J.Nat . Aq. Res. Ag. Sri Lan. 33 & 34 (1986 - 87) 65 - 73

STUDIES ON THE PRAWN FISHERY BY - CATCH FROM THE WEST COAST OF SRI LANKA

by

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ABSTRACT; The ratio of shrimp to by-catch was estimated from the data collected from shrimping vessels that operated in Negombo and Chilaw areas of the west coast of Sri Lanka for a period of two years, from February 1979 to February 1981. The by-catch comprised of 41 species of marine organisms from 13 different families. The results indicated a shrimp to by-catch ratio of 1.3 : 1 in Negombo and 1 : 1.8 in Chilaw. The average catch rates were calculated to be 1.53 kg/hr for shrimp and 1.18 kg/hr for by-catch for Negombo waters and 1.79 kg/hr and 3.12 kg/hr for Chilaw waters for shrimp and by-catch respectively. Mean length of the by-catch species ranged from 5-45 cm in standard length. Although the by-catch composition showed seasonal variations, four species of fish namely *Leiognathus splendens, Leiognathus Fasciatus, Opisthopterus tardoore* and *Nemipterus japonicus* accounted for 60-70% of the total by-catch.

INTRODUCTION :

In shrimping activities large quantities of small fish and other marine organisms are caught as by catch. As far as developed countries are concerned, there is presently no outlet for this part of the catch, and the shrimper has little alternative but to return the material to the sea. In view of the present demand for food of animal origin, particularly in countries where shrimp fisheries are established, there has been much recent interest recently in alleviating this wastage of a valuable marine resource (Mainke,1974: FAO , 1975: Allsopp, 1977). It has been recognized for many years that vast quantities of potential food are being discarded at sea such as the incidental catches of fish from shrimp trawling operations. The growing world food problem in developing countries and high fuel costs have prompted many countries and agencies to consider ways of preventing this waste and putting this resources to better use.

Although efforts have been made to process the shrimp by-catch into useful food products (Young,1978), knowledge regarding the yield and composition of the raw material appears to be scant. Estimations of potential weight ratios of shrimp: by-catch vary from 1:6 (Mainke, 1974) to 1:13 (Cheves and Arvizu, 1972). A study carried out in the Gulf of California in 1965-76 by Rosales (1976) demonstrated the incidence of 218 marine organisms in shrimp by-catch and a shrimp : by-catch ratio of 1:10. These workers do not however provide detailed information on the size distribution of the fish species comprising the by-catch. Manike (1974) cited the composition of by-catch recovered during Gulf of Mexico shrimping activities and reported a size range of 6-55 cm for by-catch fish. However in Sri Lanka there is very little available data regarding the variability in the by-catch composition and fish size within a given trawl catch and the little data available is also not reliable.

The annual by-catch in Sri Lanka has been calculated to be approximately around 3.0×10^4 t. The by-catch fish of low value that are landed go into the production of salted fish, dried fish or meal. Based on productivity studies and catch data analysis, a maximum sustainable yield of $5\text{-}10 \times 10^5$ t. of by-catch could be expected from the 2800 km2 of the continental shelf that is suitable for shrimp trawling (Subasinghe 1981).

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The present investigation was therefore undertaken to obtain a better knowledge of the yield and composition of the shrimp by-catch in Negombo and Chilaw, the two traditionally well known shrimping areas on the West coast of Sri Lanka (Fig.1).

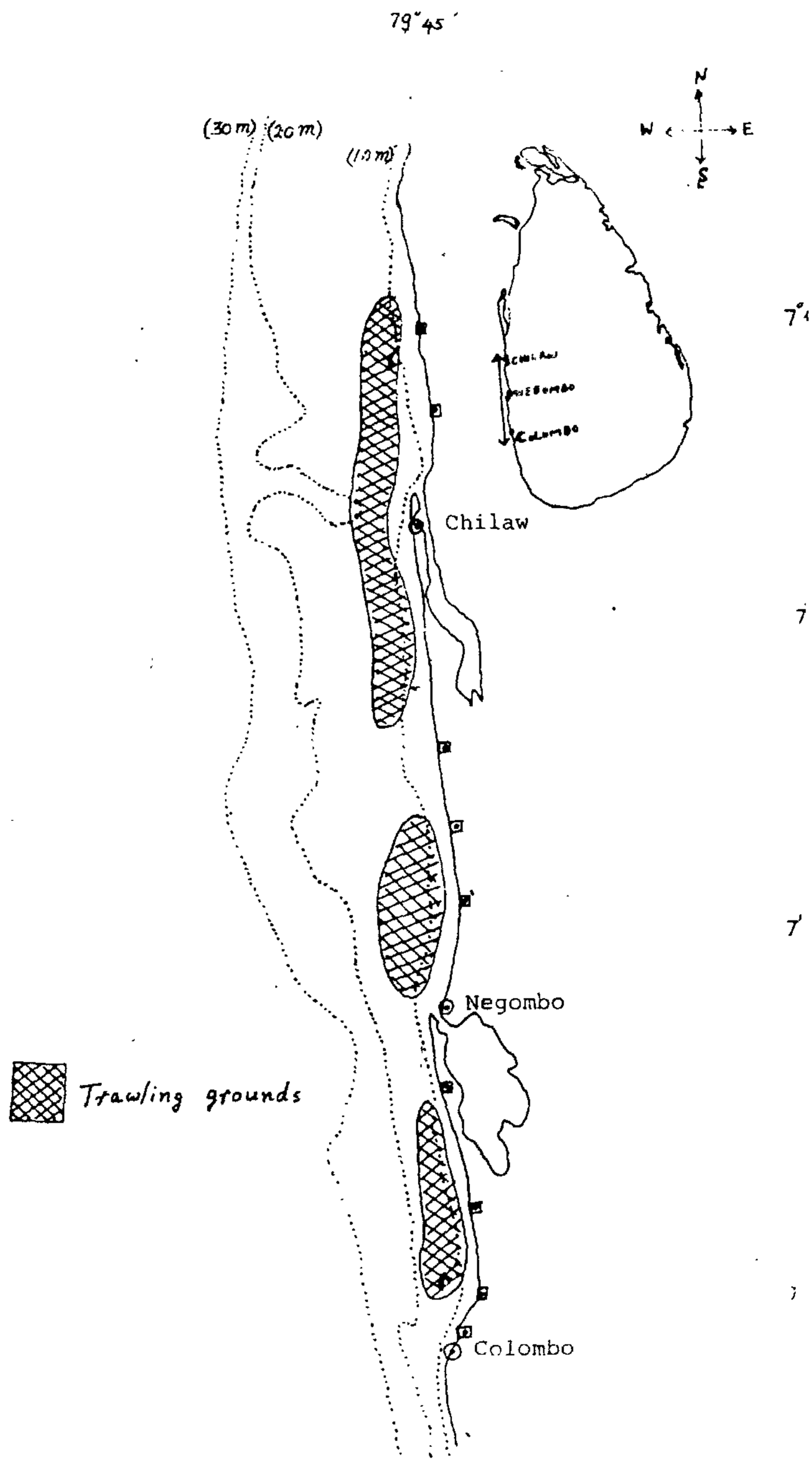

Fig. 1 Prawn trawling areas along the west Coast from Colombo to Chilaw.

MATERIALS AND METHODS:

Data necessary for this study was collected during the period extending from February 1979 to February 1981, from the commercial shrimping vessels fishing in Negombo (wooden canoes) and Chilaw (3.5 inboard engine boats). Sampling was mainly done on the commercial landings at approximately weekly intervals. The following were recorded:

1. Location of trawling
2. Date and time of sampling
3. Duration per trawl
4. Depth of trawl
5. Length and weight of shrimp and by-catch
6. Species composition of by-catch

Location of trawling areas were taken from the reference points known to fisherman. The total weight of both the shrimp and by-catch were estimated at the landing site. Shrimp were weighed routinely at the landing site and weights of by-catch were assessed from the total weight through a series of baskets, weighing approximately 2 & 5 kg. when filled with fish, and later calculating the total weight from the number of baskets required to hold the entire catch. The crafts for sampling were selected randomly using a random number chart.

RESULTS :

The relative frequency of species occurring in the by-catch in the study areas is given in Table 1. Relative frequency is defined as,

$$\text{Relative Frequency } (RF) = \frac{\text{No. of samples occurring the species} \times 100}{\text{otal number of samples}}$$

According to this definition, the most abundant or the most commonest species occurring in the samples has the highest relative frequency. As indicated in Table 1, higher relative frequency values are shown by *Oratosquilla nepa* (Mantis shrimp) *Leiognathus fasciatus, Leiognathus splendens* and *Pseudorhombus triocellatus.* The commonest categories of organisms in the by-catch and their size ranges are given in Table 2. Of these the Sciaenids and the Leiognathids are the most abundant in the by-catches. The length distribution patterns of the by-catch is given in Fig.2 and the mean total lengths of the fish varied from 5-45 cm, Fig.2 also indicate the variability in lengths of the fish in the by-catches. However, the vast majority fell within a fairly limited size range. Thus although the overall mean length was 12.53 cm, the majority of the fish measured fell between 7cm-21cm.

The shrimp: by-catch weight ratios in the coastal shrimp fishery off Negombo and Chilaw during the study period are given in Table 3 and 4. The average weight ratio of shrimp : by-catch for Negombo is 1.32:1 which is approximately 1:1 while in Chilaw the average ratio is 1:1.78 which is approximately 1:2. The seasonal variation pattern of the shrimp: by-catch values for the two year period is given in Table 5. The results indicate that during monsoonal months the by-catch production is considerably high when compared to the non-monsoonal months.

It is seen that in both these shrimp fishing areas the Leioguathids (silver bellies) and Sciaenids predominated in the by-catches throughout the year (Figs. 2 & 3). The other categories such as Elasmobranchs, Cat fish, Soles, Perches, Cephalopods, and other Crustaceans formed only small proportions of the total by-catch.

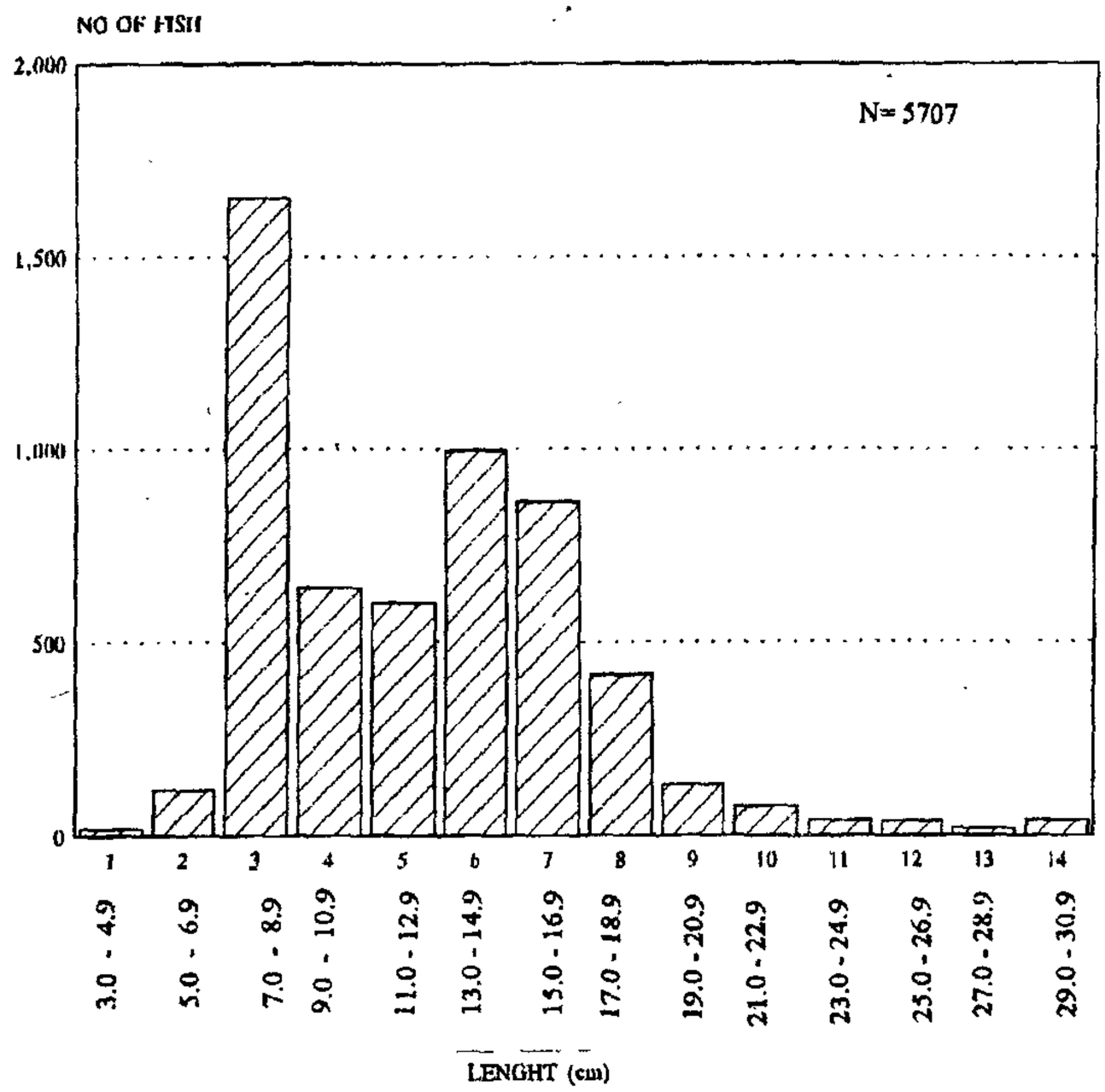

Fig. 2: Histogram representing the lenght distribution of fish recovered in samples of shrimp by-catch

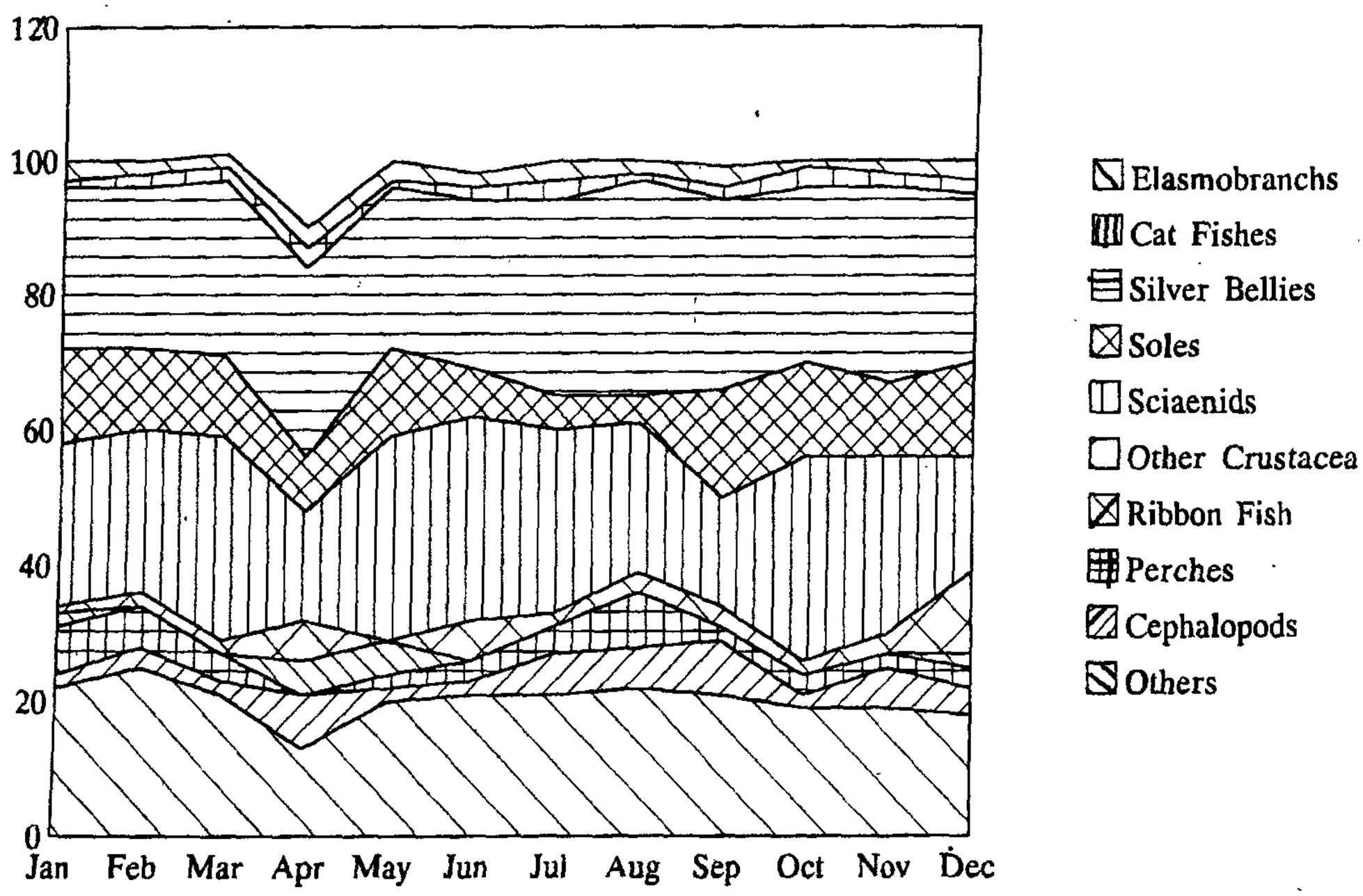

Fig 3: Seasonal composition of shrimp by catch in Negombo

DISCUSSION :

The ratio of shrimp: by-catch obtained in the present study show considerable variations from the results obtained by other workers. In the Gulf of California, the shrimp: by-catch ratio has been expressed differently by different workers, 1:13 (Chaves and Arisu, 1972); 1:6 (Meinke, 1974) and 1:10 (Rosales, 1976). According to the data available, the shrimp: by-catch ratios in countries like India, Indonesia, Thailand, Malaysia, Mexico and Japan for the year 1078, appears to be 1:5 (Slavin, 1982). The shrimp: by-catch ratio for Palk Bay and Gulf of Mannar in the Northern part of Sri Lanka has been approximated to be 1:14 and 1:12 respectively, where the by-catch primarily consisted of Silver bellies (Subasinghe, 1981). The reason for this may be due to the high productivity and shallowness of the Palk Bay area, where large shoals of silver bellies have been located. According to the present study, the shrimp: by-catch ratio for Negombo and Chilaw approximates roughly to 1. 3:1 and 1:1.8 respectively. In Negombo, high shrimp catch and less by-catch may be mainly due to the type of fishing gear used. In non-mechanized traditional crafts, which are sail driven and whose fishing power is low, the catch mainly consisted of less active small shrimps and few bottom dwelling fish like *cynoglossus sp.* and *Osteogeneiosus sp.* and *Otolithus sp.*

Considering all the values published by various workers, Allsopp (1982), tentatively suggested a rough value for shrimp: by-catch weight ratio of 1:5 for shrimp fisheries in temperate latitudes and 1:10 ratio for tropical latitudes. The results of the presents study differ considerably from these figures.

The shrimp: by-catch ratio values obtained by various workers show a wide range due to several factors. Even in a given geographical location, these ratios can change due to many factors such as seasons, currents, time of the day, behavior patterns of fish and shrimp,etc.

The results of this study reveal that by-catch landed by shrimp trawlers include a wide variety of demersal fishes and a few species of Cephalopods and Crustaceans other than shrimps. The species of fish caught in the by-catch and their size ranges are given in Table 2. According to the results obtained, the by-catch comprised of 40 species of fin fish from 13 different families. Their size varied from 5 cm to 47 cm in total length. In the Gulf of California, approximately 87 species of fish from 43 families have been recorded in samples of by-catch (Young and Remero, 1979). Rosales (1976), demonstrated the incidence of 218 marine organisms in shrimp by-catch from Californian waters. Mainke (1974), cited the size range of by-catch recovered during Gulf of Mexico shrimping activities and reported it to be between 6 to 55 cm for by-catch fish.

In western countries the by-catch yields are larger and variability is high during the warmer months (Mellado et. al. 1981). Mellado et. al. (1981), observed that during summer, high water temperature promotes increased yeiled of by-catch from shrimp fisheries from Gulf of California. However similar conclusions cannot be arrived in this study area as the temperature different during different months of the year is not very significant (approximately 5° C for the entire study period). In Sri Lanka as the present results indicate, the variability of by-catch is seem to be affected mainly by the monsoons. During the monsoonal months the shrimp catch is less and by-catch variability becomes proportionately high. The catch rate values in the study area are very law when compared to those from Californian waters, where the catch rates were 9.18 kg/hr. for shrimp and 90.27 kg/hr. for by-catch. The average catch rate in Chilaw waters was 1.79 kg/hr. for shrimp and 3.12 kg/hr. for by-catch and that of Negombo was 1.53 kg/hr and 1.18 kg/hr. respectively. These low values may be attributed both to the inefficiency of the local fishing gear and to the low productivity of benthic fish in the study area. The by-catch composition obtained in this study appears to be similar to those described by Chavez and Arvizu (1972) for Californian waters.

Despite the monsoonal effects, four genera of fish accounted for 60% - 70% of all fish recovered in by-catch samples. These were Leiognathus Splendens, *Leiognathus Fasciatus, Opisthopterus tardoore and*

Nemipterus Japonicus. As *Oratosquilla nepa* is a non edible species in Sri Lanka, fishermen mostly discard them at sea. In India, the most common shrimp by-catch category comprised of Sciaenids. According to all Indian by-catch composition results in 1979, nearly 21% of the total by-catches consisted of Sciaenids (Anonymous, 1981). In Tamil Nadu alone, around 40% of the by-catch consisted of silver bellies. According to the results of the present study (Figs. 3 & 4) the West Coast by-catches comprise around 20% silver bellies, and 30% Scieanids almost throughout the year. Of the *Scianids, Otolithus spp.* are common to Indian and Sri Lanka by-catches, and contribute in a substantial manner to the numbers.

Table 1: **The mean lengths of the by-catch species and their relative frequency values in Negombo and Chilaw areas (Pooled data for 1979 to 1981).**

Species Name	Mean length (cm)	Relative frequency
1. *Oratosquilla nepa*	08.0	0.880
2. *Otolithus ruber*	13.7	0.851
3. *Leiognathus fasciatus*	07.3	0.843
4. *Leiognathus splendens*	05.1	0.824
5. *Pseudorhombus triocellatus*	07.2	0.821
6. *Opisthopterus tardoore*	11.2	0.717
7. *Cynoglossus macrolepidotus*	13.2	0.677
8. *Euplatygaster indica*	11.7	0.613
9. *Gazza minuta*	07.2	0.456
10. *Ilisha filigera*	06.8	0.444
11. *Sardinella melanura*	10.2	0.437
12. *Sardinella sp.*	07.2	0.433
13. *Sardinella jussieu*	10.3	0.413
14. *Anchoviella commerisonni*	17.2	0.375
15. *Anchoviella commerisonni*	05.1	0.354
16. *Drepane punctata*	09.3	0.341
17. *Upenaus vittatus*	09.5	0.340
18. *Sillago sihama*	13.6	0.338
19. *Sardinella sirm*	08.4	0.327
20. *Thrissocles setirostris*	12.0	0.313
21. *Selariodes leptolepis*	08.2	0.312
22. *Sardinella albella*	09.4	0.277
23. *Lactarius lactarius*	13.7	0.276
24. *Diodon hystrix*	12.2	0.244
25. *Epinephelus fario*	11.2	0.213
26. *Kowala coval*	06.2	0.211
27. *Trichiurus savala*	30.4	0.210
28. *Epinephelus meera*	10.8	0.189
29. *Therapon jarbua*	07.5	0.177
30. *Secutor ruconius*	07.5	0.175
31. *Glossobius giuris*	06.0	0.164
32. *Polynemus sp.*	07.3	0.137
33. *Acanthurus matodies*	09.4	0.122
34. *Alectis ciliaris*	10.3	0.121
35. *Lethrinus nebulosis*	16.4	0.111
36. *Osteogeneiosus militaris*	07.3	0.110
37. *Mene maculata*	10.5	0.089
38. *Dussumieria acuta*	14.4	0.078
39. *Pampus argenteus*	12.1	0.055
40. *Actobatus narinari*	16.5	0.045
41. *Triacanthus brevirostris*	05.2	0.011es

Table 2 : **Major fish categories in the by-catch and their size ranges.**

Categories	Family	* Size range (cm)
1. Elasmobranch fishes	-	18-35
2. Eels	*Anguillidae*	30-45
3. Dorabs	*Chirocentridae*	15-85
4. Cat fishes	*Tachysuridae*	15-45
5. Perches	*Pseudochromidae*	08-13
6. Polynemids	*Polynemidae*	08-16
7. Sciaenids	*Sciaenidae*	05-16
8. Ribbon fishes	*Trichiuridae*	12-70
9. Carangids	*Carangidae*	05-25
10. Silver bellies	*Leiognathidae*	05-13
11. White fish	*Lactariidae*	06-14
12. Barracudas	*Sphyraenidae*	10-22
13. Pomfrets	*Stromateidae*	10-18
14. Soles	*Soleidae*	05-04
15. Crabs	-	06-10
16. Stomatopods	-	05-15
17. Squids & Cuttle fish	-	05-20

* Size range in standard length.

Table 3 : **Shrimp-by catch ratio values for Negombo & Chilaw for the study period (1979/1980)**

	Negombo	Chilaw
Total shrimp catch	156871.8 kg	140426.7 kg
Total by-catch	117591.7 kg	226470.0 kg
Shrimp:by-catch ratio	1.3:1	1: 1.60
No. of trawling hours	106514	92116
Catch rate (Shrimp)	1.47 kg hr^{-1}	1.49 kg hr^{-1}
Catch rate (by-catch)	1.10 kg hr^{-1}	2.46 kg hr^{-1}

Table 4 :**Shrimp-by catch ratio values for Negombo & Chilaw for the study period (1980/1981)**

	Negombo	Chilaw
Total shrimp catch	168852.0 kg	125678.7 kg
Total by-catch	132962.2 kg	231305.0 kg
Shrimp:by-catch ratio	1.30:1	1: 1.8
No. of trawling hours	105462	61425
Catch rate (Shrimp)	1.6 kg hr^{-1}	2.08 kg hr^{-1}
Catch rate (by-catch)	1.26 kg hr^{-1}	3.77 kg hr^{-1}

Table 5 : **Shrimp - by-catch ratio for Negombo 1980-1981 on a monthly Basis**

	Weight of shrimp catch (Kg)	Weight of fish (Kg)	Shrimp:by-Catch ratio
1979			
Feb.	12827.6	08118.7	1.58:1
Ma	18054.8	10086.5	1.79:1
Apr.	23047.7	12194.6	1.89:1
May.	12947.8	14882.5	0.87:1
Jun.	17964.7	14257.7	1.26:1
Jul.	10251.1	09404.7	1.09:1
Aug.	09592.1	05884.7	1.63:1
Sep.	08931.2	06117.3	1.46:1
Oct.	14419.5	15020.3	0.96:1
Nov.	11662.1	11779.9	0.99:1
Dec.	14732.0	11076.7	1.33:1
1980			
Jan.	14421.4	14138.6	1:1.02
Feb.	10904.0	16792.2	1:1.54
Mar.	10667.8	15255.0	1:1.43
Apr.	11821.1	18795.6	1:1.59
May.	07062.4	12712.3	1:1.08
Jun.	13518.6	22305.7	1:1.65
Jul.	12248.3	20699.6	1:1.69
Aug.	11938.4	23279.9	1:1.95
Sep.	12212.9	38470.6	1:3.15
Oct.	09653.7	19790.1	1:2.05
Nov.	06059.7	08362.4	1:1.38
Dec.	09748.1	13159.9	1:1.35
1981			
Jan.	12178.8	21678.2	1:1.78

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