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PRESENT STATUS OF EXPLOITATION OF FISH AND SHELLFISH RESOURCES :
RIBBONFISHES

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Abstract

The average annual ribbonfish production of the west coast is estimated at 56,883 tonnes which forms 5.71% of the total fish landings of the coast. Postmonsoon season realised 47% of the catch followed by premonsoon (39%) and monsoon (14%) seasons. This trend is well seen in States like Maharashtra and Karnataka. In Kerala, however, the peak landing (49%) was found during monsoon months while in the other two States it was during the premonsoon period. Trwal net is the only gear operated in all the States during all the seasons and it accounts for about 67% of the total catch. Boat seine occupies the second place (10%) and is limited only to Kerala where it brings in the bulk during monsoon months. Dol net comes third (9.9%) and is employed in States like Maharashtra and Gujarat. Other gears which are employed for the exploitation of ribbonfish along the west coast are purse seine, shore seine, hooks and line and a variety of gill nets. *Trichiurus lepturus* Linnaeus is predominant in all the States, while *Eupleurogrammus muticus* (Gray), *E. intermedius* (Gray), *Lepturacanthus savala* (Cuvier) and *T. auriga* Klunzinger are also found in some places. The exploitation of ribbonfish in relation to monsoon is discussed.

Introduction

Among the exploited finfish resources of India, the ribbonfishes occupy an important place along both the coasts. They rank seventh among the exploited fish groups in the order of predominance (James *et al.*, 1986 a) and contribute about 4% to the total marine fish landing in India (Chakraborty, 1990). The fishery is mainly confined to the depth zone shallower than 50 m and continues to be predominantly in the hands of the traditional and small mechanised sectors. The present account deals with the ribbonfish fishery of Indian west coast with reference to the exploitation during the monsoon period.

Data Base

The ribbonfish landing data from the west coast for the period 1984- 88 collected and maintained by the Fisheries Resources Assessment Division (FRAD) of CMFRI are utilised for the study. Apart from these, the fishery and biological data collected by CMFRI's Research Centres at Vizhinjam and Bombay, the environmental data collected at Vizhinjam and the rainfall data recorded at Trivandrum Air Port are also utilised. For the purpose of analysis, an year is divided into three seasons : premonsoon (February-May), monsoon (June-August) and postmonsoon (SeptemberJanuary) and the data are pooled accordingly.

Observations

Trend of the fishery

The average annual production of ribbonfish in the west coast during 1984-88 is estimated at 56,883 t (Table 1), forming 5.7% of the total marine fish landings of the coast (Fig. 1 A). All the five maritime States of the west coast contribute to this resource (Fig. 1 B-F). Maharashtra and Kerala produce more or less equal quantity, 15,769 t (27.7%) and 15,302 t (26.9%) respectively and Karnataka only 5,775 t (10.1%) of the total catch. In Gujarat the estimated catch is 18,569 t whereas in Goa only 1,469 t (2.8%) are landed.

Of the total ribbonfish catch of the west coast, an estimated total of 26,725 t (4.7%) was landed during the postmonsoon period followed by 21,939 t (38.6%) in the premonsoon period (Fig. 1 G) and 8,219 t (14.45%) in monsoon period. This trend is seen in States like Maharashtra and Karnataka (Fig. 1 K, I). In Kerala (Fig. 1 H) however, the lean season is observed during the premonsoon months and the peak during monsoon forming 49.1% (7,515.25 t) of the year's catch and is followed by 43.4% (6,646 t) during the postmonsoon period. Gujarat and Goa (Fig. 1 L, J) show more or less the same trend in which the premonsoon period provides the peak landing

TABLE 1. *Statewise and seasonwise average landings (tonnes) of ribbonfish and all fish in the west coast*

	premonsoon	monsoon	postmonsoon	Ribbonfish Total	%	All fish total	% of ribbon-fish in total
Kerala	1140.75	7515.25	6646.00	15302.00	26.90	366496.75	4.18
Karnataka	2797.67	37.00	2940.00	5774.67	10.15	173327.67	3.33
Goa	932.50	22.50	514.00	1469.00	2.58	52721.00	2.79
Maharashtra	5423.25	597.00	9748.75	15769.00	27.73	189198.50	8.33
Gujarat	11645.00	47.25	6876.50	18568.75	32.64	214603.00	8.65
Total	21939.17	8219.00	26725.25	56883.42	100.00	996346.92	
Percentage	38.57	14.45	49.98				5.71

A   B   C

D   E   F

G   H   I

J   K   L

☐ Ribbon fish   ⊞ All fish   ◨ Pre-monsoon
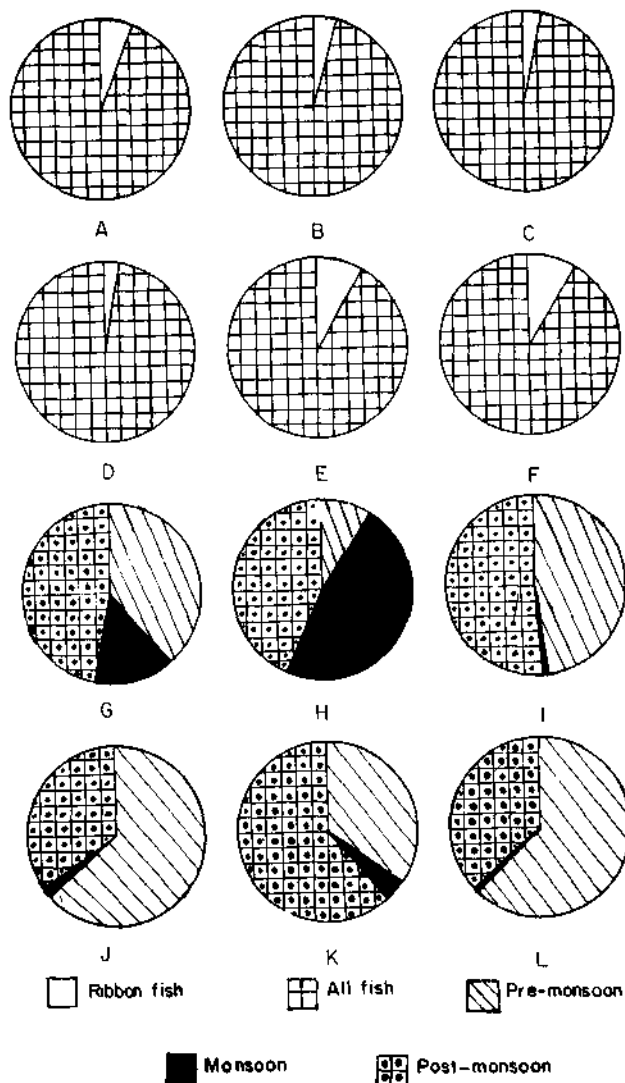
■ Monsoon   ▨ Post-monsoon

Fig. 1. Share of ribbonfish in the total fish landings of : A - west coast, B - Kerala, C - Karnataka, D - Goa, E - Maharashtra and F - Gujarat, and ribbonfish landings during the premonsoon, monsoon and postmonsoon seasons of : G - west coast, H - Kerala, I - Karnataka, J - Goa, K - Maharashtra and L - Gujarat.

followed by the postmonsoon and the lean period during the monsoon months. In Goa (Fig. 1 J) the premonsoon landing is estimated at 932.5 t (63.48%) and in the postmonsoon, 514.00 t (34.99%). In Gujarat (Fig. 1 L) the premonsoon catch is around 11,645.0 t (62.71%) and the postmonsoon around 6876.5 t (37.03%). The monsoon catch is only 47.25 t (0.25%) and 22.50 t (1.53%) respectively in Gujarat and Goa.

Gearwise contribution to the fishery

In Kerala the ribbonfishes are exploited mainly by boat seine, trawl net, gill net, hooks and line and shore seine and contribute 50.5%, 22.6%, 17.2%, 5.0% and 4.5% respectively to the fishery (Fig. 2 A). About 0.2% is brought by purse seine (not shown in the figure). Gears like boat seine, hooks and line and gillnet are operated both from motorised and non-motorised crafts. In the case of hooks and line about 83% of the units which operate them are fitted with out-board engines while in the case of boat seine and gillnet, 20% and 16% respectively of the units only are fitted with out-board engines. Almost the entire catch (99.7%) during the premonsoon period is brought by trawl net (Fig. 2 B) with CPUE ranging from 3.27 kg to 8.27 kg. The bulk of the catch (61.5%) during the monsoon months (Fig. 2 C) is brought by boat seine. Trawl net (28.9%), shore seine (6%), hooks and line (1.9%) and gillnet (1.7%) are also operated during the season in small numbers. The maximum CPUE recorded for boat seine during monsoon appears to be 5.9 kg for motorised and 5.3 kg for non-motorised units. In the postmonsoon season the main share of ribbonfish catch is taken by gill net (40%). Trawl net and boat seine contribute respectively 34.8% and 15.6% of the catch (Fig. 2 D) and the remainng catch was by hooks and line

(9.2%) and shore seine (0.4%). The maximum CPUE recorded for gillnet during the postmonsoon period was 9.3 kg for the motorised crafts and 3.5 kg for the non-motorised sector. Except boat seine and shore seine all the units contribute more during the postmonsoon period (Table 2). The catch by the above two nets is more during monsoon period. Ribbonfish catch in Karnataka is accounted mainly by trawl net, purse seine and some non-mechanised gears like drift net and *Matu bala* and each contribute respectively 87.6%, 10.6% and 1.8% of the total catch (Fig. 2 E). Of the total trawl catch, 63% and 36% respectively are landed during pre and postmonsoon periods and 1% during the monsoon period. In the case of purse seine 99% of the catch comes from postmonsoon fishing, while the rest during the other two seasons. There is not much difference in the catch by non-mechanised gears in the three different seasons (Table 2). The ribbonfish is dominant in the trawl catch during pre and postmonsoon periods (Fig. 2 F, H) and during monsoon,the non-mechanised units contribute to the bulk (Fig. 2 G). The average CPUE during pre and postmonsoon periods by trawl net is 0.03 kg and 0.02 kg respectively. The CPUE by purse seine during postmonsoon is better (0.03 kg) when compared to those of other two seasons.

About 92% of the catch in Goa is obtained by trawl net and the remaining is shared almost equally by purse seine, gillnet and other non-mechanised units (Fig. 2 I). This overall trend is seen for all the periods except for monsoon period, when the contribution from the mechanised sector is found to be slightly higher than the other two periods (Fig. 2 J, K, L). Though trawl net contributes to the bulk of the total ribbonfish catch

of the State, it fetches only small quantity (1.6%) during monsoon months (Table 2). Pre and postmonsoon periods contribute 64.8% and 36.7% respectively of the total catch. The average CPUE recorded is 0.02 kg for the premonsoon, 0.003 kg for the monsoon and 0.012 kg for the postmonsoon periods. Contributions by purse seine and non-mechanised units are more during the postmonsoon period than in the other two periods. There is no catch by the gill net during monsoon. During the other two periods, its contribution to the fishery is 40 and 60% respectively.

In Maharashtra a variety of gears contribute to the ribbonfish fishery, but the important ones are trawlnet and dol net contributing respectively 50.3% and 35.4% of the total ribbonfish catch (Fig. 2 M). The other gears involved in the fishery are gillnet (9.11%), purse seine (1.74%), hooks and line (0.60%), cast net (0.1%) and other non-mechansied units (10.0%). Almost the same overall trend can be observed for the three periods (Fig. 2 N, O, P). The landings are good in all the gears during postmonsoon period (Table 2) followed by the premonsoon months, but contribute the least during the monsoon months.

Trawl net, dol net, gill net and other non-mechanised units contribute respectively 78.1%, 13.9%, 6.1% and 1.9% to the ribbonfish fishery of Gujarat Coast (Fig. 2 Q). A more or less similar trend in which trawl net contributing more is observed during pre and postmonsoon periods (Fig. 2 R, T), but during the monsoon period the bulk of the catch comes form gill net (Fig. 2 S). Among the trawl catch, 65.7% comes during the premonsoon period (Table 2) with an average CPUE of 0.2 kg; 34.2% during the postmonsoon

TABLE 2. *Contribution (%) of ribbonfish by the different gears during different seasons in the west coast*

|	Kerala			Karnataka			Goa			Maharashtra			Gujarat			Average for the coast		
	Pr	M	Pt	Pr	M	Pt	Pr	M	Pt	Pr	M	Pt	Pr	M	Pt	Pr	M	Pt
Trawl net	29.60	9.21	61.19	63.05	0.07	36.88	64.76	1.57	33.67	38.50	7.30	54.20	65.68	0.15	34.17	52.32	3.66	44.02
Boat seine	0.10	87.70	12.20	-	-	-	-	-	-	-	-	-	-	-	-	0.10	87.70	12.20
Dol net	-	-	-	-	-	-	-	-	-	46.30	3.70	50.00	76.28	0.02	23.70	61.29	1.86	36.85
Gill net	0.08	7.30	92.62	-	-	-	40.43	-	59.57	27.20	4.20	68.60	27.46	2.14	70.40	23.79	3.41	72.80
Purse seine	-	-	-	0.28	0.19	99.53	3.70	3.70	92.59	8.30	-	91.70	-	-	-	4.09	1.30	94.61
Other nonmechanised	-	-	-	14.93	43.95	41.12	11.24	12.36	76.40	20.80	16.50	62.70	78.15	0.27	21.58	31.28	18.27	50.45
Hooks and line	-	26.90	73.10	-	-	-	-	-	-	49.20	0.50	50.30	-	-	-	24.60	13.70	61.70

Pr = Premonsoon,   M = Monsoon,   Pt = Postmonsoon.
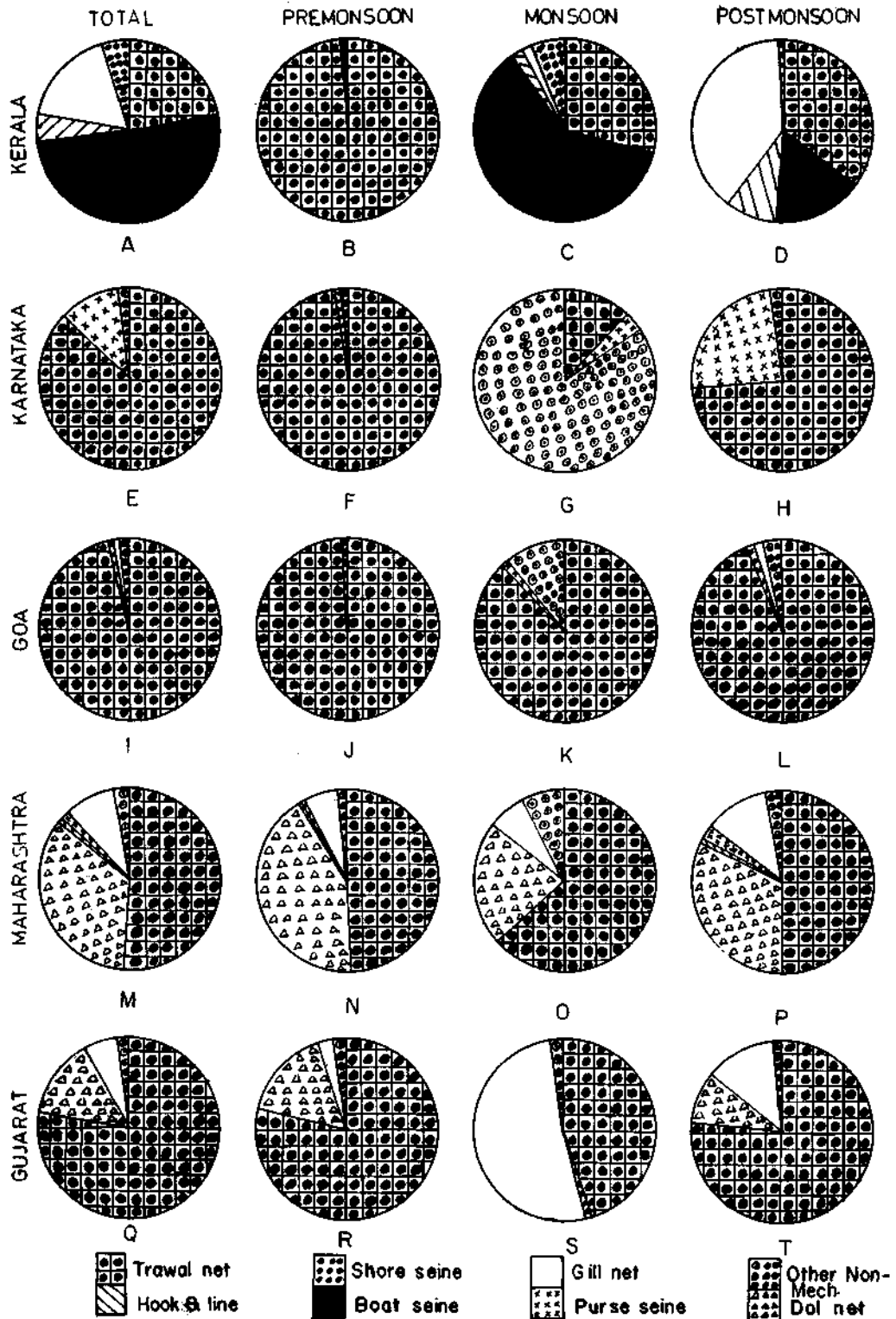
Fig. 2. Gearwise contribution of ribbonfish in different maritime States along the west coast of India during premonsoon, monsoon and postmonsoon and total.

period with CPUE of 0.1 kg and the remaining 0.1% during the monsoon months with CPUE of 0.02 kg. Similarly other non-mechanised units and dol net also contribute more during the premonsoon period than in the other two seasons. The average CPUE recorded for these two units during the period are respectively at 0.01 kg and 0.06 kg, but in the case of gill net, the contribution during the postmonsoon season is more (70.4%) than in the other two seasons.

Thus trawl net appears to be the only gear in operation in all the States during all the seasons along the west coast for the exploitation of ribbonfish. It accounts for 67.2% of the overall catch (Fig. 3 A) of the entire west coast. Out of this, only 3.7% (Fig. 3 B) is fished during the monsoon months. Its peak landing is seen in the premonsoon months in all the States except Kerala and Maharashtra where it falls in the postmonsoon months. Though boat seine ranks second (10.09%), it is limited only to Kerala where it brings the bulk during monsoon months (Fig. 3 C) forming 87.7% of the total catch. It contributes only 0.1% and 12.2% respectively to the pre and postmonsoon landings. Dol net, another important gear employed in the exploitation of ribbonfish in Maharashtra and Gujarat, accounts for 9.9% (Fig. 3 A) of the total catch. Like the trawl net this gear also brings only a meagre quantity (1.86%) during the monsoon months and the first and second peaks in landings are in the pre and postmonsoon periods respectively (Fig. 3 D). Except Karnataka, in all the States the ribbonfishes are caught in a variety of gill nets accounting to 6.6% of the total catch. Like trawl net and dol net for this gear also the lean period is seen during the monsoon months (Fig. 3 E). But, unlike the other two gears, the peak landing is observed during the postmonsoon period. In States like Karnataka, Goa and Maharashtra, ribbonfish forms a part in the catches of purse seine forming 2.6% of the total catch (Fig. 3 A). It is mainly a postmonsoon fishery (Fig. 3 F) in all the above three States contributing above 95% of the catch during the postmonsoon months. About 1.6% of the total catch is being landed by a variety of gears operated by non-mechanised crafts in all the States except Kerala (Fig. 3 G). Here also the fishery is poor during monsoon months. Hooks and lines are used for the exploitation of this resource in Kerala and Maharashtra and it forms about 1.1% of the total catch contributing to about 13.7% only during the

monsoon months (Fig. 3 H). The contribution by shore seine is only 0.9% and is restricted to Kerala where it brings the maximum (96.3%) quantity during monsoon period (Fig. 3 I). Thus, boat seine and shore seine are the two principal gears employed in the monsoon fishery for ribbonfish on the west coast and that too only in Kerala. In all the other States the monsoon landings seem to be meagre.

Biology

Five species of ribbonfishes namely, *Trichiurus lepturus, Lepturacanthus savala, T. auriga, Eupleurogrammus muticus* and *E. intermedius,* occur along the west coast of India. Of these, *T. lepturus* and *E. muticus* contribute to the fishery of the Vizhinjam region, the former predominating the catch. Along the Karnataka Coast, *T. lepturus* and *L. savala* support the fishery. On the northwest coast (Maharashtra and Gujarat), *T. lepturus* forms the main stay of the trawl fishery, while *L. savala* and *E. muticus* together with *T. lepturus* constitute the dol net fishery. Considering the entire west coast of India, *T. lepturus* is found to be the principal species supporting the fishery. Consequently more biological information is available on the species and the same is summarised along with the length details of *L. savala* and *E. muticus* from Bombay waters.

Trichiurus leptures : The peak season for *T. lepturus* falls between June and September in Kerala, October and December in Karnataka, Goa and Maharashtra, December and February in Gujarat. This species is exploited mainly from 15-40 m depth zone by boat seine in Kerala, 4-50 m depth zone by trawl net and gill net in Karnataka and from 40 to 90 m depth zone by trawl net and dol net in other States of the west coast. This species is known to undertake diurnal vertical migrations and is found close to the bottom during day time and ascends to the vertical water column and disperses at night (Rao *et al.*, 1977).

Length frequency data collected separately from boat seine and hooks and line at Vizhinjam during 1986-88 period is presented in Fig. 5. Boat seine landings in June are comprised of fishes ranging in size from 150 to 650 mm while for hooks and line it is from 50 to 650 mm. Two modes are seen at 250 and 500 mm in boat seines and at 200 and 500 mm in hooks and line operated from

A B C

D E F

G H I

△△△ Pre-monsoon   ⟍⟍⟍ Monsoon   ⊙⊙⊙ Post-monsoon

⊙⊙⊙ Shore seine   ■ Boat seine   ☐ Gill net   ⊙⊙⊙ Other Non-mech.
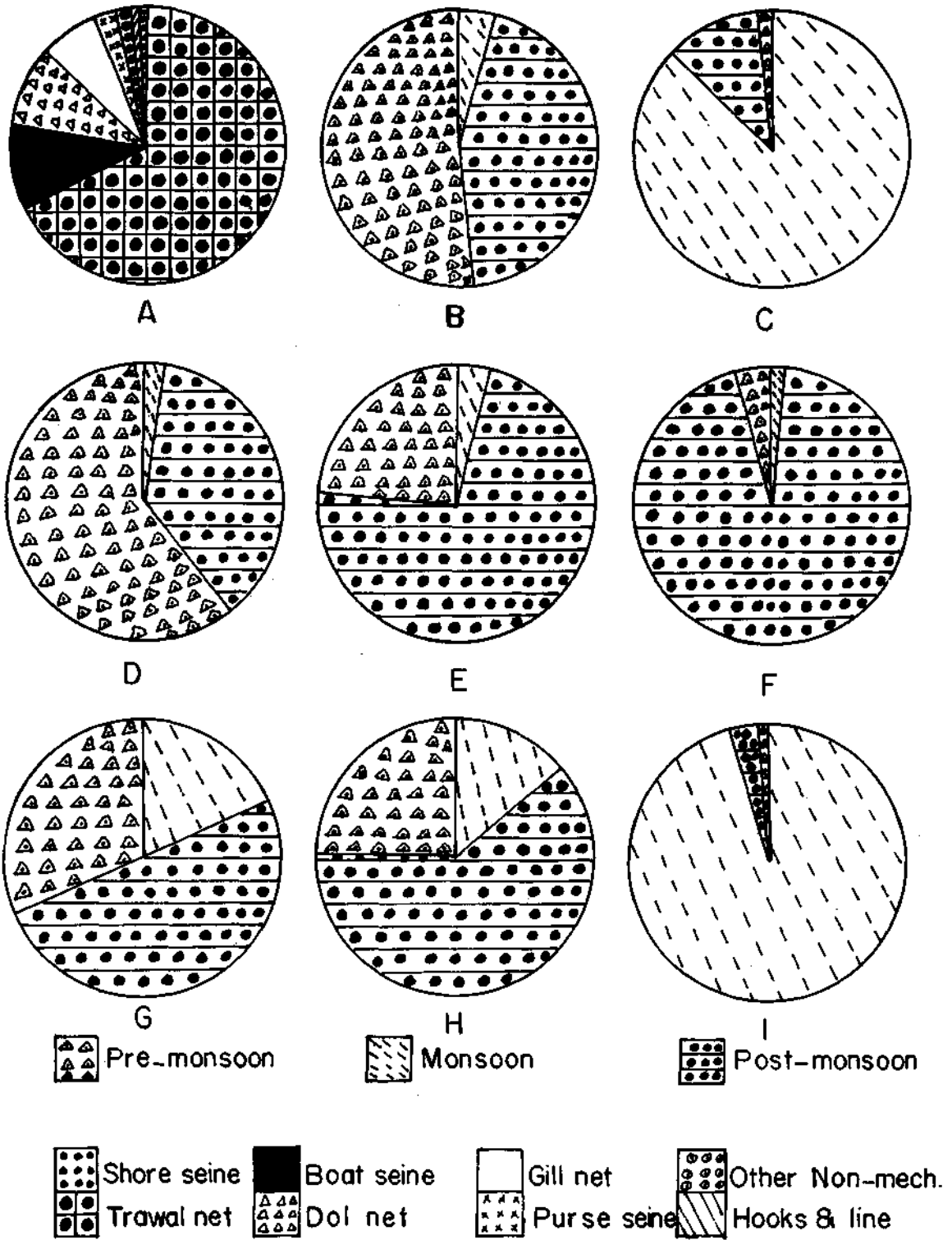⊙● Trawal net   △△△ Dol net   ✗✗✗ Purse seine   ⟍⟍⟍ Hooks & line

Fig. 3 A. Gearwise contribution of ribbonfish in the west coast and seasonwise contribution of ribbonfish by : B - Trawl net, C - Boat seine, D - Dol net, E - Gill net, F - Purse seine, G - other nonmechanised units, H - Hooks and line and I - Shore seine.

mechanised crafts. The distribution of various size groups in the above gears shows that the landing in hooks and line are composed of smaller specimens the modal difference being 50 mm less in this gear as compared with those in the boat seine catch. Of the two dominant modes noticed in June, only one representing the larger specimens is traced to July in both the gears, while the other disappers completely from the fishery. Though the fishes registered a growth of 50 mm during the period (one month), a difference of 50 mm is still discernible when the peak modes in both the gears are compared. During August, the length distribution in both the gears are similar with a mode at 650 mm. Towards the end of the season, during September-October the fishery is supported by larger specimens (650-1100 mm) and are caught by hooks and line from greater depths (50 m and above). The absence of fishes from boat seine landings towards the fag end of the season may suggest that they disappear from the surface zones as boat seine operations are confined to about 15 m from the surface. Thus, during the onset of fishing season the smaller size groups are equally distributed both in the surface as well as in the deeper areas of Vizhinjam and are caught by boat seines and hooks and line with equal intensity. As the season advances, the larger ones in the surface columns get fished and those in deeper areas, grow to larger size. The size frequency distribution observed during the fag end of the season supports this view. It is also observed that as the fish attains a size of 650 mm it shows a tendency to get confined to greater depths.

T. lepturus at Mangalore waters attains 39.1, 58.7, 70.8 and 82.8 cm at the end of I-IV year of its life (James et al., 1978). Chakraborty (1990) has reported still faster growth rate for this species from Bombay with the estimated lengths at the end of I to V years at 51.2, 82.5, 101.0, 112.3 and 119.2 cm respectively.

The size distribution of L. savala and E. muticus occurring off Bombay is given in Fig. 6. The range in size group of L. savala in dol net is from 15-19 to 115-119 cm and of E. muticus from 15-19 to 80-84 cm. No other details are available.

Maturity and spawning : Data collected on the maturity of T. lepturus at Vizhinjam during 1986-88 are presented in Table 5. About 73% of the fish examined in June are immature (Stage I). But by

July about 79% of the fish caught by boat seine and 84% by hooks and line are in maturing condition (Stage II). Fishes in all maturity stages (except in the spawning) could be observed in August and September. By October, the percentage of mature specimens increased to 44.5. The above findings show that monsoon fishery removes only immature and maturing specimens from the sea off Vizhinjam.

Studies at Mangalore (James et al., 1978) indicate a prolonged spawning for this species in almost all the months of the year. Rao et al. (1977) have also reported a similar condition for this species from the west coast. They have observed adults with fully developed and spent gonads during May-July in the catches between 8° to 10°N and juveniles from December to February and from May to August in the northern and central shelf regions. The minimum size at maturity is 43.1 cm for female and 41.2 cm for male. The number of mature ova was found to vary between 1000 and 134,000 (James et al., 1978). It appears that peak spawning of this species takes place during April-May in the northwest coast. However, mature and spent specimens are recorded from February to May and again in October (Bapat et al., 1982).

Food and feeding habits : James et al. (1978) observed food items such as mackerel, oilsardine and prawns in the stomach of larger fish and Stolephorus, Thrissocles and shrimp (Acetes) in the smaller ones. Ribbonfish shoal following the whitebait shoal has been reported by Luther (1981). Similarly ribbonfish within 10-50 m depth is seen generally mixed with those of whitebait (Rao et al., 1977). In general, T. lepturus is a voracious carnivore and predominantly piscivorous, occasionally exhibiting cannibalism.

Fishery and environment

Monthly ribbonfish landings at Vizhinjam and rainfall recorded at Trivandrum Air Port during the period February 1984 to January 1988 are given in Table 3 and 4. The maximum monthly average rainfall, 238.4 mm, is recorded in June, the month in which the southwest monsoon starts in this area, the second peak (218.3 mm) is recorded in October and is mainly due to the northeast monsoon; a third peak in August, during the southwest monsoon period (Fig. 4). A comparison of the ribbonfish landings and rainfall shows that

the maximum landing is recorded during July, the month following the peak rainfall. However, the other two peaks in rainfall do not seem to have an influence on the ribbonfish landings of the area.

month of July when the values of these two parameters are at their minimum. The dissolved oxygen content of the surface water is also low during April-October when there is ribbonfish
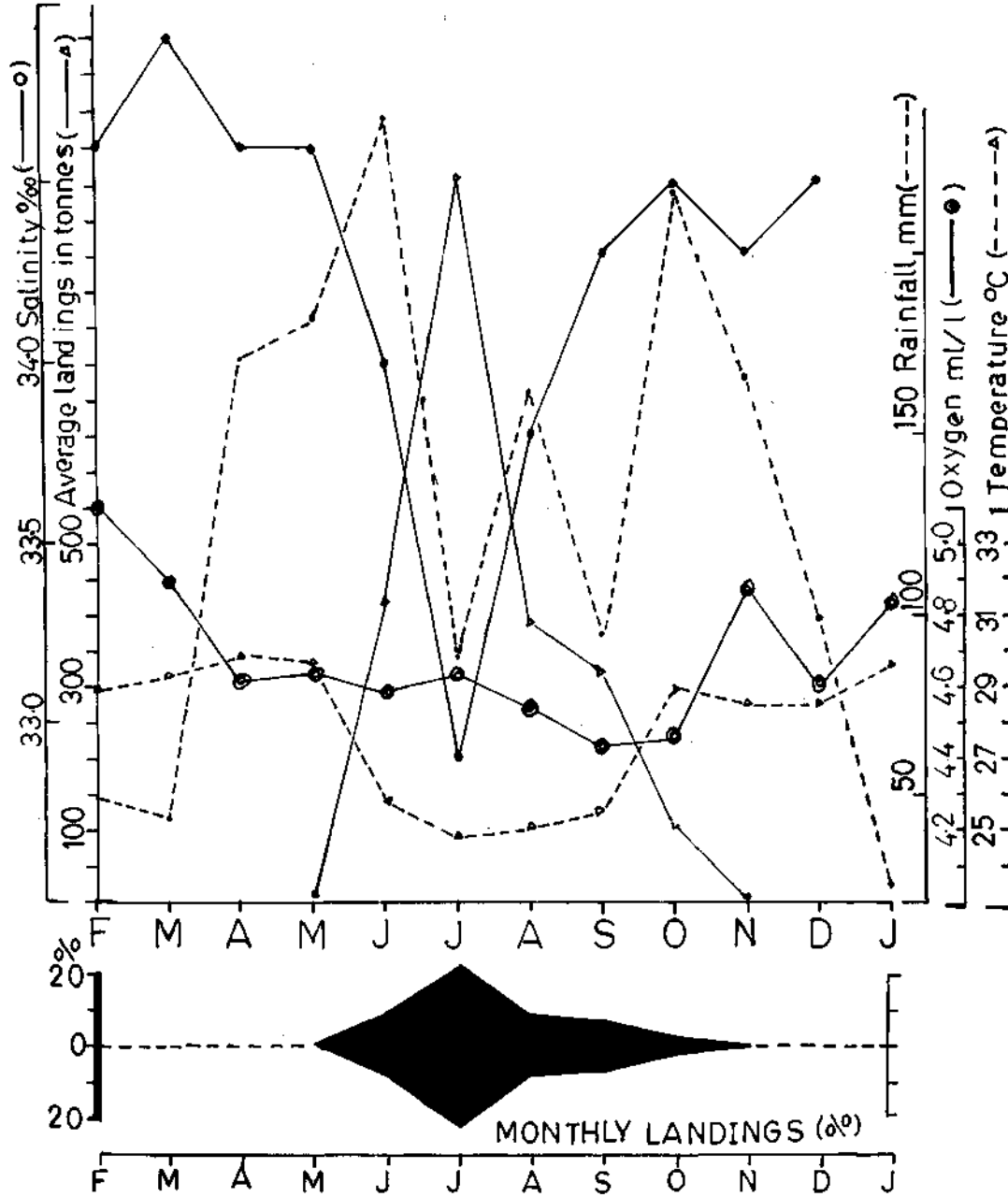

Fig. 4. Monthly average and percentage landings of ribbonfish at Vizhinjam with the environmental parameters recorded simultaneously.

Among the other parameters studied, the surface salinity and temperature seem to have some bearing on the peak landing of ribbonfish at Vizhinjam. The peak landing is observed in the

fishery (Fig. 4). The investigation of Rao et al. (1977) also shows that the ribbonfishes can thrive in oxygen deficient waters as low as 0.5 ml/1.

DISCUSSION

The contribution of ribbonfish to the local fisheries of Vizhinjam has been reported as 19.4% (712 t) in the fifties by Nayar (1958), 23.5% (592 t) in the sixties by Radhakrishnan (1973), 22.6% (102 t) in the seventies by Luther *et al.* (1982) and 43% (2124 t) during the period 1979-81 by Lazarus and Sarma (MS). Althrough these years the main fishery season was confined only to the monsoon months. According to Rao *et al.* (1977) there is considerable scope for increased exploitation of this resource,

because of its rich potential off Kerala Coast. They have even suggested to intensify the fishery during the monsoon months since appreciable standing stock is found during that period. According to them the concentration of ribbonfish shifts northward from 8° to 16°N during November/December and thereafter a southward movement commences by about April/May and a good portion of the biomass is found between 8° and 11°N from July to September when low salinity and temperature due to southwest monsoon prevail in the region.
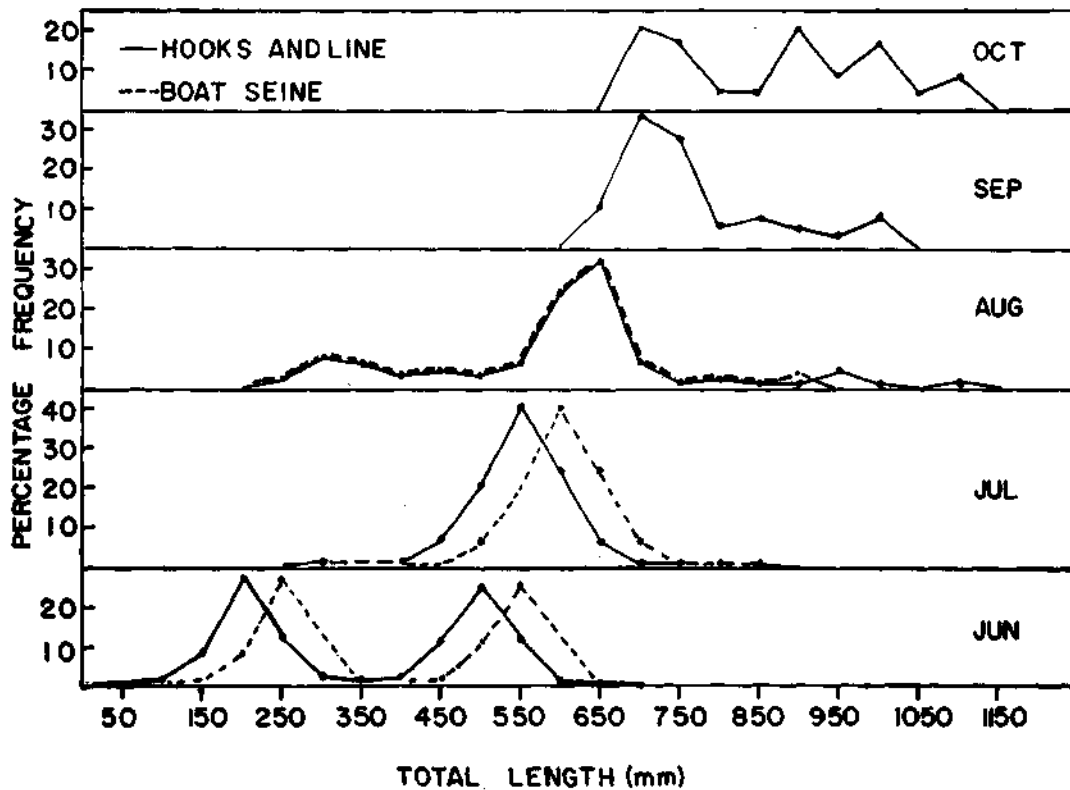

Fig. 5. Length frequency distribution of *Trichiurus lepturus* in the catches by boat seine and hooks and line at Vizhinjam.

TABLE 3. *Monthly landings (kg) of ribbonfish at Vizhinjam*

Year	Premonsoon				Monsoon				Postmonsoon						% in total
	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Total	fish catch
1984-85	-	-	-	-	199800	584130	11734	1500	4104	60	-	-	801328	14.27
1985-86	-	-	-	1384	611810	1469459	399335	507343	434695	-	-	-	3424026	33.02
1986-87	-	-	-	-	715508	1067945	385624	992310	93741	904	-	-	3246032	31.02
1987-88	-	-	-	-	520105	1366017	1106239	112235	-	-	-	-	3104596	38.88
1988	-	-	-	-	35830	555689	48740	-	-	-	-	-	640259	15.42
Total	-	-	-	1384	2083053	5033240	1951672	1613388	532540	964	-	-	11216241	
Average	-	-	-	276.8	416610.6	1006648.0	390334.4	322677.6	106508.0	192.8	-	-	2243248	26.52

Trichiurus lepturus is the only species that predominates the ribbonfish fishery of the west coast. According to Lazarus and Sarma (MS) the fish spawns off Vizhinjam around May-June. They have also observed the existence of a fishery for the juveniles (4-12 cm size) at vizhinjam during July.
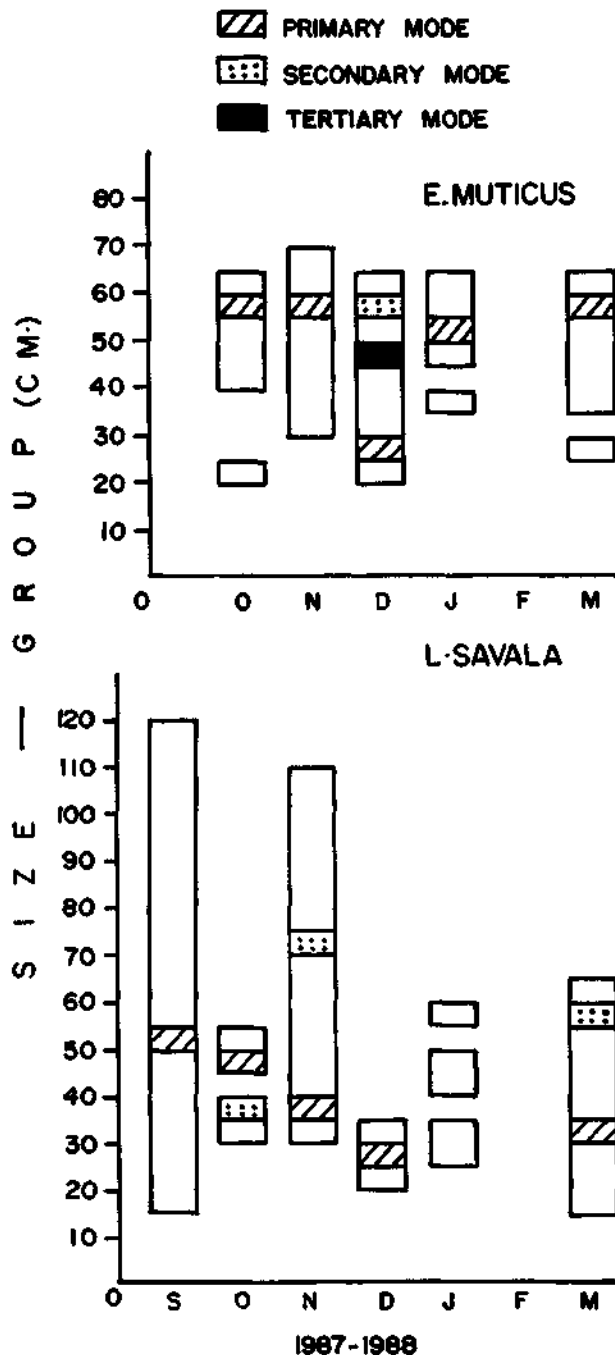

Fig. 6. Size distribution of Lepturacanthus savala and Eupleurogrammus in the catches off Bombay.

Though this phenomenon is not observed during the present study, such a situation should be viewed seriously and proper regulatory measures have to be adopted to protect this population from exploitation. However, as larger fish are available in deeper waters, especially beyond 50 m depth, it is worthwhile to consider their exploitation for advantage. Further, in consideration of the diurnal habit of ribbonfish, Rao et al. (1977) suggested bottom trawling during day and pelagic trawling or purse seining during night.

All States except Kerala along the west coast, have no fishery for this group during the monsoon months. This may not be due to the non-availability of the stock. The acoustic surveys and fishing experiments conducted by the Pelagic Fisheries Project (Rao et al., 1977) in this area have shown that good concentration of ribbonfish occurs from April to September with the maximum intensity between May and July upto 80 m depth. Large concentration of young T. lepturus (200-250 mm) is located at 250 m depth along the southern side of Wadge Bank, which may be an important nursery ground for this species.

It was earlier thought that the ribbonfish catches are always obtained from inshore waters and that it is essentially a pelagic resource obtained through gears such as shore seines, boat seines and drift nets. With the recent developments in fishing methods and extension of fishing activities to deeper areas of the sea, the resource is now increasingly being exploited from deeper waters. James et al. (1978, 1986 b) have suggested that this resource may be exploited by trawl nets and boat seines from the deeper areas of the southern and northern parts of the west coast.

According to Rao et al. (1977) the average standing stock of ribbonfish in the area between the Gulf of Mannar and Ratnagiri is about 4 times higher than the present landings and its catch could be doubled without adversely affecting the stock. The exploratory survey conducted by M.T. Muraena has also indicated significant resource of ribbonfish along the northwest coast of India, forming about 28.2% of the catch beyond 55 m (Bapat et al., 1982). The exploitation ratio (E) for T. lepturus at Bombay waters is found to be 0.46 (Chakraborty, 1990) which indicates that the stock is not under pressure or threat of depletion.

Table 4. *Monthly rainfall (mm) recorded at Trivandrum during 1984-85 — 1987-88*

Month	1984-85	1985-86	1986-87	1987-88	Total	Average	%
Feb.	128.2	40.2	28.8	0.0	197.2	49.3	3.21
Mar.	151.0	13.6	2.1	7.9	174.6	43.7	2.84
Apr.	297.0	87.4	184.5	116.2	685.1	171.3	11.16
May	153.7	223.3	150.9	196.5	724.4	181.1	11.80
Jun.	205.5	424.3	147.7	176.1	953.6	238.4	15.53
Jul.	126.0	82.5	103.0	48.5	360.0	90.0	5.86
Aug.	21.1	61.8	210.0	353.8	646.7	161.7	10.53
Sep.	40.2	96.8	77.5	162.4	376.9	94.2	6.14
Oct.	205.1	162.7	90.4	414.9	873.1	218.3	14.22
Nov.	71.8	170.4	220.4	198.6	661.2	165.3	10.77
Dec.	2.7	39.5	16.6	333.3	392.1	98.0	6.38
Jan.	91.7	2.2	2.1	0.0	96.0	24.0	1.56
Total	1494.0	1404.7	1234.0	2008.2	6140.9	1535.3	100

The reasons for the present lower level of exploitation may be the inaccessibility of the resources to the indigenous non-mechanised craft and gear, and the inability of the small mechanised craft to go out and trawl in the deeper waters. Operation of bottom trawls during day and pelagic trawls during night and also purse seining as

Table 5. *Maturity distribution (%) of* Trichiurus lepturus *at Vizhinjam*

Stages of Maturity	Boat seine					Hooks & line (Mechanised)					Boat seine and hooks and line combined				
	June	July	Aug.	Sep.	Oct.	June	July	Aug.	Sep.	Oct.	June	July	Aug.	Sep.	Oct.
I	73.2	10.7	8.8	-	-	-	-	16.7	22.2	11.2	73.2	9.1	11.5	22.2	11.1
II	26.1	79.0	59.6	-	-	-	83.8	36.7	27.8	22.2	26.1	79.8	51.7	27.8	22.2
III	0.7	7.3	19.3	-	-	-	8.1	23.3	22.2	44.4	0.7	7.4	20.7	22.2	44.5
IV	-	3.0	-	-	-	-	8.1	13.3	22.2	22.2	-	3.7	4.6	22.2	22.2
V	-	-	-	-	-	-	-	3.3	5.6	-	-	-	1.2	5.6	-
VI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VII a	-	-	12.3	-	-	-	-	6.7	-	-	-	-	10.3	-	-
VII b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

suggested by Rao et al. (1977) seem to be an effective alternative to enhance the production. And for this, only larger vessels are suitable. However, as this is not an exclusive resource, appropriate exploitation measures may have to be considered in cognizance of other resources available in the ground as well.

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