STATUS OF SEER FISH FISHERY INCLUDING SOME BIOLOGICAL CHARACTERSTIC OF *SCOMBEROMERUS COMMERSON* IN INDIAN WATERS.

Manas Kumar Sinha*, Premchandand A.Tiburtius****

Fishery Survey of India, Fishing Harbour Complex, Kasimedu, Royapuram,Chennai-600 013
***manassinhafsi70@gmail.com**
****Fishery Survey of India, Botawala Chambers, Mumbai-400 001**

****

ABSTRACT

Seer fish belongs to subfamily of the Scombridae or Mackerel family. These include species like Indo-Pacific King Mackerel, Scomberomorus guttatus, (Spotted Seer fish), Streaked Spanish Mackerel, S. lineolatus, (Streaked Seer fish or Strooed Seer Fish), Narrow-Barred Spanish Mackerel, S. commerson (King Mackerel),Korean mackerel, Scomberomorus koreanus, (Korean Seer fish) and Deep sea Seer fish, Acanthocybium solandri (Wahoo). Seer Fish resource is being mainly exploited all along the Indian coast by both mechanized and non- mechanized fishing units by employing different types of gears mainly drift gill net, hooks and line, trawl net, shore-seine etc. Present exploitation is limited to the near shore waters upto the depth of 50 m by trawlers and beyond 50 m by drift gill net and hooks and line units. Gill nets with larger mesh size from 120-170 mm have been observed to be very efficient in catching seer fish. Hooks of different sizes are used in hand line, long line and troll lines.

As per Govt. of India's 2011 revalidation report on potential, about 75076 tonnes of Seer fishes are available in Indian waters, whereas the production of S. commerson is 8,517 tonnes and the S. guttatus is 59,670 tonnes during 2012.Total exploitation of S. lineolatus and Acanthocybium solandri are only 6,393 tonnes and 303 tonnes respectively from Indian waters. This indicates that the S.guttatus are the most exploited resource followed by S.commerson and S.lineolatus. Acanthocybium solandri is the least exploited resource among the Seer fish resources.

The length range of Scomberomorus commerson during the study period varied between 487 and 1234 mm. The sex ratio (Male to Female) was found to be 0.67 : 1.0. Significant dominance of females was recorded during the study period and almost all the months except January and February. The gut content analysis indicates the presence of Mackerel, Sardine, Anchovies, Shrimps and Squids. This implies that these food items are most preferred by Seer fishes. In the present paper the fishery, present status of exploitation of Seer Fishes and some biological characteristics of S.commerson are analyzed and described along with recommendation.

INTRODUCTION :-

Seer fish refers to subfamily of the Scombridae or Mackerel family. These include species like Indo-Pacific King Mackerel, *Scomberomorus guttatus*, (Spotted Seer fish), Streaked Spanish Mackerel, *S.lineolatus*, (Streaked Seer fish or Strooed Seer Fish), Narrow-Barred Spanish Mackerel, *S. commerson* (King Mackerel),Korean mackerel, *Scomberomorus koreanus*, (Korean Seer fish) and Deep sea Seer fish, *Acanthocybium solandri* (Wahoo). In India, it is well known by various names, such as surmai in Marathi, vanjaram in Telugu, vanjaram or neimeen in Tamil, ayakkoora or neimeen in Malayalam, anjal in Tulu, arkoli in Kannada, iswaan orviswan in Konkani and thora in Sinhala. Seer fishes are well known as "King Mackerels" in some areas. Seer fishes are pelagic fishes, fast swimmers and predatory in nature, that fight vigorously when caught. It is also popular game fish, growing up to 45 kg, and is a strong fighter that has on occasion been seen to leap out of the water when hooked. It is an excellent table fish. Seer Fishes are primarily caught by troll lines, hook and lines, long lines, drift gillnets and purse seines.

For last several decades Seer fish fishery is important to artisanal fishermen who employ drift gill net. set gill net, hook and lines gears which are mainly deployed from country crafts with or without out-board engines and medium sized boats with inboard engines in the coastal waters of 25- 60 m depth zone. They are target species for these indigenous gears. During the last two and half decades they are also exploited by bottom trawls operating in the deeper waters beyond 50 to 300 m depth (Muthiah and Pillai,2003). Because of its high commercial value especially to the artisanal sector, their fishery needs to be monitored on continuous basis for judicious management of the resources. The status of exploitation of seer fish resources in the country has been well documented earlier by Chacko et al.(1962), Jones (1962), Devaraj (!977,1982), Pillai et al. (1994), Devaraj et al. (!999), Yohannan and Balasubramanian (1989), Yohannan et al. (1992) and Muthiah et al. (2000, 2002).

Though this resource forms a good fishery all along the Indian coast, the information available on the fishery and biology of the component species are limited. Hornell (1917) dealt the Seer fish fishery of Tuticorin coast along with other important fishes. Subsequently Chacko et. al. (1962) has studied the Scombroid fishery of Madras State. Silas (1962) has given an account on the fishery of seer fish while dealing in detail the fishery of Tuna, Sail fish and Marlins along the Tirunelveli coast.

Biological aspects like food and feeding, growth and spawning of different species of Seer fishes have been studied by several workers (Vijayaraghavan,1955; Krishnamoorthi, 1957; Nayar,1958; Kaikini, 1960; Rao, 1962;Kumaran, 1962). Devaraj (1977. 1983) has worked in detail on the growth and biology of Seer fishes in Palk Bay. In this paper a detailed account on the present status of exploitation of Seer fish fishery and some biological characteristics of the dominant species *Scomberomorus commerson* in Indian water is discussed.

MATERIAL AND METHODS

Data on seer fish production is collected by different agencies in India including Fishery Survey of India (FSI), Ministry of Agriculture (Govt. of India), Central Marine Fisheries Research Institute (CMFRI) and Marine Products Export Development Authority (MPEDA). The data on fish landings collected through multi-stage random sampling procedure by the CMFRI and submitted by the Government of India to the Indian Ocean Tuna Commission (IOTC) as National report is also utilized in this paper for analyses. In addition the Nominal catch data of tuna and tuna like fishes from Indian Ocean were retrieved from the website of Indian Ocean Tuna Commission (http://www.iotc.org/English/data.php) for trend analyses. Landing data collected from the respective state fisheries department is also utilized. For Biological characteristic studies two years (January 2013 to December 2014) random sampling data on length and biology were collected from near by Kasimedu Fish landing centre .and market.

RESULTS AND DISCUSSION

FISHERY AND STATUS OF EXPLOITATION

Seer Fish resource is being mainly exploited all along the Indian coast by both mechanized and non- mechanized fishing units by employing different types of gears like drift gillnet, hooks and line, trawl net, shore-seine etc.Present exploitation is limited to the near shore waters upto the depth of 50 m by trawlers and beyond 50 m by drift gill net and hooks and line units. Drift gill nets are of different types varying in mesh size from 25 mm to 205 mm with different vernacular names from region to region are deployed to exploit these resources. Smaller mesh sized gill nets are employed for exploiting smaller clupeids like sardines and anchovies and the bigger mesh size for sharks and rays. Gill nets with larger mesh size from 120-170 mm have

been observed very efficient in catching seer fish. Hooks of different sizes are used in hand line, long line and troll lines. The gill nets and hooks and lines have been found to be highly selective and exploit this resource effectively whereas the trawl net and shore-seine are less selective and only smaller individuals of seer fish are caught more in these gears. As per Marine census carried out in 2010 by Govt. of India; altogether 52,982 Traditional crafts, 73,410 Motorized crafts and 72,749 Mechanized crafts are in operation along the coast of India which contributes to the total Marine landing of the country including Seer fish landing.

Though seer fish resource are exploited through out the year, the peak landing period is during July to September along West coast and South East coast of India including Lakshadweep. In the North East coast and Andaman seas it is during November to January.

As per Govt. of India's 2011 revalidation report on potential, about 75,076 tonnes of seer fishes are available in Indian waters, out which about 75,022 tonnes are available within 0-100 m depth zone and only 54 tonnes are available in 100-200 m depth zone. As per the report the *S. commerson* is available abundantly i.e 50,270 tonnes followed by *S.guttatus* (24,610 tonnes) , *S.lineolatus* (90 tonnes) and Other seer fishes (106 tonnes).

Fig.1 represents the Exclusive Economic Zone of India, which is 2.02 millon sq.Km and Fig-2 indicates the landing of Seer fishes in Indian ocean which shows that among the seer fishes the exploitation of *S.commerson* is highest followed by *S.guttatus* in Indian ocean. The production of *S.commerson* is 1,31.710 tonnes whereas the *S. guttatus* is 39,027 tonnes during 2013.Total exploitation of *S.lineolatus* and *Acanthocybium solandri* are only 28 tonnes and 799 tonnes respectively from Indian ocean.

The landing of tuna and tuna like fishes from Indian waters during the period 2008-2012 can be seen from Table 2 (A) , 2 (B) and 2 (C). However Fig.5 represents the area wise and year wise landing of seer fishes from Indian waters. This indicates that in Indian waters, the Seer fish landing was highest during 2011 but on an average 204671 tonnes has been landed during 2008-2012. Area 51 showed higher landing compared to Area 57 except in the year 2012, where the Area 57 landed more catch than Area 51. The year wise and species wise landing of seer fish can

also be seen from Table 2 (A), 2 (B) and 2(C).

From the Fig.6, it can be observed that on an average during 2008-2012 the Indo-Pacific King Seer landing was highest among the seer fishes with 41,489 tonnes followed by Narrow Barred Spanish Mackerel with 15,653 tonnes and Struooed Seer fish with 13,645 tonnes. More interestingly it can also be observed that non identified Scomberomerus spp. landing was 41,331 tonnes. This implies that still a good quantity of Seer Fishes are yet to be indentified by the fisher folk and data collectors which is area of concern and needs attention.

As per IOTC data bank, the Indo-Pacific King Mackerel is mostly caught by gillnet fisheries in the Indian Ocean but significant numbers are also caught in trolling gears. (Table-1 (A), Fig.3). Estimated catches have increased steadily since the mid 1960's, reaching around 24,000 t in the late 1970's and over 30,000 t by the mid1990's when catches remained stable until around 2006. Since the late 2000s catches have increased sharply, to over 40,000 t, with the highest catch recorded in 2009 which is about 53,000 t { Fig.3(a)}. In recent years, the countries attributed with the highest catches are India (36%) and Indonesia (31%) and to a lesser extent, Iran and Myanmar (19%) {Fig.3(b)},which account for over 85% of the total catches of King Mackerel. Catches of King Mackerel in the Eastern Indian Ocean have been higher in recent years. The total annual catches for Indo-Pacific King Mackerel have stabilized over the past five years at around 47,000 t.

As per IOTC, there is insufficient information to evaluate the impact of Seer Fish fisheries that this level of catch or an increase in catch may have on the resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be considered as a high priority for this species. If the fishery of this species required to be studied then data collection needs to be improved. Based on the realistic data a realistic stock assessment can be arrived. From the data on fisheries the present study it is imperative that the information on Seer fish fisheries is scanty. More and more information are needed for taking measures the sustainable fisheries.

Narrow-Barred Spanish Mackerel is targeted throughout the Indian Ocean by artisanal and recreational fishers. The main method of capture is gillnet, but significant numbers are also caught trolling. As per IOTC data base, the catches of Narrow-Barred Spanish Mackerel

increased from around 50,000 t the late1970's to over 100,000 t by the late 1990's. The highest catches of Narrow-Barred Spanish Mackerel were recorded in 2012, at over 1,60,000 t {Fig.4(a)}. Narrow-Barred Spanish Mackerel is caught in both Indian Ocean basins, with approximately equal proportions of catches recorded in the East and West Indian Ocean since the mid-2000s.

In recent years, the countries attributed with the highest catches of Narrow-Barred Spanish Mackerel are Indonesia (29%) and India (23%) and to a lesser extent, I.R. Iran, Myanmar, the UAE and Pakistan (25%) {Fig.4(b)}The landing of Narrow Barred Spanish Mackerel by gears is given in Table. 1(B).

From the IOTC report it is understood that, the continued increase of annual catches for Narrow-Barred Spanish Mackerel in recent years has further increased the pressure on the Indian Ocean stock as a whole, and the stock is probably near full/optimal utilization. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries is the need of the hour. Given the rapid increase in Narrow-Barred Spanish Mackerel catch in recent years, some measures need to be taken to slow down or reduce catches in the Indian Ocean. This indicates that the in Narrow-Barred Spanish Mackerel fisheries is in alarming state.

Table.3 and Fig.7 indicates the state wise and species wise landing along the Indian Coast. From the figure it can be learnt that the reported landing from the state of West Bengal, Odisha, Puduchery, Gujarat and Union territory A & N Islands, the species wise identification is lacking. Where as in the state of Kerala the Indo-Pacific King Mackerel landing is dominating the catch followed by Tamilnadu. Some catches of Indo- Pacific King Mackerel is also reported from Andhra Pradesh and Daman & Diu. The landing of Narrow Barred Spanish Mackerel is reported from Karnataka followed by Daman & Diu and Andhra Pradesh. The Maharastra and Andhra Pradesh state reported the landing of Struood seer fish. The Union territory, Lakshadweep landing is purely dominated by Wahoo as the fisheries in Lakshadweep is purely Island fisheries. Due to the oceanic nature of water, Seer fish catch is dominated by Wahoo in Lakshadweep Islands.

Silas (1962) stated that the Seer fish fishery is constituted by *3* species, *Scomberomorus commersoni, S. guttatus* and *S. lineolatus* which is also confirmed in the present study. But in the oceanic realm *Acanthocybium solandri* is available which is evident from the present study.Similar results were also recorded by Deveraj et al. 1999.

Silas (1962) opined that Seer fishes are caught from the inshore waters by gill nets, drift nets and hook and lines which are also observed in the present study. The fishing season extends from October to March is also confirmed in the present study.

SOME BIOLOGICAL CHARACTERISTIC OF *S.COMMERSON :*

The length range of *Scomboromorus commerson* during the study period varied between 487 and 1234 mm. Higher size groups were recorded during May, June, July and August compared to other months. Table.4 shows the size frequency and sex ratio recorded during the study period. Fig.8 depicts the length frequency of *S.commerson* in Kasimedu fish landing centre. During the study altogether 485 nos. of *S.commerson* was observed in the landing centre out of which 196 are males and 289 were females.

The sex ratio with respect to the different size groups are furnished in Table.4. The Male to Female sex ratio was found to be 0.67: 1.0. Significant dominance of females was recorded during the study period and almost all the months except in the month of January and February.

The gut content analysis of *Scomberomerus commerson* indicates the presence of Mackerel, Sardine, Anchovies, Shrimps and Squid. This implies that these groups or variety of fishes are more preferred by *Scomberomerus commerson*. The percentage composition of the gut content is depicted in Fig.9. Mackerel is the most preferred food item with 25% followed by Sardine (20%), Shrimps (23%),Squid (19%) and Others (13%).

While carrying out the biology of the species it was found that the matured females were observed during April to July. From this it is imperative that the spawning occurs during May to August. Similar observations were also recorded by Silas (1962). However more and more in depth study is required for arriving to a conclusion.

CONCLUSION

The fishery of seer fish in India is mainly supported by the Indo-Pacific King Seer and Narrow barred Spanish Mackerel though other two varieties also are caught in stray quantities from different parts of the country. The drift gill net with larger mesh size to 170-190 mm and hooks and line can be considered well suited for the exploitation of this resource. Operation of these gears may be encouraged for easing the prevailing higher fishing pressure and to increase the seer fish production as well. In the present context, the exploitation in India is well within the sustainable limit as per available data. However it is also worthy mention here that a large quantity (13,644 tonnes) of Scomberomerus *Spp*. is reported from Indian water which needs immediate attention. The present study emphasizes the species level identification at landing centre so as to take further measures on the fisheries of this fishery. As the present level of exploitation of *S. lineolatus* is very meager, the details are not described and it is assumed that the stock is in the initial stage of exploitation. Fisher-folk along the Indian coast need to be given training so that the reporting of species-wise landing is reported to the concerned authorities, which will help in assessing the stock status and in long run it will also help in managing the stock in the days ahead. The size range of *Scomboromorus commerson* recorded during the study period varied between 487 and 1234 mm and it also appraises that the higher size groups were recorded during May, June, July and August compared to other months. Sex ratio study indicates the dominance of Female in the landed catches. The gut content analysis of *Scomberomerus commerson* indicates the presence of Mackerel, Sardine, Anchovies, Shrimps and Squid. From the gonadal studies it is concluded that this species spawns during April to July. However further study on the biology of each species of seer fish needs greater attention in the days to come, however the present study is the first attempt towards this goal.

ACKNOWLEDGEMENT :

The authors are thankful to the Zonal Director, Chennai base of FSI, Chennai for permitting to undertake study in the Kasimedu landing centre. Thanks are also due to the Secretary, Dept. of Animal Husbandry Dairying and Fisheries (DAHD&F), Ministry of Agriculture, Joint Secretary (Fy), DAHD&F, MOA, and other officials of MOA for approving the paper to present in the 5th Working party on Neritic Tuna organized by IOTC at Zanziber, Tanzania.

BIBLIOGRAPHY

ANON,2014. Hand book on Fisheries Statistics-2014. Published by Dept. of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India.pp166

CHACKO, P. I., S. D THOMAS AND C. MALUPILLAI.1962.Scombroid fisheries of Madras State, India.*Proc. Symp. Scombroid fishes,* MBAI, 3: 1006-1008.

DEVARAJ, M. 1977. The Biology and Fishery for the Seer fishes of India. Thesis submitted to the Madurai Kamaraj University for the award of Ph. D.degree, pp 337.

DEVARAJ, M. 1983. M. 1983. Fish population dynamics-Course manual.*CIFE Bulletin,*3 (10), pp. 98.

DEVERAJ,M.,H.MOHAMAD KASIM,C.MUTHAIAH AND N.G.K.PILLAI,1999. Assessment of the exploited seerfish stocks in the Indian waters.J.Mar.Bio.Ass.India,41(1&2);62-83.

HORNELL, J. 1917. A statistical analysis of the fishing industry of Tuticorin (South India).*Madras Fish. Bull.,* 11 .• 67-117.

KRISHNAMOORTHI, B. 1957.Fishery resources of the Rameswaram Island.*Indian J. Fish.,* 4 (2): 229-253.

KRISHNAN KUTTY, M AND S. Z. QASIM. 1968. The estimation of optimum age of exploitation and potential yield in fish populations. *J. Cons. perm. int. Explor Mer.,* 32 (2) : 249-255. 62

KUMARAN,M. 1962. Observations on the food of juveniles of *Scomberomorus commerson* (Lacepede) and S.g*uttatus* (Bloch and Schneider) from Vizhinjam, West coast of India.*Proc. Symp. Scombroid Fishes.*MBAI, 2:586-590.

KASIM, H M. AND MOHAMMAD ZAFAR KHAN, 1986.A preliminary account on the gill net fishery off Veraval during 1979-82.*Indian J. Fish.*, 33 (2) : 155- 162.

MUTHAIAH,C.H.M KASIM AND UMA S BHAT,2000. Exploited seerfish fishery resources of India- A Review In. V.N.Pillai and N.G.Menon (Eds) Marine Fisheries Research and Management, CMFRI,Cochin : 426-467.

MUTHAIAH,C.H.M.KASIM,N.G.K.Pillai,T.M.YOHANNAN,B.MANOJKUMAR,K.SAID, KOYA,UMA S BHAT, T.S.BALASUBHRAMANIAN,M.N,K,ELAYATHU,C.MANIMARAN, H.K DHOKIA AND M.V.SOMARAJU,2002. Status of exploitation of seer fishes in the Indian seas,In. N.G.K.Pillai,N.G.Menon,P.P.Pillai and U,Ganga (Eds). Management of Scombroid Fisheries,CMFRI,Kochi-177-186.

MUTHAIAH,C AND N.G.K.PILLAI,2003. Status of Seer fish fishery in the Indian Seas, In.V.S.Somavanshi,S.Varghese and A.K.Bhargava (Eds). Proc.Tuna Meet- 2003: 73-85.

NAYAR, S. G. 1958. A preliminary account of the fisheries of Vizhinjam *Indian J.* Fish., 5 : 32-55.

PAULY, D. 1980.A selection of simple methods for the assessment of tropical fish stocks.*FAO Fisheries Circular* 729, FIRM/129, pp. 54.

PAULY, D. 1984. Length converted catch curves: A powerful tool for fisheries Research in the tropics (part II). *Fishbyte,* 2 (1): 17-19.

PILLAI,P.P.,N.G.K PILLAI,T.V.SATHYANANDAN AND M.N.K.ELAYATHU,1994. Fishery Biology and Stock Assessment of *Scomberomerus commerson* (Lacepede) from the South West coast of India.FAO/IPTP Expert consultation on the Indian Ocean Tunas.coll. Vol. Working. Doc.TWS/93/2.2.

RAO, G. SUDHAKARA AND H. MOHAMAD KASIM. 1985. On the commercial trawl fishery off Veraval during 1979- 82. *Indian J. Fish.*, 32 (3) : 296-308.

RAO, K. SRINIVASA. 1962. Observation on the food and feeding habits of *Scomberomorus guttatus* (Bloch & Schneider) and juveniles of S *lineolatus* (Cuvier EfValenciennes) and *S. commerson*(Lacepede) from the Waltair coast. *Proc. Symp. Scombroid Fishes.*MBAI,2: 591-598.

RICKER, W E. 1945. A method of estimating minimum size limits for obtaining maximum yield. *Copeia,* No. 2 : 84-94.

SILAS, E. G. 1962. Tuna fishery of the Tineruveli coast.Gulf of Mannar. *Proc. Symp. Scombroid Fishes,* MBAI, 3: 1083-1118.

SRINATH, M. AND K. ALAGARAJA. 1982. A method of estimation of mortality rates from length samples. *Indian J. Fish v*ol 29 (1 &2) : 183-188.

VIJAYARAGHAVAN, P. 1955. Life history and feeding habits of the Spotted seer *Scomberomorus guttatus* (Bloch Schneider). *Indian J. Fish..2 :*360-372

YOHANNAN, M. 1982. Population dynamics of Indian Mackerel based on data from Mangalore during 1967-75. *Indian J. Fish.*.29 (1 & 2) : 50-62.

YOHANNAN, T.M. A.A.JAYAPRAKASH, M.SRINATH, R.THIAGARAJAAN, P. LIVINGSTON, H.MOHAMMAD KASIM AND G.LUTHER.1992. Stock assessment of *Scomberomerus commerson* along the Indian coast. *Indian J.Fish,* 39.(3,4): 111-118

TABLE.1(A). LANDING OF INDO-PACIFIC KING MACKEREL BY GEARS IN INDIAN OCEAN

Fishery	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Purse Seine	786	768	720	1,109	1,239	1,605	1,116	1,236	1,089	1,166
Gill Net	21,837	20,031	20,744	27,278	31,074	31,887	25,975	28,046	27,336	28,710
Lines	2,345	2,530	2,190	3,264	3,452	3,980	3,174	3,395	3,420	3,285
Others	8,159	8,334	8,208	10,872	11,929	15,733	11,543	12,336	11,003	11,201
Total	**33,127**	**31,663**	**31,862**	**42,523**	**47,694**	**53,206**	**41,808**	**45,012**	**42,847**	**44,363**

(Source. IOTC)

TABLE.1(B)LANDING OF NARROW BARRED SPANISH MACKEREL BY GEARS IN INDIAN OCEAN

Fishery	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Purse Seine	4,566	5,880	7,632	6,586	6,130	8,459	8,850	8,812	8,758	8,487
Gill Net	61,998	57,819	66,205	71,501	71,263	72,426	74,925	80,050	88,621	82,368
Lines	17,398	19,191	19,846	21,293	23,065	25,847	25,550	27,435	31,769	31,941
Others	19,564	20,515	23,905	25,516	22,735	28,170	25,519	27,455	30,970	25,899
Total	**103,526**	**103,406**	**117,588**	**124,895**	**123,192**	**134,902**	**134,844**	**143,753**	**160,118**	**148,695**

(Source. IOTC)

TABLE.2(A) LANDING OF TUNA AND TUNA LIKE FISHES FROM BOB & A.SEA.

SPECIES	2008	2009	2010	2011	2012	TOTAL	AVE.
YELLOWFIN TUNA	11620	5509	1959	1859	12788	33735	6747
BIG EYE TUNA	5083	5159	1004	1109	10089	22444	4488.8
SKIPJACK TUNA	1353	1370	1068	2944	2063	8798	1759.6
SWORD FISH	1221	1287	3094	165	184	5951	1190.2
SAIL FISH	27	28	1697	34	33	1819	363.8
MARLIN	2730	2728	839	2499	631	9427	1885.4
LONG TAIL TUNA	9080	4427	758	3692	1122	19079	3815.8
AUXIS SPP	2856	3231	5577	6391	14449	32504	6500.8
KAWA KAWA	1107	676	3165	4296	2761	12005	2401
TUNA LIKE FISHES	9863	12955	10509	12288	13366	58981	11796.2
WAHOO	854	0	2306	318	18	3496	699.2
SPANISH MACKEREL	5436	5437	6111	7184	5433	29601	5920.2
KING MACKEREL	3226	3320	893	2972	15201	25612	5122.4
SCOMBEROMERUS SPP.	22619	24878	24400	25456	28279	125632	25126.4
STRUOOED SEER FISH	1171	1205	4365	2332	78	9151	1830.2
TOTAL	78246	72210	67745	73539	106495	398235	79647

(Source: Hand Book on Fisheries Statistics, 2014; Govt.of India)

TABLE.2(B) LANDING OF TUNA AND TUNA LIKE FISHES FROM ARABIAN SEA

SPECIES	2008	2009	2010	2011	2012	TOTAL	AVE.
YELLOWFIN TUNA	10535	6174	6009	5685	9257	37660	7532
BIG EYE TUNA	146	97	424	115	1245	2027	405.4
SKIPJACK TUNA	8823	8993	8497	15990	5149	47452	9490.4
SWORD FISH	0	0	0	2	0	2	0.4
SAIL FISH	0	0	186	0	0	186	37.2
MARLIN	102	121	49	3823	402	4497	899.4
LONG TAIL TUNA	13045	12726	12200	217	12059	50247	10049.4
AUXIS SPP	4279	4896	1118	4531	3592	18416	3683.2
KAWA KAWA	2270	1670	328	1553	898	6719	1343.8
TUNA LIKE FISHES	190	1111	7391	74464	2922	86078	17215.6
WAHOO	566	0	290	106	285	1247	249.4
SPANISH MACKEREL	76	259	124	45120	3084	48663	9732.6
KING MACKEREL	45459	45385	46281	237	44469	181831	36366.2
SCOMBEROMERUS SPP.	22375	22633	18369	1379	16267	81023	16204.6
STRUOOED SEER FISH	7607	7607	7970	29573	6315	59072	11814.4
TOTAL	115473	111672	109236	182795	105944	625120	125024

(Source: Hand Book on Fisheries Statistics, 2014; Govt.of India)

TABLE.2 (C) LANDING OF TUNA AND TUNA LIKE FISHES FROM INDIAN WATERS

	2008	2009	2010	2011	2012	TOTAL	AVE
YELLOWFIN TUNA	22155	11683	7968	7544	22045	71395	14279
BIG EYE TUNA	5229	5256	1428	1224	11334	24471	4894.2
SKIPJACK TUNA	10176	10363	9565	18934	7212	56250	11250
SWORD FISH	1221	1287	3094	167	184	5953	1190.6
SAIL FISH	27	28	1883	34	33	2005	401
MARLIN	2832	2849	888	6322	1033	13924	2784.8
LONG TAIL TUNA	22125	17153	12958	3909	13181	69326	13865.2
AUXIS SPP	7135	8127	6695	10922	18041	50920	10184
KAWA KAWA	3377	2346	3493	5849	3659	18724	3744.8
TUNA LIKE FISHES	10053	14066	17900	86752	16288	145059	29011.8
WAHOO	1420	0	2596	424	303	4743	948.6
SPANISH MACKEREL	5512	5696	6235	52304	8517	78264	15652.8
KING MACKEREL	48685	48705	47174	3209	59670	207443	41488.6
SCOMBEROMERUS SPP.	44994	47511	42769	26835	44546	206655	41331
STRUOOED SEER FISH	8778	8812	12335	31905	6393	68223	13644.6
TOTAL	193719	183882	176981	256334	212439	1023355	204671

(Source: Hand Book on Fisheries Statistics, 2014; Govt. of India)

TABLE. 3. STATE WISE AND SPECIES WISE LANDING OF SEER FISHES FROM INDIAN WATERS.

STATE	WAHOO	SPANISH MACKEREL	KING MACKEREL	STRUOOD SEER FISH	SCOMBEROMORUS SPP.
WEST BENGAL	0	0	0	0	853
ODISHA	0	0	0	0	3571
ANDHRA PRADESH	18	5433	2699	78	9600
TAMILNADU	0	0	12502	0	11690
PUDUCHERRY	0	0	0	0	1695
A& N ISLANDS	0	0	0	0	870
GUJURAT	0	0	0	0	9634
MAHARASTRA	0	0	0	6315	2072
DAMAN & DIU	0	511	232	0	163
KARNATAKA	0	2573	0	0	305
GOA	174	0	0	0	1616
KERALA	0	0	44237	0	2477
LAKSHADWEEP	111	0	0	0	0
TOTAL	**303**	**8517**	**59670**	**6393**	**44546**

(Source: Hand Book on Fisheries Statistics, 2014; Govt. of India)

Table – 4: MONTH WISE SIZE DISTRIBUTION AND SEX RATIO OF *S.COMMERSON*

Month	Size range (cm)	MALE	FEMALE	SEX RATIO (M:F)
Jan	49.7- 75.8	25	14	1.78:1.0
Feb	48.7 – 84.4	19	11	1.72:1.0
Mar	52.1 – 75.3	15	23	0.65:1.0
Apr	67.5 – 95.0	12	24	0.5:1.0
May	59.6 – 123.3	08	12	0.66:1.0
Jun	75.1 – 123.4	11	24	0.45:1.0
Jul	67.8 –120.6	21	32	0.65:1.0
Aug	92.1 – 102.4	14	25	0.56:1.0
Sep	65.4 – 98.7	15	23	0.65:1.0
Oct	72.8 – 79.3	23	31	0.74:1.0
Nov	69.5 – 97.4	14	25	0.56:1.0
Dec	56.6 – 88.9	19	45	0.42:1.0
		196	**289**	**0.67:1.0**

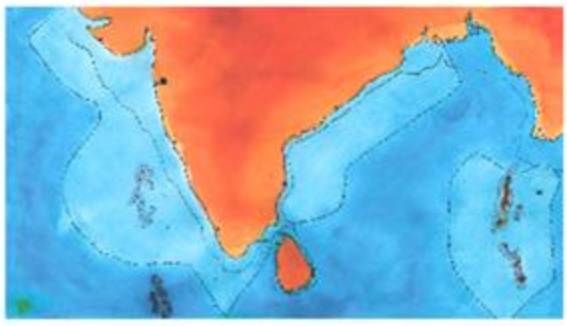
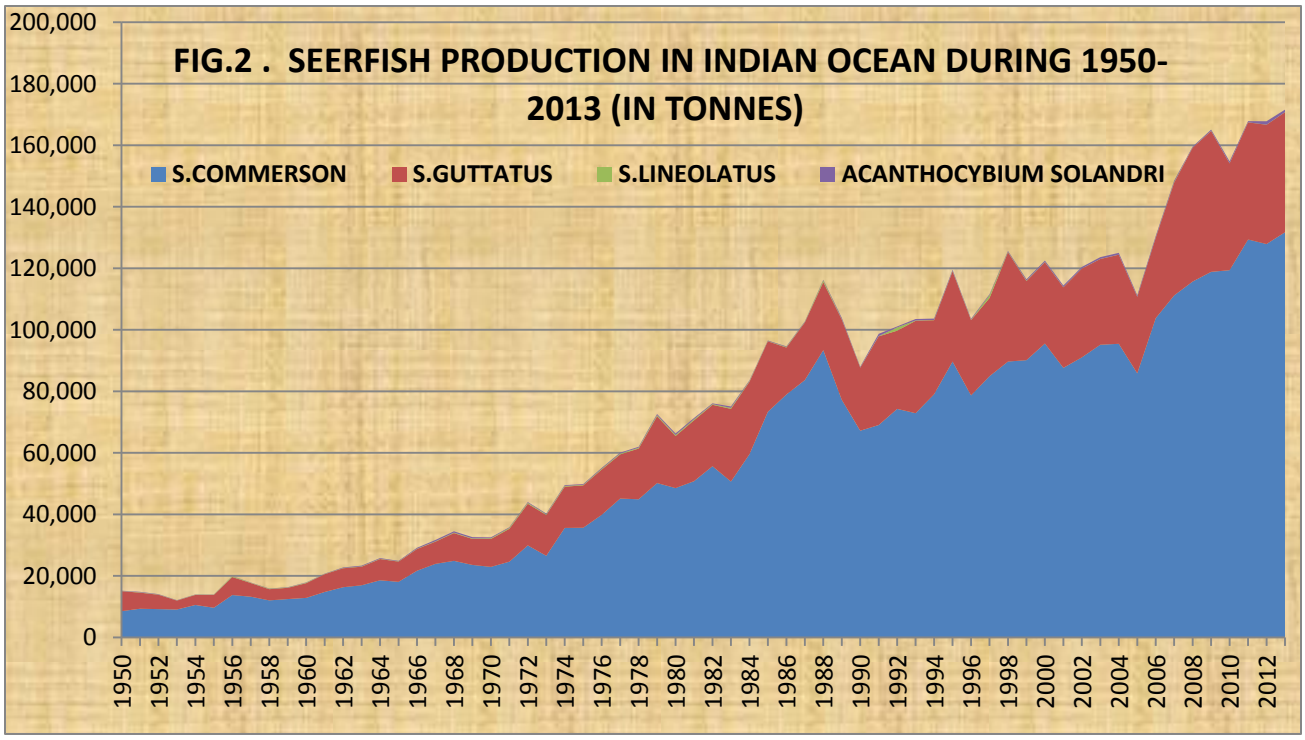


Fig. 1. Exclusive Economic Zone of India



Source. IOTC

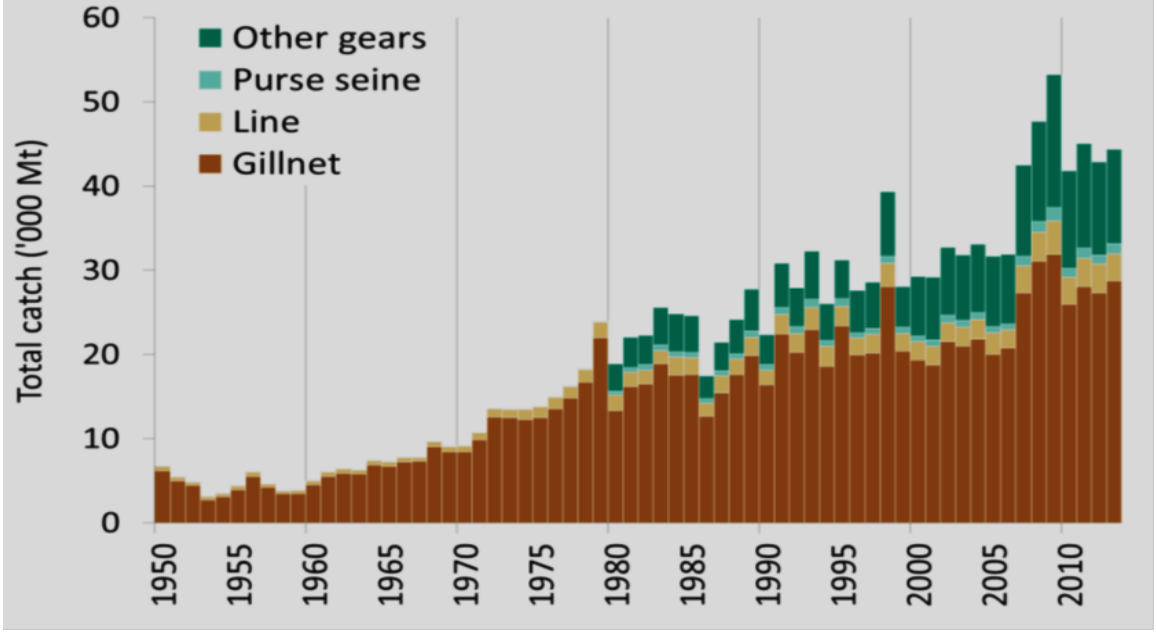


Fig.3(a) Gear wise annual catch of *S. guttatus* In Indian Ocean (Source- IOTC)

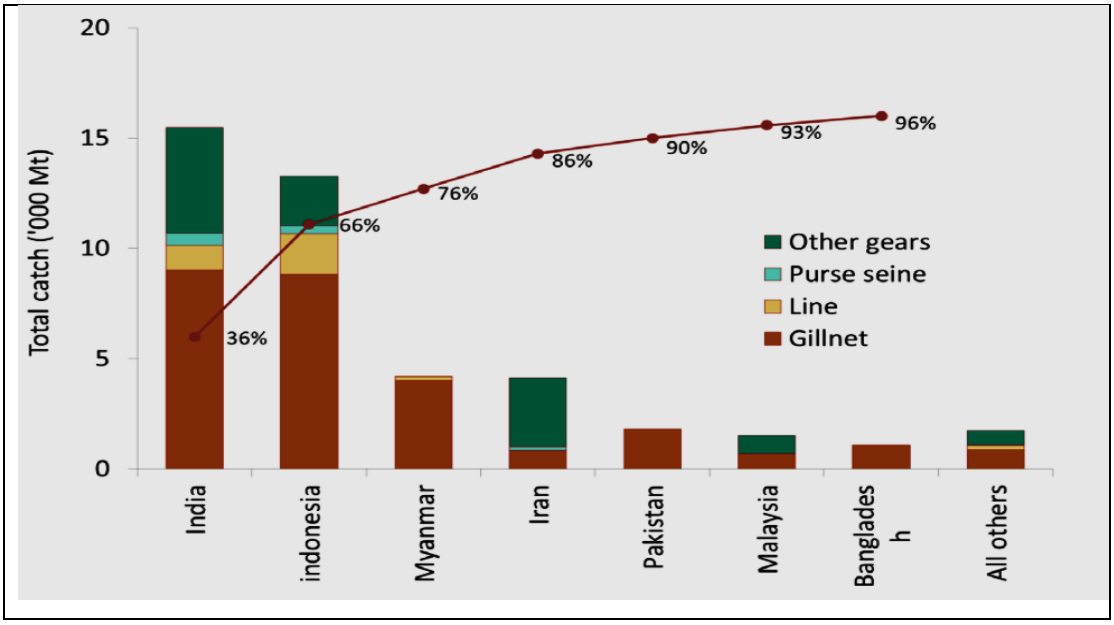


Fig.3 (b) Average catch of S.guttatus by country in Indian Ocean (Source.IOTC)

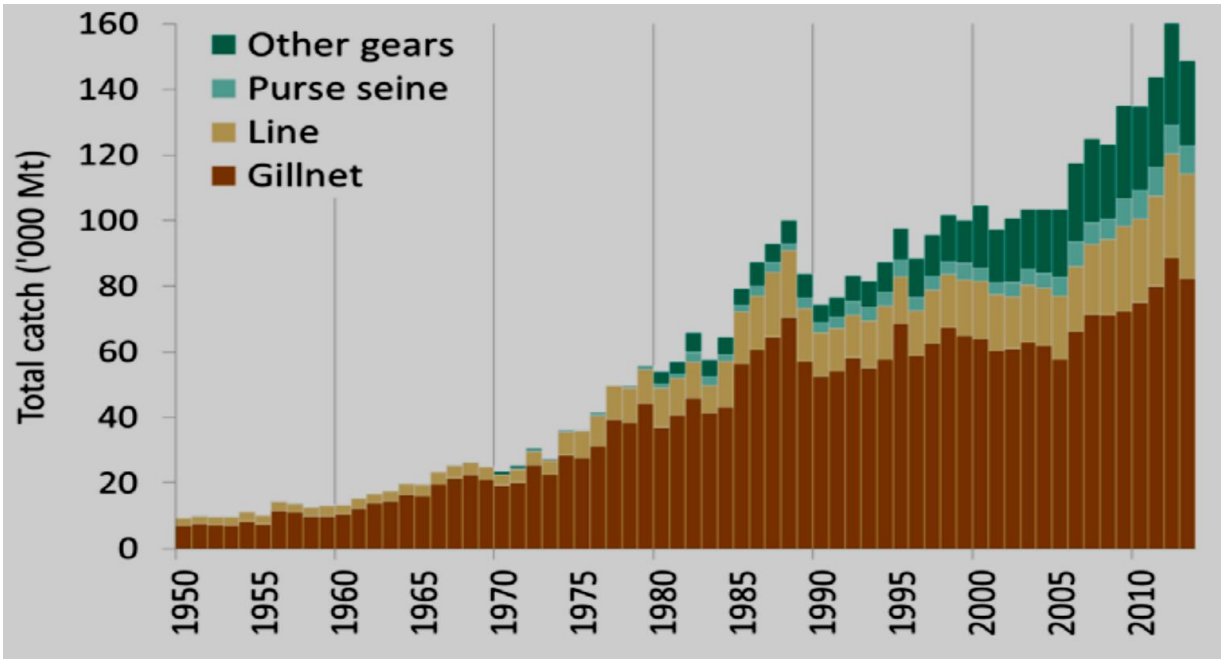


Fig.4 (a) Gear wise annual catch of *S. commerson* In Indian Ocean (Source- IOTC)

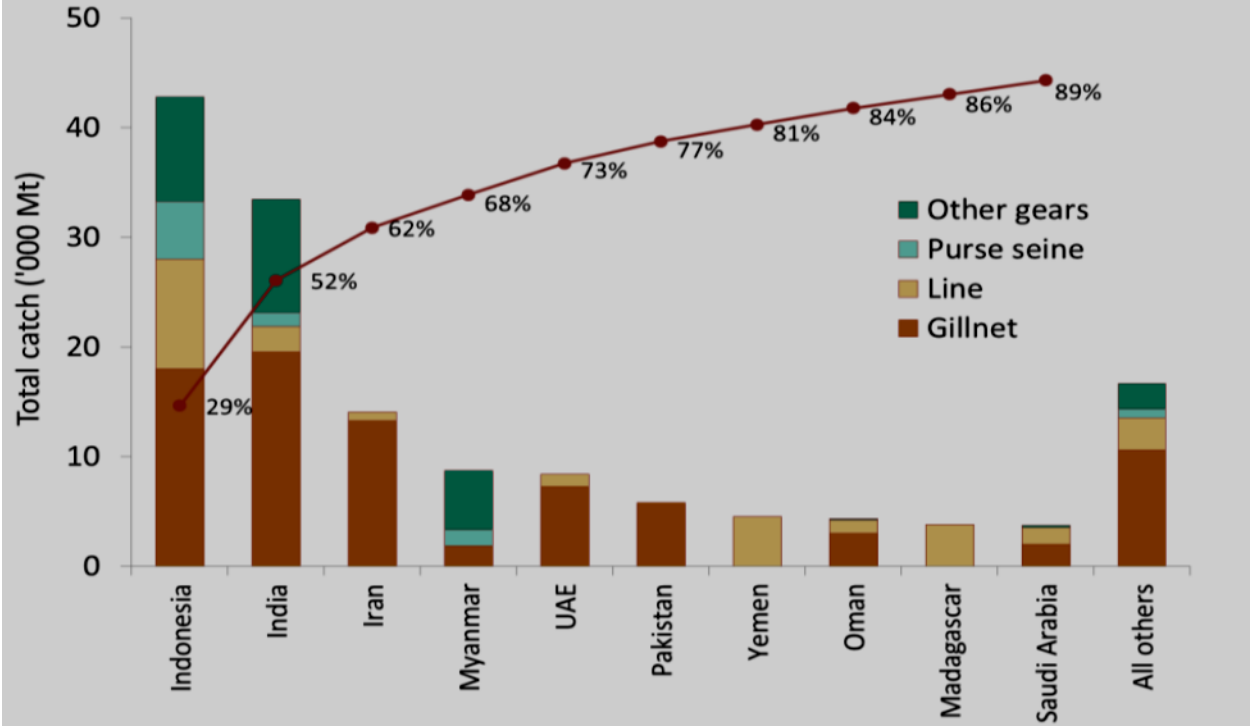


Fig.4 (b) Average catch of *S.commerson* by country in Indian Ocean (Source.IOTC)

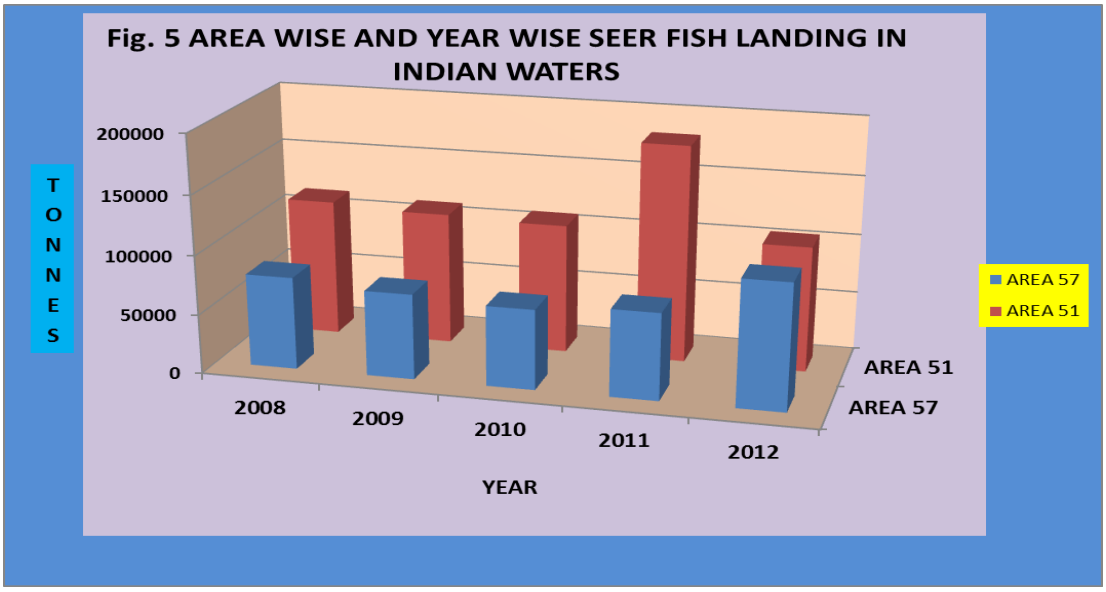


Fig. 5 AREA WISE AND YEAR WISE SEER FISH LANDING IN INDIAN WATERS
TONNES
200000
150000
100000
50000
0
2008
2009
2010
2011
2012
YEAR
AREA 51
AREA 57
AREA 57
AREA 51

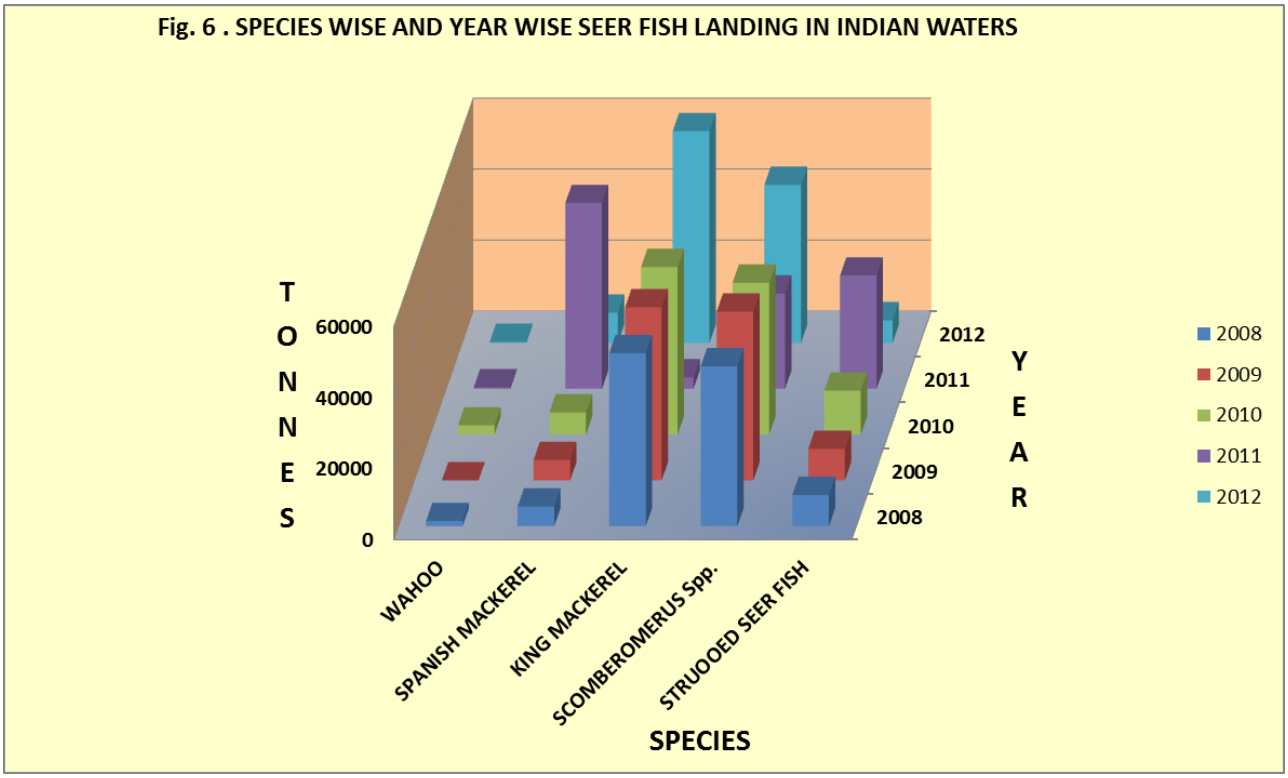


Fig. 6 . SPECIES WISE AND YEAR WISE SEER FISH LANDING IN INDIAN WATERS
TONNES
60000
40000
20000
0
WAHOO
SPANISH MACKEREL
KING MACKEREL
SCOMBEROMERUS Spp.
STRUOOED SEER FISH
SPECIES
2012
2011
2010
2009
2008
YEAR
2008
2009
2010
2011
2012

Fig.7 STATE WISE AND SPECIES WISE SEER FISH LANDING DURING 2012 IN INDIA

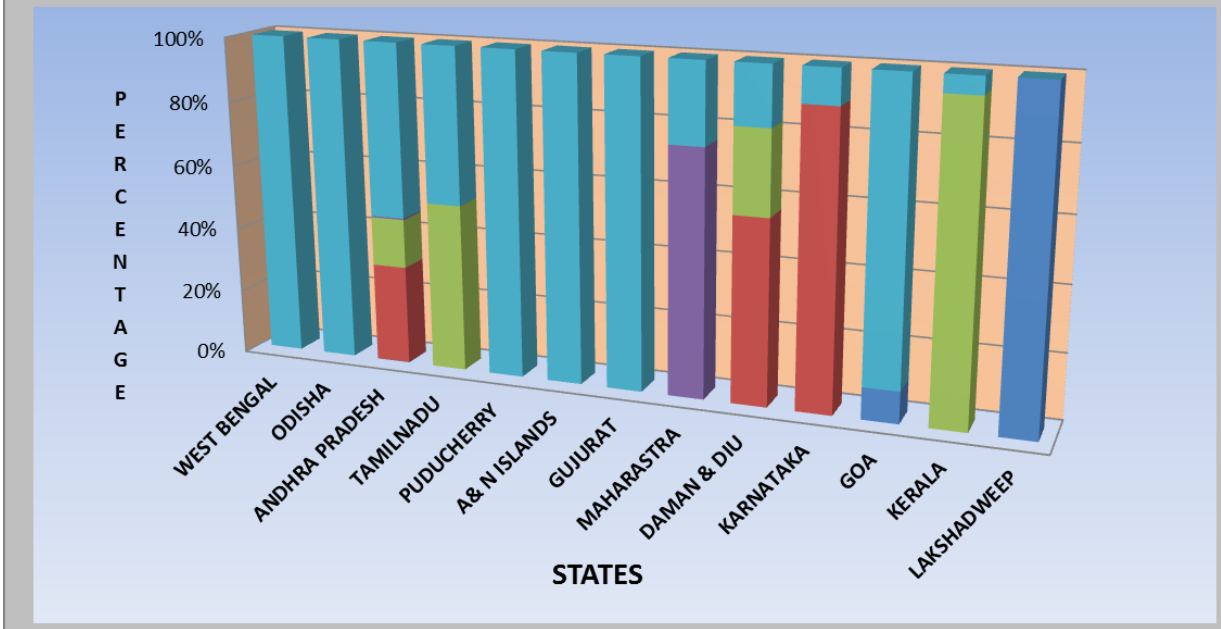
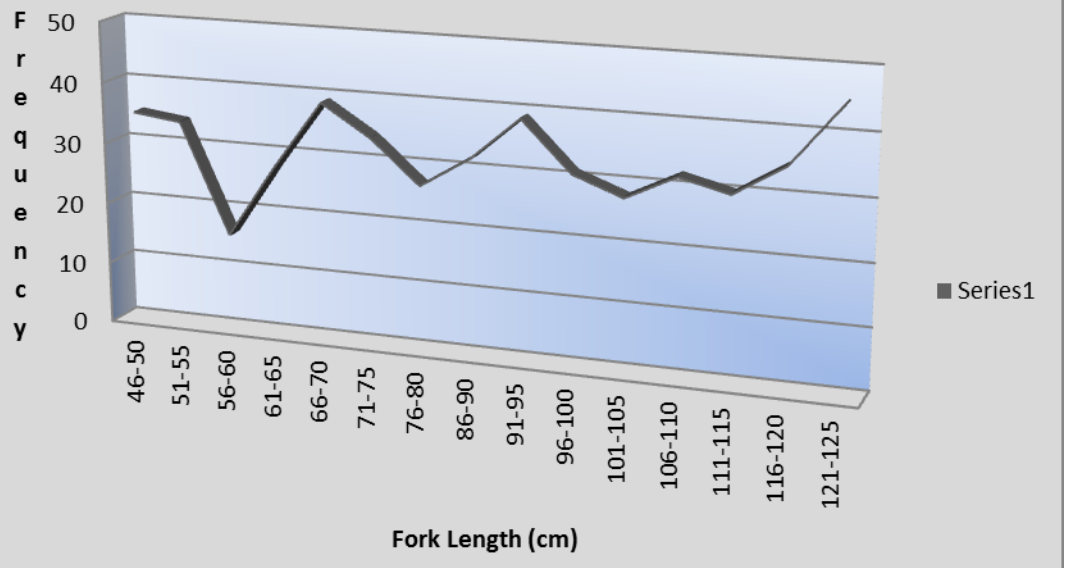


Fig.8 Length Frequency study of *S.commerson* in Kasimedu Fish landing centre



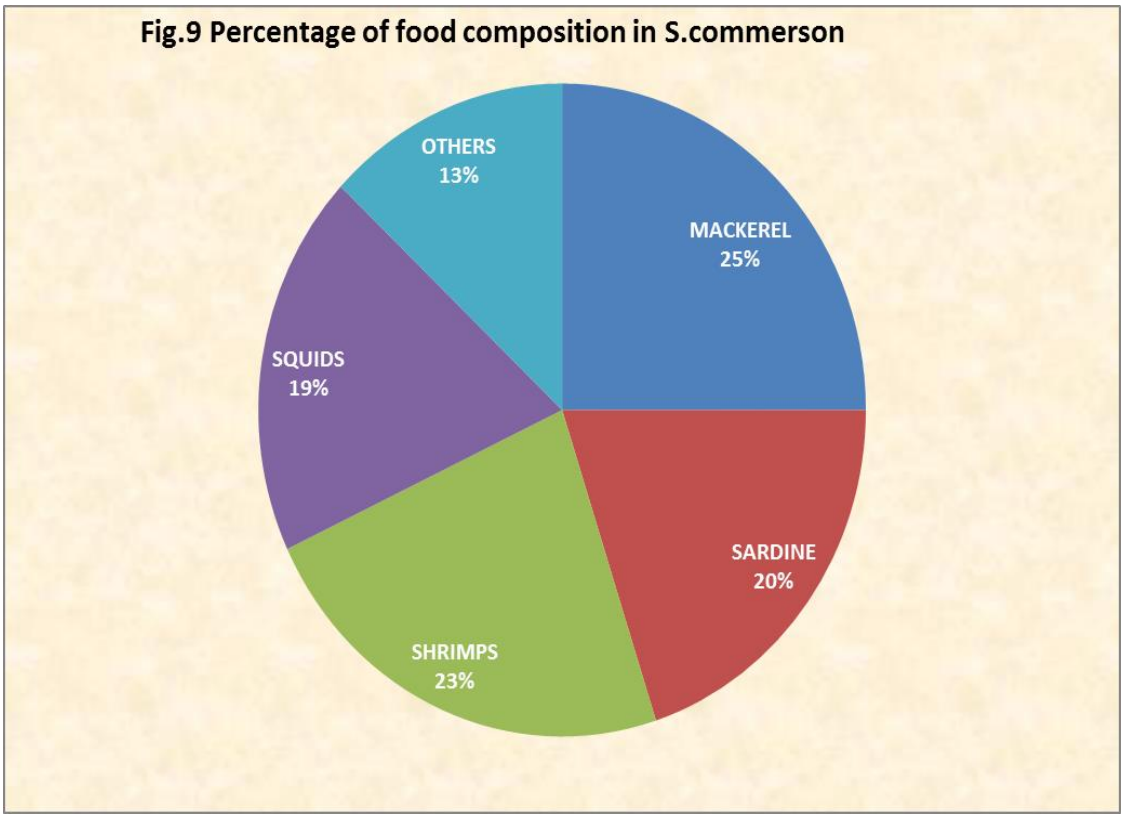


Fig.9 Percentage of food composition in S.commerson
OTHERS
13%
MACKEREL
25%
SQUIDS
19%
SARDINE
20%
SHRIMPS
23%

$$$$$@@@@@@$$$$$$$$$$