fourfinger threadfin*	Thailla	125 (TL)	50 (TL)
Pomadasyidae					
39	*Pomadasys hasta*	White grunter*	Sada datina	55 (SL)	30 (SL)
40	*Pomadasys argenteus*	Silver grunter*	Datina	70 (SL)	30 (SL)
41	*Pomadasys maculatus*	Blotched grunter*	Guti datina	45 (SL)	30 (SL)
Psettodidae					
42	*Psettodes erumei*	Indian halibut	Samudra serboti	60 (TL)	50 (TL)
Siaenidae					
43	*Johnius spp.* (8-10 species)	Croaker*	Lalpoa, Rupali poa	27-45 (TL)	20-35 (TL)
44	*Otolithoides argenteus*	Bronze Croaker*	Bara poa, Lambu	160 (SL)	100 (SL)
45	*Pterotolithus maculatus*	Spotted Croaker*	Gutipoa	45 (TL)	40 (TL)
46	*Otolithes ruber*	Tiger toothed croaker*	Poa	70 (SL)	40 (SL)
47	*Argyrosomus amoyensis*	Amoy Croaker	Poa	40 (SL)	30 (SL)
48	*Dendrophysa russelii*	Goatee croaker	Dhari poa	25 (TL)	15 (TL)
49	*Panna microdon*	Panna croaker	Chotta lambu	30 (SL)	20 (SL)
50	*Pennahia anea*	Greyfin jewfish*	Sada poa	30 (SL)	20 (SL)
51	*Protonibea diacanthus*	Black spotted croaker	Kala poa	150 (SL)	100 (SL)
Scombridae					
52	*Scomberomorus guttatus*	King Mackerel*	Maitya/Surma	125 (FL)	55 (FL)
53	*Scomberomorus commerson*	Spanish mackerel*	Maitya/Surma	120 (FL)	60 (FL)
54	*Euthynnus affinis*	Mackerel tuna	Bom maitta	100 (FL)	60 (FL)
55	*Katsuwonus pelamis*	Striped tuna*	Bom maitta	108 (FL)	80 (FL)
56	*Thunnus obesus*	Big-eye tuna	Bom mittya	180 (FL)	130 (FL)
57	*Auxis rochei*	Bullet tuna	Bom mittya	50 (FL)	40 (FL)
58	*Rastrelliger kanagurta*	Indian Mackerel*	Champa/Ailla	35 (TL)	25 (TL)
Theraponidae					
59	*Therapon jarbua*	Therapon perch	Barguni	20 (TL)	20 (TL)
Sillaginidae					
60	*Sillago domina*	Lady fish	Hundra baila	45 (TL)	25 (TL)
Sphyraenidae					
61	*Sphyraena forsteri*	Barracuda*	Dharkuta	75 (TL)	50 (TL)
Stromateidae					
62	*Pampus argenteus*	Silver Pomfret*	Fali chanda	60 (SL)	30 (SL)
63	*Pampus chinensis*	Chinese Pomfret*	Rup chanda	40 (SL)	20 (SL)

Synodontidae					
64	*Saurida tumbil*	Lizard fish	Tiktiki machh	45(SL)	30 (SL)
Trichiuridae					
65	*Lepturacanthus savala*	Ribbon fish/Hair tail*	Churi machh	125 (SL)	70 (SL)
66	*Trichiurus lepturus*	Large-headed Ribbon fish*	Churi machh	234 (TL)	100 (TL)
Shark/Skates/Rays					
67	*Scoliodon spp.* (2-3 species)	Spadenose shark/Dog fish	Thutte hangor/ hangar	90-120 (TL)	60-80 (TL)
68	*Carcharhinus spp.* (5-6 species)	Shark, Dog shark	Hangor	110-260 (TL)	100-200 (TL)
69	*Rhizoprionodon acutus*	Milk shark	Hangor	175 (TL)	110
70	*Sphyrna blochii*	Hammerheaded shark	Haturi hangor	370-430 (TL)	100-150 (TL)
71	*Himantura uarnak*	Stingray	Sapla pata	150 (DW)	80-100
72	*Dasyatis spp.* (5-6 species)	Stingray	Haush pata	50-70 (DW)	50 DW
73	*Rhinobatos granulatus*	Skate	Pitambori	185 (SL)	100-120 SL
74	*Rhinchobatus djeddensis*	Skate	Pitambori	300 (SL)	150-200 SL

(TL-Total length, SL-Standard length, FL-Fork length & DW-Disc wide), * High priced and demanded species.

The least total fish catch was 931 MT in 1988-89 and highest catch was 69388 MT in 2011-12 and shrimp catch showed not any mentionable value (1MT) in 1989-90 to the highest 315 MT in 1985-86. The total fish landing has been showed an increasing trend during the present decade. The trend of fish catch was gradually increased since the year of 2000-01 (16027 MT) to 2009-10 (29584 MT). Then, the trend was sharply increased, which was 67994 MT in 2012-13 and is being continued (Figure 3).

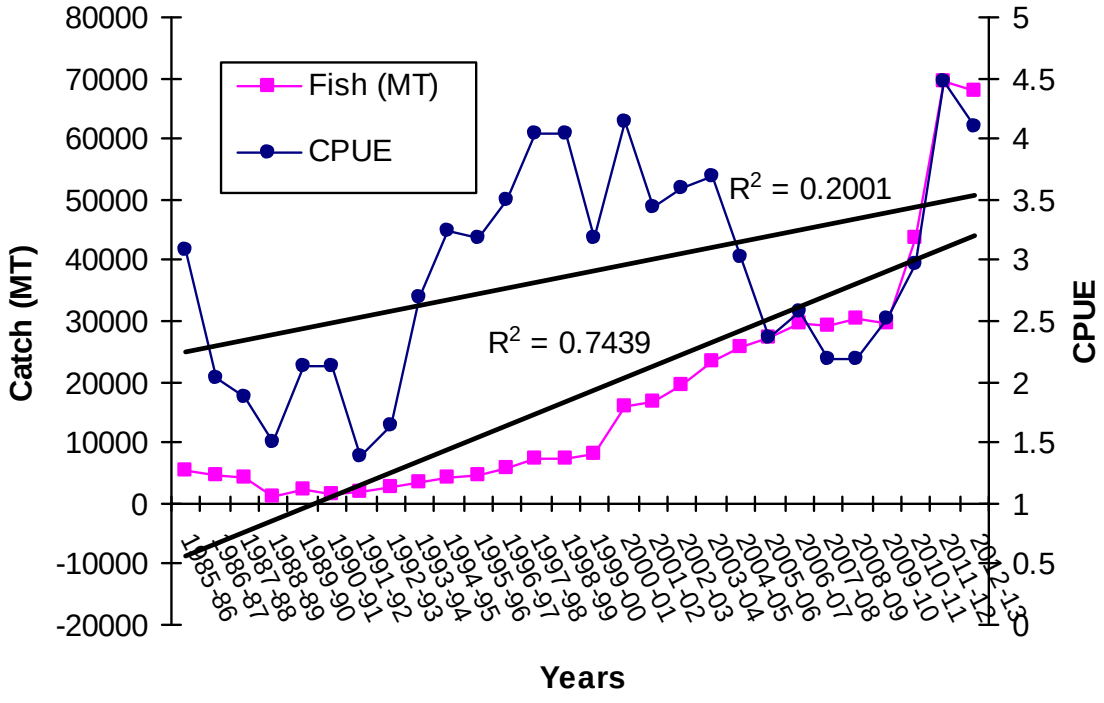

Figure 3. Landed catch and Catch per unit effort (CPUE) of finfish trawlers from 1985-86 to 2012-13 in Bangladesh marine waters (Source: MFO, DoF).

Demersal species were dominated in the landed trawl catch (Figure 4), but recently large quantities of small pelagic like sardines, mackerel and hilsa have been reported in trawl catches (Figure 5). To assess effort status, the annual catch of 10 wooden body trawlers and 10 steel hull trawlers of highest catch in each category for the year of 2010-11 to 2012-13 was calculated. The CPUE of steel hull trawlers were 4 to 6 times greater than that of wooden body trawlers (Figure 6).

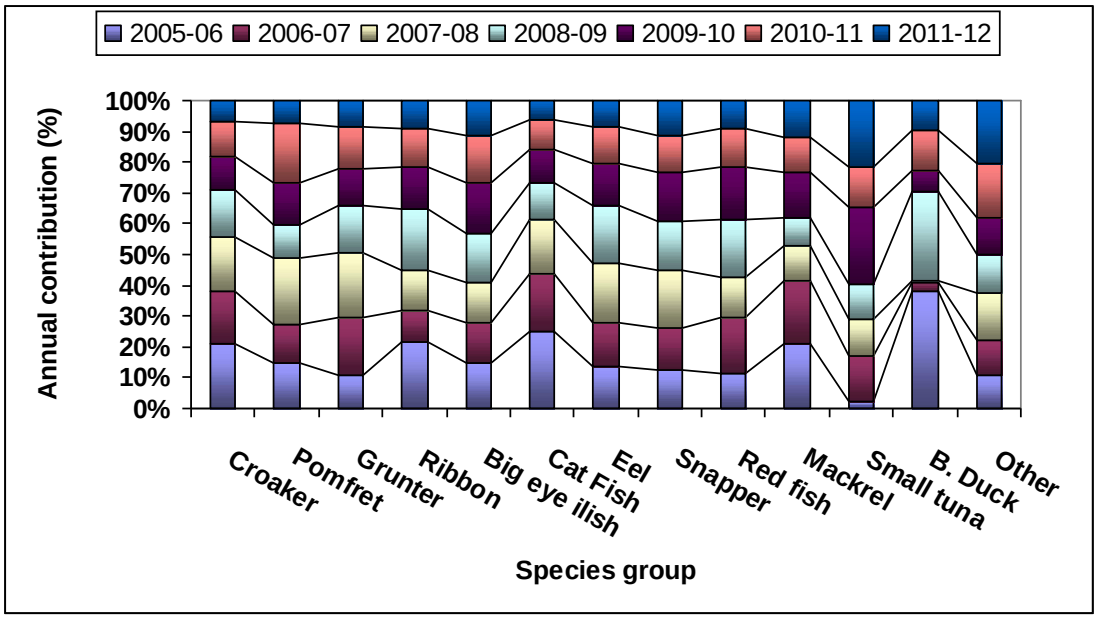

Figure 4. Percent contribution of major fish species in landed trawl catch since 2005-06 to 2011-12 (Source: MFO, DoF).

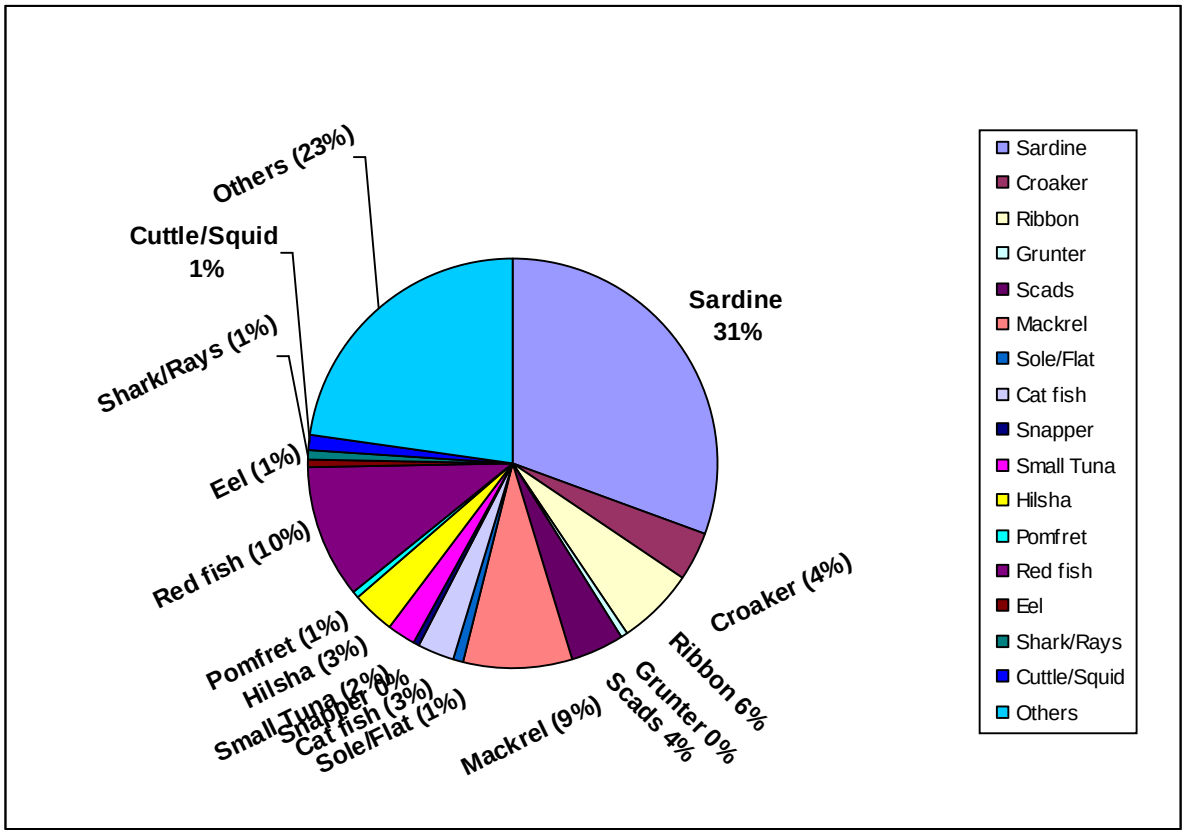

Figure 5. Percentage of major fish species in landed trawl catch of 2012-13 (Source: MFO, DoF).

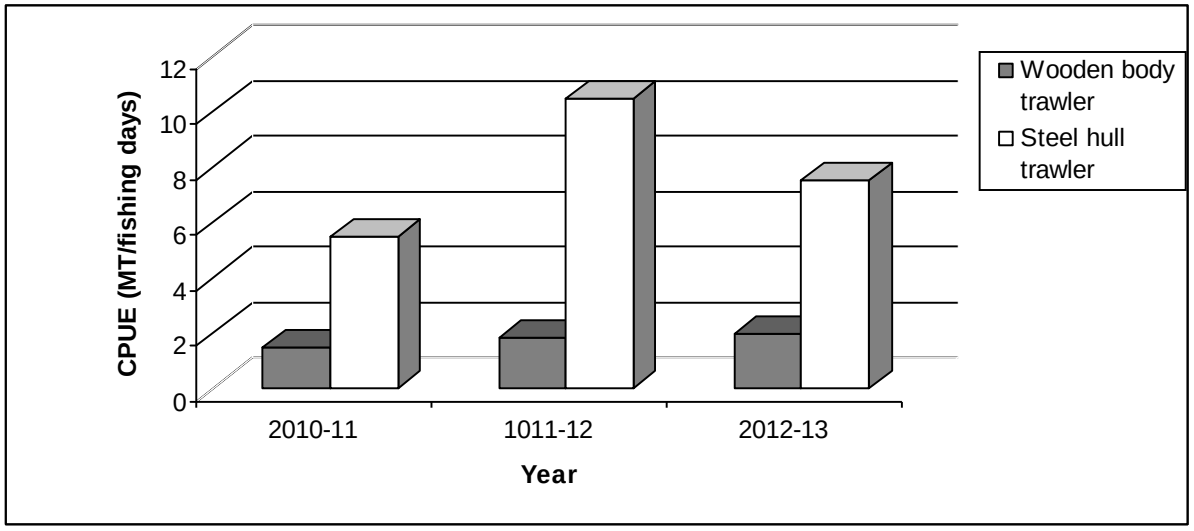

Figure 6. CPUE in wooden body trawlers and steel hull trawlers (Source: MFO, DoF).

Over the last 25 years, there has been a big shift in the composition of catches of the finfish trawlers. Catches in 1985-86 showed that the major commercial species were white grunters, croakers, catfish, snappers and hair tails. Since 2005-06 these have mostly been replaced by the low valued species like Bombay duck, bream (Red fish), mackerel, sardine, small tuna and baby fish of various species (Khan 2008). In 1984-86 surveys, there were 20 species contributing to the main catch, whilst in 2005-06 this has declined to 12. This indicates that the more valuable and longer-lived species are being fished out and being replaced by smaller, short-lived pelagic fish (World Fish Center, 2008). A recent report in Science (Jørgensen et al, 2007) suggests that these shifts are difficult to reverse and have long-term implications for ecosystem structure and function – and their human dependents. There were a considerable percentage of commercially important species group in annual catch since 2005-06 to 2011-12, though a distinct variation depicted for small tuna (locally known as ailla, *Rastrelliger kanagurta*) and Bombay duck catches during 2005-06 to 2007-08 (Figure 4). There were no data on species-wise catch before 2005-06. Catch log sheet from 2005-2011 didn't represent all available species group which have commercial importance. That's why, a new catch log addressing major species group of all commercially important fish has been provided to the skippers and officers of fishing trawlers since July 2012. More than 30% of total catch was predominated by sardine followed by red fish (10%), mackerel (9%), etc. in the landed trawl catch of 2012-13 (Figure 5).

During this industrialization of country's marine fishing sector, there are three phases could easily be demarcated, according to Fig. 2 & 3. Phase I indicates from 1985-86 to 1999-2000, Phase II indicates from 2000-01 to 2009-10 and Phase III from 2010-11 to onward. In Phase I, the number of active fishing trawlers and fishing days were at low level and the annual catch also shown the same pace. This nursery phase, however demonstrated higher trend of CPUE due to fishing in almost a virgin stock, though it was undergo some fluctuation at the initial stage. From phase II, The number of trawlers were gradually increased including fishing days but ended with slightly decrease in number of trawlers. Same pace was shown in catch but, abundance index (CPUE) was in decreasing trend. The number of trawlers and fishing days are sharply being increased in Phase III. There were only 31 active fishing vessels in 2000-01 and that is reached to 152 in 2012-13. The catch and CPUE are being demonstrated same sharpness in tandem to increased number of active fishing trawlers and fishing days. Modern, hi-tech and very equipped fishing vessels are being added into the fishing fleet, which thereby given a huge catch and CPUE as well.

Besides, there was a trend to undeclared actual catch by the trawler owners and organization. The amount of unreported catch was about 25-30% of actual catch (report from

an informal survey). After 2010-11, concerned authority took a vibrant step so that the trawler owners or organizations must submit supplier tally sheet (actual catch) during taking sailing permission (SP) of next voyage. This is why, the level of unreported catch is being down to below 10 percent. Efforts were concentrated on only demersal stock for ages since its inception but the trend has been going towards pelagic fishing for couple of years as marked itself mid-water trawling. In the industrial fisheries, demersal fishing is the most destructive. It is responsible for the destruction of sea bed and the killing too many benthic fauna with the disruption of entire food chain (Hiddink, *et al.,* 2006b). In consequence, large quantity of pelagic species including sardine and mackerel has been reported in recent trawl catches (Figure 5).

Though, there are various category of vessels engaged in trawl fishing in the Bay of Bengal, grossly categorized into wooden body and steel hull. The highest catch and fishing days of steel hull trawlers in the year 2010-11, 2011-12 and 2012-13 were 1362MT and 258, 2950MT and 191 and 1989MT and 187 respectively; whereas, the highest catch and fishing days of wooden body trawlers in reported years were 300MT and 171, 368MT and 152 and 292MT and 130 respectively. Consequently, the CPUE of steel hull trawlers was higher than that of wooden body trawlers (Figure 6). This huge gap in catches between two categories of trawlers is being made tension in the industrial fishing sector as all categories of trawlers are fishing in beyond 40 meters depth contour as per regulation. Catch ceiling or quota may be enacted to prescribe limitation on the total quantity of fish captured for a specific period of time (Chowdhury 2008) would be a major step to reduce such inequality side by side to maintain sustainable exploration of fishery resources.

CONCLUSIONS

A multi-species, multi-gear fishery exploits fishery resources in the traditional fishing grounds in Bangladesh marine waters. No comprehensive management decision can ideally be taken on such multifarious condition. New surveys and new information on stock are required to adopt proper management strategy with regard to maintaining sustainability especially before adding new effort in the existing fishing fleet. Harvesting traditions, methods and technologies are heading for profitability cause serious pressure and damage to the fisheries resources and marine environment. The concepts of precautionary management and catch ceiling have a proven record as a tool to effectively rectify this trend. There is no research vessel towards to survey on fishery resources; it would be preferable to assay assumption on standing stock including MSY, replacement yield, allowable catch, etc. using catch and effort data until added any research vessel to the fishing fleet.

CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interests associated with this article.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the skippers and the crews of the finfish trawlers those were engaged in fishing in Bangladesh marine waters and made a very good catch report. Special thanks are due to the officers and staff of Marine Fisheries Office, Chittagong. The authors are also indebted to all brilliant reviewers for improving this manuscript.

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