Distribution, Abundance and some biological aspects of Bill fish species under the family **Xiphiidae** (*Xiphias gladius*) and **Istiophoridae** (*Istiophorus platypterus, Istiompax indica Makaira nigricans*) in Indian EEZ

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Abstract

Distribution, abundance of bill fishes of the family Xiphiidae (Sword fish- *Xiphias gladius*) and Istiophoridae (Indo-Pacific sailfish-*Istiophorus platypterus,* Black marlin-*Istiompax indica* and Blue marlin-*Makaira nigricans*) in the Indian seas were investigated by analyzing the data collected during the exploratory tuna longline fishing conducted by the Fishery Survey of India. There are four Tuna long line fishing vessels (*M.F.V. Blue marlin, M.F.V Yellow fin, M.F.V Matsya Vrushti and M.F.V Matsya Drushti*) were involved for this survey cruises during the period from 2009 – 2018. The targeted Tuna and other bycatch details were excluded for this analysis and only bill fish catches during the survey were furnished in this report. The data from East coast of India including Andaman waters (FAO area 57) and West coast of India (FAO area 51) were divided in to 5 degree Latitude / Longitude grid. Seasonal and temporal variation of bill fish abundance during the study period of 10 years were given in this report. The abundance of *Xiphias gladius* revealed a diminishing trend from the 2009 to 2018 in Andaman waters but in area Lat7-12°N/Long.89-94°E the cpue was moderate and stable throughout the study period. However, *X. gladius* was dominated amoung the bill fish catches (54.6%) by an average catch per unit effort of 0.13 nos. per 100 hooks in Andaman waters. In general *Istiophorus platypterus* was dominated in the catches of East coast of India by 57% amoung the Bill fish catches during the past 10 years period from 2009-2018. Interestingly in west coast also the Indo pacific sail fish dominated in the catches

by 49% during the study period, whereas the catch per unit effort was between 0.051 and 0.54 nos. per 100 hooks during 2009-2018. The length (LJFL) range of *X.gladius* occurred in Indian seas was between 65cm and 316cm, the length weight relationship was 0.000002 $L^{3.28}$ during the year 2018, whereas the length range of *I.platyperus* was 53-289cm (LJFL) and the length weight relationship was 0.00009 $L^{2.2}$.

Introduction

India's oceanic fishery exploitation augmented by fishing fleet includes coastal multipurpose boats operating a number of traditional gears, small pole and line boats, small long liners and industrial longliners etc. The bill fishes are normally landed as bycatches of tuna long liners in India. Bill fishes are reported to migrate to coastal waters for feeding and spawning and have an affinity for the shelf area thereby forming part of coastal fisheries of many countries in the Indian Ocean including India (Campbell and Tuck, 1998). In India, the estimated billfish landing was 18,357 t. during the year 2018, whereas Sail fish (10026t.) Marlin (5455t.) and sword fish (2877t.) were the important components of the oceanic bill fish fishery. The total production of tunas and tuna-like fishes, including neritic and oceanic tunas, billfishes and seerfishes during the year 2011 was 15,9924 tonnes, against a total production of 12,7616 tonnes during the year 2010, where in 2014 it was 1,54,850 tonnes however during 2018 it reached around 2,01,717t. in India. However, in Indian Ocean it was reported to have tripled from 14,568 t in 1983 to 52,221 t in 1995 and the average annual catch during 2002 - 2006 was around 24,000 t (Campbell and Tuck, 1998) it reached 29860t. in 2014 (IOTC–2015–WPB13–26- updated 2017). The catch of billfish in the western region of the Indian Ocean (FAO Area 51) is always higher than the eastern region (FAO Area 57) and the countries with high catches of sailfish are Iran, Sri Lanka, India and Pakistan (Ganga *et al.* 2008). Studies on billfish fisheries its distribution, abundance and biology in different regions (De Sylva, 1957, 1974; Morrow, 1964; Williams, 1970; Chiang et al., 2004;

Hoolihan, 2004, 2006; Hoolihan et al., 2004; Nelson and Fitchett, 2006; Hoolihan and Luo, 2007). Fishery Survey of India for the past three decades continuing its exploratory survey in the Indian ocean (mostly restricted to Indian EEZ) by deploying long line fishing vessels (Sudarsan et al., 1988; John et al., 1995; Somvanshi et al., 1998; Bhargava et al., 2005; Sivaraj et al., 2005; Varghese et al., 2005, Kar et al 2011, BishnupadaSethi and Ansy Mathew,2014, Premchand *et al*., 2015). Being a highly migratory species, the bill fishes move freely across international borders and Exclusive Economic Zones (EEZs) and contribute to fisheries on their migratory routes. An understanding of the local fisheries is an important step to assess the bill fish stock. Data on fishing effort and size groups of billfishes in the catches from the countries of the Indian Ocean region to make a quantitative regional assessment of the stocks (Campbell and Tuck, 1998; Uozmi, 2003; IOTC, 2008). Considering these facts the data on bill fishes for the past 10 years from 2009-2018 from the exploratory survey were analysed for the understanding of distribution and abundance in the different sectors of Indian EEZ to ensure better management measures within the frame work of IOTC.

Material and method

Data were collected on board four tuna longline survey vessels belongs to Fishery Survey of India during January 2009 to December 2018 were analysed for studying the distribution and abundance Bill fishes. The vessels, M.F.V.*Matsya Vrushti* (OAL 37.5 m, GRT 465 t) and M.F.V *Yellow Fin* (OAL 36.0 m, GRT 290 t,) operated for conducting survey in the west coast of India (eastern Arabian Sea), while the other two vessels, M.F.V *Matsya Drushti* (OAL 37.5 m, GRT 465 t) and M.F.V *Blue Marlin* (OAL 36.0 m, GRT 290 t) Port Blair Base surveyed the Andaman and Nicobar waters. Conventional Japanese multifilament longline with 5 hooks (‘J’ hook) per basket was operated from the vessels Yellow Fin and Blue Marlin, whereas, the other two vessels operated monofilament longline gear with 7 hooks (Circle hook) per basket. Every month, these vessels were envisaged for long line fishing in

the scheduled area with 20 days endurance, and about 15 longline operations (sets) were conducted in each voyage by operating an average of 9000 hooks. Shooting of the line commences before sunrise and is completed in about 2-2.5 hours. On an average 550 hooks are operated in a set. Immersion period of 5 hours is allowed and hauling is done in the afternoon. The fish caught during the survey, after the identification, were subjected to morphometric measurements using a measuring tape to the nearest cm and then weighed using digital weighing balance having a precision of 1.0 kg. The fish were dissected out to study their sex, maturity stages, stomach condition etc. For data analysis, seas around India was divided in to three regions viz., eastern Arabian Sea, western Bay of Bengal and Andaman and Nicobar waters and further divided in to 5 x 5 degree grid for analysing abundance of each species (table 1). Hooking Rate (HR), the number of fish caught in 100 hooks and Catch Rate (CR), weight of fish caught in kg per 1000 hooks operated was expressed as relative abundance index.

Results and Discussion

Abundance of Bill fishes in West coast of India (FAO area 51)

There are 7 grids of 5 degree lat. and 5 degree long. viz. from Lat. 4-7°N/long.64-69°E to Lat.17-22°N/long.74-79°E were surveyed by operating longline, there were about 0.85million hooks were operated in these area during the period from 2009-2018 (Fig.1). In west coast of India *Istiophorus platyperus* dominated the catches by 49% followed by *Xiphias gladius* (45%), whereas *Makaira nigricans* was 6% of the total bill fish landings (Fig.14.c). When analysing area wise distribution it is understood that the area Lat.12-17°N/Long.69-74°E was moderately productive throughout the study period, as for as the abundance of *Xiphias gladius* concerned (Fig.12) with marginal difference from the neighbour areas of the west coast may be due to highly productive sea mounts attract the

foraging bill fish groups throughout the year. The highest catch rate for *Makaira nigricans* of 41.3kgs/1000hooks was reported during the year 2016, whereas it was 6.2kg/1000hooks during the year 2018. The present study revealed that the 66% of total bill production in India (Fig. 15) was obtained from west coast (FAO area 51). The pertinent literature also revealed that Bill fish catches always higher in western Indian ocean (FAO area 51) than Eastern (FAO area 57) Indian region (Ganga *et al*., 2008).

Distribution of Bill fishes in East coast of India (FAO area 57)

There are 4 grids of 5 degree lat. and 5 degree long. viz.Lat. 7-12°N/long.79-84°E to Lat.17-22°N/long.84-89°E were surveyed by operating longline, there were about 91,015 hooks were operated in these area during the period from 2009-2018 (Fig.1). In East coast of India, average CPUE (hooking rate) for the study period of past 10 years revealed that *I. platypterus* dominated the catches by 57% followed by *X.gladius* (28%), however *Makaira nigricans* was 15% of the total bill fish landings (Fig.14.b). Area wise distribution of bill fish species was revealed that the area Lat.12-17°N/Long.79-84°E was comparatively more productive throughout the study period (Fig. 8-11). Whereas *I.platypterus* shown moderate catch rate throughout the year, however during the year 2011, the a highest catch rate of 40kg/1000hooks was reported. Hooking rate of *Xiphias gladius* shown comparatively lesser abundance but no much change in the area 12-17°N/79-84°E during study period (table 6). The highest catch rate for *Istiopmax indica* of 37.6kgs/1000hooks was reported during the year 2018, whereas it was 100.3kg/1000hooks during the year 2014.

Distribution of Bill fishes in Andaman waters (FAO area 57)

There are about 4 grids of 5 degree lat. and 5 degree long. viz. lat.4-7°N/Long.89-94°E to Lat.17-22°N/long.94-99°E have been surveyed for the period of 10 years from 2009-2018 by operating tuna longline, there were about hooks were operated in these area (Fig.1). In

Andaman waters, average CPUE (hooking rate) for the study period of past 10 years revealed that *X.gladius* dominated the catches by 54.6% followed by *I. platypterus* (36.5%), however *Makaira nigricans* was 8.9% of the total bill fish landings (Fig.14.a). Area wise distribution of sailfish species was revealed that the southern part of Andaman i.e. Nicobar waters was comparatively more productive throughout the study period whereas the relative abundance was ranged between 1.53kg/1000 hooks and 9.7 kg/1000hooks (table 9). Whereas *I. platypterus* shown a maximum catch rate of 15.7kgs/1000hooks during the year 2012. However, a highest catch rate of 144 kg/1000hooks was reported for *Xiphias gladius* in the area 4-7°N/94-99°E during study period (table 7). The habitat preference of bill fishes is reported to be waters above the thermocline and close to islands (Suzuki et al., 1977; Hoolihan and Luo, 2007). The catch rate of *X.gladius* was moderately obtained throughout the study period which ranges between 13kg/1000hooks and 16.89 kg/1000hooks in the area 7-12°N/89-94°E. The highest catch rate for *Makaira nigricans* of 53.96kgs/1000hooks was reported during the year 2016, whereas the catch rate of *Istiopmax indica* ranges between 1.2 kg/1000hooks and 5.8 kg/1000hooks in the year 2018 the catch rate of this species was 2.67 kg/1000hooks.

Biological aspects of *Xiphias gladius*

Length frequency study revealed that mostly moderate size *X. gladius* specimen (Fig. 16) reported in the survey throughout the Indian EEZ, however the commercial landing from the landing centre have more larger specimen. The survey (fishing operation) of Fishery Survey of India have been carried out only at day time but the commercial tuna long line fishing vessels mostly operating during night targeting the Oceanic resources of commercial size preferably foraging on surface waters and thus made available more larger specimens of sword fishes in the landing centres. Length weight relationship of *X. gladius* was 0.000002 $L^{3.28}$ during 2018. Analysis of data food and feeding habits (Fig. 19) of *X.gladius* revealed

that *Sthenoteuthis sp*. itself contributed 36%, *Ethynnus* sp. 13%, other squid species contributed 23%. However Varghese *et al.,* (2013) reported that *Sthenoteuthis s*p. Dominated the diet of *X.gladius* in west coast of India. Spawning ground was identified in the Lakshadweep waters of west coast of India (FAO area 51) as mature females with hydrated oocytes were observed during December to April (Varghese *et al.,* 2013).

Biological aspects of *Istiophorus platyperus*

Analysis of length frequency study on *I. platyperus* from the survey data revealed that 80% specimens are in the length range of 185-205cm (Fig. 17) reported in the survey throughout the Indian EEZ. However the length range of *I.platyperus* was 53-289cm (LJFL) and the length weight relationship was 0.00009 $L^{2.2}$ during 2018. However in Andaman waters the length range occurred was 113-232cm (Kar *et al.,* 2015). Analysis of data on food and feeding habits (Fig. 18) of *I. platyperus* revealed that cephalopods contributed 60% of the diet during the year 2018, where as *Sthenoteuthis sp*. itself contributed 40%, *Ethynnus* sp. 25%, other squid species contributed 20%. However Ramlingam and Kar (2011) reported that cephalopods dominated the diet of *I.platypterus* in Andaman waters of India EEZ. Spawning ground was identified in the Andaman waters of East coast of India (FAO area 57) as mature females with hydrated oocytes were observed during February to June (Ramlingam and Kar, 2011).

Conclusion

Oceanic fishery in India is beginning to face serious issues mainly due to declining the catches of oceanic resources. As these resources are highly migratory in nature, the over exploitation in one region will influence the abundance in other regions. India's contribution to total oceanic fishery resources from the Indian Ocean during 2006 was 2.01%. Our oceanic tuna catches are far below the potential estimated (Anon, 2018). India adopts a precautionary

approach and thus practicing fishing ban for a period of 65 days in East coast (FAO area 57)and West coast (FAO area 51). India is also committed to the conservation and management measures within the framework of the IOTC for sustainability of the Oceanic tuna and allied fishery without affecting the livelihood of millions of coastal fishermen in the country.

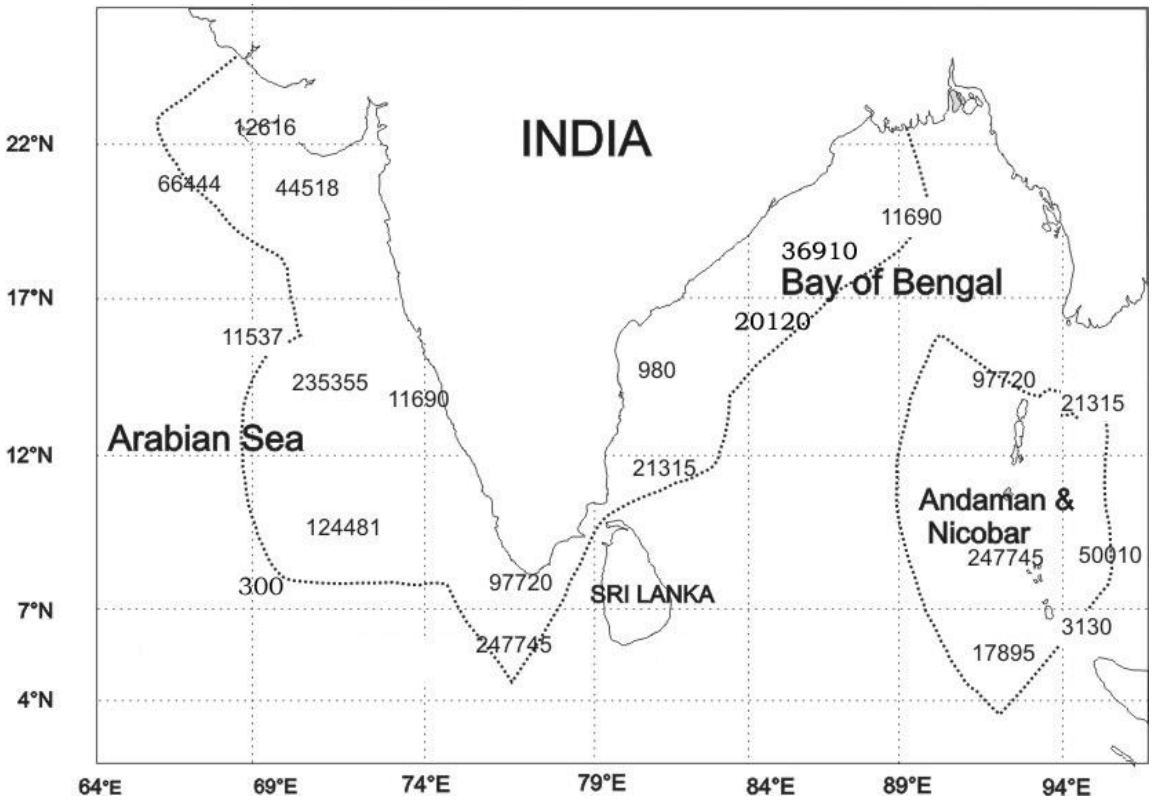


Fig.1. Map showing distribution of fishing effort in No.of Hooks in different sectors of Indian EEZ during the period form 2009-2018

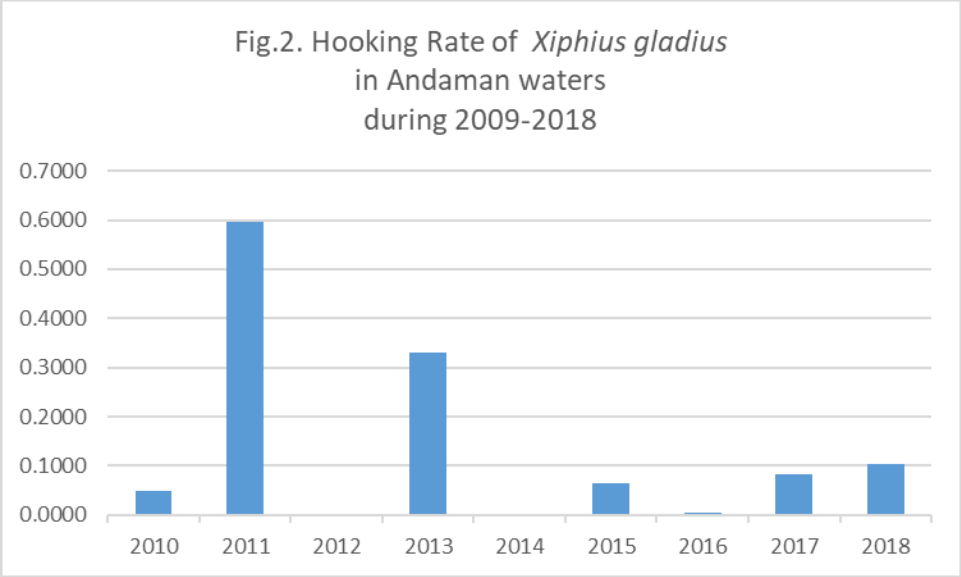


Fig.2. Hooking Rate of Xiphius gladius
in Andaman waters
during 2009-2018
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
2010
2011
2012
2013
2014
2015
2016
2017
2018

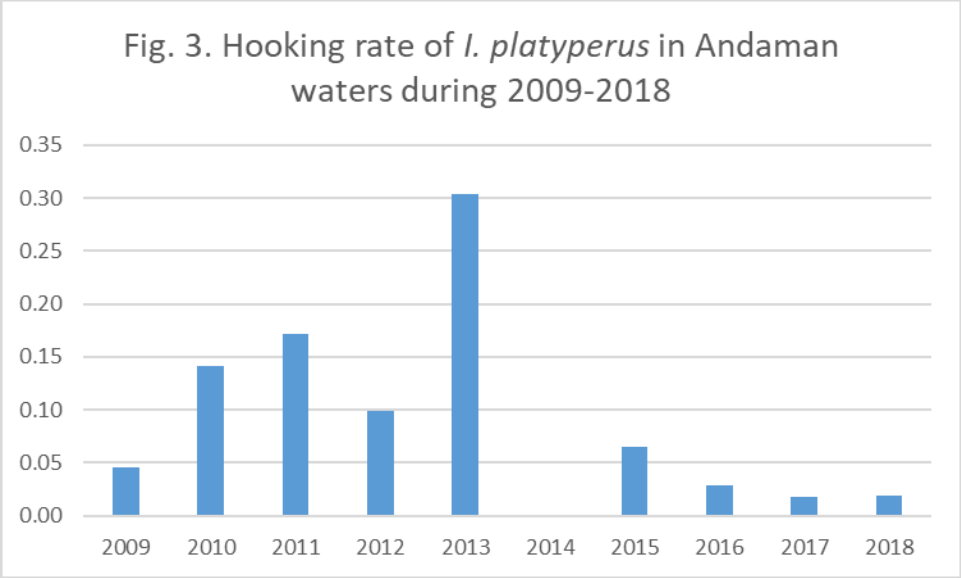


Fig. 3. Hooking rate of I. platyperus in Andaman
waters during 2009-2018
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

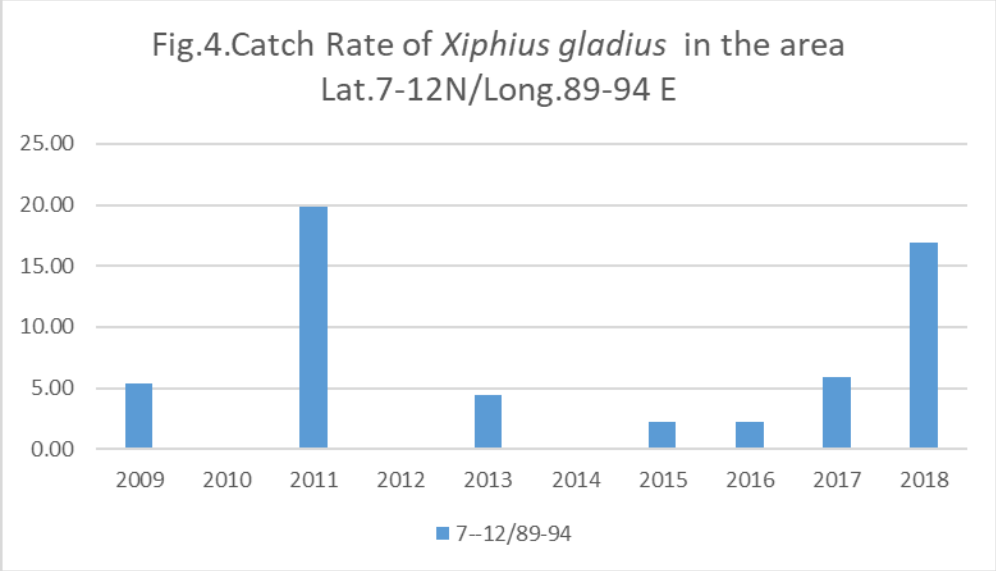


Fig.4.Catch Rate of Xiphius gladius in the area
Lat.7-12N/Long.89-94 E
25.00
20.00
15.00
10.00
5.00
0.00
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
7--12/89-94

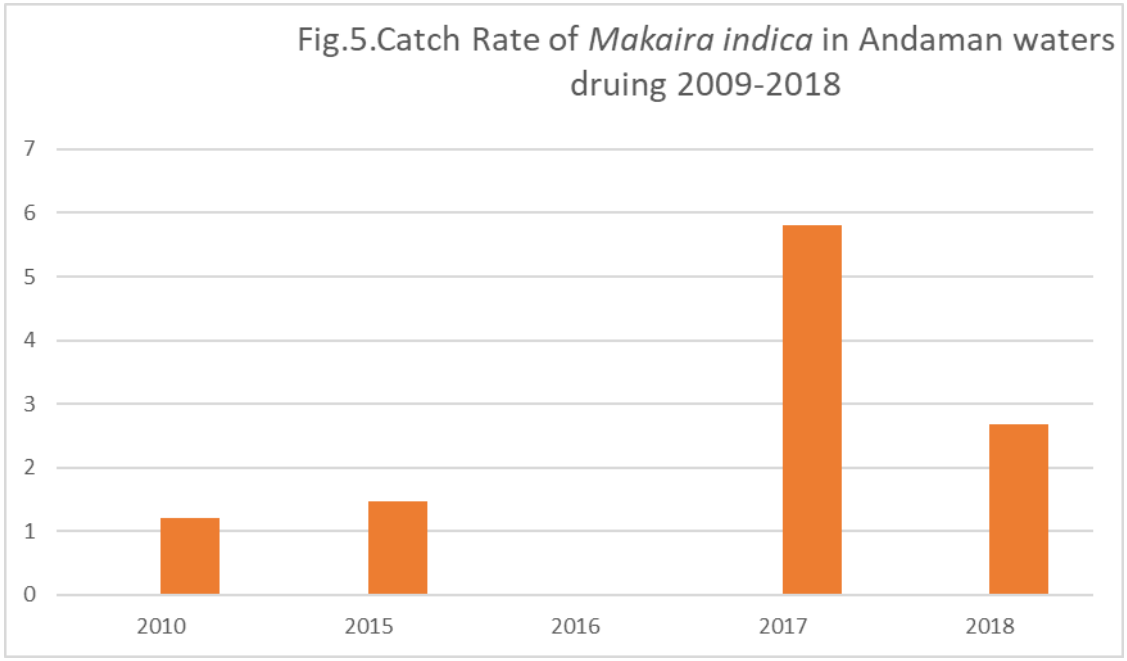


Fig.5.Catch Rate of *Makaira indica* in Andaman waters druing 2009-2018
7
6
5
4
3
2
1
0
2010
2015
2016
2017
2018

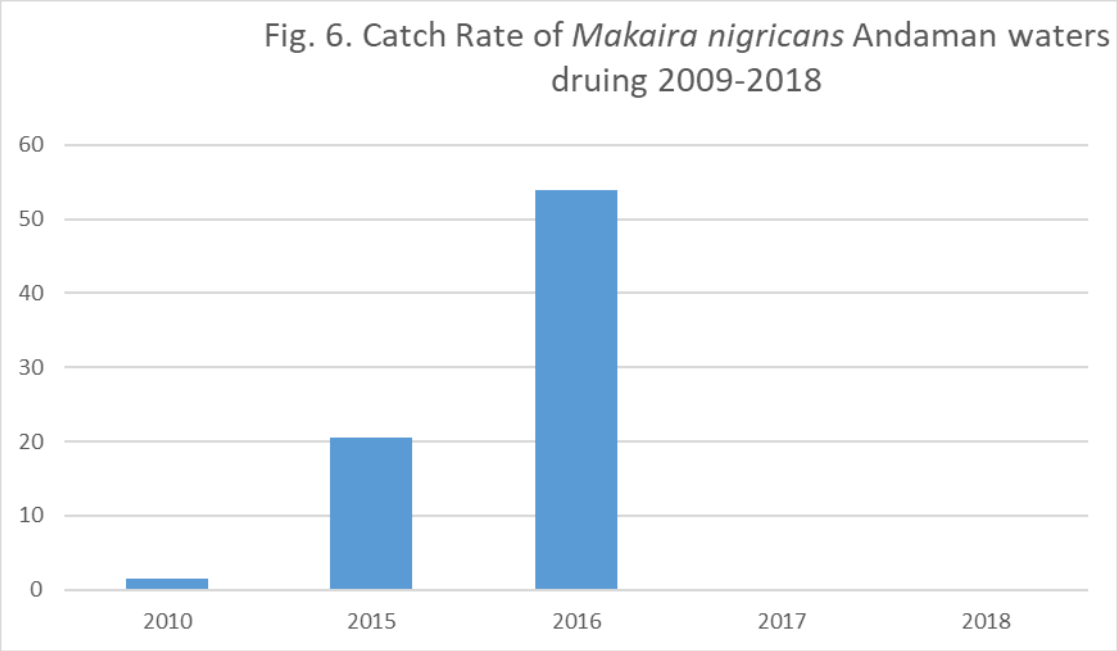


Fig. 6. Catch Rate of *Makaira nigricans* Andaman waters druing 2009-2018

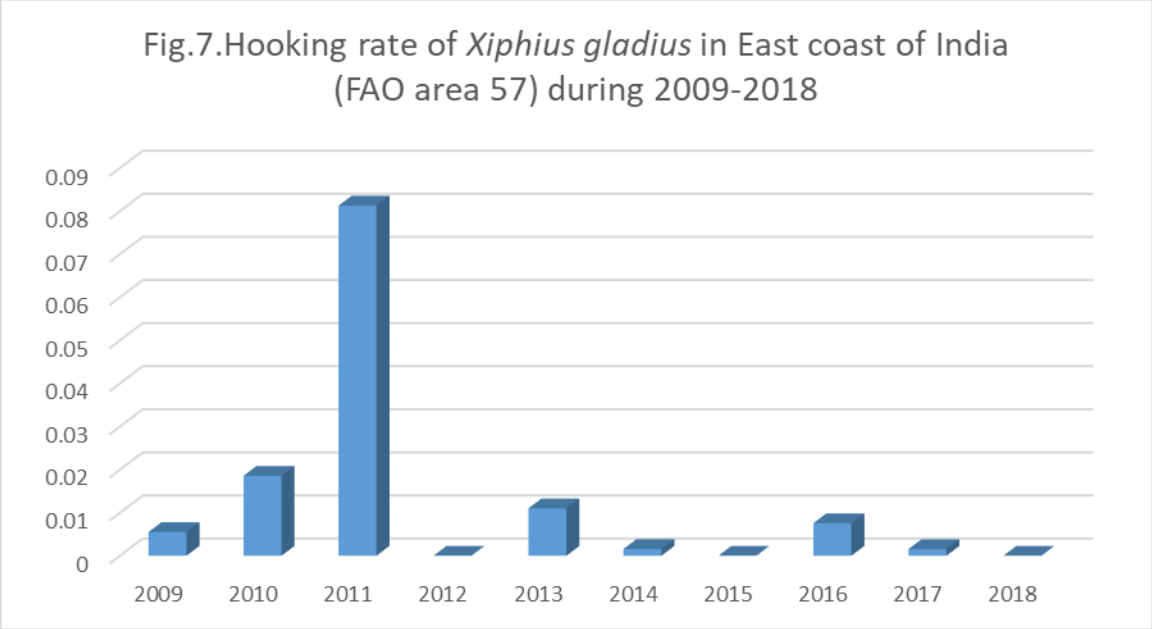


Fig.7.Hooking rate of *Xiphius gladius* in East coast of India (FAO area 57) during 2009-2018

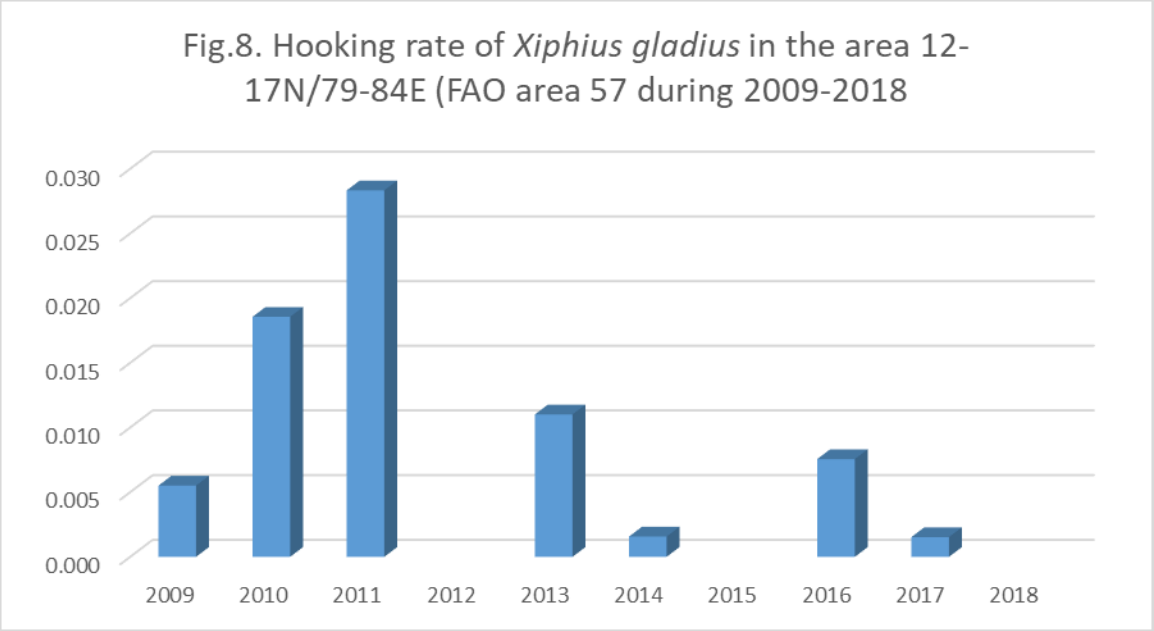


Fig.8. Hooking rate of Xiphius gladius in the area 12-17N/79-84E (FAO area 57 during 2009-2018
0.030
0.025
0.020
0.015
0.010
0.005
0.000
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

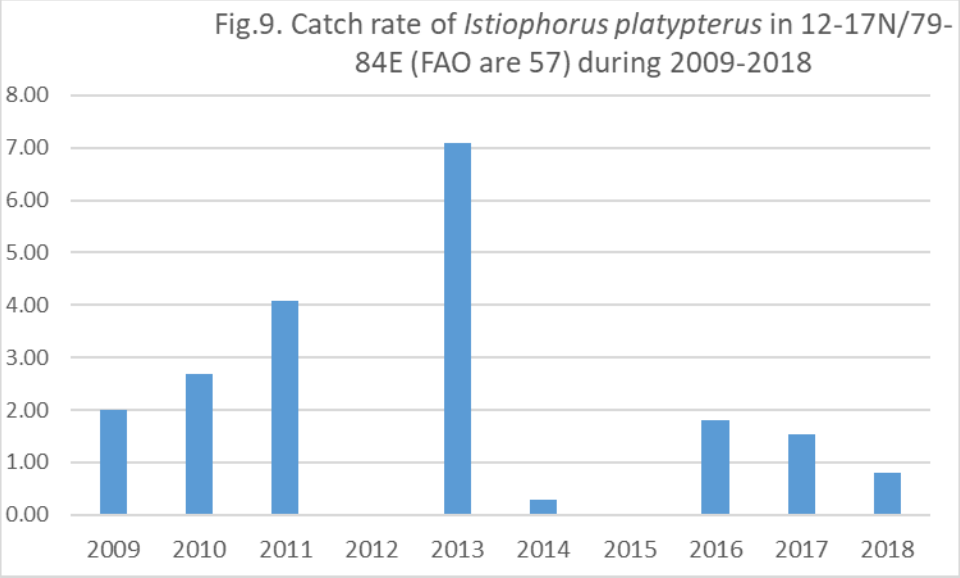


Fig.9. Catch rate of Istiophorus platypterus in 12-17N/79-84E (FAO are 57) during 2009-2018
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

Fig.10. Hooking rate of *Istiophorus platypterus* in East coast of India (FAO area 57) during 2009-2018

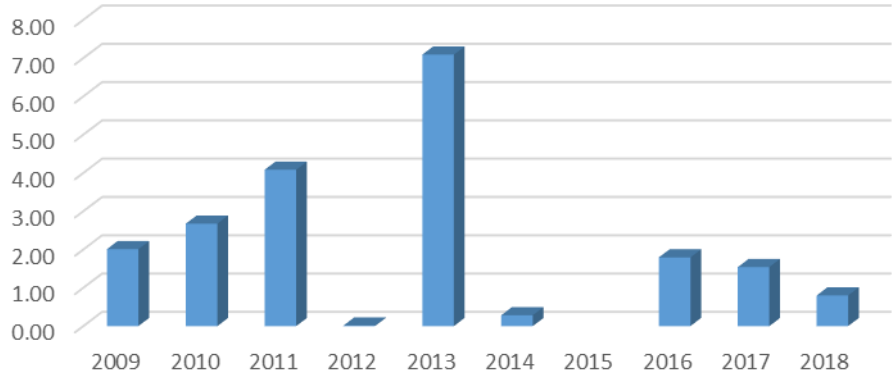
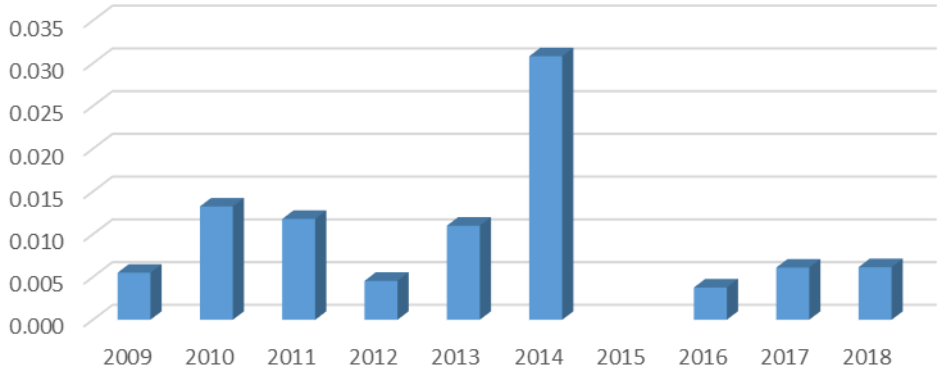


Fig.11. Hooking rate of *Istiophorus platypterus* in the area 12-17N/79-84E (FAO area 57) during 2009-2018



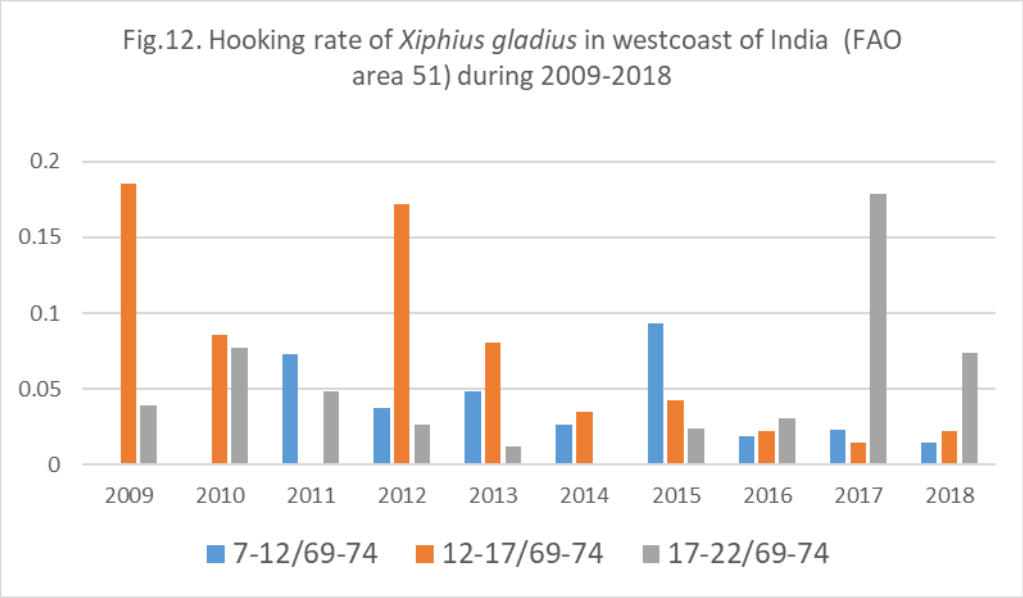


Fig.12. Hooking rate of *Xiphius gladius* in westcoast of India (FAO area 51) during 2009-2018
0.2
0.15
0.1
0.05
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
7-12/69-74
12-17/69-74
17-22/69-74

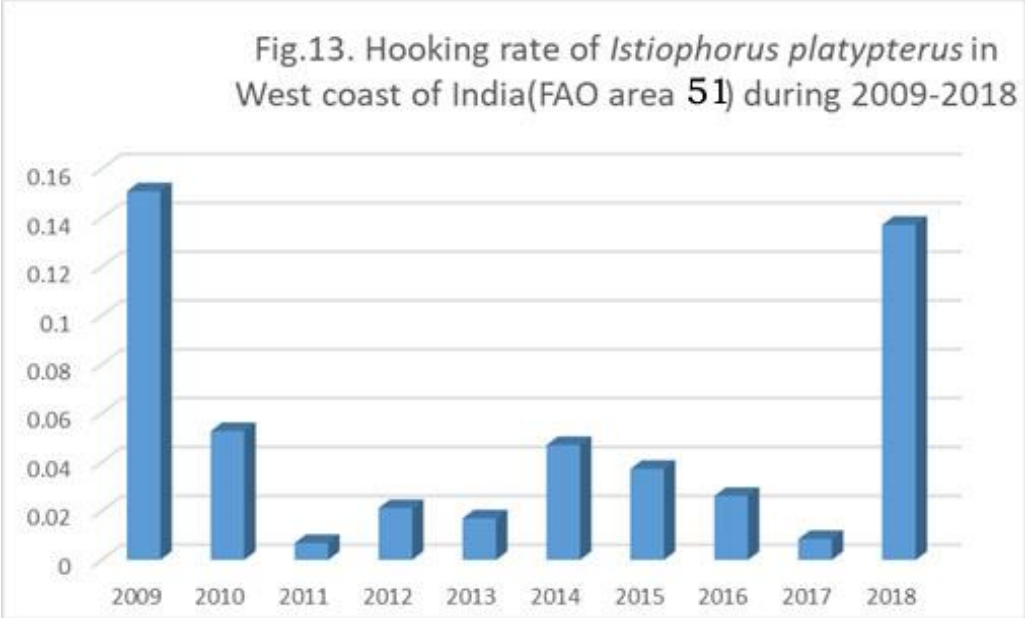


Fig.13. Hooking rate of *Istiophorus platypterus* in West coast of India(FAO area 51) during 2009-2018
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

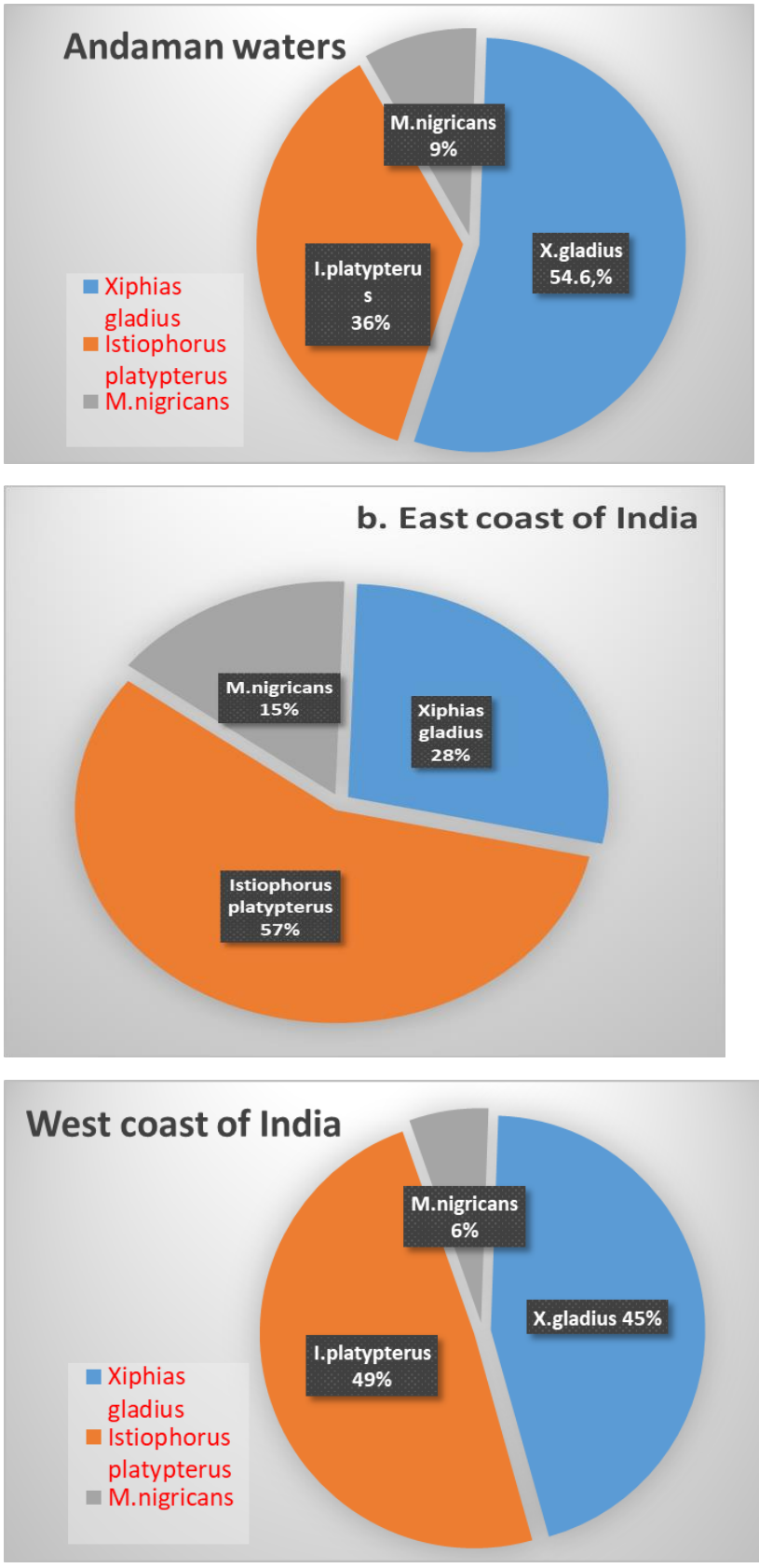


Fig.14. percentage composition of bill fishes in the long line catches of different coasts of India

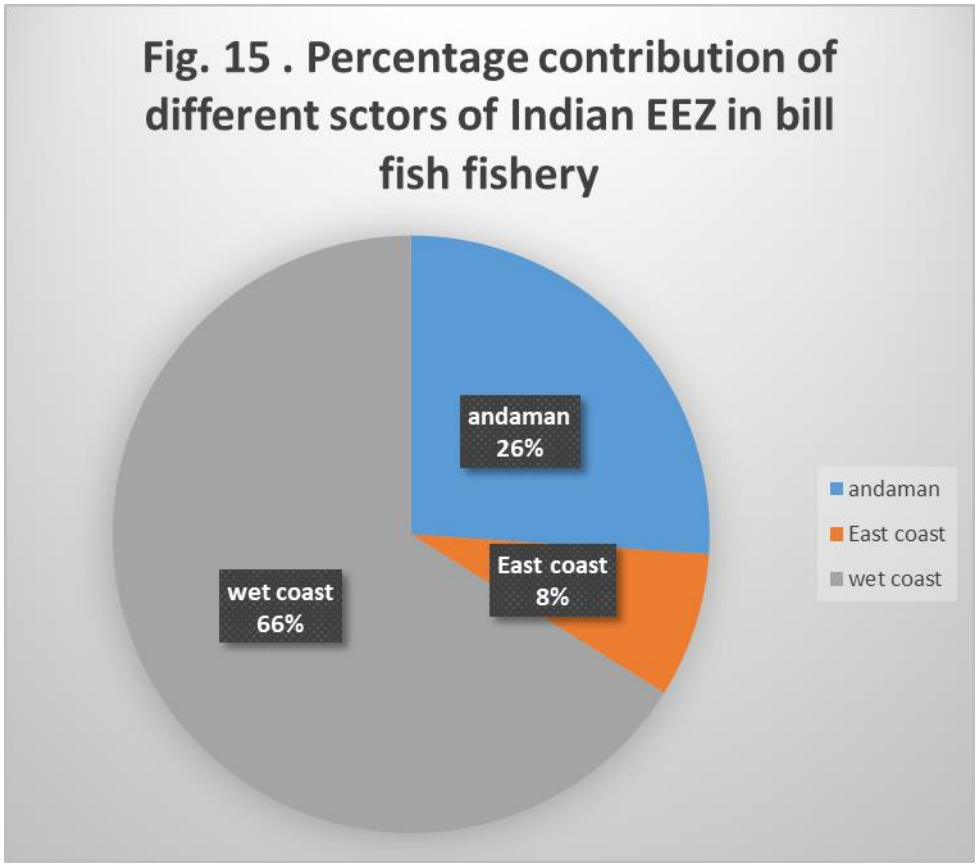


Fig. 15 . Percentage contribution of different sctors of Indian EEZ in bill fish fishery
andaman 26%
East coast 8%
wet coast 66%
andaman
East coast
wet coast

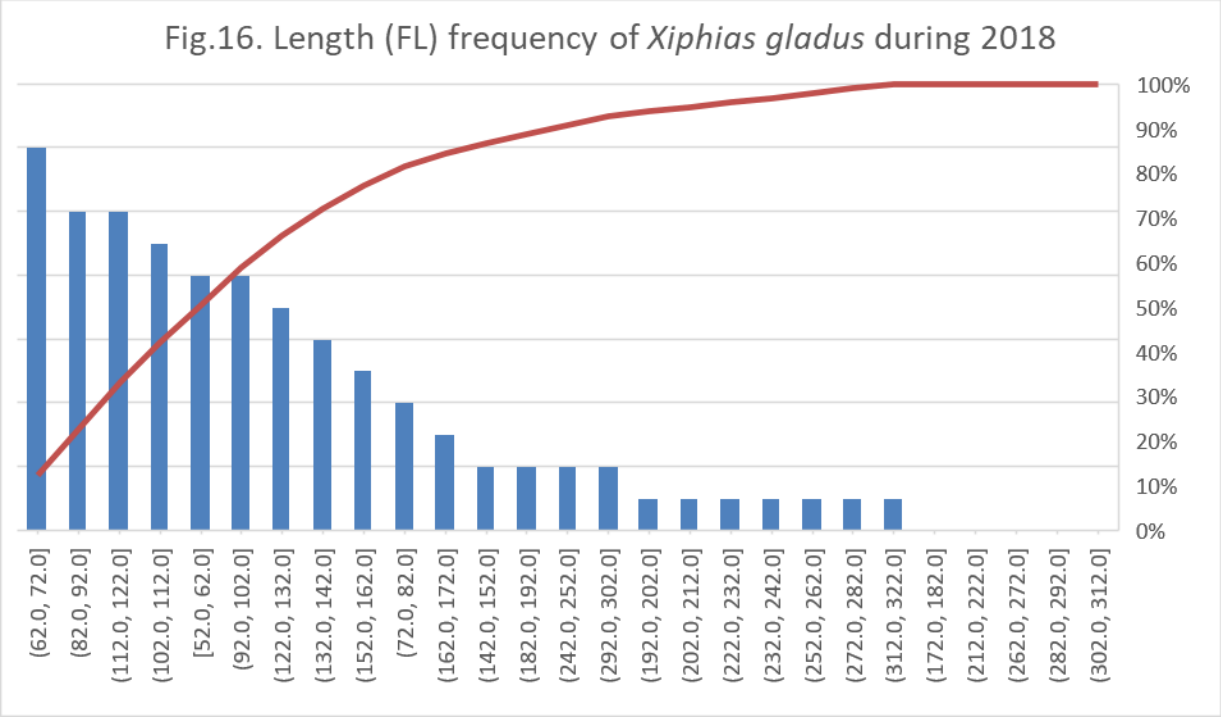


Fig.16. Length (FL) frequency of Xiphias gladus during 2018
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
(62.0, 72.0]
(82.0, 92.0]
(112.0, 122.0]
(102.0, 112.0]
[52.0, 62.0]
(92.0, 102.0]
(122.0, 132.0]
(132.0, 142.0]
(152.0, 162.0]
(72.0, 82.0]
(162.0, 172.0]
(142.0, 152.0]
(182.0, 192.0]
(242.0, 252.0]
(292.0, 302.0]
(192.0, 202.0]
(202.0, 212.0]
(222.0, 232.0]
(232.0, 242.0]
(252.0, 262.0]
(272.0, 282.0]
(312.0, 322.0]
(172.0, 182.0]
(212.0, 222.0]
(262.0, 272.0]
(282.0, 292.0]
(302.0, 312.0]

Fig.17. Length (FL) frequency of *Istiophorus platypterus* during 2018

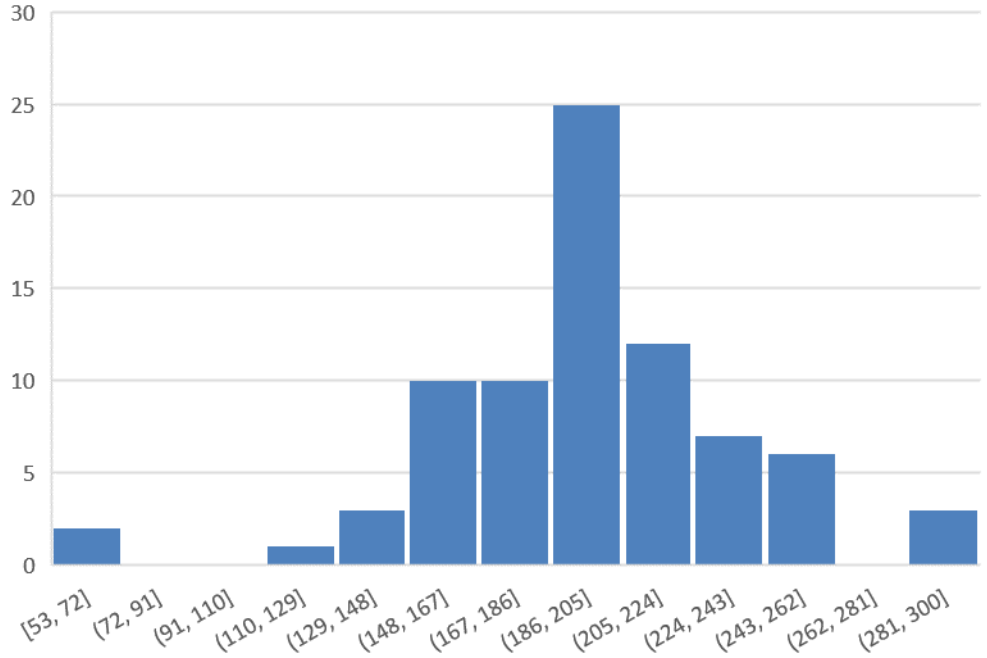
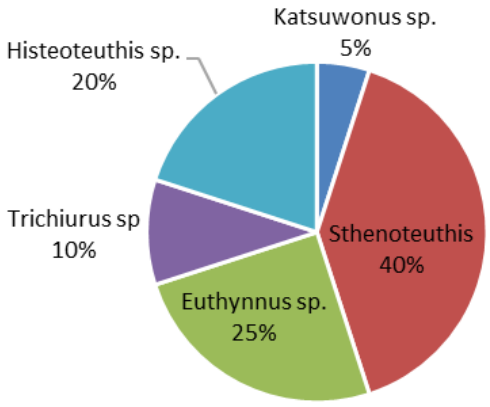


Fig.18.percentage diet composition of *I. platyperus*



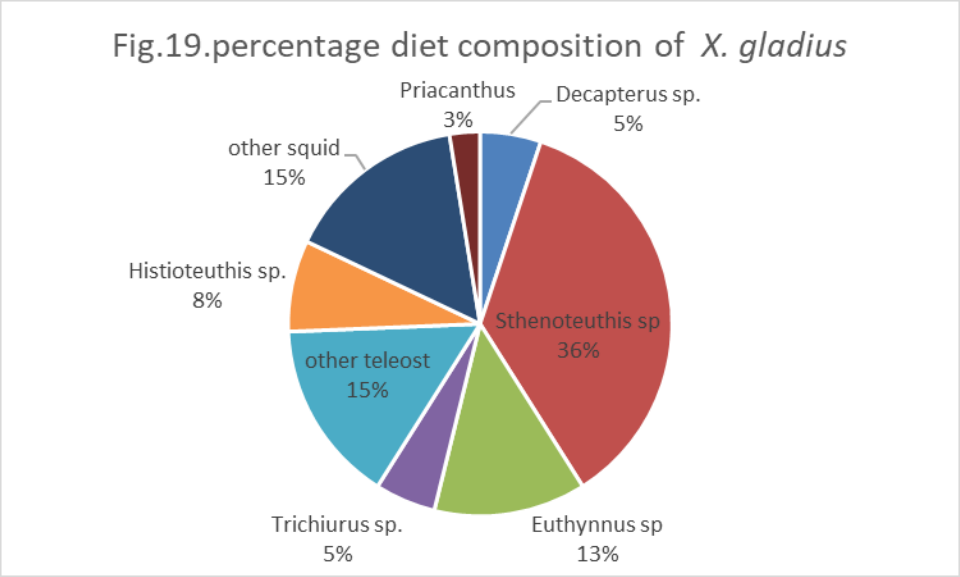


Table 1. Hooking rate and catch rate of *Makaira nigricans* in west coast of India (FAO area 51)

Makaira nigricans	Hooking rate (nos). per 100 hooks/catch rate Kgs per 1000 hooks)								
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2014	2015	2016	2018
4-7/64-69									
7-12/64-69									
12-17/64-69				0.005 /1.31					0.007 /6.20
17-22/64-69	0.166 /41.5	0.018 /11.04	0.03 /9.3		0.05 /10.37			0.087 /41.3	
22-27/64-69							0.158 /2.5		
4-7/69-74									
7-12/69-74			0.003 /2.19			.005/2.73	0.009 /.5		
12-17/69-74		0.006/4.5					0.006 /.6	0.004 /3.09	
17-22/69-74							0.016 /1.26	0.007 /3.99	

Table 2. Area wise Hooking rate of *Istiophorus platypterus* in west coast of India (FAO area 51)

	Hooking rate nos. /100hooks									
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
12-17/64-69						0.16				
17-22/64-69	0.166	0.055	0.025	0.051			0.009	0.111		0.541
4-7/69-74	0.064		0.016							
7-12/69-74				0.000	0.005	0.061	0.061	0.005	0.023	0.029
12-17/69-74	0.168	0.018		0.015	0.005	0.030	0.032	0.012	0.028	0.059
17-22/69-74	0.156	0.213		0.026	0.012		0.008	0.015	0.000	0.018
4-7/74-79					0.079		0.091	0.000		0.159
7-12/74-79	0.352	0.030		0.035		0.032	0.023	0.013		0.016

Table 3. Area wise catch rate of *Istiophorus platypterus* in west coast of India (FAO area 51)

I.platypterus	Catch rate (weight in Kgs. /1000 hooks)									
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
12-17/64-69						4.76				
17-22/64-69	41.55	20.34	6.86	13.42			2.66	51.83		92.03
4-7/69-74	14.05									
7-12/69-74			5.51	0.00	1.67	11.71	14.74	1.43	5.06	5.46
12-17/69-74	35.19	4.91		5.26	1.46	6.06	8.22	6.44	15.91	12.93
17-22/69-74	46.69	61.99	5.19	2.91	4.64		3.01	8.45	0.00	3.70
4-7/74-79					1.83		19.95			18.52
7-12/74-79	70.37	5.97		0.04		6.17	6.01	7.04		1.64

Table 4. Area wise hooking rate of *Xiphius gladius* in west coast of India (FAO area 51)

Xiphias gladius		Hooking rate nos / 100hooks								
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
4-7/64-69		0.33								
12-17/64-69						0.158				
17-22/64-69	0.055	0.074	0.038	0.007			0.018			
4-7/69-74	0.20									
7-12/69-74			0.07	0.04	0.05	0.03	0.09	0.02	0.02	0.01
12-17/69-74	0.186	0.086		0.172	0.080	0.035	0.043	0.023	0.014	0.022
17-22/69-74	0.039	0.077	0.049	0.026	0.012		0.024	0.031	0.179	0.074
4-7/74-79								0.10		0
7-12/74-79	0.070	0.030		0.000		0.016		0.040		0.033
12-17/74-79	0.03			0.09						

Table 5. Area wise Catch rate of *Xiphius gladius* in west coast of India (FAO area 51)

Xiphias gladius		Catch rate kgs./1000 hooks								
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
4-7/64-69		16.66								
12-17/64-69						11.11				
17-22/64-69	2.77	0.00	6.73	5.92			16.50			
4-7/69-74	9.26									
7-12/69-74			3.07	2.07	5.28	0.96	14.74	5.14	16.78	1.47
12-17/69-74	22.78	4.66		10.07	6.50	1.69	8.18	13.85	13.64	4.19
17-22/69-74	0.78	7.75	1.79	0.79	0.49		4.12	17.28	38.63	22.37
4-7/74-79								4.81		0
7-12/74-79	1.41	2.99		0.00		0.97		1.99		2.13
12-17/74-79	1.06			10.23						

Table 6. Hooking rate and catch rate of *Xiphius gladius* in East coast of India (FAO area 57)

Xiphias gladius	Hooking rate nos./100hooks									
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2014	2015	2016	2017	
4-7/79-84										
7-12/79-84			0.05							
12-17/79-84	0.006	0.019	0.028		0.011	0.002		0.008	0.002	
4-7/79-84										
	Catch Ratewt. In kgs/1000hoks									
7-12/79-84		39.43	8.11							
12-17/79-84	2.01	0	2.05			0.16	1.47	0.19	0.87	

Table 7. Hooking rate and catch rate of *Xiphius gladius* in Andaman waters (FAO area 57)

X.gladius	hooking rate nos. /100 hooks							
Arera	2009	2010	2011	2013	2015	2016	2017	2018
7--12/89-94	0.08	0.02	0.13	0.01	0.01	0.01	0.07	0.09
12--17/89-94	0.02		0.18					0.02
4--7 /94-94			0.16	0.32				
7--12/94-99		0.02	0.04		0.01		0.01	
12--17/94-99		0.00	0.10		0.05			
17--22/94-99								
7--12/89-94	5.34	0.13	19.89	4.39	2.27	2.24	5.87	16.89
12--17/89-94	1.31	4.84	146.00					1.28
4--7 /94-99			9.60	144.00				
7--12/94-99			8.53		7.67		0.22	
12--17/94-99		3.93	48.96		1.14			
7--12/89-94	5.34	0.13	19.89	4.39	2.27	2.24	5.87	16.89

Table 8. Hooking rate and catch rate of *Istiophorus platypterus* in East coast of India (FAO area 57)

Istiophorus platypterus	hooking rate nos. /100 hooks								
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2014	2016	2017	2018
4-7/79-84									
7-12/79-84		0.057		0.016		0.026		0.011	
12-17/79-84	0.006	0.013	0.012	0.005	0.011	0.031	0.004	0.006	0.006
17-22/79-84	0					0.011		0.040	
	Catch rate								
7-12/79-84		11.43			4.63			2.96	
12-17/79-84	2.01	2.68	4.08	0.02	7.09	0.28	1.80	1.54	0.80
17-22/79-84	0			0.00	1.06			6.35	

Table 9. Hooking rate and catch rate of *Istiophorus platypterus* in Andaman waters (FAO area 57)

Istiophorus platypterus	hooking rate nos. /100 hooks								
Area Lat.°N/Long.°E	2009	2010	2011	2012	2013	2015	2016	2017	2018
4--7 /89-94			0.16						
7--12/89-94	0.02		0.01	0.01	0.01	0.01	0.00	0.02	0.02
12--17/89-94	0.01	0.01			0.01	0.02	0.03		
17--22/89-94	0.00	0.10			0.16				
4--7 /94-94	0.00	0.00							
7--12/94-99	0.01	0.01		0.04	0.02	0.01			
12--17/94-99		0.01		0.05	0.11	0.02			
4--7 /89-94	0.00		40.00						
7--12/89-94	4.31	1.53	2.86	2.15	3.37		3.07	0.00	9.71
12--17/89-94	3.46	3.02	0.00		2.52		6.34	9.89	
17--22/89-94	0.00	10.20			10.32			0.00	
4--7 /94-94	0.00	0.00			0.00				
7--12/94-99	0.61	3.06		10.97	5.69		3.73		
12--17/94-99		3.07		15.87	11.73		5.68		

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