

Status of the Gill Net Fishery for the Small Pelagic Fish Species in Western, South-Western and Southern Coastal Waters of Sri Lanka during 1995-1997

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Abstract

KEY WORDS: SMALL PELAGICS; GILLNET; CATCH RATE; SPECIES ABUNDANCE

Small pelagic fish species are mainly caught by gill nets operated by fibre reinforced plastic boats fitted with 8-25hp out board engines, traditional crafts fitted with 8-10hp out board engines and non mechanised traditional crafts. Around 28 to 55% of the small pelagic catch in the study area consisted of trenched sardine *Amblygaster sirm* during 1995-1997 period. Another 26-36% of the catch composed of other *Sardinella* species such as *Sardinella gibbosa*, *S.albella*, *S.sindensis* and *S.longiceps*. Engraulids such as *Encrasicholina heteroloba*, *Stolephorus insularis* and *Stolephorus indicus* and *Thryssa spp* formed around 3-5% of the catch. The major component of this fishery consisted of Clupeids and Engraulids and over 65 species ranged between smaller Engraulids to incidental rock fish, sail fish, seer fish, sharks, skates and rays. Around 1.4 to 1.9% of the catch consisted of *Chirocentrus dorab*, *Sphyraenaspp*, *Scomberomorus spp*, *Lepturacanthus sp* and *Megalaspis cordyla*. Around 1-11% of the catch consisted of incidentally catches of sharks, rays, skates and sail fish. Another 1.6 to 6% of the catch consisted of *Selar crumenophthalmus* and *Rastrelliger kanagurta*.

The best fishing season appeared to be from June to October in the west coast and August to December in the south coast.

The major components of *Amblygaster sirm*, *Sardinella albella* and *Sardinella gibbosa* were caught within the size ranges of 10.0-22.5cm, 11.0-13.0cm and 11.0-15.0cm respectively. However, smaller sized fish of above species of sizes between 6.9cm to 9.7cm total length were incidentally caught in the gill nets operated for small Engraulids with a stretched mesh size of 1.6cm.

The overall catch rate for the major fish landing centre at Negombo indicated an increase from 38.5 kg/boat trip during 1984–1990 period to 49.5 kg/boat trip during 1995–1997 period. The catch rate for the dominant species *Amblygaster sirm* has decreased from 28.17 kg/boat trip during 1983 – 1990 period to 17.47 kg/boat trip during 1995 – 1997 period at Negombo.

The paper also discusses the changing overall catch rates, change in species abundance and possible management consequences that should be considered.

Introduction

Marine small pelagic fish species form an important part of animal protein requirements of Sri Lankans with a per capita consumption of 18.0kg per year. They constitute over 40% of the marine fish production of the country. Around 90% of these fishes are caught by small meshed gill nets while beach seines contributing around 8%. The status of these fisheries has been analysed since early 1980's (Karunasinghe and Fonseka 1985, Karunasinghe and Dayaratne 1997a, Karunasinghe and Dayaratne 1997b and Dayaratne and Karunasinghe 1994). Several analyses based on population dynamics of dominant species has also been recorded by Siddeek *et al.* 1985, Karunasinghe 1987, Karunasinghe and Wijeyaratne 1991, Dayaratne and Sivakumaran 1995. Some of these studies from localised areas indicate that the stocks of the dominant species are exploited to the optimum level. However, recent studies on *Amblygaster sirm* based on genetic identification indicate that the stocks around Sri Lanka are of the same maternal origin (unpublished data). Therefore, attempts are now underway to analyse the stocks around Sri Lanka considering them as one stock. The present study aims at analysing the catch rates of different species encountered in the small meshed gill nets operated by mechanised fibre reinforced plastic (FRP) boats from Negombo to Tangalle during 1995-1997 period and comparing them with records available since 1983. Non mechanised traditional crafts and mechanised traditional crafts were not considered in this study as the major contribution comes from the FRP boats. However, in Oluvil as the fishery is carried out only by non mechanised and mechanised traditional crafts the latter crafts were considered for this study.

Material and Methods

Catch, effort statistics and species composition of the small meshed gill net fishery operated by mechanised FRP boats were collected from

Negombo in the west coast, Beruwala from the south west coast and Matara and Tangalle from the south coast of Sri Lanka during 1995-1997 period. Data was collected from around 10 boats per day selected randomly from each landing centre in every other day for ten days a month. The abundance in terms of catch rate was estimated as catch per boat trip. The depth of fishing, stretched mesh sizes and the number of net pieces used in this fishery against each boat were also recorded. The total lengths of economically important species were also noted down to nearest 0.1cm.

In the field only the Clupeids and other major species were identified to the species level while pony fishes and *Thryssa spp.* were identified to the genus level. Most rock fishes, most Carangids, half beaks, gar fish and flying fish etc. were grouped into their respective families. The squids and cuttle fish were grouped as Cephalopods. All other fish encountered in the catch and not listed in the tables were grouped as 'other' fish.

The catch rates and species composition and other relevant information were compared with the previous records and estimates made on this fishery since 1983 and available in the data base.

Results

Fishery

Small pelagic fishery is carried out using small meshed gill nets with mesh sizes ranging from 0.9 to 6.25cm. The depth of fishing also varied from 6 to 70 meters depending on the area of operation. Fishing was usually carried out in the early morning hours before dawn or sometimes after dusk. Each craft carried around 9-24 pieces of net. A summary of the fishing operations are given below.

Fishing season

The best fishing season in the west coast during 1997 was from June to October (Fig 1). In the south coast the best season was from August to December.

A summary of the fishing operations from the study area

Area	Type of craft	Mesh size range (cm)	No.of pieces of net *	Depth of fishing (m)	Height of .net (m)	No.of fishing trips per day
Tangalle	FRP boat	1.25-3.0	15-30	6 to 56	10-20	1 to 2
Matara	FRP boat	3.0-3.1	10 to 22	60-70	10-20	1 to 2
Beruwala	FRP boat	1.25-6.25	9 to 20	20-30	10-20	1 to 2
Negombo	FRP boat	0.9-3.75	16 to 24	14-40	10-20	1

**a single net piece with mesh sizes between 2.8-3.75cm have 1500 x 250 meshes
a single net piece with mesh sizes between 0.9 to 1.25 have 3000 x 500-600 meshes*

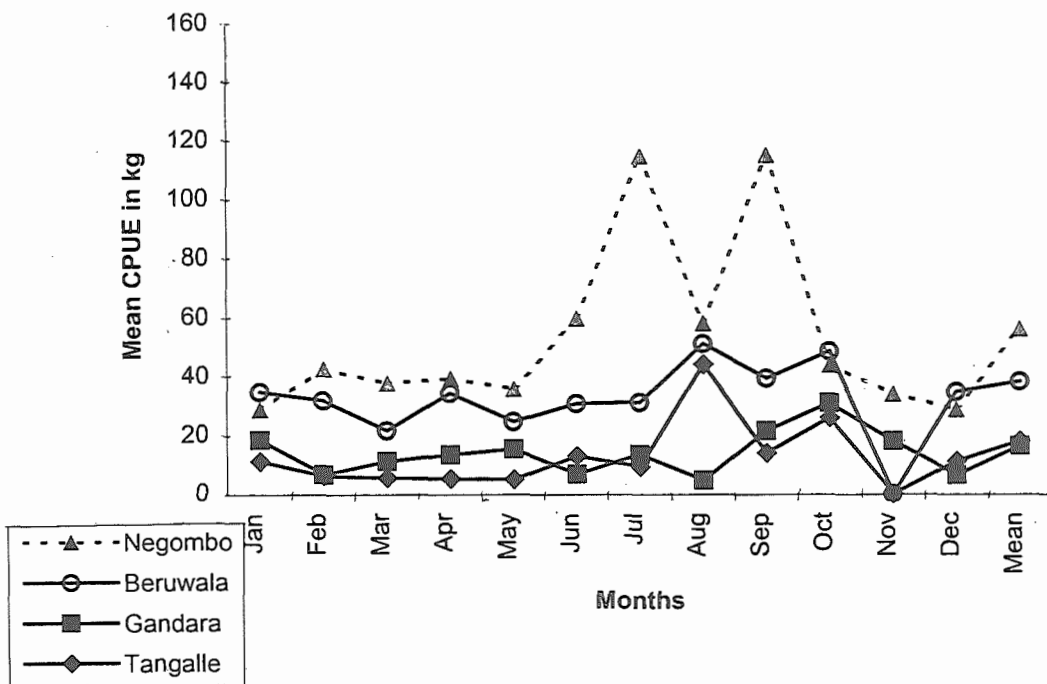


Fig.1: Monthly variation of the total mean CPUE during 1997

Species composition

Over 65 species have been identified from this fishery. The data for all areas during 1997 showed that *Amblygaster sirm* was the dominant species followed by *Sardinella gibbosa*, *Sardinella albella* and *Selar crumenophthalmus*. In all areas except Tangalle *Amblygaster sirm* was the dominant fish species contributing between 33.5 to 43.3% to the catch (Table 1)). At Tangalle the contribution by *A.sirm* was 22.1%. Tangalle showed an exceptionally low contribution of 3.9kg per boat trip of *A. sirm* while *Sardinella sindensis* was the dominant with a contribution of 7.9kg per boat trip. At Negombo and Beruwala a considerable proportion of the catch (21-22%) consisted of 'other' species such as skates, small sharks sail fish etc. caught incidentally. At Beruwala, Matara and Oluvil 11.5-16.9% of the catch composed of *Selar crumenophthalmus*. At Matara around 3.7% of the catch consisted of high valued *Scombridae spp*. The overall catch composition also consisted of 42.6% *Amblygaster sirm* followed *Sardinella giibosa*, *S.albella* and *Selar crumenophthalmus* contributing 19% 5.6% and 5.2% respectively during 1997. Around 11% of the overall catch consisted of incidentally caught other varieties such as sail fish, sharks, skates etc.

A comparison of overall species composition of this fishery during 1995,1996 and 1997 is given in Table 2. The species composition during 1995 and 1996 also showed a dominance of *A.sirm* in the overall species composition (28.6 to 54.6%). The overall contribution by *Sardinella spp* alone varied from 26-36% during 1995-1997 period. The catch composition in all three years indicated the dominance of species feeding on plankton, small benthic invertebrates and crustaceans. The proportion of macro carnivores such as *Chirocentrus dorab*, *Shyraena spp*, *Scomberomorus spp*, *Lepturacanthus spp* and *Megalasis cordyla* were less than 2% of the catch. Incidentally caught mega carnivores such as sharks, rays, skates and sail fish formed around 1-11% of the catch.

The contribution of clupeids to the fishery during 1997 were 64.6%, 37%, 45% and 81% in the areas of Negombo, Beruwala, Matara, and Tangalle respectively (Table 1). The contribution of Clupeids in this region however, has remained same over the years at 37%. At Beruwala the catch composition was 0.25-10% Engraulids in 1995-97 period.

Size of major species

At Negombo the dominant species *Amblygaster sirm* was caught within the size range of 6.9cm to 22.5cm total length. Small sized fish of *A. sirm* between 6.5-9.5cm total length were mostly caught in the gill nets operated for smaller Engraulids with a stretched mesh size of 1.6cm. However, in other areas the size range of *Amblygaster sirm* caught in gill nets ranged from 10.0- 22.5cm (Fig.2). *Sardinella albell* was caught within the size range 11.0-13.0cm total length while occasional smaller fishes between 6.0-9.0cm total length were caught in the nets operated for smaller Engraulids at Negombo and Beruwala. *Sardinella gibbosa* was caught mainly within the size range of 11.0-15.0cm total length in all areas except for occasional catches of fish of the size range 6.5-9.5cm total length caught similarly in the nets operated for smaller Engraulids at Negombo and Beruwala.

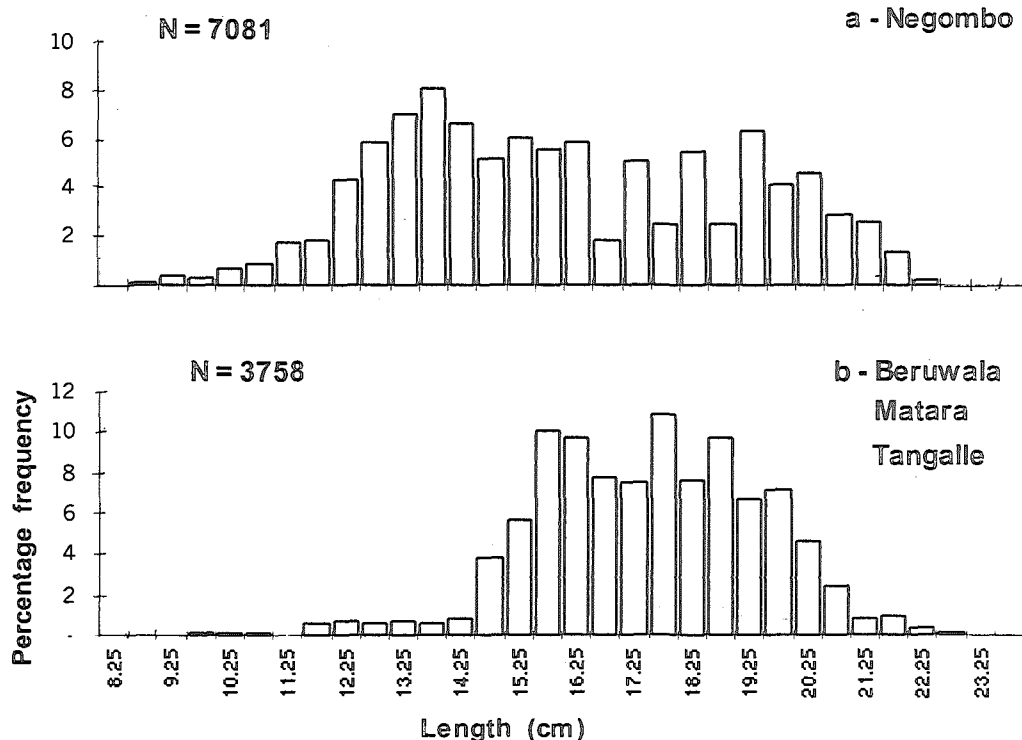


Fig.2: Length frequency distribution of *A. sirm* caught by gillnets during 1995 - 97 period.

(a) Lengths recorded from Negombo

(b) Lengths recorded from Beruwala Matara & Tangalle

Catch rate

In 1997 the best mean annual catch rate of 56.2kg per boat trip was produced from Negombo. This was followed by 38.2kg per boat trip for FRP boats from Beruwala (Table 1). A comparison of the overall catch rate between 1997 and the previous two years showed that the overall mean catch per boat trip for all areas was around 3.3kg and 17.0kg less than from the estimate for 1996 and 1995 (Table 2). Average catch rate for the whole area was estimated at 47.5kg/boat during 1995-1997 period. The catch rate of *A.sirm* at Negombo was 17.47kg/boat during the period 1995-1997.

The mean catch rates and the average of mean catch rates during the past years for different areas are given below. Table 3. shows a slight decrease in the catch rates from 1995 onwards.

Mean catch rates of the small meshed gill net fishery during different years.

	1995	1996	1997	1995-97
Tangalle	21.29	7.32	17.89	15.5
Matara	34.99	25.63	16.19	25.6
Beruwala	26.15	67.85	38.22	44.0
Negombo	61.34	30.93	56.16	49.4
Average	57.83	44.11	40.77	47.57

Discussion

The fishery has developed over the years in respect of fishing season, gear and the type of species caught. The best fishing season in the west coast was from June to October during 1997. Records of early 1980's (Karunasinghe 1990), 1995 and 1996 indicate that the best fishing season for the west and south coasts were from April to November and August to December respectively.

In Tangalle and Beruwala the use of nets with mesh sizes ranging from 1.25-1.5cm used for the capture of smaller Engraulids were recorded during the present study in addition to 2.8-3.0cm mesh sizes which were in use during early 1980's (Karunasinghe and Fonseka 1985). At Negombo the use of smaller mesh size of 0.9cm in addition to the 1.25-1.5cm nets for the capture of smaller Engraulids were recorded. In early 1980's

fishing has not taken place during the peak monsoonal months of May-June in Tangalle and April to August in Beruwala (Karunasinghe and Fonseka 1985). However, the study during 1995-1997 showed that fishing takes place through out the year in all areas. This extension of the fishery towards monsoonal months could be due to the experience gained on craft navigation and gear handling over the years.

The number of species caught in this fishery has increased over the years. This is supported by the fact that only 30 species have been identified from the catches of early 1980's while currently the catch was composed of over 65 species. Records of early 1980's indicate that the contribution by clupeids were 91%, 37%, 73% and 93% in the areas of Negombo, Beruwala, Matara and Tangalle (Karunasinghe and Fonseka 1985). The entry of considerable proportions of *Selar crumenophthalmus* in areas of Beruwala, Matara and Negombo, *Megalaspis cordyla* at Beruwala and incidentally caught varieties such as sharks, skates, rays, sail fish, rock fish and Carangids from all areas during the 1990's are noteworthy. This indicates that currently at Negombo, Matara and Tangalle the fishery is targeting on additional species compared to early 1980's. This could be a result of increase in abundance of these varieties over the years. However, *Amblygaster sirm* has dominated the catches for the past 15 years.

Present study indicates that *A. sirm* was caught within the size range of 6.9-22.5cm total length. This indicated a gradual shifting towards smaller fish sizes from 10.0cm minimum total length in early 1980's to 6.9cm presently compared with Siddeek *et al* 1985. However, majority were caught within the size range from 10.0-22.5cm and this was the same size range of *A. sirm* caught in gill net fishery in the west and south coasts during early 1980's (Siddeek *et.al.* 1985 and Karunasinghe 1987).

The total mean catch rates for the areas between Negombo and Tangalle for 1980's (Karunasinghe and Fonseka 1985 and Dayaratne and Karunasinghe 1994) are given below. This indicates that in Negombo, Beruwala and Matara the catch rates have increased by about 9-10kg per boat trip. However, in Tangalle the catch rates during 1995-1997 has reduced by around 10kg per boat trip compared to the period between 1983-1990.

Average of mean total catch rates recorded in kg/boat trip

	Negombo	Beruwala	Matara	Tangalle
Mean 1983-1990*	40.45	25.00	14.4	25.60

Source *Karunasinghe and Fonseka 1985 and Dayaratne and Karunasinghe 1994

The overall average of mean catch rates for all areas has increased from 23.8kg per boat trip in 1984 to 28.9kg per boat trip in 1989/90 (Karunasinghe 1990 and Dayaratne and Karunasinghe 1994). This has further increased to 57.83kg per boat trip in 1995 and has decreased by about 13.7- 17.0kg per boat trip in 1996-1997 period. The increase of the number of species encountering the fishery could be the reason for the increase in catch rates up to 1995.

Mean catch rates of the small meshed gill net fishery during different years

	1984 *	1989/90 **
Tangalle	24.18	27.00
Matara	09.70	19.10
Beruwala	19.00	31.00
Negombo	42.40	38.50
Average	23.82	28.90

Source * Karunasinghe 1990 and ** Dayaratne and Karunasinghe 1994

Average of mean catch rate for *A.sirm* from Negombo was 28.17kg/boat trip during 1983-1990 period (Karunasinghe 1990 and Dayaratne and Karunasinghe 1994) and this has declined by 10kg/boat trip during 1995-1997 period. In 1996 and 1997 the contribution by clupeids have declined considerably while the contribution by others such as sharks, skates and rays, seer fish (Scombridae), rock fish and Carangids have increased 3 to 5 times compared to 1995 (Table 2). It is unfortunate that the data available for the 1980's do not carry a detail breakdown of the catch rates of species such as Scombridae, rock fish, Carangids and cartilagenous fish. Therefore it is difficult to come to a conclusion on the impact of these fishes on the clupeid stocks.

It is obvious from this study that the mean catch rate of the dominant species *Amblygaster sirm* at Negombo has declined by about 10kg per boat trip during the past 15 years. The contribution of Clupeids in areas of Negombo, Matara and Tangalle has also declined by around 28%, 28% and 12% respectively during the past 15 years (Table 1 compared with Karunasinghe and Fonseka 1985).

Table 1: Annual mean catch rate and percentage species composition summary in the small mesh gill net fishery during 1997

	Annual Mean CPUE					% Species Composition				
	Negom-bo	Beru-wala	Mat-ara	Tan-galle	Mean CPUE for all areas	Negom-bo	Beru-wala	Mat-ara	Tan-galle	All areas
<i>Amblygaster sirm</i>	20.17	12.80	7.01	3.94	17.38	35.91	33.48	43.28	22.11	42.53
<i>Sardinella gibbosa</i>	12.35	1.16	0.00	0.00	7.92	22.00	3.04	0.00	0.00	19.38
<i>Sardinella albella</i>	3.80	0.27	0.01	2.69	2.29	6.77	0.70	0.06	15.09	5.60
<i>Sardinella sp.</i>	0.71	0.01	0.50	7.95	1.13	1.27	0.03	3.09	44.59	2.76
<i>Encrasicholina heteroloba</i>	1.45	0.43	0.01	0.02	0.81	2.57	1.13	0.07	0.08	1.98
<i>Stolephorus sp.</i>	2.06	0.12	0.00	0.00	1.09	3.68	0.31	0.00	0.00	2.67
<i>Thryssa spp.</i>	0.99	0.09	0.01	0.14	0.76	1.76	0.23	0.04	0.76	1.86
<i>Leiognathus spp.</i>	0.49	0.12	0.00	0.25	0.32	0.88	0.33	0.03	1.42	0.78
<i>Pellona sp.</i>	0.37	0.30	0.00	0.39	0.26	0.65	0.78	0.00	2.21	0.64
<i>Dussumieria acuta</i>	0.22	1.17	0.15	0.54	0.31	0.39	3.06	0.92	3.04	0.76
<i>Chirocentrus dorab</i>	0.00	0.53	0.01	0.05	0.07	0.01	1.39	0.06	0.28	0.17
<i>Sphyraena sp.</i>	0.17	1.74	0.96	0.18	0.43	0.31	4.56	5.91	1.02	1.05
<i>Decapterus sp.</i>	0.01	0.21	0.67	0.04	0.09	0.02	0.55	4.13	0.23	0.22
<i>Rastrelliger kanagurta</i>	0.09	0.92	0.21	0.04	0.30	0.16	2.42	1.27	0.23	0.73
<i>Selar crumenophthalmus</i>	1.04	4.42	2.74	0.03	2.13	1.84	11.55	16.89	0.14	5.21
<i>Cephalopod</i>	0.00	0.01	0.65	0.01	0.07	0.00	0.02	3.98	0.03	0.17
<i>Carangidae</i>	0.00	0.23	0.00	0.01	0.04	0.00	0.59	0.00	0.04	0.10
<i>Scomberomorus sp.</i>	0.00	0.75	0.58	0.05	0.00	0.00	1.96	3.55	0.27	0.00
<i>Rock Fish</i>	0.00	0.35	0.41	0.48	0.14	0.00	0.92	2.53	2.71	0.34
<i>Hemiramphidae</i>	0.00	0.22	0.00	0.00	0.03	0.00	0.56	0.00	0.00	0.07
<i>Others</i>	12.28	12.62	2.27	1.02	5.39	21.87	33.01	14.02	5.74	13.19
Total	56.17	38.23	16.17	17.83	40.77					

Table 2: Mean catch per boat and percentage contribution for the area between Negombo and Kirinda for FRP boats

	1997	1996	1995	1997	1996	1995
No. of boats sampled	3960	2878	2695	%	%	%
<i>Amblygaster sirm</i>	17.38	12.62	27.19	42.63	28.61	47.02
<i>Sardinella gibbosa</i>	7.92	9.39	11.56	19.43	21.29	19.99
<i>Sardinella albella</i>	2.29	6.64	8.96	5.62	15.05	15.49
<i>Sardinella sp.</i>	0.76	0.19	0.21	1.86	0.44	0.25
<i>Encrasicholina heteroloba</i>	0.81	3.81	0.86	1.99	8.65	0.99
<i>Stolephorus sp.</i>	1.09	0.11	1.02	2.67	0.24	1.18
<i>Thryssa spp.</i>	0.76	1.31	1.10	1.86	2.96	1.27
<i>Leiognathus spp.</i>	0.32	0.23	0.41	0.78	0.52	0.48
<i>Pellona ditchella</i>	0.26	0.41	0.04	0.64	0.93	0.05
<i>Dussumieria acuta</i>	0.31	1.24	0.31	0.76	2.81	0.36
<i>Opisthopterus tardoore</i>	0.02	0.06	0.07	0.05	0.13	0.09
<i>Escualosa thoracata</i>	0.35	0.57	0.73	0.86	1.28	0.85
<i>Chirocentrus dorab</i>	0.07	0.26	0.33	0.17	0.59	0.38
<i>Decapterus sp.</i>	0.09	0.13	0.64	0.22	0.30	0.74
<i>Rastrelliger kanagurta</i>	0.30	0.32	0.40	0.74	0.72	0.46
<i>Selar crumenophthalmus</i>	2.13	1.67	0.98	5.22	3.79	1.13
<i>Cephalopod</i>	0.08	0.58	0.12	0.20	1.32	0.14
<i>Sphyraena spp.</i>	0.43	0.26	1.10	1.05	0.59	1.28
<i>Rock fish</i>	0.06	0.00	0.00	0.20	0.00	0.00
<i>Carangidae</i>	0.07	0.00	0.00	0.17	0.00	0.00
<i>Otolithus spp.</i>	0.01	0.00	0.00	0.02	0.00	0.00
Others	5.21	4.32	1.68	12.78	9.78	2.91
Total	40.77	44.11	57.83	100	100	100

**Table 3: Mean CPUE in different areas for FRP boats
between 1995 and 1997.**

	Negombo			Kalutara			Matara			Tangalle		
	1997	1996	1995	1997	1996	1995	1997	1996	1995	1997	1996	1995
<i>Amblygaster sirm</i>	20.17	10.26	32.97	12.80	5.40	6.38	7.01	4.86	12.18	3.94	2.92	17.55
<i>Sardinella gibbosa</i>	12.35	8.40	15.48	1.16	1.10	0.00	0.00	0.03	0.07	0.00	0.00	0.00
<i>Sardinella albella</i>	3.80	5.87	8.13	0.27	0.95	2.07	0.01	0.07	0.00	2.69	1.10	0.00
<i>Sardinella sp.</i>	0.71	0.60	0.64	0.00	1.06	0.86	0.37	0.19	0.53	8.00	0.80	2.42
<i>Stolephorus sp.</i>	2.06	0.09	0.84	0.10	0.06	0.25	0.00	0.03	0.00	0.00	0.02	0.00
<i>Thryssa spp.</i>	0.99	1.15	0.81	0.09	0.04	0.00	0.01	0.07	0.23	0.14	0.00	0.00
<i>Leiognathus spp.</i>	0.49	0.19	0.34	0.12	0.13	0.16	0.00	0.02	0.00	0.26	0.52	0.32
<i>Pellona ditchella</i>	0.37	0.34	0.04	0.30	0.07	0.00	0.00	0.00	0.00	0.39	0.00	0.00
<i>Dussumieria acuta</i>	0.22	0.99	0.14	1.17	0.25	0.00	0.15	0.81	0.61	0.54	0.02	0.29
<i>Chirocentrus dorab</i>	0.00	0.00	0.06	0.53	2.63	0.00	0.01	0.06	0.16	0.05	0.00	0.00
<i>Decapterus sp.</i>	0.01	0.00	0.38	0.21	0.03	0.33	0.67	0.95	0.25	0.04	0.20	0.21
<i>Rastrelliger kanagurta</i>	0.09	0.01	0.01	0.92	2.68	0.05	0.21	0.43	1.59	0.04	0.16	0.30
<i>Cephalopod</i>	0.00	0.00	0.00	0.01	0.00	1.23	0.64	3.16	2.38	0.01	0.01	0.00
<i>Sphyraena spp.</i>	0.17	0.10	0.33	1.74	0.16	0.56	0.96	1.02	12.34	0.18	0.05	0.00
<i>Carangidae</i>	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
<i>Rock fish</i>	0.00	0.00	0.00	0.28	0.00	0.00	0.46	0.00	0.00	0.49	0.00	0.00
Others	14.94	2.95	1.31	21.75	56.99	15.51	5.70	13.96	4.68	1.28	1.73	0.24
Total	56.16	30.93	61.34	38.22	67.85	26.15	16.19	25.63	34.99	17.89	7.32	21.29

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