



Production trends of different group of industrial marine fishes in Bangladesh

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Abstract

The study was conducted during 2006-07 to 2015-16 in trawl data analyzing by different commercial fish trawlers in the Bay of Bengal region of Bangladesh. The catch trend of trawlers from 2011- 2016 that most of the group has declined with the expectation of groups of low commercial values. It is observed that fishes which are higher up in the food chain called the predatory fishes has declined, while forage fishes lower down the food chain and low economic value like sardines (family- Clupeidae), anchovy (family- Engraulidae), thread fin bream (family- Nemipteridae) and etc has increased. Among the two survey vessels, R V Anushandani was used to survey area beyond 10 m depth up to 200 m depth contour beginning of 1984. The formal cruising of RV Machranga was start in June 1988 used to survey below 20 m depth contour. A total of 84 cruise was done in the in life time of R V Anushandani and 22 cruise was done in the in life time of R V Machranga. Now both RV are in damage position.

After the 106 cruising recorded main groups of species represented in Bangladesh waters are Sciaenidae-jewfishes 12.8%, Ariidae- catfishes 11.6%, Nemipteridae- threadfin breams 4.4%, Carangidae- jacks, scads and black pomfrets 3.2% and Mullidae-goatfishes 3%. These 5 families account for 35.0% of the total catch of cruise times. Other species of good commercial value are present in lesser quantities.

During these study period it was found that, shallow area between 10 to 20 m was the most productive with 34% of the total fish biomass and a fish density of 7.9 tons/km² followed by the 20-25 m stratum with 28% and 6.7 tons/km² then 50-80 m stratum with 16% and 4.7 tons/km² and finally 80-100 m stratum with 22% and 2.9 tons/km² 62% of the total biomass were situated inside the 50 m depth line.

During 2006-07 to 2015-16 harvested dominant Sciaenidae species were *Otolithoides pama*, *Otolithes maculatus*, *Otolithoides pama*, *Otolithes cuvieri*, *Protonibea diacanthus*, *Johinus argentatus* and *Panna microdon*. Among them highest and lowest catch were *Johinus argentatus* and *Otolithoides pama* respectively.

In 2006-07 to 2015-16 different sizes (baby kata, pencil kata and rita kata) of cat fish (*Arius spp.*) are found within the 50 m depth region. Most common species are *Sciades sona*, *Arius maculatus*, *A. gagora* and *A. arius* are commercially important.

During 2006-07 and 2015-16 two threadfin breams (red fish species -*Nemipterus japonicus* and *Nemipterus bathybius*) are available and *Nemipterus bathybius* was the most abundant in the Bay of Bengal of Bangladesh region.

Among 30 species of carangids (jacks, scads and black pomfrets) most commercially and abundantly 07 species were *Parastromateus niger*, *Scomberoides commersonianus*, *Selar boops*, *Megalaspis cordyla*, *Carangoides malabaricus*, *Alepes djedaba* and *Seriolina nigrofasciata* were reported during 2006-07 to 2015-16.

Two ribbon fish species *Trichiurus lepturus* and *Lepturacanthus savala* were caught in our marine water; among them *Trichiurus lepturus* was highly abundant and two grunter species- *Pomadasyss hasta* and *Pomadasyss maculatus* were found in our territory.

During 2012-13 to 2015-16 four species of Sardines were recorded from the Bangladesh continental shelf and viz. *Sardinella fimbriata*, *Dussumieria acuta*, *Sardinella gibbosa* and *Sardinella melanura* were harvested, generally two sardine species *Sardinella fimbriata* and *Dussumieria acuta* are abundantly available in our marine territory.

In 2006-07 to 2015-16 four mackerel species were available in our region and these are *Scomberomorus guttatus*, *Scomberomorus commerson*, *Rastrelliger kanagurta* and *Rastrelliger brachysoma*. Among them, *Rastrelliger kanagurta* was harvested in 1st position.

During 2006-07 and 2014-15 mainly three pomfret species constitute *Pampus argenteus*, *Pampus chinensis* and *Parastromateus niger* were mostly harvested.

Three major groups of cephalopods e.g. *Sepia spp.*, *Loligo spp.* and *Octopus vulgaris* are available in the Bangladesh marine water. *Sepia spp* is most abundantly caught.

Two sole fish *Cynoglossus lingua* and *Cynoglossus bilineatus* were found in deep sea areas also.

During 2006-07 to 2015-16 there were seven species of tuna recorded in our territory and they are *Enthyunus affinis*, *Auxis thazard*, *Katsuwonus pelamis*, *Thunnus tonggal*, *Auxis rochi*, *Thunus obesus* and *Thunnus albacores*. *Enthyunus affinis* is the most abundantly caught.

Keywords: Cruise, predatory fish, forage fish, survey and food chain.

Introduction

Bangladesh is located in the northern end of the Bay of Bengal between Latitude 20 ° 34 '' and 22 ° 25 '' North and Longitude 88 ° 01'' and 92 ° 41'' East. It is bordered by India (West and North), Myanmar (East) and the Bay of Bengal in the South. It is endowed with vast marine, coastal and fresh waters having great fisheries potential. The Republic has a 710 km long coastal line on the southern 14 coastal districts of the country. The continental self of Bangladesh covers areas of 66440 sq.km of which 37000 sq. km is no deeper than 50m. In these areas operate fleets of deep-sea fishing confined beyond 40m depth to open seas. Now a day, 253 numbers of commercial trawlers are engaged in fishing of which 37 shrimp trawlers, 97 commercial fish trawlers, 119 mid water trawlers; whereas 32,859 numbers of mechanized and 34,810 numbers of non-mechanized boats are plying in fishing in coastal and marine waters of Bangladesh. These waters are relatively rich in plankton and contain high oxygen (4.8ppm at the surface and 4.0 ppm at 35 m, depth), nitrates and minerals. The salinity ranges from 12-33 ppt in monsoon and 16-39 ppt in the dry season (Rahman, 1995).

Our marine fisheries consist of multi gear and multi species fishery, which means same species caught at different stage by different gears. It has been recognized as an important part of the economy of Bangladesh. Fish production from Bay of Bengal (BoB) marginally increased over the last 10 years but its relative share in fisheries production has declined. Bangladesh's coastal waters contain diverse fisheries resources, with 475 species of finfish including the cartilaginous fishes - sharks, skates and rays. The majority of the commercially targeted stocks are

reported to be over-exploited and there were significant declines in catches during last decades. In the Bay of Bengal, both industrial and artisanal fisheries exploit coastal and offshore marine fisheries resources without any management plan. Hussain (1970), mention 475 species of fish from the Bay of Bengal, out of which 53 species were cartilaginous and 422 species were bony fishes. Hussain (1971) also described 42 species of commercially important fin fish.

Several surveys have been conducted to assess and estimate the marine fisheries potential of Bangladesh since 1958 by national and international agencies with foreign collaboration. The Japanese fishing vessels, CHOSUI MARU, KAGAWA MARU and KINKI MARU made some short surveys and offered some firsthand information about the ground, water current presence of shrimp larvae and availability of commercial species of fish by trawling (1958-62). Three surveys (FAO/NORAD/BGD 1979-80; BGD 1983 and FAO/BGD1984-86) gave estimates of demersal standing stock between 150,000-160,000 t within the exploited 10 – 100 meter shelf area (Saetre 1981, Khan, 1983 and Lamboeuf, 1987). An additional 100,000 t of fish stock is available within the 24,000 km² open brackish water area between the shore line and 10m depth (Saetre, 1981). In terms of species of commercial importance, stocks of croakers and catfishes were approximately 40,000 t, threadfin bream was 7,000t and Bombay duck was 1,000t respectively (Lamboeuf, 1987). The total production from all sources of marine and brackish water fisheries has been estimated to be 264,000 t (Khan, 1994). The drift gillnet fishery and the ESNB fishery account for

the bulk of the production, followed by the MSBN and trawl fisheries, accounting for 136,000 t, 73,000t., 26,000 t and 17,000 t respectively (Khan and Latif 1997).

Under the pre-investment survey scheme a joint collaboration by BFDC and FAO (UNSF-PAK-22) project, two research vessels – SAGAR SANDHANI (1008) AND MEEN SANDHANI (57) were acquired and carried out systematic and comprehensive survey during 1967-71. As a result of this survey three major fishing grounds namely South patches, Middle ground and Swatch of no ground enveloping an area of about 15,000 sq. km was charted. Moreover, for the shrimps to mention specially the fishing ground named South of South patches (South west of St. Martin island) was found as important as the other areas and even more important than others for the tiger shrimp (Rhaman,1995).

Using the results of the stock assessment studies it was possible to calculate the fisheries potential for demersal fish. The results indicated that 40,000 to 55,000 t of demersal finfish can be harvested annually from the offshore fishing grounds lying 10-100 m depth zones. This potential could be calculated for penaeid shrimp on the basis of biological information. The results indicated that 7,000 – 8,000 t can be harvested annually (Khan, 1989). The stock contributed around 10% of the total production from all fisheries during 2005- 06. Of these, 7% were mature adults caught by trawlers; 85%, were caught in set bag nets and were mainly pre-juvenile and immature individuals; and the remaining 8% came from trammel net and other fisheries (Penn 1983, White and Khan 1985).

Acoustic estimates of the biomass of pelagic fish over the shelf covered were:

38,000 t in November-December 1979; and 76,000 t in May 1980. The part of shelf in Bangladesh inside 10m depth which could not be covered by the Sustainable Management of Fisheries Resources of the Bay of Bengal 10 surveys is very extensive: about 7,000 n mi². If it is assumed that the density of pelagic fish here was the same as in the area between 10 and 100 m depth (about 9,400 nmi²) where the pelagic fish was observed, then raised totals of 66,000 t in November-December and 133,000 t in May would represent the whole Bangladesh shelf. These are likely to be underestimates because of the generally negative bias of this first generation of acoustic equipment

(R/V Dr. Fridtjof Nansen programme, 1979, by Saetre, 1981). Another survey conducted during 1979 recorded eight species of tuna and skip jack from Bangladesh water (Khan, 1986) but the abundance was not studied. It was however recommended that an experimental tuna fleet may be worth to try (Khan and Latif, 1997).

The coastal zone of Bangladesh is comprised of 14 districts that contain a mixture of very old settlements and new land developments. According to a 2001 population census, the coastal zone of Bangladesh has a population of 35.1 million, 28 percent of the total population. From 1991- 2001 this population increased exponentially by 1.36 percent annually. This was lower than the national rate of 1.48%, something that was indicative of the net out-migration from the coastal zone to other areas. The natural system of the coastal zone generates a multitude of natural resources. In rural areas, agriculture laborers comprise the largest livelihood group in terms of number. At least one in every three rural households lives on agriculture labor. Among the non-farmers (those whose principal occupation is not agriculture), fishers are the single largest group. In urban areas, the majorities of people serves as laborers in both the formal and informal sectors or are engaged in a wide range of self-employment activities (PDO-ICZMP, 2004).

Materials and Methods

Data were collected from the month wise log sheets of the different commercial fish trawlers during 2006-07 to 2015-16, which are on board filled up by the skipper. The month wise log sheet / form were brought/ supply from the Marine Fisheries Office, Chattogram to the Marine Fisheries Survey Management Unit Office, Chattogram where the data were analyzed both manually and computer.

Results

10 m depth up to 200m depth contour. R.V Machranga was used to survey below 20 m depth contour. A total of 84 cruise was done in the in life time of R.V Anushandani. A total of 22 cruise was done in the in life time of R V Machranga.

The result of the past surveys:

Resource	Stock (mt.)	MSY (mt.)
Shrimp (Khan, 1983)	2,000 – 4,000	7,000 – 8,000
Demersal Fish and Pelagic accessible to demersal trawl in 10-200 M depth (Lamboeuf, 1987)	1,88,000	47,500 – 88,500
Pelagic (R.V. Dr. Fridtjof Nansen estimate)	90,000 – 160,000	Not determined

It may be mentioned here that all surveys estimated stocks above the 10 meter depth contour. Dr. Fridtjof Nansen Programme 1979-80 made some estimate of fisheries resources within 10 meter depth

* Area within 10 m depth is extensive and covers over 30% of the total fishery area of Bangladesh

* It is about 7000 nmi²

* There might be high density of clupied and engraulids in within 10 m depth area (The Dr. Fridtjof Nansen Programme 1979-80

The biomass as per Dr. Fridtjof Nansen Programme 1979-80 in inshore <10 m is Pelagic 55,000 tons, Demersal 67,000t, Sharks and Rays 7000 t. No estimation of shrimp was given. Total 1, 29,000 tons of fish resource was estimated in within the 10 m depth contour.

The Survey species composition:

Lamboeuf (1987), compiled 17 cruises conducted during 1984-86 using 581 trawl stations under the FAO/UNDP project “Strengthening of National Programme for Marine Fisheries Resources Management, Research and development. This is the most comprehensive report on the survey undertaken so far. The report concluded:

A Summary of biomass estimates for the 19 major groups of species is given in table -1 with percentage of abundance in each depth stratum. The overall biomass of fish accessible to a bottom trawl in Bangladesh waters between 10 and 100 m depth is 161080+/-3900 tons, an additional biomass of 27230 tons in the 100 to 200 m zone, brings the overall estimate in Bangladesh EEZ deeper than 10 m to the rounded figure of 188000 tons.

Pelagic fish account for 25600 tons in this biomass, this evaluation is certainly an underestimate, as pelagic fish are not correctly sampled by a bottom trawl.

Table -1: Summary of biomass estimates of major families and repartition by depth strata in the area between 10 and 100 m depth.

Family	Common Name	Biomass Range	Distribution by Depth Starta %			
			10-20	20-50	50-80	80-100
		Metric tons				
1. Sciaenidae	Jewfishes	20 670(12.8%) +/- 16175	66.5	28.5	3.1	2.0
2 . Ariidae	Catfishes	18729(11.6%)+/- 2785	50.8	31.1	10.6	7.4
3. Nemipteridae	Threadfin breams	7 117(4.4%) +/- 306	0.1	3.3	15.2	81.4
4. Carangidae	Jacks, scads, black pomfrets	5 093 (3.2%) +/- 172	21.4	28.3	24.0	26.4
5. Mullidae	Goatfishes	4 811(3.0%) +/- 286	2.4	47.8	35.7	14.2
6. Synodontidae	Lizard fishes	4 663(2.9%) +/- 63	10.3	25.1	23.4	41.1
7. Trichiuridae	Hairtail fishes	4 043(2.5%) +/- 200	20.8	48.5	16.2	14.5
8. Leiognathidae	Pony fishes	3 998(2.5%) +/- 790	24.5	69.5	4.1	1.9
9. Pomadasyiade	Grunters	3 415(2.1%) +/- 836	81.0	15.3	2.5	1.2
10. Clupeidae	Sardines	3 109(1.9%) +/- 252	43.7	45.1	9.7	1.5
11. Scombridae	Mackerels	1 836 (1.1%) +/- 42	10.5	10.8	21.6	57.2
12. Priacanthidae	Bullseyes	1 433(0.9%) +/- 25	0.1	1.6	7.6	90.8
13. Stromateidae	White chinese pomfrets	1 348 (0.8%) +/- 62	44.7	34.8	18.2	2.3
14. Cephalopoda	Squids, Cuttlefishes	1 296 (0.8%) +/- 12	12.8	10.7	27.7	48.8
15. Engraulidae	Anchovies	1 082(0.7%)+/- 37	36.5	45.4	16.4	1.7
16. Gerreidae	Silver-biddies	959 (0.6%) +/- 27	2.5	50.7	37.2	9.6
17. Harpadontidae	Bombay duck	783(0.5%) +/- 139	65.5	34.4	.0	.0
18. Lutjanidae	Snappers	356 (0.2%) +/- 4	24.0	41.4	14.9	19.7
19. Rays		6 714 (4.2%) +/- 4712	88.1	10.8	.9	.2
20.Others fish groups		69 625 (43.2%) -	-	-	-	-
21.Commercially important demersal spp.		85366 (53.0%) +/- 4514	38.6	26.4	12.7	22.3
22.Commercially important pelagic spp.		25 676 (15.9%)+/- 1266	19.6	29.2	22.0	29.2
23.All fish		161080(100%) +/- 3894	35.0	28.5	14.9	21.6

Note: Estimates calculated separately for each family does not exactly add up to the general estimates and are not in the same order which presented non-stratified estimates. Densities of the major groups of fish are given per depth strata in Table-2.

Table 2: -Summary of fish densities by depth strata (kg/km²)

Family	Common Name	Densities kg/km ²				
		10-20 m	20-50 m	50-80 m	80-100 m	10-100 m
Sciaenidae	Jewfishes	2182	727	72	31	658
Ariidae	Catfishes	1490	741	392	111	598
Nemipteridae	Threadfin breams	2	42	243	448	227
*Carangidae	Jacks, scads, black pomfrets	168	247	200	97	162
Mullidae	Goatfishes	12	334	334	54	153
Synodontidae	Lizard fishes	59	165	213	162	149
Trichiuridae	Hairtail fishes	131	250	139	58	129
Leiognathidae	Pony fishes	114	432	34	9	128
Pomadasyiade	Grunters	391	87	16	4	108
Clupeidae	Sardines	204	202	53	5	99
Scombridae	Mackerels	33	35	83	75	59
Priacanthidae	Bullseyes	0	3	20	107	46
*Stromateidae	White and chinese pomfrets	98	77	22	3	43
Cephalopodae	Squids, cuttlefishes	18	22	73	51	41
*Engraulidae	Anchovies	63	67	31	2	35
Gerreidae	Silver-biddies	5	58	77	10	31
Harpadontidae	Bombay duck	97	17	0	0	25
Lutjanidae	Snappers	11	21	10	6	11
Rajidae	Rays	899	71	8	2	214
Commercially important demersal spp.		4794	3362	2112	1488	2724
All fish		7925	6745	4662	2913	5139

*Not representative from bottom trawl catches

No new resources accessible to the type of trawl gear used, or new interesting fishing grounds were indentified in the part of Bangladesh waters covered by the present survey.

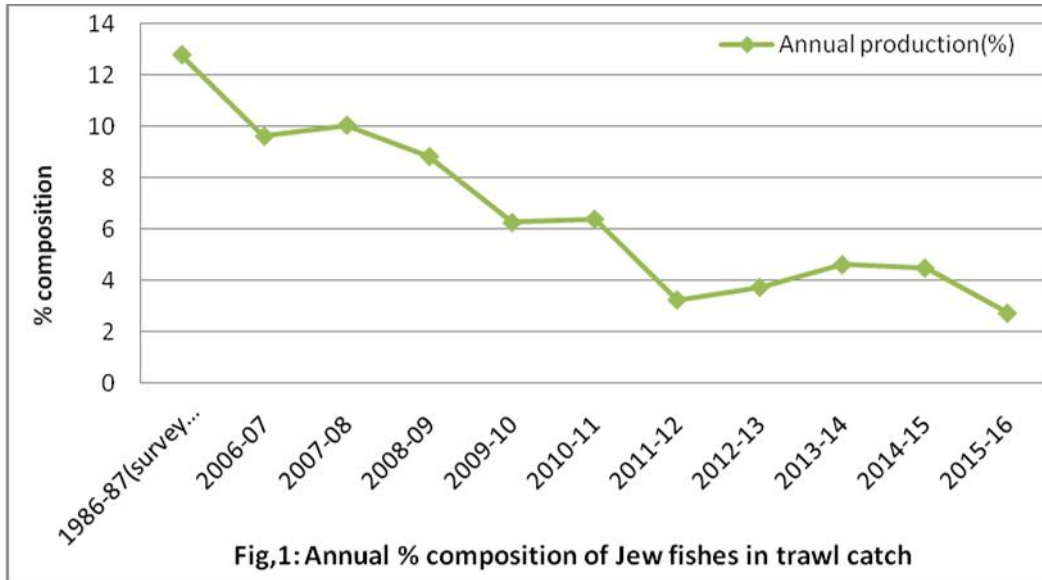
Geo-climatic environment has a strong bearing on behavior, migration and distribution of fish in the Bay of Bengal; some species undertake seasonal migrations in relation with the extent of the turbid less saline waters flowing out of the rivers during the monsoon.

The present scenario:

The catch trends of trawler from 2006- 2016 that most of the group has declined with the expectation of groups of low commercial values. It is observed that fishes which are higher up in the food chain the predatory fishes has declined, while fishes lower down the food chain like sardines, threadfin breams has increased. The following is the trend in catch of trawler from 2006 to 2016. It may be noted that the log book of trawler were changed time to time to

accommodate the catch trends. So some groups, which were present before may not be founded.

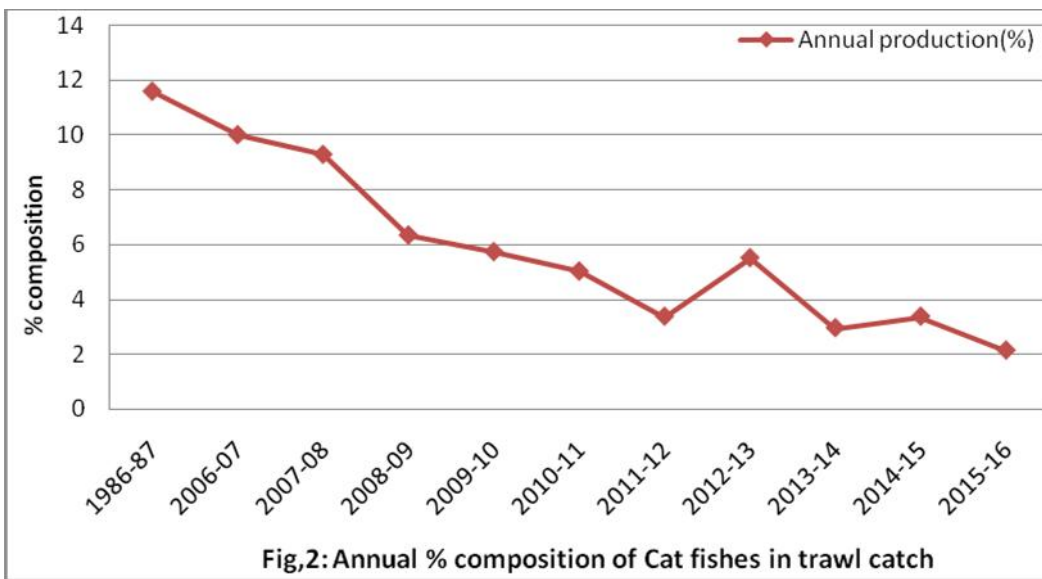
Jew Fish:



The available Sciaenidae species for capture were *Otolithoides pama*, *Otolithes maculatus*, *Otolithoides pama*, *Otolithes cuvieri*, *Protonibea diacanthus*, *Johnius argentatus* and *Panna microdon*. Exploitation trends of Jew fish showed that during 2006-07 the highest annual catch was 4235.0 MT, which were

gradually decrease up to 1741.0 MT during 2009-10 periods and rising 3271.0 MT in 2012-13 but again decrease up to 2245.0MT in the year 2015-16. Annual production of percentage composition during 1986-87 was 12.8% which gradually decrease 2.74 % in the year 2015-16 (Fig: 1).

Cat Fish



There are many species of cat fish under the family Ariidae present in our region. Among them *Sciades sona*, *Arius maculatus*, *A. gagora* and *A. arius* are abundantly available. Annual production of catfish decrease gradually from 2006-07(4235.0 MT) to 2009-

10 (1741.0 MT), but again gradually increased up to 3271.0 MT during 2012-13 and zigzag in 2013-14 to 2015-16 periods. Percentage composition of this group was gradually decreased from 1986-87 (11.6%) to 2015-16 (2.13%) periods (Fig: 2).

Red Fish

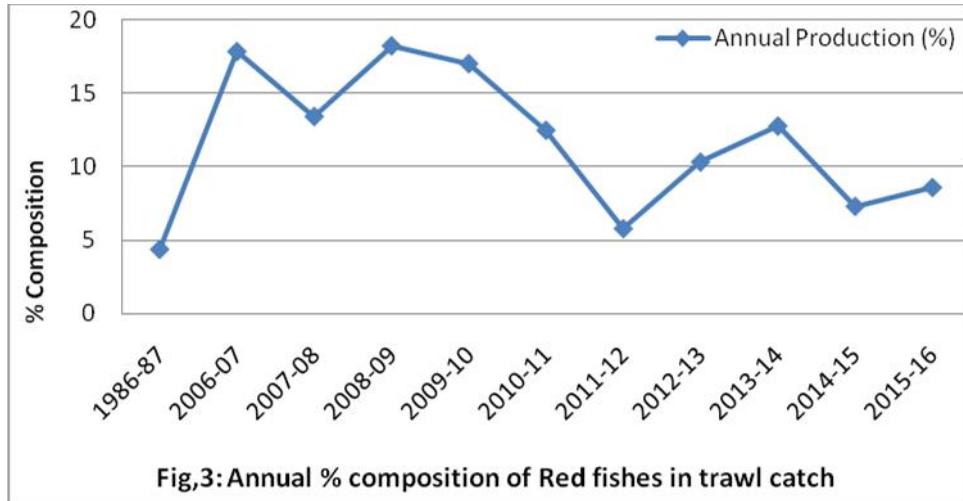


Fig.3: Annual % composition of Red fishes in trawl catch

There are two red fish species (*Nemipterus japonicus* and *Nemipterus bathybius*) are abundantly available in the Bay of Bengal of Bangladesh region. Annual production of redfish was 7542.0 MT in 2006-07 periods, which were in zigzag position in 2011-12 and increased up to 9781.0 MT during 2013-14 but again

zigzag position in the year 2015-16. Annual % composition of red fish was 4.4 during 1986-87 which sharply increased 17.82 % in 2006-07, but gradually decreased 5.81% during 2011-12 and zigzag up to 2015-16 periods (Fig: 3).

Scads

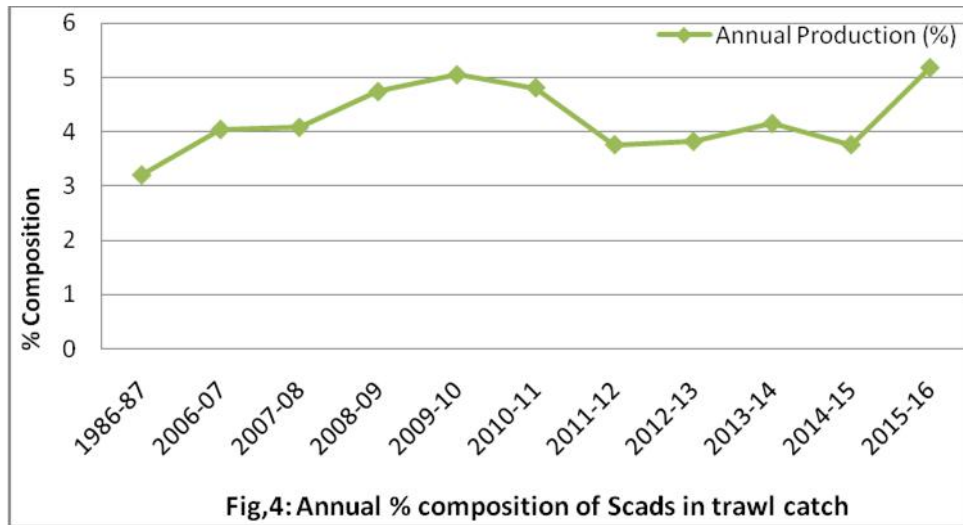


Fig.4: Annual % composition of Scads in trawl catch

There are about 30 species of carangids (jacks, scads and black pomfrets) recorded from the Bay of Bengal. Scads group is one of them. Shad fish production was 1709.0 MT during 2006-07 which gradually increased

up to 5324.0 MT in 2015-16 periods. It was observed that annual percentage composition of shads was 3.2% during 1886-87 and gradually increased 5.1% in 2015-16 (Fig: 4).

Ribbon Fish

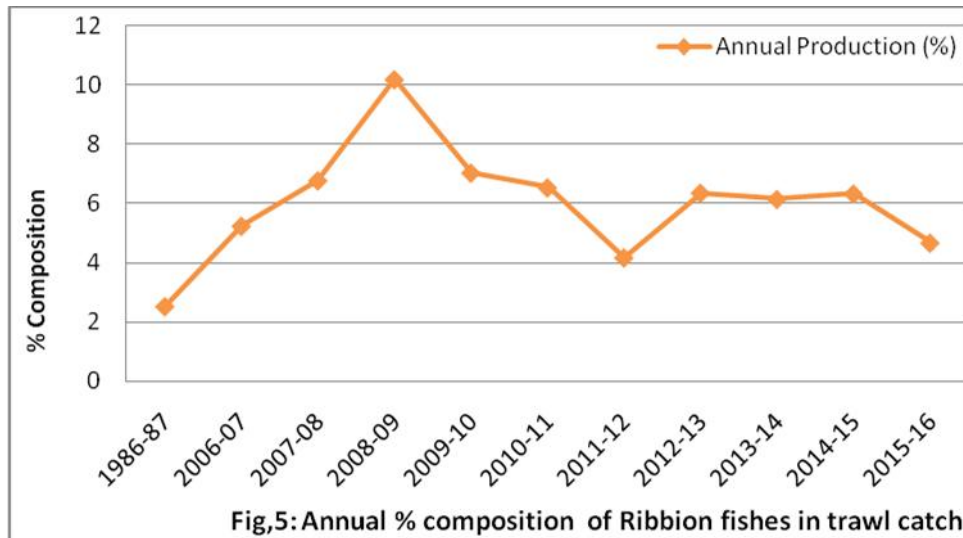


Fig.5: Annual % composition of Ribbon fishes in trawl catch

Two species of ribbon fish species *Trichiurus lepturus* and *Lepturacanthus savala* were recorded in the study periods. Annual production of ribbon fish was 2208.0 MT in 2006-07 and gradually increased up to 5359.0 MT during 2014-15 but in 2015-16 periods decreased

4778.0 MT. Percentage composition of ribbon fish was 2.5% during 1986-87 which gradually increase 10.18% in 2008-09 and gradually decreased 4.65% in the year 2015-16 (Fig: 5).

Grunter fish

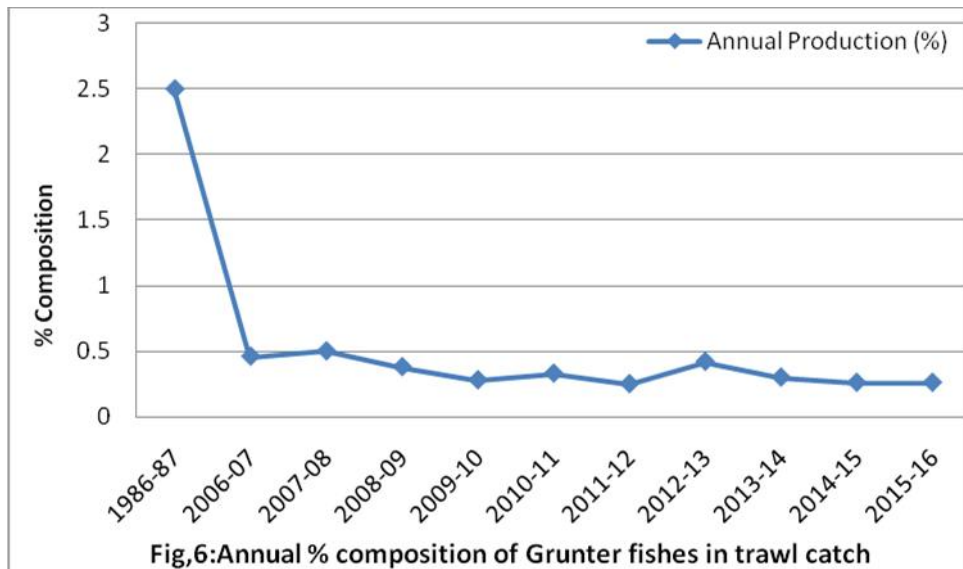


Fig.6: Annual % composition of Grunter fishes in trawl catch

There are two grunter species- *Pomadasys hasta* and *Pomadasys maculatus* are found in our territory whose under family Pomadasyidae. During 2006-07 annual production of grunter was 195.0 MT which decreased gradually 85.0 MT in 2009-10 and rose up 268.0 MT

during 2015-16 periods. Annual percentage composition of grunter was 2.5% during 1986-87 which suddenly decreased 0.46-0.26% in the year 2006-07 to 2015-16 periods (Fig: 6).

Sardine

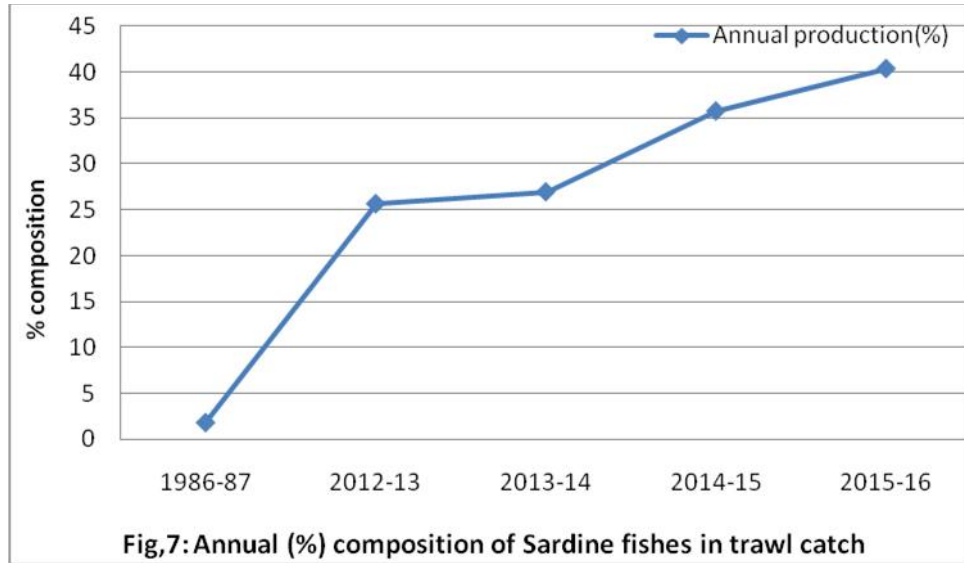


Fig.7: Annual (%) composition of Sardine fishes in trawl catch

There are four species of Sardines (*Sardinella fimbriata*, *Dussumieria acuta*, *Sardinella gibbosa* and *Sardinella melanura*) were harvested from our continental shelf. Among them, *Sardinella fimbriata* were mostly harvested. In trawl fisheries sardines data were reported from 2012-13 periods and total 20,679.0

MT of sardines was landed, which gradually increased in double (42,576.0MT) during 2015-16. Percentage composition of sardine was 1.9% during 1986-87 which sharply increased was 40.41% in the periods of 2015-16 (Fig: 7).

Mackerel

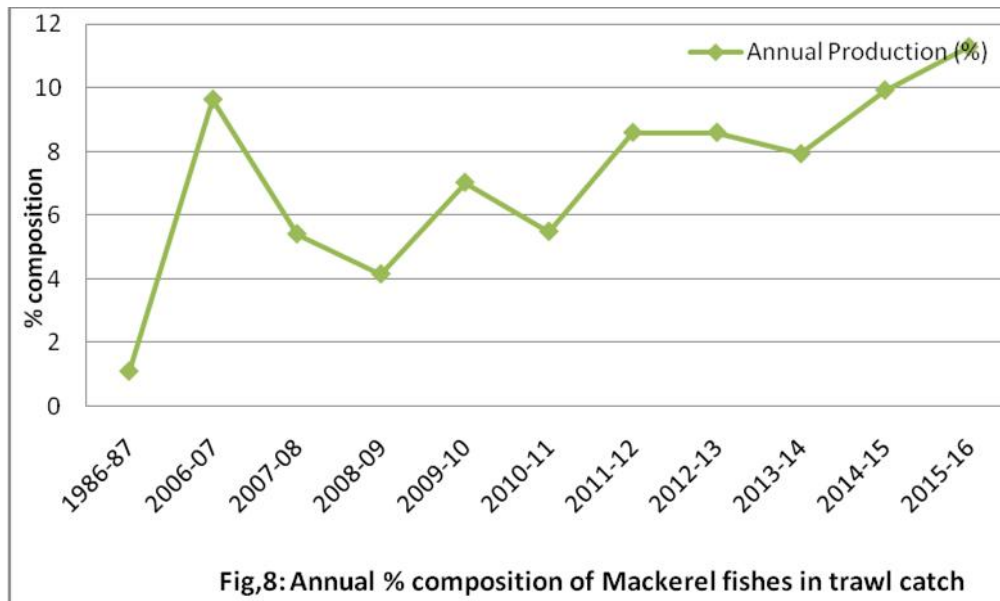
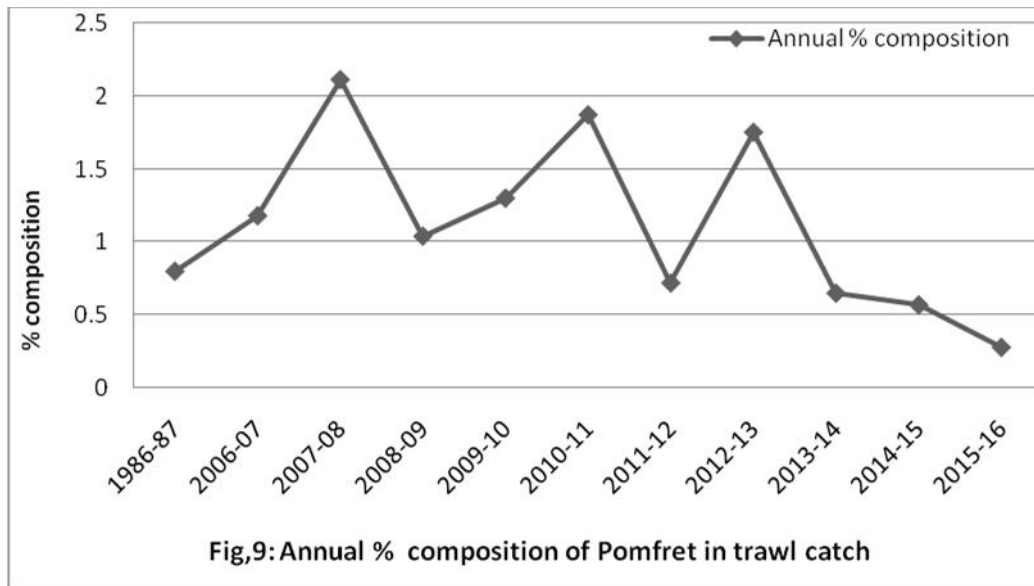


Fig.8: Annual % composition of Mackerel fishes in trawl catch

Four mackerel species are available and these were *Scomberomorus guttatus*, *Scomberomorus commerson*, *Rastrelliger kanagartha* and *Rastrelliger brachysoma*. Among them *Rastrelliger kanagartha* was harvested in 1st position. Annual production of mackerel during 2006-07 was 4083.0 MT which

decreased 2138.0 MT in 2008-09 periods and gradually increased up to 11614.0 MT in the year 2015-16. Annual percentage composition was 1.1% during 1986-87, which increased 9.65% in 2006-07 and decreased 4.16% during 2008-09 but gradually rise up to 11.3% in 2015-16 periods (Fig: 8).

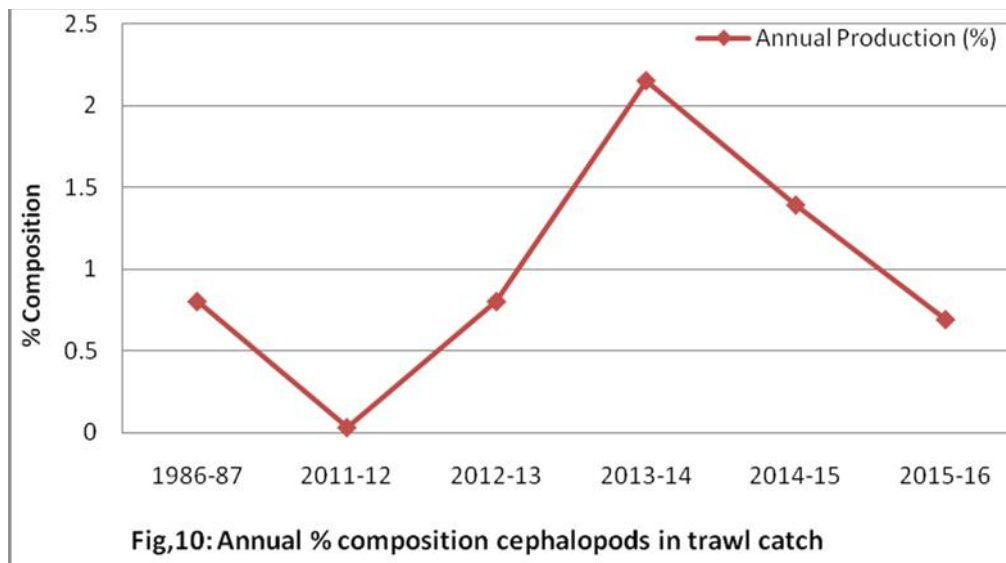
Pomfret:



The pomfrets mainly constituted of three species- *Pampus argenteus*, *Pampus chinensis* and *Parastromateus niger* were mostly harvested. Annual production of pomfret during 2006-07 was 498.0 MT, which increasing 1038.0 MT in the year 2012-13 but

gradually decreasing 293.0 MT in 2015-16 periods. Percentage composition was 0.8% in the year 1986-87 which zigzag in position during 2012-13 was 1.75% and gradually decreased 0.28% in 2015-16 (Fig: 9).

Cuttle fish/ Squid/Octopus



Three major groups of cephalopods e.g. *Sepia spp.*, *Loligo spp.* and *Octopus vulgaris* whose are available in the Bangladesh territory. *Octopus vulgaris* is the most abundantly aught. Annual production records on cephalopods reported from 2011-12 was 21.0 MT but sharply increased 1646.0 MT in the year 2013-14 and

gradually decreased 704.0MT in 2015-16 periods. Percentage composition of cephalopods in the year 1986-87 was 0.8% which decreased 0.03% during 2011-12, but during 2013-14 increased 2.15% and gradually decreased 0.28% in 2015-16 periods (Fig: 10).

Sole/ Flat fish/ Halibut

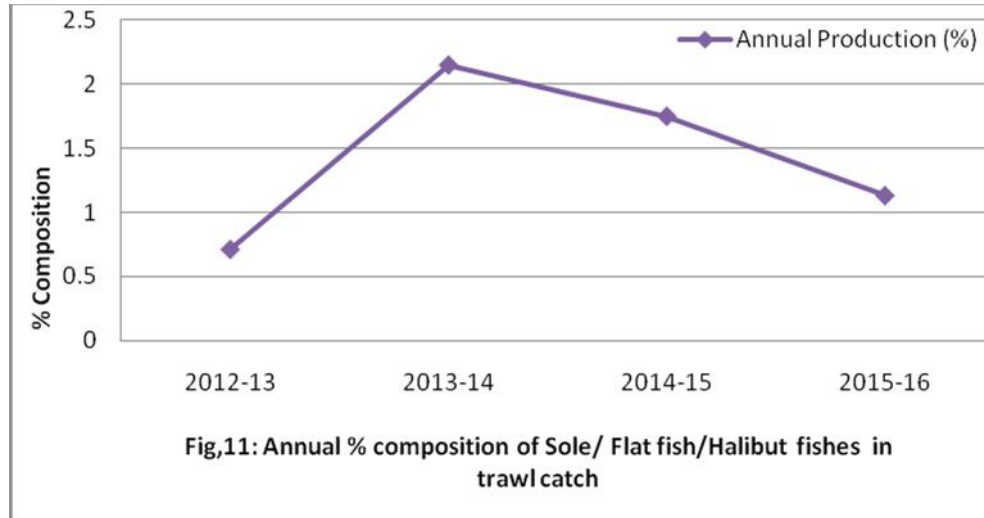


Fig.11: Annual % composition of Sole/ Flat fish/Halibut fishes in trawl catch

Sole fish or flat fish and Indian Halibut catch consists of mostly *Cynoglossus lingua*, *Cynoglossus bilineatus* and *Psettodes erumei*. Data recording of sole or flat fish started from 2012-13, in this period 426.0 MT was landed which increased up to 1651.0 MT during 2013-14 and gradually decreased 1161.0 MT in 2015-16.

Annual percentage composition was 0.71% during 1986-87 and decreased 0.03% in 2011-12 which gradually increased 2.15% in 2013-14 and decreased 0.69% in the year 2015-16 periods (Fig: 11).

Small Tuna

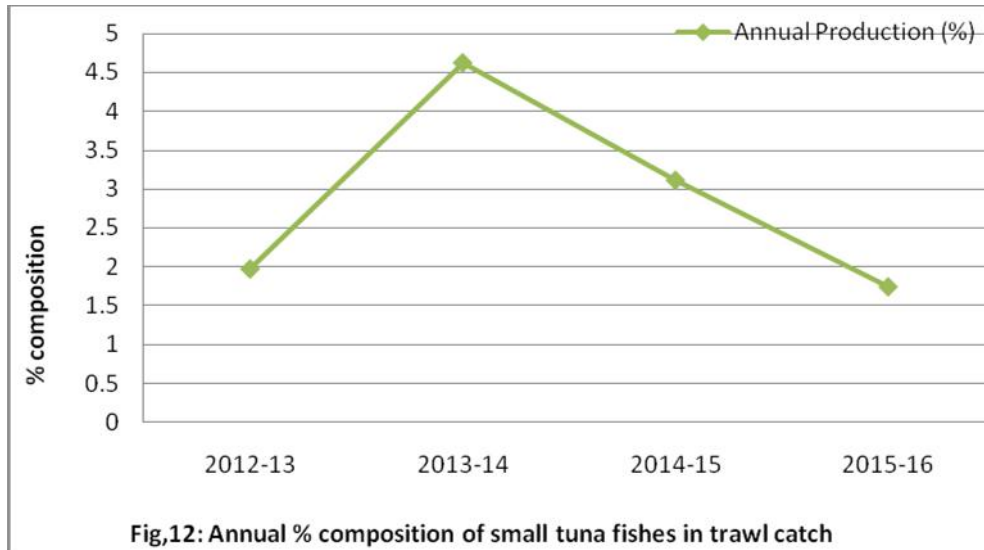
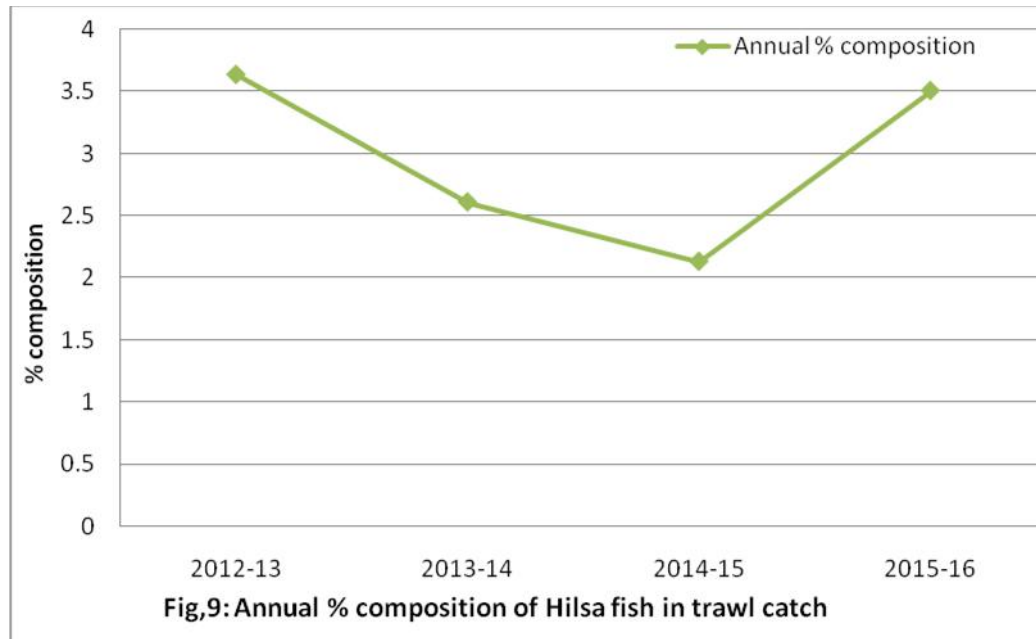


Fig.12: Annual % composition of small tuna fishes in trawl catch

There are seven species of tuna recorded in Bangladesh of which the Kawa kawa *Enthyunus affinis* is the most abundantly caught followed by the long tail tuna *Thunnus tonggol*. Annual production (%)

by weight) of small tuna was 1171 MT (1.97%) during 2012-13 which increased 3540.0 MT (4.62%) in 2013-14, but gradually decreased 1783.0 MT (1.74%) in the year 2015-16 (Fig: 12).

Hilsa



National fish Hilsa catch (*Tenualosa ilisha*) in trawl fishery has been recorded since 2012-13. Annual production or percentage composition by weight of hilsa was 2159.0 MT (3.64%) in the year 2012-13, which gradually decreased 2.13% (1815.0 MT) during 2014-15 and increased 3.51% (3695.0 MT) in the year 2015-16 periods (Fig: 13).

Discussion

Survey were conducted since 1958 in the marine waters of Bangladesh were of exploratory nature and oriented to studies of fishing feasibility. Others, however, assessed the standing stock of the marine resources, particularly the demersal fish and shrimp resources. The demersal fish and shrimp assessment survey result varies to a great extent. Pelagic fish surveys were not conducted extensively. Present estimates are based mainly on demersal surveys and acoustic survey by R.V. Dr. Fridtjof Nansen. Survey work on the marine fisheries resources of the EEZ of Bangladesh has stopped since 2002 as two of its Survey and Research Vessels; R V Anushandani and RV Machranga was out of order and was not fit for operation.

R V Anushandani was used to survey area beyond. Surveys conducted since 1958 in the marine waters of Bangladesh were of exploratory nature and oriented to studies of fishing feasibility. R V Anushandani and RV Machranga were out of order and were not fit for operation. Others, however, assessed the standing

stock of the marine resources, particularly the demersal fish and shrimp resources. The demersal fish and shrimp assessment survey result varies to a great extent. Pelagic fish surveys were not conducted extensively. Present estimates are based mainly on demersal surveys and acoustic survey by R.V. Dr. Fridtjof Nansen. Survey work on the marine fisheries resources of the EEZ of Bangladesh has stopped since 2002 as two of its Survey and Research Vessels ; R V Anushandani and RV Machranga was out of order and was not fit for operation. But newly introduced of RV Meensandhani, survey works again start in our territory.

Fishery resources of the deep sea offshore regions in India (Pelagic fish resources) of the 7,42,000 t of potential yield (PY), 4,01,000 t is from the 50-100m and the rest from the 100-200 m depth zone. The potential of the northwest coast is 1,61,000 t in the 50-100 m depth and 27,000 t in the rest of the area in deep sea the 100-200 m depth zone. The southwest coast accounts for the highest potential yield of pelagic resources (2,45,000 t), comprising 1,83,000 t in the 50-100 m zone and 62,000 t in the rest of the continental shelf. The southeast coast of India contributes 32,000 t in the 50-100m depth and 29,000 t in the 100-200 m. The estimated PY of the northeast coast is only 46,000 t with 25,000 t in the 50-100 m depth zone. In the seas around Lakshadweep, the potential is assessed at 63,000 t while around the Andaman and Nicobar Islands, it is 1,39,000 total (Devaraj 1984).

According to the Devaraj 1984 report offshore regions in India's Pelagic fish resources were 7,42,000 t of potential yield, but there is no clear idea about the pelagic stock in the Bay of Bengal of Bangladesh region.

Based on the data collected through exploratory surveys and information on primary and secondary production, marine fisheries potential beyond 50 m in the Indian EEZ is estimated at 1.69 million tones, contributed by 7,42,000 t of pelagic fish resources, 2,95,000 t of oceanic fish resources and 6,53,000 t of demersal fish resources (Anon, 1991).

According to the Anon, 1991 report in Indian EEZ pelagic, oceanic and demersal resources are describe, in our territory many demersal survey work was conducted and estimated 1,88,000 MT of demersal fish, but few pelagic survey were done and estimated 90,000 to 1,60,000 MT which are related to the Anon report, 1991.

The important fish groups instituting the above potential resources are the anchovies, carangids, ribbon fishes, tunas and pelagic sharks. Of these, the anchovies form a promising group, especially in the Gulf of Mallard during July to September and along the southwest coast during October to December. The magnitude of the additional yield is estimated to be 100-150 thousand tonnes, particularly in the mid-continental shelf region (Devaraj, 1984).

Another report on Devaraj, 1984, most of similar in this study report to the abundance of species/ group in the Bay of Bengal of Bangladesh region.

Estimate group wise fishery potential in the Indian EEZ (in '000 tonnes- Groups Beyond 50 m) Elasmobranchs 103, Catfish 63, Other clupeids 14, Lizardfish 21, Perches 125, Sciaenids 22, Ribbon fish 216, Carangids 304, Silver bellies 4, Pomfrets 12, Mackerels 62, Tunas 242, Cephalopods 21, Priacanthus sp, 55, Black ruff 9, Indian drift fish 7, Deep sea prawns 3, Deep sea lobster 5, Oceanic tunas 209, Bill fishes 4, Others 189, Total 1690 (Devaraj, 1984).

In our study report the densities of species number in each group are small, but according to Devaraj, 1984 report, the abundance of each group are in high position.

Recently from the new survey, four Ribbon fish species *Trichiurus lepturus*, *Eupleurogrammus moticus*, *Lepturacanthus savala* and *Trichiurus gangeticus* were recorded form our territory.

Five sardine species viz. *Sardinella fimbriata*, *Dussumieria acuta*, *Dussumieria elopsoides*, *Sardinella gibbosa* and *Sardinella melanura* were harvested. Among them *Sardinella fimbriata* fished in 1st position; but newly introduce *Dussumieria elopsoides* covered the 2nd highest position and *Dussumieria acuta* were in 3rd position of total sardine catch. Sardine contributed 7.31 % of the marine catch during 2016-17.

Sole fishes are belonging to several families the *true soles*, Soleidae, the tongue *soles*, Cynoglossidae and several species of right eye flounder in the family Pleuronectidae. Sole fish or flat fish (*Cynoglossus lingua* and *Cynoglossus bilineatus*) also known as kukur jeeb and Indian Halibut (*Psettodes erumei*) are exploit in trawl catch mainly shrimp trawl.

Sciaenidae species are commercially important and highest abundant number of species were *Otolithoides pama*, *Otolithes maculatus*, *Otolithoides pama*, *Otolithes cuvieri*, *Protonibeia diacanthus*, *Johnius argentatus* and *Panna microdon*. But now a day's *Nibeia soldado*, *Johnius belangari* and *Chrysochir aureus* are exploits suddenly large densities in the Sowatch of no ground areas. During 2016-17 Jew fish contributed 5.33% of the total marine catch.

Arius is a genus of catfishes (order Siluriformes) of the family Ariidae. Among the catfish species *Sciades sona*, *Arius maculatus*, *A. gagora* and *A. arius* are common in Bay of Bengal of Bangladesh region and high commercial value. Percentage composition of Cat fish was 1.39% of the total marine landed in 2016-17 period.

Pomfret was contributed 1.62% during 2016-17 of the total marine catch production.

Among the Tuna catch *Enthyunus affinis* and *Thunnus tonggol* are the most abundantly caught in mid water trawl and artisanal catch also.

National fish *Tenualosa ilisha* contributed around 43.76% of the total marine fish production of a single species during 2016-17.

Conclusion

For the MSY, need survey work which is a continuous process. Bangladesh first carried out a survey on marine fisheries in 1973, through a research ship of the Soviet Union and further advancements were made by RV Anushandani and RV Machranga, which broke down in 2000. RV Meen Sandhani, the research vessel brought from Malaysia to survey marine resources in the Bay of Bengal, for the survey RV Meen Sandhani undertake scientific cruise from December 2016. After finishing the survey in the Bay of Bengal of Bangladesh region the scientific group submitted a report about our marine stock. In recent years, the Department of Fisheries is working to bring sustainability in the marine fishing sector as part of the continued effort.

During 2006-07 to 2015-16 harvested highest Sciaenidae species was *Johnius argentatus* and lowest catch *Otolithoides pama*. In these periods maximum and minimum cat fish catch were *Arius maculatus* and *Arius sona* respectively. The available threadfin bream species *Nemipterus bathybius* is available in the Bay of Bengal of Bangladesh region. Among the carangid species *Megalaspis cordyla* was most abundantly available during study periods. The ribbon fish species *Trichiurus lepturus* was highly abundant and grunter species *Pomadasys maculatus* was highest catch in our territory. During study periods sardine species *Sardinella fimbriata* and *Dussumieria acuta* are highest densities in our marine jurisdiction. Among the Mackerel species *Rastrelliger kanagurta* was dominant catch. Pomfret species *Pampus argenteus* was harvested mostly. Cephalopods e.g. *Sepia spp* is available in the Bangladesh marine water. Sole fish - *Cynoglossus lingua* was found abundantly in deep sea areas also. Among the tuna species *Enthyunus affinis* is most abundantly caught during 2006-07 to 2015-16.

There is a general drop of catch of commercially important demersal species. More conservation measure is needed to conserve the large demersal's like lumbu poa, ranga chowka, kala datina, cat fish, lakhua, datina and others important species. Protection of the fish reserve and creating more no take zone may be one of the measures. Creation of artificial reef by dumping old vessels, old railway compartment, tare, block etc. in selected areas may also be another measure.

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