

Purse seining for Small Pelagic Fish around Sri Lanka

By

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Introduction

THE Skipjack Fishery Development Project conducted with the assistance of UNDP/FAO initially investigated the availability of small pelagic fish species suitable for use as Skipjack live bait. Subsequently, the programme of work was expanded to include the resources survey of the commercially important small pelagic fish varieties in the coastal waters around Sri Lanka.

The results of the survey carried out during the period September 1972 to October 1973 has been published in the form of a preliminary report (*Bull. Fish. Res. Stn. Cey., Vol. 25, 1974*). The results of the investigations carried out during that period made a very significant contribution towards improving the survey techniques and fishing operations during the period under review.

Though no new or additional fishing grounds were covered during the second year (November 1973 to October 1974) the results of the survey for live bait resources and small pelagic fishes showed considerable improvement, and the purse seine established itself as a very efficient gear for the exploitation of small pelagic fish from the coastal waters of the island.

In the present paper, an attempt has been made to observe the availability of Skipjack live bait and other small pelagic fish varieties, seasonal variations in their distribution, species and size composition etc. based on the results of the investigations carried out from September 1972 to October, 1974.

The programme of work will be continued and will cover ; investigations for live bait and small pelagic fish in areas not already investigated ; trials for improving the keeping quality of live bait fish varieties available around the island and, trying out of other bait fishing methods and efficient exploitation of small pelagic fish utilising existing fishing boats and crafts.

Materials and Methods

The two 11-ton class steel vessels used for the survey during the first year were handed back to the C.F.C. and the survey during the second year was conducted using a 38 ft. G.R.P. boat acquired by the Department of Fisheries. This vessel was equipped and fitted with an echosounder (basdic), a winch (Make-Rapp Fabrikker. Double warping horizontal head with a hauling speed of 30 meters minute per head) and a generator (Make—Honda, Power 2 KW, voltage 110v) for purse seine fishing with light attraction by the FAO Masterfisherman, Mr. G. Pajot.

The method of survey was the same as in the first year, viz : echosounding and surface look out during the day time, and light attraction within most suitable and specific areas in the night. Surface lamps each of 500 watts intensity were used for attraction of pelagic fish. The total light intensity

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used for attraction was varied to determine the effect of such variations on the catches. On the west coast a light intensity of 1500 watts was used between December, 1973 and January, 1974. This was increased to 3000 watts between February and May, 1974, in the same area. In the east coast from May to October, 1974, the light intensity used was 2500 watts. The possible effects of this variation of light intensity on the catches will be discussed later.

The lampara net, which failed to compare favourably with the performance of the purse seine, was not used in fishing operations during the period under review. The dimensions of the purse seine used during 1973/74 is given below and this net was smaller than the one used during 1972/73.

Hung length along :	
Cork Line	.. 175 M
Lead Line	.. 175 M
Stretched depth	.. 31 M
Hanging ratio	.. 0.80
Mesh size :	
in body	.. 16 m.m. SM
in bunt	.. 10 m.m. SM

As in the previous year the areas investigated depended on the monsoon wind patterns. From December, 1973 to April, 1974, survey and fishing operations were carried out on the west coast areas. With the onset of South-West monsoon, investigations were shifted to the east coast areas from May, 1974 to October, 1974.

The same procedure adopted in the first year as regards the method of survey, fishing operations and sampling of catches were adhered to during the period under review too. An account on these various aspects of the survey appears in the preliminary report. Statistics of the catches made during the experimental fishing operations were reported by the Masterfisherman. Sampling of the catches were done by the author and other Department officers who went on board the vessel periodically during the survey programme.

Results and Analysis

During the survey period under consideration, emphasis was given to those areas which provided the best results during the first year of investigations. Therefore, the main areas investigated during this second year were 'W' and 'SW' on the west coast and 'NE' and 'E' on the east coast. The total number of light stations, fishing effort and the catches obtained in different areas during 1973/74 is given in table I.

TABLE I

Light Stations, Fishing effort and catches obtained by the Purse Seining in different Areas

Area	No. of Light Stations	No. of Sets	Total Catch (KG)	AV. Catch/Set
W	.. 55	.. 37	.. 16,300	.. 440.5
SW	.. 32	.. 18	.. 7,441	.. 413.4
NNE	.. 9	.. 8	.. 6,700	.. 837.5
NE	.. 111	.. 105	.. 74,539	.. 709.8
E	.. 26	.. 26	.. 12,147	.. 467.1

Fishing operations were attempted in 83% of the total number of light stations, the corresponding figure for 1972/73 being 65%. On an area wise basis, the percentage of successful light stations were, W-67% ; SW-56% ; NE-94% and E-100%. The catch per unit of effort for all these areas compare favourably with those obtained for the same areas during 1972/73.

Percentage Species Composition by Area

The percentage composition of the major varieties of pelagic fish caught by the purse seine in the different areas investigated is given in table II.

TABLE II

Percentage Composition of the Major Varieties of Pelagic Fish caught by the Purse Seine in the different Areas

	West Coast (Nov. '73 April '74)		East Coast (May '74 Oct. '74)		
	W	SW	NNE	NE	E
Sardine ..	34.5	30.1	76.5	43.2	46.2
Herring ..	6.5	23.4	1.3	29.2	44.6
Red Bait ..	30.8	10.8	—	6.4	3.5
Anchovy ..	13.6	15.0	19.2	3.8	—
Silver Belly ..	1.2	8.1	—	—	—
Carangids ..	2.0	1.3	2.6	10.2	1.9
I. Mackerel ..	2.7	1.0	—	2.6	—
Squids ..	4.4	5.2	—	1.0	—

In the area 'W', Sardines (34.5%) Red bait (30.8%) and Anchovy (13.6%) dominated the catches. The percentage values of sardines and red bait are more or less similar to the percentages of sardines and red bait obtained in 1972/73. The percentage of herrings in the catches made off 'W' showed a drop from 24% in 1972/73 to 6.5% in 1973/74.

Sardines (30.1%), Herrings (23.4%), Anchovy (15.0%) and red bait (10.8%) were the dominant varieties in the catches made off 'SW' region. In 1972/73 the percentage of sardines in the species composition was 67.7% while for herrings and red bait, the percentage values were 8.0% and 8.4% respectively.

On the east coast, sardines (43.2%) herrings (29.2%) and smaller varieties of carangids (10.2%) were the dominant varieties in the catches made off the area 'NE'. The percentage of sardines and herrings in the species composition obtained for 1972/73 for 'NE' were 31.3% and 18.6% respectively. The carangids which contributed 26.6% to the catches in 1972/73 made only 10.2% contribution to the species composition in 1973/74. This could probably be due to the fact that the Back Bay area off Trincomalee, which was a very productive area yielding good catches of carangids in 1972/73, was not available for investigations and fishing trials during the period under review.

The percentage of sardines and herrings in the catches made during fishing operations in the area 'E' were 46.2% and 44.6% respectively. The percentage of sardines in the species composition of the catches in 1973/74 was the same as that observed during 1972/73, while the percentage of herrings

in catches has improved considerably from 12.6% in 1972/73 to 44.6% in 1973/74. On the other hand, percentages of red bait and carangids were lower than in the previous year.

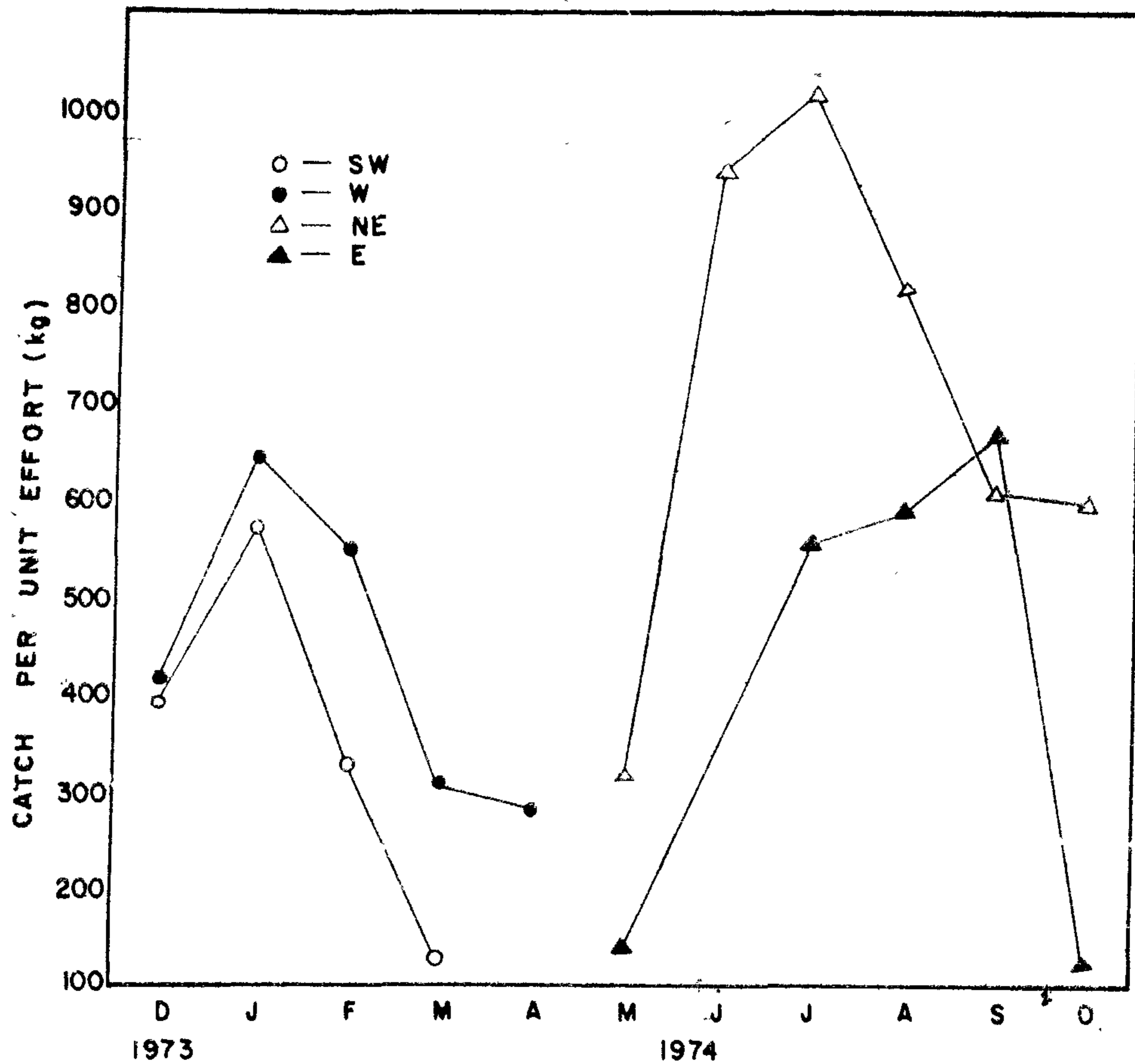


Fig. 1.—Monthly variation in catch per unit effort for different areas.

Seasonal Variation of Major Varieties

The monthly variation in the catch per unit of effort for the different areas is given in figure 1. A strikingly similar pattern was observed in the areas 'W' and 'SW'. High values observed during December and January showed a gradual decrease from January to April in both these areas. It was also seen that the catch per unit effort values obtained in the area 'W' in different months were higher than the corresponding values obtained in the area 'SW'.

Figure 2 shows the monthly variation of the major varieties of pelagic fish in the different areas investigated. In the area 'W' catches of sardines showed high values in December, February and April while in January and March, sardines recorded less than 100 kg. per set. Red bait catches showed a maximum in February and then a gradual decline from February to April. Catches of herrings, recorded between January and March, were less than 100 kg. per set in this area. It should be mentioned that in the area 'W' during 1972/73, catches of Sardines improved from February onwards while red bait was present from February to April. Good catches of herrings too were recorded in February to April period.

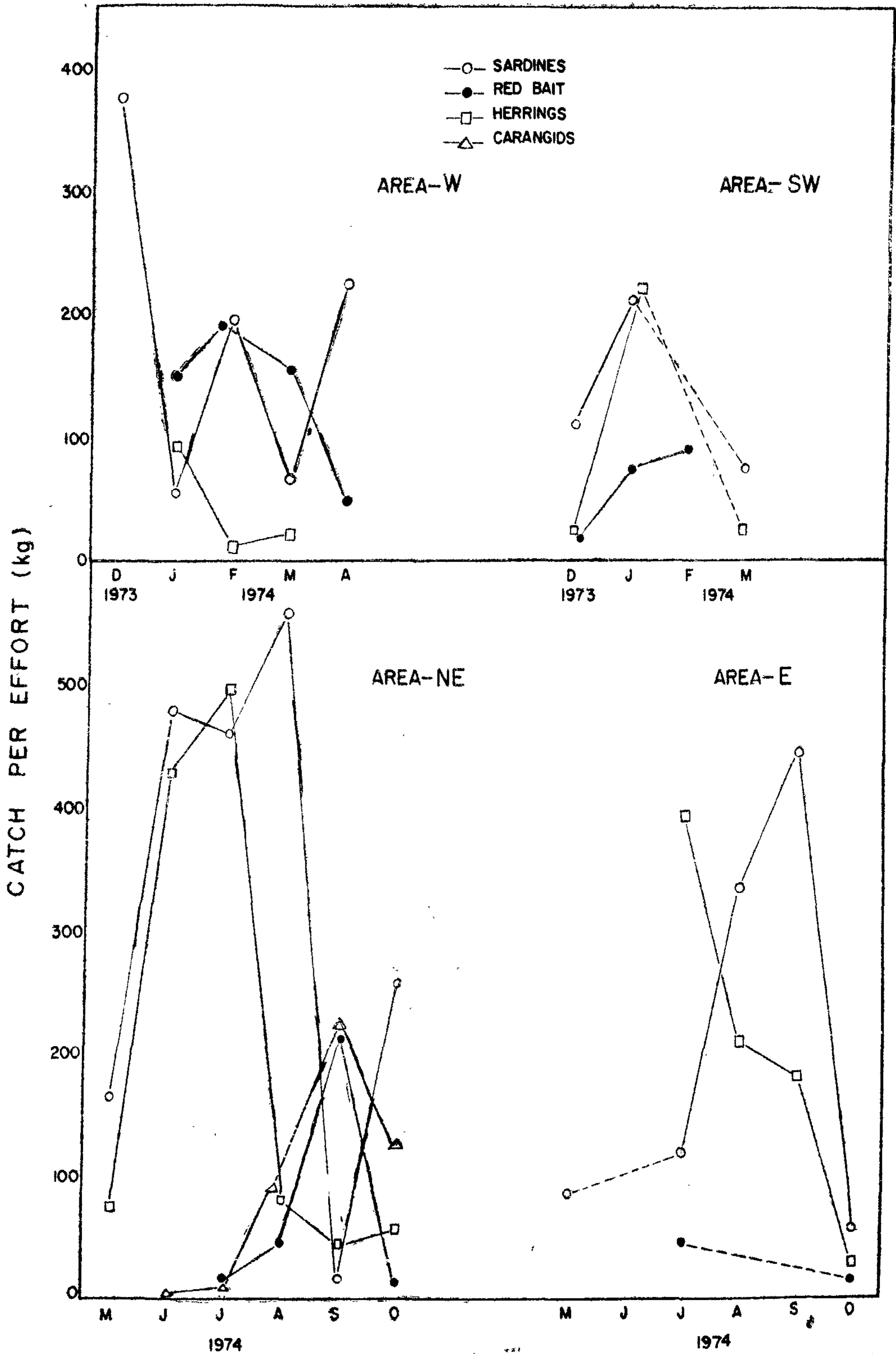


Fig. 2.—Monthly variation in major varieties of pelagic fish in different areas.

It is seen from figure 2 that in the area 'SW', the catches of sardines and herrings increased from December to January and then declined towards March. Red bait catches showed an increase from December to February.

Although the monthly variation in the catch per unit effort for the areas 'W' and 'SW' showed a similar pattern, no clear cut trends were observed as regards the monthly variation of the major varieties in those two areas.

On the east coast areas, high monthly catch rates were obtained during June, July, August and September (fig. 1). In 'NE' the monthly catch increased from about 300 Kg. per set in May to about 1000 Kg. per set in July and then dropped gradually to record 600 Kg. per set in October.

Fig. 2 shows that the monthly catch of sardines in 'NE' has increased from May to August. Catches of sardines dropped to a very low level in September and then increased again in October. Catches of herrings closely followed the monthly variation in the catch per set observed for sardines from May to July. From August to October, catches of herrings have dropped to less than 100 Kg. per set in 'NE'. Smaller varieties of carangids which first appeared in July increased gradually to a maximum in September and then declined towards October. Red bait catches too followed the same monthly variation pattern as the carangids, increasing from July to September and then showing a decrease in October.

In the area 'E', it is seen from figure 1 that there was an increase in the monthly catch per effort value from May to September and then a steep drop in October. The monthly catch per effort values obtained in the area 'E' were also lower than those observed in the area 'NE'. From figure 2 it is seen that catches of sardines gradually increased from May to a maximum in September. Catches of herrings showed just the reverse trend, declining gradually from June to October.

A significant contribution to the fish catches was made by the smaller varieties of carangidae, particularly in the sub-areas on the east coast. Their effect on the species composition and the seasonal variation of these varieties with the other major pelagic fish types was shown in the preliminary report. During 1973/74, the same pattern of seasonal variation was observed with regard to sardines, herrings and carangids in the sub areas 'NE' and 'E', but this seasonal pattern was not well marked in 1973/74 due to low catches of carangid species. As stated earlier this could be due to some areas being not available for investigations. As in 1972/73 these carangid species entered the catches from late July onwards. The seasonal variation of these different varieties of pelagic fish in the sub-area 'NE' from May to October 1974 is shown below :—

	<i>May-June</i>	<i>July-August</i>	<i>September-October</i>
Sardines 51.3	.. 56.5	.. 22.7
Herrings 34.6	.. 29.2	.. 8.0
Carangids..	.. —	.. 5.7	.. 28.8
Others 14.0	.. 7.2	.. 39.2

Size Composition of Major Species

The percentage composition of the fish catches in different areas given in table II shows that sardines, herrings, carangids, Anchovy and red bait to be the dominant varieties of pelagic fish caught by the purse seine in most of the areas investigated.

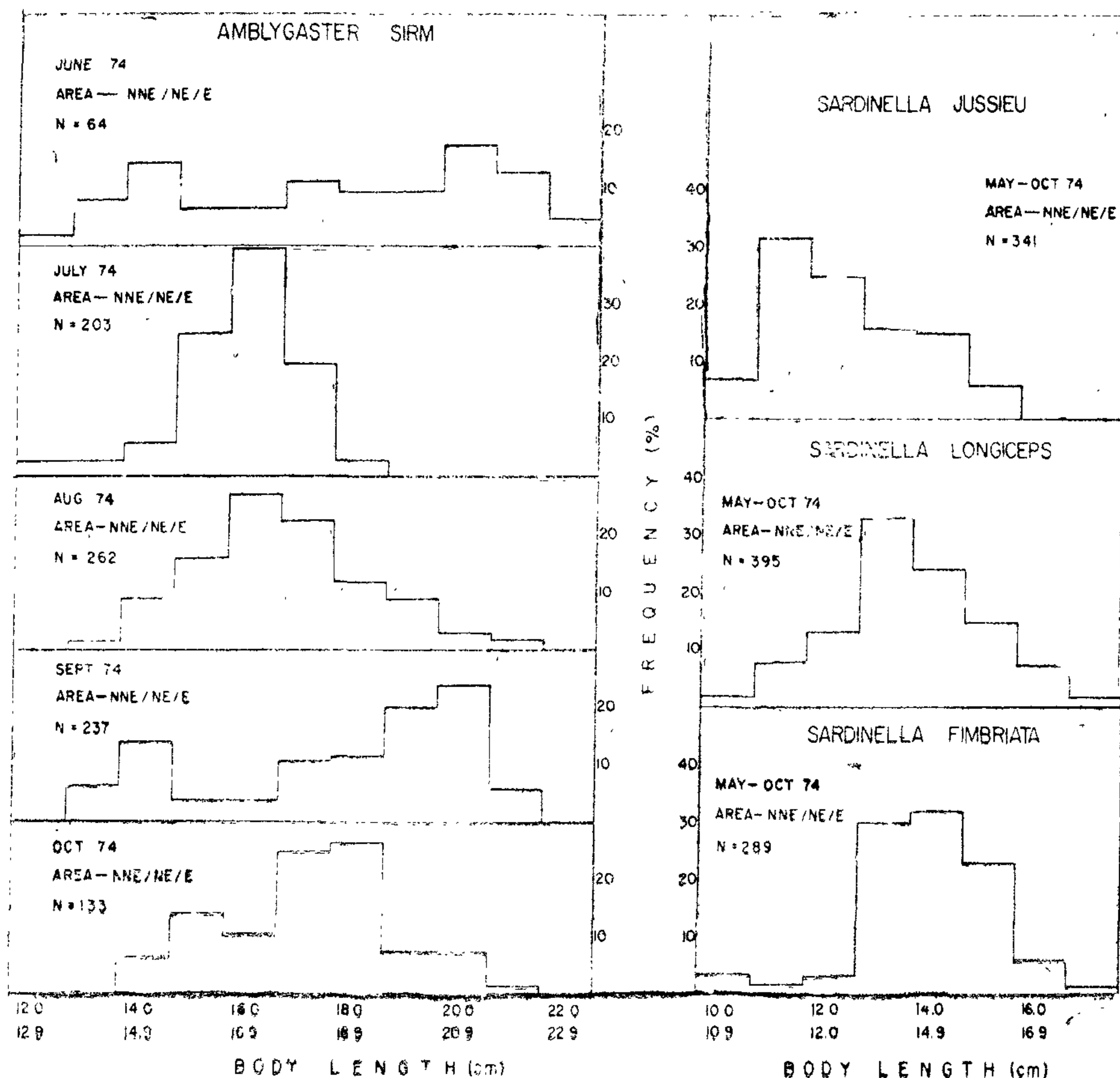


Fig. 3.—Length frequency distribution of Sardines and Herrings for different areas in the east coast.

Sardinella jussieu, *Sardinella longiceps* and *Sardinella fimbriata* were the most abundant species among the sardines. Length frequency distributions of these species of sardines caught in the east coast areas 'NE', 'NNE', and 'E' for the period May to October 1974 are given in figure 3. For *S. jussieu* the size range was from 9.7 cm. to 16.0 cm. with a unimodal distribution, and the mode at 11.0–11.9 cm. size group. During the first year (May to October 1973) the mode for *S. jussieu* was observed at 10.0–10.9 cm. size group in 'NNE' and at 12.0–12.9 cm. group in 'NE' and 'E'. *S. longiceps* had a size range of 10.0 cms. to 17.0 cms. and a unimodal distribution, with the mode at 13.0–13.9 cm. size group. The size range for *S. fimbriata* for these areas was from 10.4 cms. to 17.3 cm. The distribution was unimodal and the mode was observed at 14.0–14.9 cm size group.

The smaller variety of herrings, *Amblygaster sirm* was caught in large quantities in the areas 'SW', 'NE' and 'E'. Figure 3 shows the length frequency distribution of *A. sirm* for the months June to October, 1974, in the east coast areas 'NE' and 'E'. A bimodal distribution was observed for the month of June with a size range of 12.3 cms. to 22.5 cms.

One mode was observed at 20.0–20.9 cm. size group while the second mode was observed at 14.0–14.9 cm. size group. This second mode was observed at 16.0–16.9 cm. size group during the months July and August and at 20.0–20.9 cm. size group during September. Another mode, observed

in September at 14.0–14.9 cm. size group was again seen in October at 18.0–18.9 cm. size group. The size range of the samples measured were, 10.6 cms to 18.4 cm in July, 13.8 cm to 22.5 cms in August 13.0 cm. to 21.9 cm in September and 14.1 cm. to 21.4 cms in October.

Red bait was obtained in larger quantities in the west coast areas 'W' and 'SW' than in the east coast areas (Table II). In 'SW' the size range of red bait sampled was from 4.8 cm. to 10.0 cm. The distribution was unimodal with the mode observed at 7.6–8.0 cm size group. The size range for area 'W' was from 5.2 cm. to 10.2 cm. and the length frequency distribution was bimodal. The first mode was observed at 5.6–6.0 cm size group while the second mode was observed at 8.1–8.5 cm. size group (figure 4).

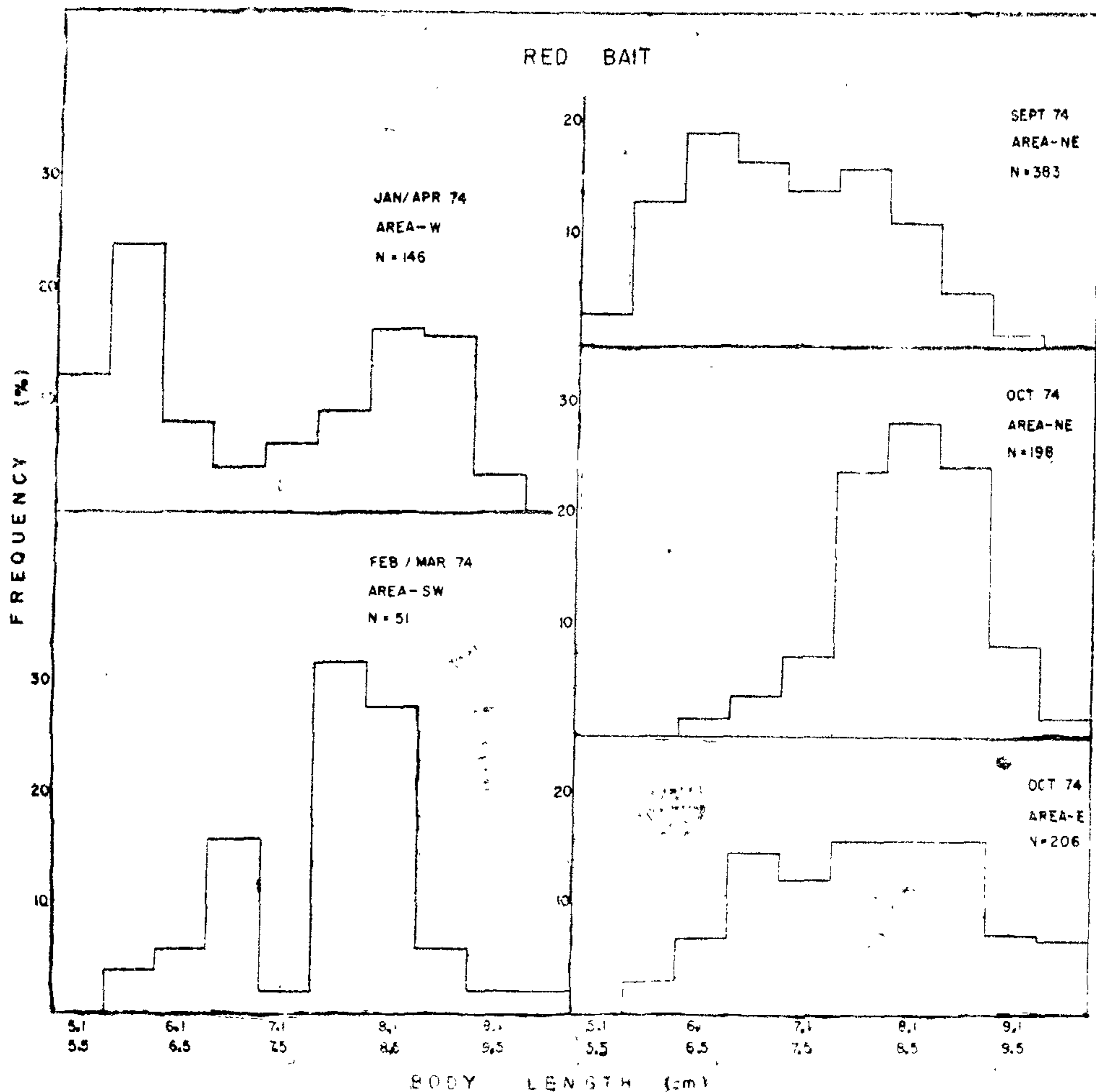


Fig. 4.—Length frequency distribution of Red Bait obtained for different areas.

On the east coast areas, good catches of red bait were obtained only in late August, September and October, 1974. Red bait sampled in the area 'NE' during the month of September had a size range of 4.9 cm. to 10.0 cm. The distribution was unimodal and the mode was observed at 6.1–6.5 cm. size group. In October, for the same area the size range of red bait sampled was from 6.3 cm. to 9.5 cm. and the mode had shifted to 8.1–8.5 cm. size group. The size range of red bait sampled in the area 'E' during October was from 5.4 cms. to 10.5 cm. The distribution was unimodal and the mode was seen to be spread between size groups ranging from 7.6 cms. to 9.0 cms. (figure 4).

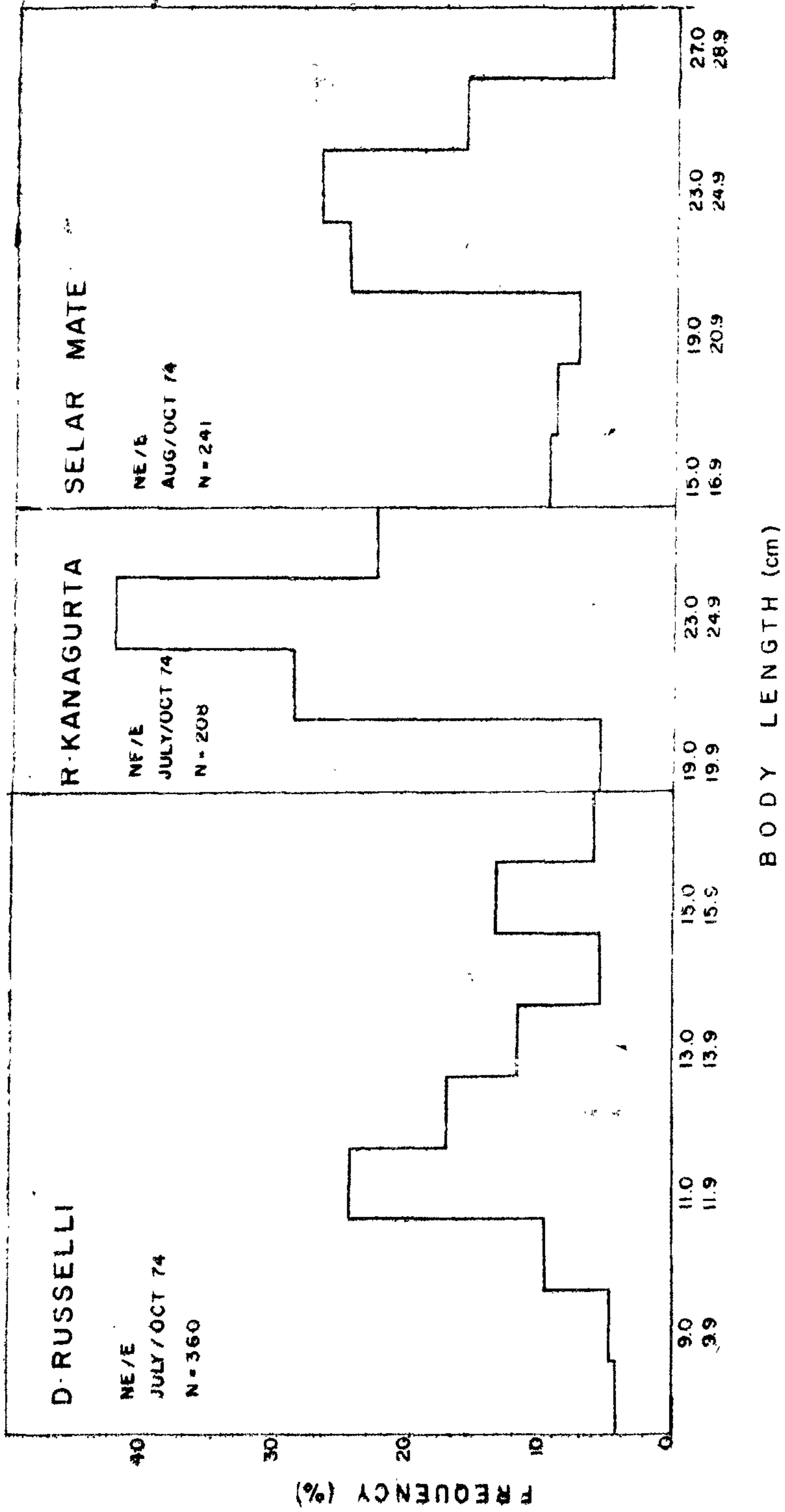


Fig 5.—Length frequency distribution of *D. russelli*, *R. kanagurta* and *S. mate* for different areas in the east Coast.

Length frequency measurements were also taken of some of the carangid species which were taken in large quantities by the purse seine in the east coast areas. These were mostly the smaller varieties of carangids like *Decapterus russeli*, *Selar mate*, *Selar cruminophthalmus* etc. The length frequency distribution of some of these carangid species for the areas 'NE' and 'E' is given in figure 5. *D. russelli* was the most dominant species of carangid encountered with a size range of 7.5 cms. to 21.0 cms. The distribution was bimodal with the first mode at 11.0-11.9 cm. size group and the second mode at 15.0-15.9 cm. size group. *S. mate* had a size range from 13.5 cms. to 30.5 cms. and a unimodal distribution, the mode being observed at 23.0-24.9 cm. size group. *Rastrelliger kanagurta* (Scombridae) also appeared consistently along with other varieties of carangids in the east coast areas. Catches of *R. kanagurta* sampled in east coast areas from July to October had a size range of 19.0 cms to 26.8 cm. and a unimodal distribution with the mode at 23.0-24.9 cm. size group.

DISCUSSION

The survey for skipjack live bait and small pelagic fish varieties around the coastal waters of Sri Lanka has now completed two years. The results and conclusions that could be derived from the investigations done in 1973/74 collaborates with most of the conclusions drawn in the preliminary report after investigations carried out in 1972/73.

Availability of Skipjack Live Bait

As regards the popular skipjack live bait, viz., red bait ; investigations show that red bait is distributed along both west and east coasts, mainly in the areas 'SW', 'W', 'NE' and 'E'. Some new fishing grounds for red bait were located during this survey, mainly off Colombo, Pamunugama and Chilaw. In spite of these new resources it is evident that the concentrations of red bait encountered during these investigations will not be sufficient to support an expanded pole and line fishery for skipjack tuna.

Hence, it is necessary to find other pelagic fish varieties which are small, hardy and giving a good response to skipjack and yellowfin tuna, in order to sustain a good live bait fishery. It is felt that there are about ten species of small pelagic fish, including some species of small Sardines and Herrings that could be used as skipjack live bait. Investigations are now being carried out to determine the suitability of these pelagic species as skipjack live bait. The findings of these investigation will be reported later.

Choice of Gear and Mode of Capture

Initial results at the beginning of the survey showed that fishing operations during the day time were not very successful. This was mainly due to lack of sufficient schools of pelagic fish during the day time. Light attraction techniques were adopted for night fishing and there was a significant improvement in the catches.

The lampara net which was used for fishing operations during the initial stages of the survey could not fare favourably with the performance of the purse seine. Hence only the purse seine had been used for fishing operations during the rest of the survey period. With light attraction in the

night, the purse seine has proved to be an excellent gear for the capture of skipjack live bait and other species of pelagic fish. If it is possible to use other pelagic varieties as skipjack live bait in addition to red bait, purse seining would then be a very useful mode of capture of these small pelagic fish varieties. From table I, it is seen that the areas investigated on the west coast recorded an average catch of 400 kgs of small pelagic fish per night while those on the east coast recorded catches ranging from 400 to 800 kg per night. Catches of this magnitude would reduce the number of days spent on bait fishing and would also ensure a steady supply of live bait for an expanded pole and line skipjack fishery.

There are certain other factors that must also be considered when discussing about the choice of gear for live bait fishing. Except for short periods, most of the coastal areas that have proved to be good grounds for small pelagic fish varieties are in the open sea, exposed to windy weather and strong currents. Furthermore, strong winds prevailing in the nights mean that fishing for live bait must be at most times carried out under severe conditions.

The purse seine used during 1972/73 was 234 meters in length with a stretched depth of 30 meters. A smaller net was used during 1973/74, having a length of 170 meters and a stretched depth of 30 meters. Comparison of catches made with these two nets show that the difference in the length of the nets had no significant effect on their performance. The radius of attraction is small enough to permit a further reduction of the size of the purse seine; and it is felt that a purse seine with a length of 150 meters would give the same performance as the larger nets used earlier.

It was stated at the beginning that the total light intensity used was varied to determine if such variations had any influence on the catches made by the purse seine. The different light intensities used and the average catch per set obtained in different areas for the different total light intensities are given below :

<i>Light Intensity</i>	<i>Period</i>	<i>Area</i>	<i>Catch/Operation</i>
1500 watts	.. Dec.-Feb. '74 ..	W	.. 578 Kg
		SW	.. 497 Kg
3000 watts	.. Feb.-May '74 ..	W	.. 357 Kg
		SW	.. 180 Kg
2500 watts	.. May-Oct. '74	E	467 Kg
		NE	.. 709 Kg
		NNE	.. 837 Kg

From the results obtained for different light intensities, it is clear that a total light intensity of 1500 watts is adequate for a good attraction, yielding an average catch per set of 400-500 Kg in most of the areas investigated.

Improvements to Traditional Live Bait Fishery

There are about three hundred and fifty large sized out-rigger canoes engaged in pole and line fishery for skipjack tuna in the 'SW' between November and April and in the 'E' between June and October (Sivasubramaniam, 1972). Most of the traditional pole and line fishermen use red bait as the only skipjack live bait. This species alone can survive the crude system of bait handling practised by the local pole and line fishermen. Therefore, due to problems of availability of red bait, and time consumed in searching and collecting the live bait, the traditional crafts average only 9-10 days of

active fishing per month. Since the efficiency of the pole and line operations by this class of vessels is relatively high, the catches made by these vessels make a significant contribution to the skipjack production in Sri Lanka. Any improvement in the traditional live bait fishery will thus be reflected in an increase in production of skipjack tuna by pole and line fishery.

Local pole and line fishermen capture red bait with a special kind of lift net or a scoop net. This particular species at times aggregates or balls up at the surface of water, and are then scooped up by pole and line fishermen. As mentioned elsewhere the results of the survey show that red bait is widely distributed around the island and not concentrated in the south-west or eastern areas of the coastal waters. This wide distribution, together with the location of new bait grounds for red bait, is of great significance in the development of the existing traditional live bait fishery. This would involve introduction of cheap, and efficient fishing methods which can be easily adopted by the local pole and line fishermen with the existing types of crafts. Under this programme of work a ring net and a lift net has been constructed. These could easily be used by the local fishermen with the existing crafts. The ring net is lighter and cheaper than the purse seine and could be used without a hauling device on a small boat. Investigations on these new fishing devices commenced in late 1975 and the efficiency of these methods together with the descriptions of the fishing gears will be reported later. Light attraction techniques are used with these new gears for attraction of fish in the night. This is advantageous because red bait need only a short duration of lighting for attraction. When attracted, red bait is a slow moving fish, so that these new devices may prove to be as efficient as the purse seine for red bait.

Exploitation of Small Pelagic Fish Varieties

Another important objective of the survey was to make investigations into the availability of small pelagic fish varieties around the coastal waters of the islands, for direct consumption, canning and fish meal, and also to develop efficient techniques for exploiting such resources.

Commercial exploitation of small pelagic varieties in Sri Lanka is mainly by the beach seines and drift nets. Since coastal fisheries contribute 85-90% of the total fish production in the country, development of new fishery resources and techniques for exploitation of pelagic fishery resources will make a significant increase in production. Fishery with purse seine has proved to be relatively more efficient than any other method of fishing applied on the small pelagic fish species, and the use of light attraction enables this method to be effective even when these fish are not in aggregate or schooling conditions. Further, purse seining with light attraction appear to be effective off areas and seasons when the traditional small pelagic fishery show poor results.

Purse seining with light attraction produced good results in the areas 'SW' 'W' 'NE' and 'E'. Areas on the east coast, 'NE' and 'E' produced the best results for this type of gear. During the six months period from May to October 1974, the purse seine was tried out 139 times for a total catch of 93400 kgs. 72% and 90% of the catches taken off 'NE' and 'E' respectively consisted of sardines and herrings. It was also observed that purse seine operations on the north-east coastal areas were successful even after the immigrant fishermen had discontinued operation there.

These results and observations made on the investigations carried out from October 1972 to October 1974 indicates that purse seining (with this class of vessels and even with smaller ones of 30' length) can be successful and commercially adoptable for live bait and small pelagic fishery development in Sri Lanka.

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