

STATUS OF SEERFISH FISHERY IN THE INDIAN SEAS

C.Muthiah and N.G.K.Pillai

Central Marine Fisheries Research Institute, Kochi

ABSTRACT

Seerfish landings in India during 1998-02 showed an increasing trend as had been witnessed over the last five decades (1950's-1990's). However, the rate of increase through successive decades continues to show a decreasing trend. The annual production varied from 42,478 t in 2001 to 54,871 t in 1998 with an average of 48,847 t, forming 1.9% of the total marine fish landings of the country. East coast contributed 40% and West coast 60%. The first to fourth quarters recorded 26%, 14%, 33% and 27% of the annual catch respectively in the East coast and 24%, 9%, 22% and 45% in the West coast. Gillnet, trawl, hook and line and 'other gears' contributed 66.3%, 14.3%, 6.9% and 12.5% respectively to the total seerfish catch of the country. The king seer *Scomberomorus commerson* and the spotted seer *S. guttatus* contributed 66.3% and 33.5% respectively. The king seer was dominant in all parts of the Indian coast, except in North-east and North-west areas where, the spotted seer was dominant.

The size range of king seer in large mesh gillnet was 30-140 cm along West coast and 14-154 cm along East coast with mean length at 67 and 71 cm respectively. In trawl, the size varied from 10 to 100 cm in West coast and 10 to 110 cm in East coast with mean size at 34 cm at both coasts. The length at first maturity (L_m) and length with optimum yield (L_{opt}) were estimated to be 72.1 and 93.9 cm respectively for West coast and 78.4 and 103.5 cm for East coast. For spotted seer, the length range in large mesh gillnet was 14-58 cm along West coast and 10-70 cm along East coast with mean size at 40 cm at both coasts. In trawl, the size range was 18-62 cm in West coast and 8-60 cm in East coast with mean size at 39 and 25 cm respectively. The L_m and L_{opt} were 35.1 and 40.8 cm respectively for West coast and 39.1 cm and 46.1 cm for East coast. The management option for protecting the seerfish resources in the Indian waters against growth and recruitment overfishing, is to encourage the large mesh gillnet and hook and line exploitation and by increasing the trawl mesh size.

Introduction

Fishes of the genera *Scomberomorus* and *Acanthocybium* (family Scombridae), commonly called as seerfishes or Spanish mackerels are esteemed table fishes in all parts of the world. In India, they are considered as one of the high value resources due to their quality meat content, high economic return and export market. For the last several decades seerfish fishery is important to artisanal fishermen who use driftnet/gillnet/hook and lines employing country crafts with or without out-board engines and medium size boats with inboard engines in the coastal waters of 25-60 m depth zone. They are the target species for these indigenous gears. During the last two and half decades they are also exploited by bottom trawlers operating in the deeper waters beyond 50 to 300 m depth. Because of its high commercial value especially to the artisanal sector, their fishery has to be monitored on a continuing basis for judicious management of the resources. The status of exploitation of seerfish resources in the country has been documented earlier by Chacko *et al.* (1962), Jones (1962), Devaraj (1977, 1986), Pillai *et al.* (1994) Devaraj *et al.* (1999), Yohannan and Balasubramanian (1989), Yohannan *et al.* (1992) and Muthiah *et al.* (2000, 2002). This paper deals with the present status of seerfish fishery of India, based on the data collected during the five-year period 1998-2002.

Database

State-wise, gear-wise, quarter-wise and species-wise catch data collected by the Fisheries Resource Assessment Division of Central Marine Fisheries Research Institute, Kochi, formed the main database for the present study. The gear-wise length distribution data collected from eight centres - four from the East coast (Visakhapatnam, Kakinada, Chennai, and Tuticorin) and four from the West coast (Kochi, Calicut, Mangalore and Veraval) of India during 1998-2002 were weighted to the annual average gear-wise catches of West and East coasts separately. From the maximum length (L_{max}) observed, the asymptotic length (L_{∞}), length with optimum yield (L_{opt}) and length at first maturity (L_m) were estimated using the following empirical relationships of Froese and Binohlan (2000):

$$\begin{aligned}\log L_{\infty} &= 0.044 + 0.9841 * \log(L_{max}) \\ \log L_{opt} &= 1.0421 * \log L_{\infty} - 0.2742 \\ \log L_m &= 0.8979 * \log L_{\infty} - 0.0782\end{aligned}$$

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Results

All-India catch trend

The yearly catch of seerfish in India had fluctuated from a mere 4,505 t in 1953 to an all-time high of 54,871 t in 1998 (Fig.1). Table 1 presents the decade-wise maximum, minimum and average annual production of seerfishes in India. It

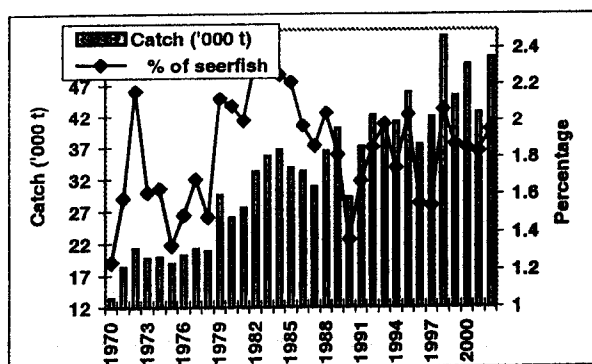


Fig.1 Annual catch and percentage contribution of seerfish to the total marine fish catch of India during 1970-2002

Table 1 : Decade-wise maximum, minimum and average annual production (t) of seerfish in India

Decade	Maximum		Minimum		Average annual catch	% of seerfish in total marine fish catch
	Catch	Year	Catch	Year		
1950s			4505	1953	7278	1.2
1960s	12792	1968	8650	1960	10471	1.3
1970s	29447	1979	13410	1970	20158	1.6
1980s	25986	1980	10984	1989	32760	2.1
1990s	54876	1998	29469	1990	41113	1.8

can be seen that seerfish landing in the country shows an increasing trend over the past five decades; however, the rate of increase through successive decades is reducing. It has come down from 92.5% in 19970s, to 62.5% in 1980s, 27.6% in 1990s and further to 16.9% during 1998-02. The annual production during 1998-02 varied from 42,578 t in 2001 to 54,871 t in 1998 with an average of 48,847 t forming 1.9% of the marine fish landing of the country. The contribution of seerfish by East and West coasts of India during the last five decades is given in Table 2. It is seen that East coast which ranked first in seerfish production during

Table 2 : Decade-wise percentage contribution of seerfish by East and West coast of India

Decade	1950s	1960s	1970s	1980s	1990s	1998-2002
East coast	60	60	50	37	35	40
West coast	40	40	50	63	65	60

1950s and 1960s with around 60%, had progressively reduced to 35% in 1990s. During 1998-02, East coast contributed 40% (19,759 t) and West coast 60% (29,088 t) as compared to the reverse trend during 1950s and 1960s. During the study period, the growth rate showed increasing trend in East coast and a decreasing trend in West coast.

Region-wise catch

The region-wise average annual landing during different decadal periods and the rate of increase through successive decades are presented in Table 3. It can be seen that the rate of increase in seerfish production showed manifold

Table 3 : Region-wise annual average catch (t) and rate of increase (%) through successive decades in India during 1998-2000

Region/Decade		1960s	1970s	1980s	1990s	1998-2002
Northeast	Catch	292	980	2076	3252	3834
	Rate of increase		235.4	111.7	56.6	17.9
Southeast	Catch	5996	9105	9907	11138	15225
	Rate of increase		51.9	8.8	12.4	36.7
East coast	Catch	6288	10086	11983	14390	19059
	Rate of increase		60.4	18.8	20.1	32.4
Southwest	Catch	2392	5513	9994	9200	9590
	Rate of increase		130.5	81.3	-7.9	4.2
Northwest	Catch	1791	4559	10782	17523	19430
	Rate of increase		154.6	136.5	62.5	10.9
West coast	Catch	4182	10072	20776	26723	29019
	Rate of increase		140.8	106.3	28.6	8.6
Union Territories	Catch				677	769
	Rate of Increase					13.6
All-India	Catch	10471	20158	32760	41790	48848
	Rate of Increase		92.5	62.5	27.6	16.9

increase in almost all states during 1970's as compared to 1960's and thereafter it showed decreasing trend during 1980s and 1990's. During 1998-02, North-west region (Gujarat and Maharashtra) topped in seerfish production in the country with an average annual catch of 19,429 t (39.8%) followed by South-east region (Pondicherry, Tamil Nadu and Andhra Pradesh) with 15,225 t (31.2%), South-west region (Goa, Karnataka and Kerala) with 9,590 t (19.6%), North-east region (Orissa and West Bengal) with 3,834 t (7.8%) and Union Territories (Andamans and Lakshadweep) with 769 t (1.6%) respectively (Fig.2).

Seasonal variations

Quarter-wise contribution to annual seerfish catch during 1998-02 is shown in Fig.3. It can be seen that on an all-India basis, fourth quarter contributes higher landings (37.4%) followed by third quarter (26.4%), first quarter (24.9%) and second quarter (11.3%). East coast records maximum catch during third quarter (33%) and West coast during fourth quarter (45%).

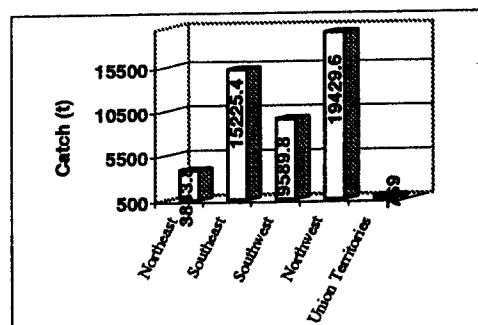


Fig.2 Region-wise average annual seerfish landings in India during 1998-2002

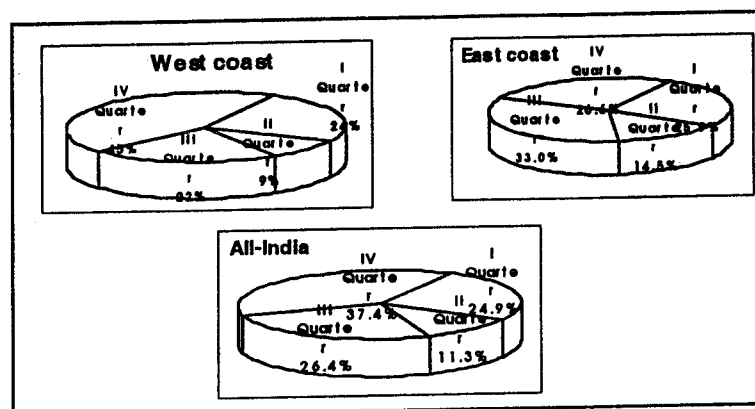


Fig.3 Quarter-wise seerfish production (%) in India during 1998-2002

Gear-wise catch

Fig. 4 shows the average gear-wise percentage contribution seerfish to all-India catch during 1998-02. It is seen that gillnet operated all along the Indian coasts is the major contributor of seerfish in the country, accounting

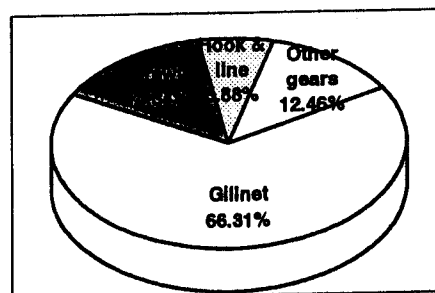


Fig.4 Gear-wise contribution of seerfish in India during 1998-2002

for 66.3% (31,800 t). Its contribution is more on the West coast (54.6%) as compared to East coast (45.4%). Gillnet is the dominant gear operated along the coasts of West Bengal (90.7%), Orissa (87.2%), Andhra Pradesh (70.9%), Tamil Nadu (73.7%), Pondicherry (96.9%), Kerala (71.2%), Karnataka (54.8%), Maharashtra (45.7%) and Gujarat (75.3 %). In Goa it is the second important gear (28.8 %).

Trawl contributes 14.3% (6,879 t) next to gillnet. It accounts for 22.3% (1,531 t) in East coast and 77.7% (5,348 t) in West coast. About 59.3% of the trawl catch comes from Maharashtra and Gujarat waters where it forms the second dominant gear for seerfish exploitation with 2,212 and 1,865 t respectively.

Hook and line contributes 6.9% (3301 t) of seerfish to the total catch. This gear is most common along the East coast contributing 61.3% (2,022 t). It is the second dominant gear in Tamil Nadu (1,079 t, 12.0%) and Andhra Pradesh (771 t, 13.0%). Along West coast, this gear lands appreciable catch only in Kerala (458 t, 9.6%), Maharashtra (495 t, 5.2%) and Gujarat (303 t, 3.1%).

Purse seine occasionally catches seerfish as one of the incidental catches especially during the post-monsoon season along Kerala, Karnataka, Goa and Maharashtra coasts. It is the dominant gear along Goa coast with 1053 t (64.1%) annually and second dominant gear along Karnataka coast (895 t, 28%). Along Maharashtra coast this gear lands appreciable catch of 1,836 t (19.1%) annually.

Species composition

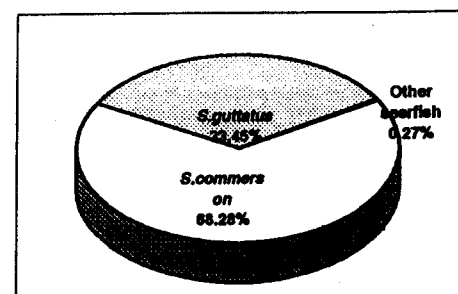


Fig.5 Species composition of seerfish in India during 1998-2002

On an all-India basis, the king seer *Scomberomorus commerson* dominated the landing by all gears (68.3%), followed by the spotted seer *S. guttatus* (33.5%) (Fig.5). The other two species, the streaked seer *S. lineolatus* and the wahoo *Acanthocybium solandri* occurred rarely forming 0.14 and 0.13% respectively (Table 4). While the king seer is the dominant species along the Mid-

Table 4 : Region-wise average species composition of seerfish in India during 1998-2002

Region/Species	<i>S.commerson</i>	<i>S.guttatus</i>	<i>S.lineolatus</i>	<i>A.solandri</i>
Northeast	1750	2009	0	0
Southeast	12473	2679	64	16
East coast	14223	4688	64	16
Southwest	8724	820	3	43
Northwest	8832	10529	0	5
West coast	17555	11349	3	48
All-India	31778	16036	67	64
Percentage	66.3	33.5	0.1	0.1

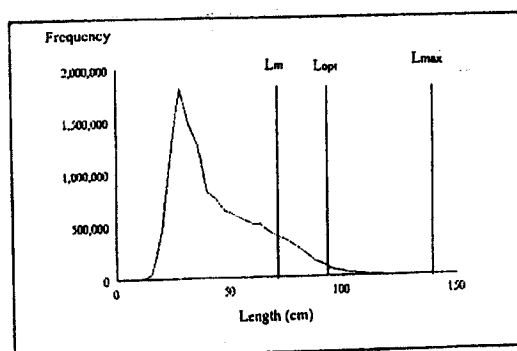
east, South-east, South-west and Mid-west coasts of India, the spotted seer is most common along the North-east and North-west coasts of India. The streaked seer is recorded only from South-east and South-west coasts (Andhra Pradesh, Tamil Nadu and Kerala). The wahoo occurs along South-east to North-west coasts.

Size distribution

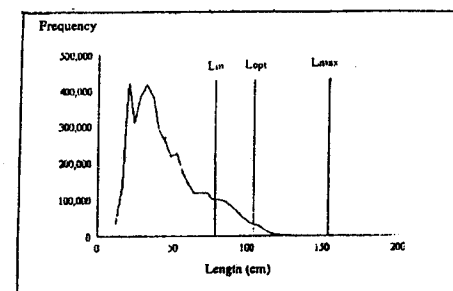
S. commerson

Figs. 6 and 7 show the average annual length frequency of *S. commerson* caught by gillnet and trawl (pooled) along West coast and gillnet, hook and line and trawl (pooled) along East coast respectively. The observed L_{max} was 140

cm for West coast and 154 cm for East coast. From these values, the L_{∞} , the L_{opt} and the L_m were estimated to be 143.2, 93.9 and 72.1 cm respectively for West coast and 157.3, 103.5 and 78.4 cm for East coast. The length frequency of *S. commerson* in the

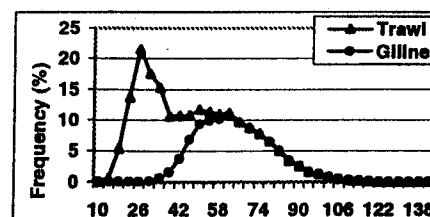
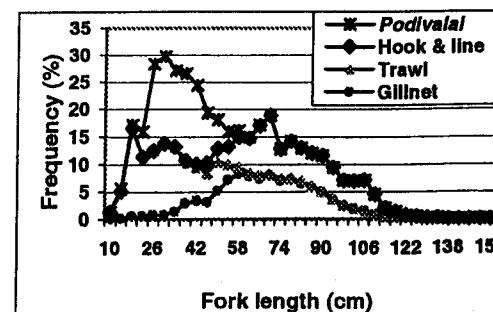
**Fig.6 Length frequency graph (gillnet and trawl-pooled) of *S. commerson* along West coast indicating L_m , L_{opt} and L_{max}**

large mesh gillnet (65-170 mm), trawl, hook and line and small mesh gillnet (40-70 mm) along the West and East coast is given in Figs.8 and 9.

**Fig.7 Length frequency graph (gillnet, hook and line and trawl-pooled) of *S. commerson* along East coast indicating L_m , L_{opt} and L_{max}**

About 10% of the fishes were caught at an optimum yield level. Along East coast, out of 4.41 million fishes caught, 35.8% fishes had spawned before being caught and the number of specimens with optimum yield was 4.7 lakhs (10.6%).

In trawl net, the size varied from 10-100 cm in West coast and 10-110 cm in East coast with mean-

**Fig.8 Annual average length distribution of *S. commerson* in different gears along West coast of India during 1998-2002****Fig. 9 Annual average length distribution of *S. commerson* in different gears along East coast of India during 1998-2002**

In the large mesh size gillnet the length range was 30-140 cm along West coast and 14-154 cm along East coast with mean size at 67 and 71 cm respectively. Youngfish (< 34 cm) exploitation is almost negligible along West coast (0.09%) and East coast (2.8%). Along West coast on

an average, out of 4.27 million fishes caught by the gear, 29.7% fish had a chance to reproduce before being caught.

size at 34 cm at both coasts (Fig.8 and 9). This gear exploited young fishes in bulk quantities; their average percentage of exploitation was 58.8% in West coast and 57.8% in East coast. In West coast out of 8.44 million fishes caught, the number of fishes with optimum yield was only 0.009%. Only 0.5% of the fishes had chance to reproduce before being caught. Along East coast this gear caught 3.17 million fishes annually, of which 0.04% fishes were within the optimum yield level. Only 1.04% fishes caught had chance to reproduce before being caught.

The size range in hook and line in the East coast was 30-146 cm with a mean size of 82 cm and the young fish exploitation was almost negligible (0.01%) by the gear (Fig.9). This gear caught on an average 5.4 lakh fishes every year along East coast during 1998-02. About 54% fishes had spawned before being caught and the number of fishes with optimum yield was 18.1%.

Small mesh gillnet, *podivalai* along Tuticorin coast of Tamil Nadu targets the species at much smaller lengths, the size ranging from 10-70 cm with mean size at 38 cm (Fig.9). All fish caught were below the minimum size at maturity (78.4 cm)

S. guttatus

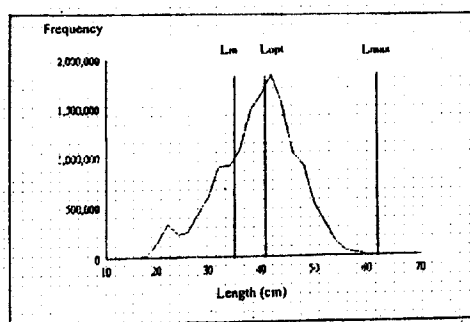


Fig.10 Length frequency graph (gillnet and trawl - pooled) of *S. guttatus* along West coast indicating L_m , L_{opt} and L_{max}

gillnet was 14-58 cm in West coast (Fig.12) and 10-70 cm in East coast (Fig.13) with mean size at 40 cm at both coasts. Youngfish (< 18 cm) was negligible, 0.2% in West coast and 9.6% in East coast. Along West coast, out of 10.92 million fishes caught, 67.6 % of fishes had chance to reproduce before caught and 56.5% fishes were caught with optimum yield. Along East coast, out of 6.3 million

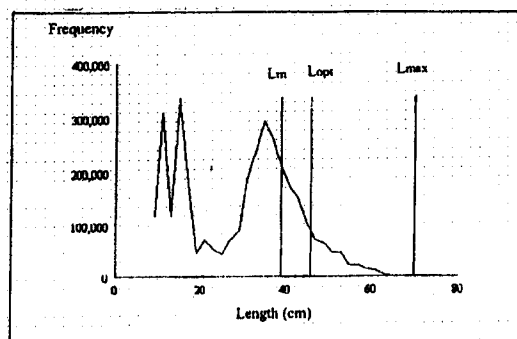


Fig.11 Length frequency graph (gillnet and trawl - pooled) of *S. guttatus* along East coast indicating L_m , L_{opt} and L_{max}

The length frequency distribution of *S. guttatus* in gillnet and trawl (pooled) along the West and East coasts of India is shown in Fig.10 and 11 and different gears separately in Figs.12 and 13. From the observed L_{max} of 62 and 70 cm along West and East coasts respectively, the L_{∞} , L_{opt} and L_m were estimated to be 64.3, 40.7

and 35.1 cm respectively for West coast and 72.4, 46.1 and 39.1 cm for East coast. The length range in large mesh size

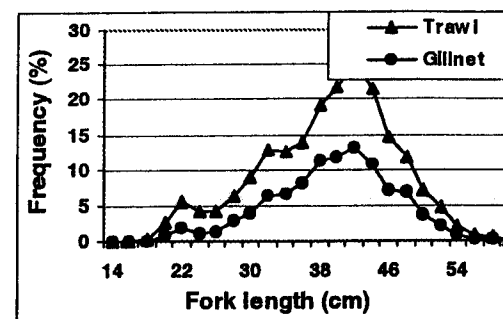


Fig. 12 Annual average length distribution of *S. guttatus* in different gears along West coast of India during 1998-2002

before caught and the number of specimens with optimum yield were 53.6%. Along East coast out of 3.25 million fishes caught,

only 8.2% fishes had chance to reproduce and the number of fishes with optimum yield were 1.4%.

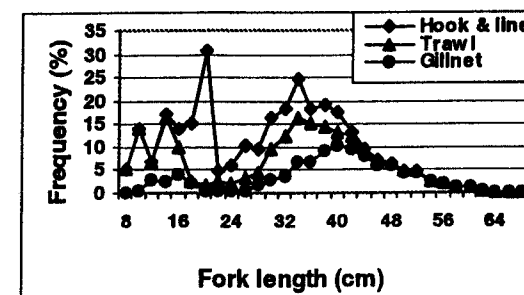


Fig. 13 Annual average length distribution of *S. guttatus* in different gears along East coast of India during 1998-2002

Discussion

Seerfish production in India during 1998-02 showed an increasing trend as being witnessed over the last five decades (1950s-1990s). However, the rate of increase through successive decade continues to show a decreasing trend. It was 92.5% in 1970s which reduced to 62.5% in 1980s, 27.6% in 1990s and to 16.9% during the current period. The East coast which produced 60% of the total seerfish catch in the country during 1950s and 1960s showed reduction to the tune of 50% during 1970s, 37% during 1980s and 35% during 1990s had subsequently increased to 40%, indicating improvement during the current period. This improvement was due to better harvest of the resources along the coasts of Tamil Nadu, Pondicherry and Andhra Pradesh. During 1998-02 seerfish catch had increased in all states except Kerala and Gujarat. Kerala which

fish caught annually, 56.4% of the fishes had a chance to reproduce before being caught and the number of fishes with optimum yield was 22.3%.

In trawl, the size range was 18-62 cm in West coast and 8-60 cm in East coast with a mean size of 39 cm and 25 cm respectively (Figs.12 and 13). While youngfish exploitation was almost nil along West coast, they were caught abundantly along East coast (42.5%). Along West coast, out of 3.34 million fishes caught, 73.2% of the fish had chance to spawn

registered negative growth (-7%) during 1990s continue to record diminished catches (-12.9%) during 1998-02 and Gujarat which recorded 124.2% growth in 1990s over the previous decade had stumbled to a negative growth (-9.5%).

Analysis on the seasonal catch trends showed that during 1998-02, the first to fourth quarters recorded 26, 14, 33 and 27% respectively in the East coast and 24, 9, 22 and 45% in the West coast. Similar trend was reported during 1989-94 (Muthiah *et al.*, 2000) and 1995-99 (Muthiah *et al.*, 2002) except a minor deviation during the current period, third quarter recorded improved landings along both coasts.

Gillnet, trawl, hook and line and 'other gears' contributed 65.1, 6.9, 11.5 and 16.5% respectively to the total seerfish catch of the country during 1989-94 (Muthiah *et al.* 2000) and 64.8, 17.4, 4.0 and 13.9% during 1995-99 (Muthiah *et al.* 2002). The present studies indicated that while gillnet and 'other gears' contribution was steady with 66.3 and 12.5%, the trawl contribution had decreased by 3% and that of hook and line by 3%.

S. commerson and *S. guttatus* constituted 55 and 44% respectively during 1982-94 (Muthiah *et al.* 2000), 62.8 and 33.4% during 1998-02 (Muthiah *et al.* 2002) as compared to 66.3 and 33.4% during the current period. This shows that exploitation of *S. commerson* continues to show an increasing trend while that of *S. guttatus* a decreasing trend.

The large growing *S. commerson* is mainly caught by gillnet, trawl and hook and line along the East coast and by gillnet, trawl and purse-seine along the West coast. The size range in the major gear gillnet was wide along the East coast (14-154 cm) as compared to West coast (30-140 cm) with mean size at 71 and 67 cm respectively. On an average, this gear caught 8.68 million fishes annually during 1998-02 from the Indian coasts, of which 32.8% of the fishes had chance to spawn before they were caught and only 10% of them were caught with optimum yield. Hook and line harvest this species at higher length and out of 5.4 lakh fishes caught along East coast, 53.9% of them had chance to reproduce before caught and the specimens with optimum yield was 18.1%. As compared to the exploitation of the species at a higher length by gillnet and hook and line, the bottom trawl targets the species at a much smaller length. Out of 11.61 million fishes landed by trawl from the Indian seas only 0.63% of them had chance to reproduce before being caught. Similar exploitation of the species was reported earlier by Kasim and Hamsa (1984), Pillai *et al.* (1994), Yohannan *et al.* (1992), Devaraj *et al.* (1999) and Muthiah *et al.* (2000, 2002). This shows that *S. commerson* is optimally harvested by hook and line and bigger meshed gillnets (65-170 mm). Trawl and small mesh gill nets (40-70 mm) especially the

podivalai along the Tuticorin coast in the East coast target small sized fishes which might lead to depletion of spawning stocks, thereby affecting recruitment.

In the case of *S. guttatus*, out of 17.25 million fishes caught from the Indian Seas annually during 1998-02 by the bigger mesh size gillnet, about 44% of the fishes were with optimum yield and more than 63% fishes had chance to reproduce before caught. In trawl exploitation, 41.1% of 6.6 million fishes caught had chance to breed once before being caught and fish with optimum yield was 27.9%. More fishes were caught at younger sizes along East coast, while 73.2% fish caught along West coast had chance to reproduce as against 8.2% in the East coast. This may lead to growth and recruitment over fishing along the North-east coast where this species is abundant. The management option to protect these resources is to allow more fish to breed by increasing the trawl mesh size especially along East coast.

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