GOVT. OF INDIA

BULLETIN OF THE EXPLORATORY
FISHERIES PROJECT

(Abbr: Bull. Expl. Fish. Proj.)

Number 6.

RESULTS OF EXPLORATORY FISHING CONDUCTED DURING 1976-77

NOVEMBER 1977

EXPLORATORY FISHERIES PROJECT
GOVT. OF INDIA
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The Bulletin of the Exploratory Fisheries Project, Bombay is published at irregular intervals as and when information of a useful nature become available for dissemination.

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PREFACE

Dissemination of valuable information of the data collected from the fishing efforts of the vessels belonging to the organisation and scientifically processed to bring out meaningful inferences is a major objective of the Exploratory Fisheries Project. These information are meant to help the fishermen and fishing vessel operators to identify theareas that have rich fish-concentrations in relation to time, depth and space. Fishery being a highly fluctuating natural phenomena, the data collected through short-term periods of 12 months will furnish quick information to fishermen and fishing vessel operators to plan and schedule the operation of their vessels for short periods immediately ahead. This bulletin, the 6th of its series is a sincere attempt by Exploratory Fisheries Project to reach the actual operators to furnish them with the results of the exploratory and experimental fishing operations conducted from the 12 bases during the year 1976-77.

Compilation of data pertaining to consecutive periods of time, like consecutive years, over a long range period, will ultimately help to evolve an information system for monitoring the stock position, to effect scientific management for economic exploitation and healthy development of fishery resources. The data presented in this bulletin will do help to expand the store-house of information mentioned above.

I record my appreciation of the excellent work done by the 'Skippers and their team-mates' of all our fishing vessels and the officers and the staff of various bases during the year 1976-77. I am grateful to Smt. S.L. Singla, Joint Secretary(Fisheries) and Prof. P.C. George, Joint Commissioner (Fisheries) for the special care bestowed

by them on all matters relating to Exploratory Fisheries Project especially the publication of this bulletin. The imaginative leadership given by the previous Director Sri K.M.Joseph in formulating the plan of operations and translating these programmes into action is commendable. Mention is also made to the leadership provided by Dr. S.N. Dwivedi who held additional charge as Director, Exploratory Fisheries Project for a period of six months during 1976-77. The officers and staff of the Extension unit deserve congratulations for their hard work in bringing out this bulletin. Once again I thank all officers and staff of Exploratory Fisheries Project.

7th November, 1977

M. SWAMINATH
D I R E C T O R.

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1. INTRODUCTION

This bulletin 6th in the series covers the results of exploratory fisheries survey conducted by the Project during 1976-77. A historical account of Exploratory Fisheries Project, its aims, objectives, results of exploratory fishing conducted since inception upto 1976 etc. have been presented in previous bulletins.

During the year under report, special attention was given to diversify the fishing techniques and for putting more effort in areas in respect of which information is inadequate. Here it can be noted that the information regarding the fishery potential of deeper areas were not available until very recently Exploratory Fisheries Project vessels did such attempt to collect information in respect of virgin grounds and could give some useful information about such grounds. Government of India took keen interest in exploration of untapped grounds using bigger vessels. In addition to this an agreement was signed between Polish People's Republic and Government of India, as a result of which a freezer trawler M.T.Murena (69 m O.A.L.) arrived from Poland and commenced industrial fisheries survey along north west coast of India, since January 1977. A series of reports giving results of operation of M.T.Murena and ancillary vessels are being published by Exploratory Fisheries Project. Therefore this report gives only the results of survey operations conducted by Exploratory Fisheries Project vessels.

2. AREA AND FISHING PROGRAMME

During 1976-77, 23 vessels were in operation from 11 bases of the project. There was no major deviation from the charted programme, except in the case of Meena Bharati of Bombay base, which was earmarked as supporting vessel in the Indo Polish Industrial Survey programme and since January 1977 she is operating along with M.T.Murena. Also mid-water trawling and kalava hand lining could not be continued as envisaged in the programme due to various technical handicaps.

The fishing programme chalked out for 1976-77 is given in the Table I. While drawing up the programme special attention was given to concentrate in areas within 40 m depth which are yet to be explored or inadequately surveyed. As can be seen from the table, demersal trawling was carried out from all bases. In addition to this, special survey for shrimp resources, survey for pelagic resources by purse-seining, trolling, long lining, hand lining, etc. continued from selected bases during this year also. In order to facilitate exploratory survey along Saurashtra coast, a base set up at Veraval started functioning during this year. Since Central Advisory Committee on Exploratory Survey of Marine Fisheries did not meet, the programme could not be discussed and got approved by the members and industrialists.

3. FISHING VESSELS

The fleet of survey vessels of the project did not vary from the previous year. Nineteen indigenously constructed trawlers were the mainstay of the fleet. In addition, one indigenously constructed

Base	Vessel	Programme	Area	Depth range mts.	Remarks
KANDLA	Kalyani V	Exploratory demersal trawling	22-67 21-68 23-67	40-150 40-100 40-100	
	Meena Udyog	Exploratory shrimp survey/midwater trawling	22-68 22-69 21-69	40-90 30-80 30-70	Midwater trawling will commence when the expert under Colombo Plan arrives.
VERAVAL	Base will be established subject to the availability of officers & vessels.				
BOMBAY	Meena Bharati	Exploratory demersal trawling	19-69 18-70 20-69	60-200 50-200 50-200	
	Meena Sachetak	Exploratory demersal/mid-water trawling	19-71 19-70	30-90 30-90	
	Meena Prapi	Exploratory demersal/mid-water trawling	17-72 17-71 18-71	30-90 30-90 30-90	
GOA	Meena Netra	Exploratory demersal trawling	14-73 14-74 15-73	30-90 20-50 50-90	
	Meena Ayojak	Exploratory shrimp survey/ Purse-seining	16-72 15-72	30-90 30-90	
MANGALORE	Meena Tarangini	Exploratory demersal trawling Kalava hand line	13-73 13-74	30-90 30-70	
C	Meena Anaveshak	Exploratory shrimp survey/ Purse-seining	12-74 11-74 11-75	30-90 50-90 20-80	
COCHIN	Meena Utpadak	Exploratory demersal trawling	8-76 7-76 7-77	50-100 50-100 30-80	
	Meena Sangrahak	Exploratory shrimp survey/ Kalava hand line	8-76 9-76 10-75	30-80 30-80 40-100	

BASE	Vessel	Programme	Area	Depth range (mts)	Remarks
TUTICORIN	Meena Niryantak	Exploratory demersal/mid-water trawling	8-77 8-77 7-77	20-40 50-100 30-90	Midwater trawling will commence when the expert under Colombo Plan arrives
	Meena Saudagar	Exploratory demersal trawling	9-78 9-79	20-50 40-90	
	Jheenga	Exploratory shrimp survey	8-78 9-79	30-70 30-70	
MADRAS	Meena Sitara	Exploratory demersal trawling	11-79 11-80 13-80 14-80	20-60 40-90 30-80 30-80	
	Meena Gaveshak	Exploratory shrimp survey	10-79 10-80 12-80	20-50 30-80 30-80	
VIZAG	Meena Jawahar	Exploratory shrimp survey	18-84 19-85 19-86	30-90 30-90 30-90	
	Meena Shodhak	Exploratory demersal trawling	16-81 15-80 17-83	30-90 40-100 50-90	
PARADEEP	Meena Prasarak	Exploratory shrimp survey	20-87 20-86	30-90 30-90	
	Meena Grahi	Exploratory demersal trawling	19-86 21-87 20-86	30-90 30-90 30-90	
CALCUTTA	Matsya-vigyani	Exploratory demersal trawling	20-87 21-87 19-86	80-200 80-200 80-200	
		Exploratory shrimp survey	20-87 20-88	20-80 20-80	
PORT BLAIR	Meena Khojini	Exploratory demersal trawling/ kalava hand line	11-92 12-93 11-93	30-80 30-80 30-80	
	Meena Prayas	Tuna long lining and trolling	11-93 12-93		

Table I. Exploratory Fishing Programme for 1976-77

23 m vessel, M.F.V.Meena Bharati and three imported steel trawlers viz. Jheenga, Kalyani V and Matsyavigyani were also available for operation. Major specifications of these vessels had been already furnished in previous bulletins (Bull. Expl. Fish. Proj. 4).

4. FISHING GEAR AND METHODS

As discussed earlier, bottom trawl was the main gear operated by the vessels of the project. The important types of demersal trawls operated during the course of survey were 24 m, 30 m and 35 m fish trawls and 28 m shrimp trawl. Meena Bharati and Kalyani V, operated 30 m and 35 m fish trawls with oval otter boards and Matsyavigyani operated 46.5 m shrimp trawl. The diagrams and specifications of important types of bottom trawls and midwater trawl operated by the vessels of the project had been incorporated in the bulletin No.4 of the project (Bull. Expl. Fish. Proj. No.4). In addition, purse-seining was conducted from Mangalore and Goa bases from 17.5 m vessels. Tuna long lines and trolling lines were operated from 17.5 m vessels of Port Blair base. The specifications of these gears are presented elsewhere in this report.

5. RESULTS OF DEMERSAL FISHERIES RESOURCES SURVEY

As stated earlier, 22 vessels of the project were employed for exploratory demersal trawling from 11 bases. Out of these, 18 were 17.5 m vessels. The bigger vessel Meena Bharati (22.5 m) and Kalyani V (30.9 m) were operating from Bombay and Kandla respectively. Another bigger vessel Matsyavigyani (32.3 m) was based at Calcutta and Jheenga (16.5 m) operated from Tuticorin. The vessels have surveyed about 46,000 sq. km of unsurveyed or partially surveyed area by bottom trawling during 1976-77. About 13,252 hrs. of actual fishing was done and an incidental catch of about 1806 tons of fish and prawns were landed.

The summary of the results of demersal trawling operations is given in Table II. While examining the catch rates obtained by 17.5 m vessels operated from east and west coasts of India, it can be seen that the vessels Meena Prasarak and Meena Grahi of Paradeep base registered the highest catch rates of 242 kg/hour and 238 kg/hour respectively. During the previous year also these vessels obtained the highest catch rates, eventhough the catch rate was slightly higher than that of the current year. Excepting six 17.5 m vessels - two vessels of Mangalore base, two vessels of Tuticorin base, one vessel of Vizag base and one at Port Blair base - all other 17.5 m vessels recorded a catch rate between 100-150 kg/hour. The average catch rate obtained by all the eighteen 17.5 m vessels was 102 kg/hour.

The three vessels Matsyavigyani, Meena Bharati and Kalyani V obtained catch rates of 235 kg/hour, 172 kg/hour and 202 kg/hour respectively. Of these, only Kalyani V showed an increase of about 25% in her catch rates over that of the previous year.

5.1. Species composition

Occurrence of different species of fish in the trawl catches of all the regions have been examined here so as to get an idea about the magnitude of different fishery in these regions. The distribution of these species in different geographical divisions and depth belts have been discussed in the ensuing chapters.

Fig. 7 gives the composition of important varieties of fishes in the trawl catches obtained from the different bases along the north west coast of India viz. Kandla, Bombay and Goa.

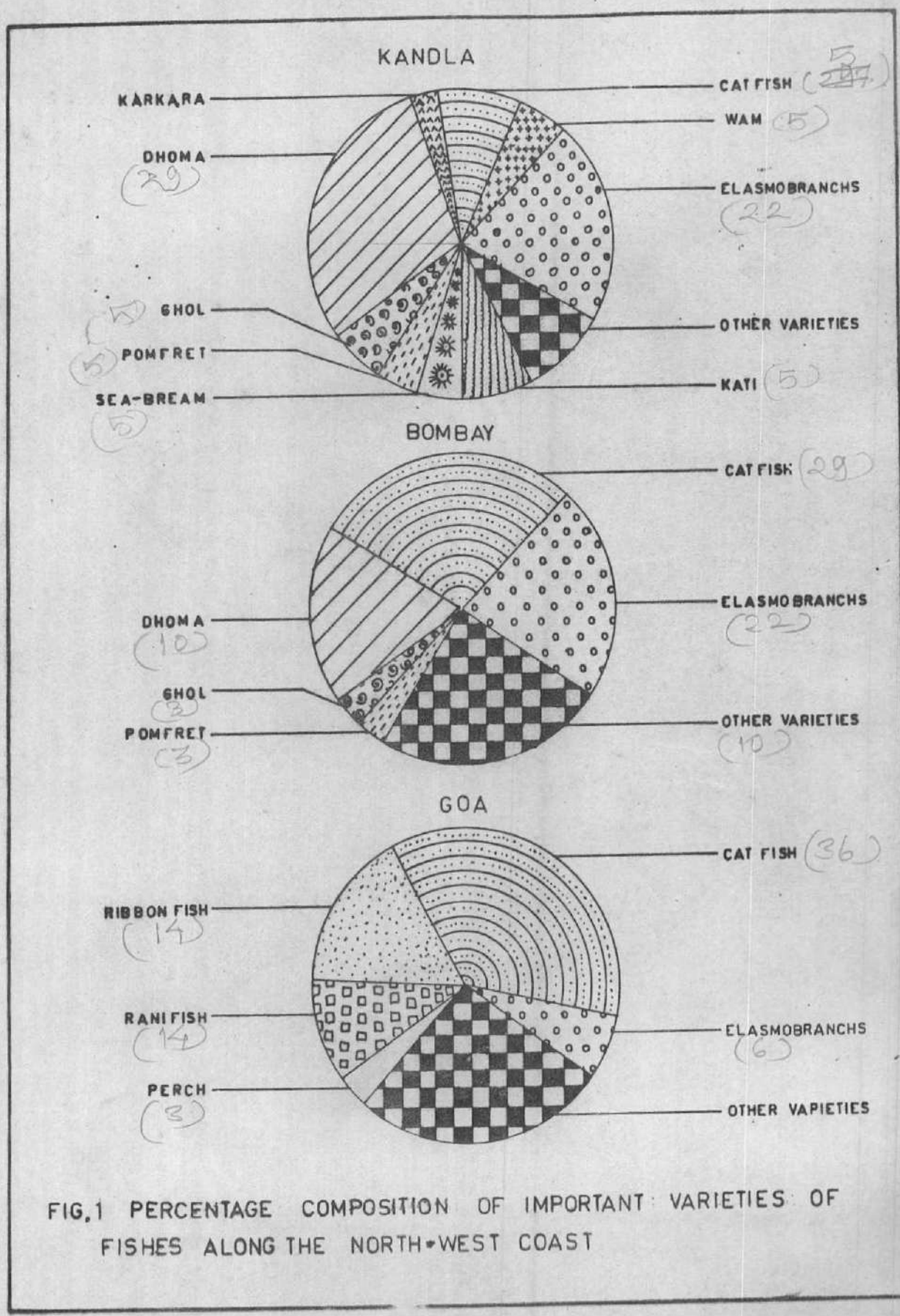


FIG. 1 PERCENTAGE COMPOSITION OF IMPORTANT VARIETIES OF FISHES ALONG THE NORTH-WEST COAST

Base	Vessel	Area surveyed	Fishing effort (hrs)	Extent of area surveyed (sq.km)	Catch/hour (kg)
KANDLA	Meena Udyog	22-67, 21-69, 22-68, 22-69 & 21-68	840	2856	123
	Kalyani V	22-68, 21-68, 21-69, 22-67 & 23-67	393	1336	202
BOMBAY	Meena Bharati	17-71, 17-72, 18-71, 18-72 & 19-72	772	2625	172
	Meena Sachetak	17-72, 18-72, 19-71 & 19-72	346	1177	105
	Meena Prapi	17-72, 18-72 & 19-72	887	3016	123
GOA	Meena Netra	15-73 & 16-73	816	2774	124
	Meena Ayojak	15-73 & 16-73	493	1676	137
MANGALORE	Meena Tarangini	12-74 & 13-74	1171	3981	89
	Meena Anaveshak	12-74 & 13-74	422	1435	93
COCHIN	Meena Utpadak	9-76, 10-76 & 9-75	303	1030	132
	Meena Sangrahak	9-76, 10-75, 10-76, 19-71, 19-72 & 18-72	472	1605	125
TUTICORIN	Meena Niryantak	8-78, 9-78 & 8-77	840	2856	96
	Meena Saudagar	8-78 & 9-78	801	2723	89
	Jheenga	8-78	81	275	45
MADRAS	Meena Sitara	12-80, 13-80, 14-80 & 11-79	640	2176	112
	Meena Gaveshak	12-80, 13-80, 11-79, 14-80 & 10-79	633	2152	137
VIZAG	Meena Jawahar	16-81, 16-82, 17-82, 17-83, 18-83 & 18-84	830	2822	108
	Meena Shodhak	16-81, 16-82, 17-82, 17-83, 18-83 & 18-84	672	2285	78
PARADEEP	Meena Grahi	19-86 & 20-86	514	2768	238
	Meena Prasarak	20-86 & 19-86	475	1615	242
CALCUTTA	Matsyavigyani	20-87, 20-88, 20-86 & 21-87	481	1635	235
PORT BLAIR	Meena Khojini	11-92, 12-92 & 12-93	370	1258	99

Table II Summary of demersal trawling operations conducted by the project vessels.

It can be seen from the figure that Dhoma constituted about 31% of the total catch of Kandla. Elasmobranchs occupied the next place with a consistency of about 9% sharks and 13% Rays. Cat fish, kati, ghol, wam, Sea-bream, pomfret etc. were present around 5% each.

In Bombay region cat fish occupied the first place which constituted 29% of the total catch. Elasmobranchs occupied about 22% of the total catch while Dhoma and other varieties were present at the rate of 10% each. Ghol and pomfret were present in 3% each.

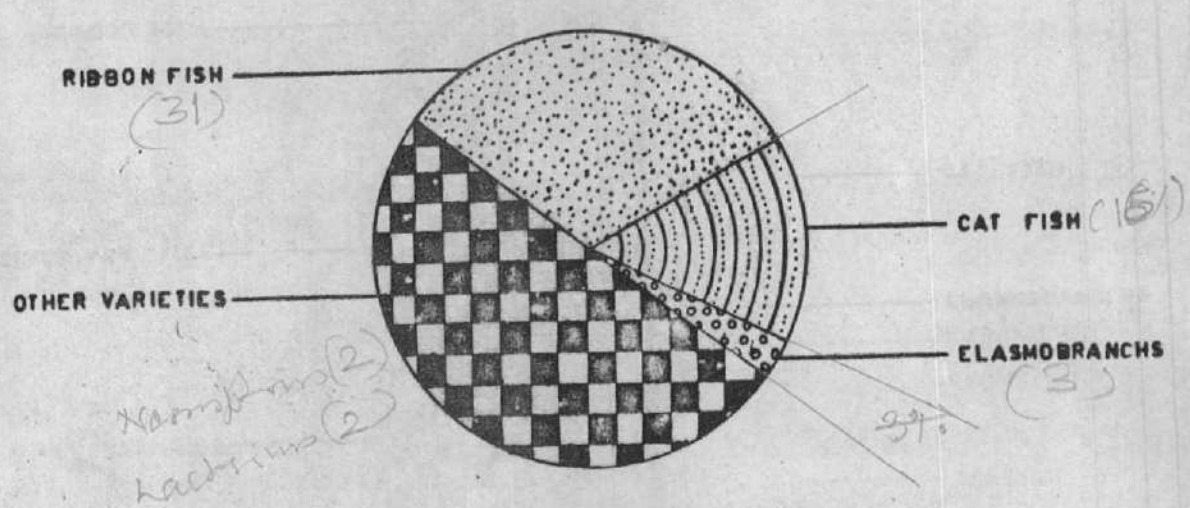
The percentage of cat fish in the total catch is found to increase still further towards Goa, where it occupied about 36%. The composition of elasmobranchs is decreasing constituting only 6% of the total catch. Ribbon fish and Rani fish are more conspicuous species in this region constituting about 14% each.

The presence of about 3% of perches and total disappearance of dhoma and ghol is also noteworthy. The catch composition of Goa region presents a sort of transitional stage between the regions north and south of it.

Proceeding further northwards, the percentage of ribbon fish increases which is maximum (31%) in Mangalore region (Fig. 2). The percentage of cat fish and elasmobranchs have decreased occupying about 16% and 3% respectively. 'Kilimeen' and Lactarius were present in less than 2% each.

In Cochin region the occurrence of cat fish was in the same intensities as in the case of Mangalore, but a remarkable reduction in the percentage of ribbon fish is noteworthy. Elasmobranchs showed a slight increase to 8% and prawn constituted about 2% of the total catch.

MANGALORE



COCHIN

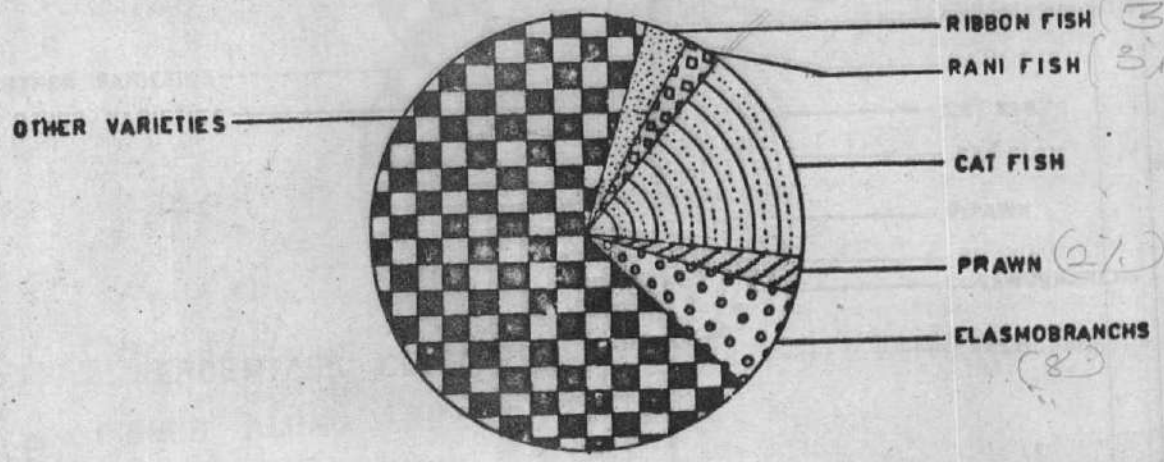


FIG. 2 PERCENTAGE COMPOSITION OF IMPORTANT VARIETIES OF FISHES ALONG THE SOUTH-WEST COAST

Fig. 3 gives the species composition of the lower east coast. In Tuticorin region perches contributed 38% of the catch followed by elasmobranchs (mainly rays) amounting to 30%. Sciaenids (3%), caranx (2%) and cat fish (1%) were the other important varieties.

It can be seen that in Madras region, there is a reduction in the percentage of elasmobranchs in the total catch from that of Tuticorin region. It constituted only 7% of the catch. Leiognathids constituted 13%, perches, caranx, moon fish, ribbon fish and Lactarius were present at the rate of 1% each.

Fig. 4 represents the species composition of the catch obtained from the three bases of upper east coast viz. Vizag, Paradeep and Calcutta. About 14% of the catch was constituted by cat fish in Vizag region. Elasmobranchs constituted 9% and perches and eels contributed four percent and two percent respectively.

In Paradeep region, dhoma constituted 12% of the catch, elasmobranch accounted for 9%, and prawn accounted for 4% in the catch. Cat fish, pomfret and wam were also present in 2-3% each.

In Calcutta region, 20% of the catch was constituted by elasmobranchs. Wam was the next abundant species constituting about 4% of the catch followed by cat fish (3%), karkara and pomfret (2% each). About 1% each of the catch was constituted by eel and tam.

5.2 Relative abundance

As mentioned in the earlier bulletins, catch per unit effort is considered as the index of relative abundance. Since the 17.5 m vessels were fitted with identical engines and deck machineries and the gear operated being identical, the results obtained by these vessels

are readily comparable. However, Matsyavigyani, Kalyani V, Meena Bharati and Jheenga operated trawls of different sizes. Therefore, the results obtained by these vessels are analysed separately as comparison of the results obtained by these vessels among themselves and with that of the 17.5 m vessels are not feasible.

5.3 Relative abundance by area

For convenience of analysis, the entire area of study was demarcated into five zones.

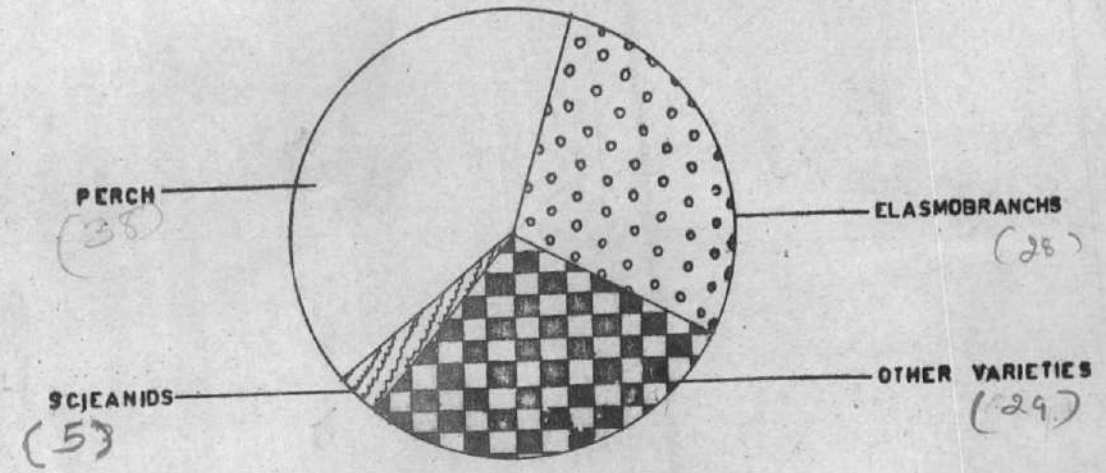
1) North west coast: covering states of Maharashtra and Gujarat coasts and Union Territory of Goa	Between latitude 24° N and latitude 15° N
2) South west coast: covering the Karnataka and Kerala coasts	Between latitude 15° N and latitude 7° N
3) Lower east coast: Tamil Nadu and Lower part of Andhra Pradesh	Between latitude 7° N and latitude 14° N
4) Upper east coast: covering upper part of Andhra Pradesh, Orissa and West Bengal	Between latitude 14° N and latitude 19° N
5) Andaman & Nicobar Islands:	Between latitude 10°30' N and latitude 13°40'

5.3.1 North west coast

Three types of vessels viz. Kalyani V, Meena Bharati and 17.5 m vessels were employed for survey of bottom fish in this region. Kalyani V surveyed five major areas and one 17.5 m vessel viz. Meena Udyog also surveyed five areas, both along Gujarat coast.

Six areas off Maharashtra coast were surveyed by Meena Bharati. A group of 17.5 m vessels surveyed six areas off Maharashtra and Goa coasts. The total fishing effort put in and the catch/hour obtained by these vessels from the different areas are given in Table III.

TUTICORIN



MADRAS

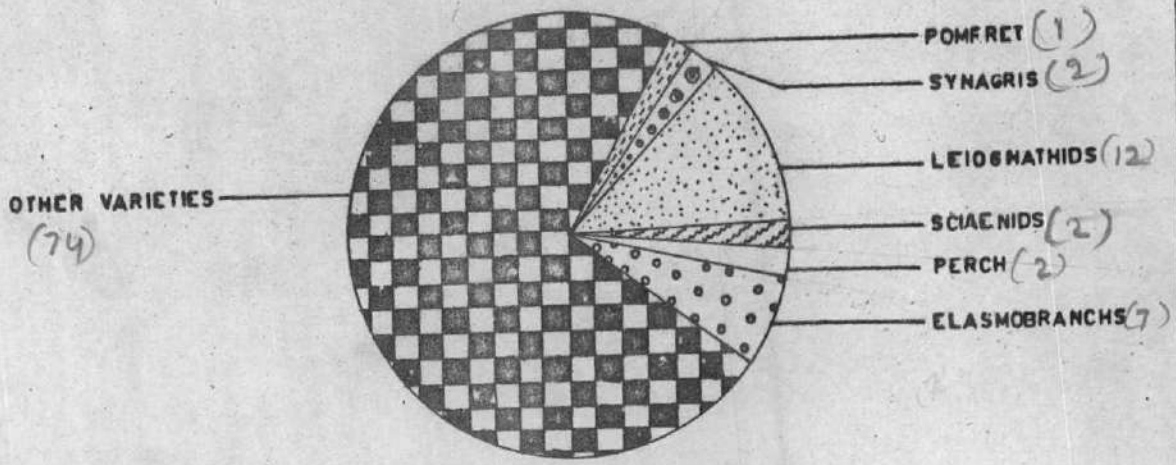


FIG. 3 PERCENTAGE COMPOSITION OF IMPORTANT VARIETIES OF FISHES ALONG THE LOWER EAST COAST

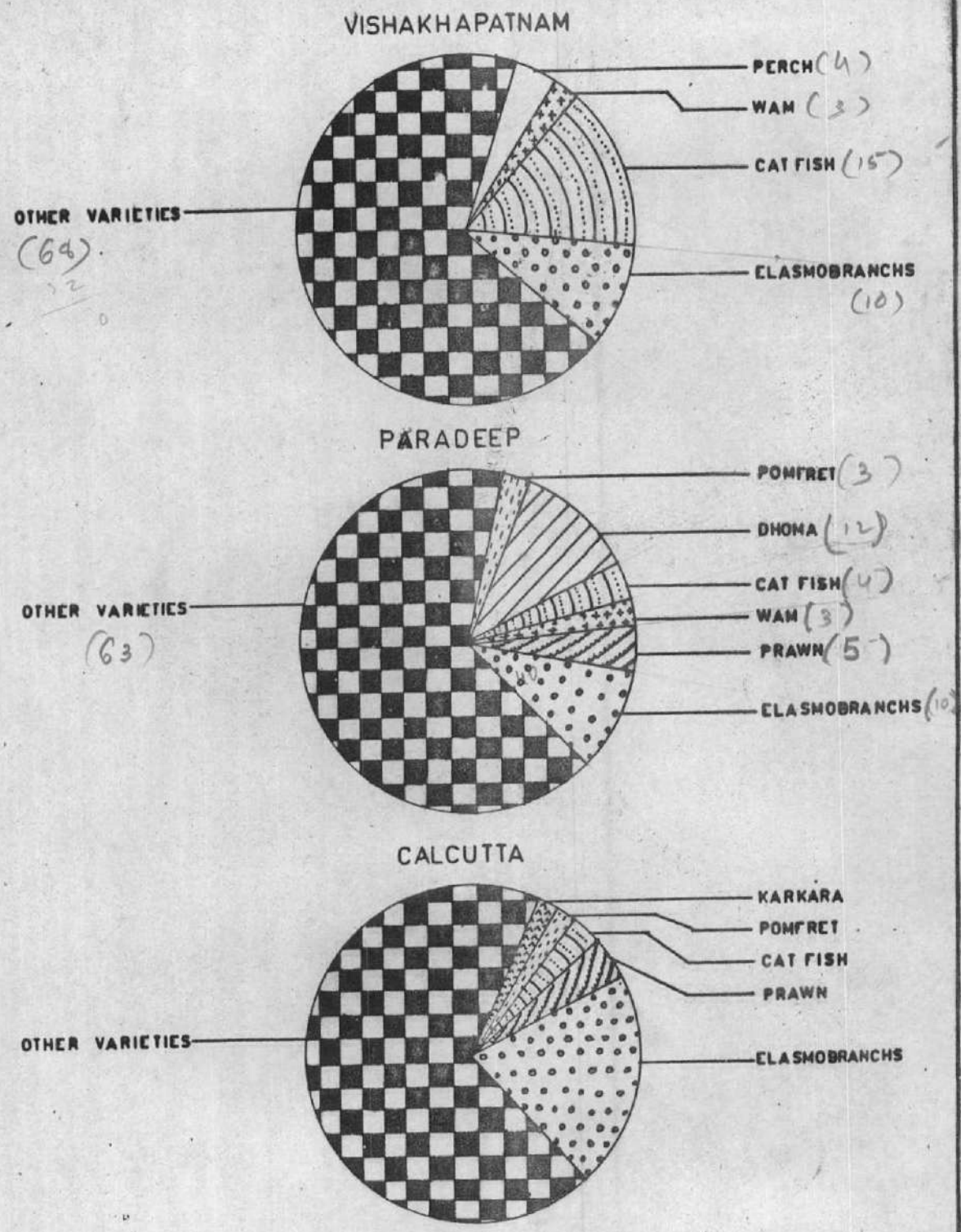


FIG. 4 PERCENTAGE COMPOSITION OF IMPORTANT VARIETIES OF FISHES ALONG THE UPPER EAST COAST

Vessel	Area	Fishing effort (hrs.)	Catch/hour in kg															
			Elasmo-branchs	Prawn	Wam	Cat fish	Karkara	Tam	Dhoma	Ghol	Pomfret	Kati	Sur-mai	Koth	Ca-ranx	Sea bream	Other qua-lity	Misc.	All spe-cies
Kalyani	21-68	154	29.7	-	11.4	7.1	11.5	0.8	45.1	6.1	13.1	16.7	-	3.9	5.8	13.3	-	14.2	178.7
	21-69	37	35.2	-	5.1	1.6	1.1	0.7	21.4	2.5	3.5	6.4	2.9	-	4.3	10.4	-	2.1	97.2
	22-67	3	23.0	-	19.3	3.3	1.7	-	10.0	16.7	-	16.7	1.7	-	-	5.0	-	-	97.4
	22-68	193	73.6	-	19.6	8.6	12.1	0.8	63.7	18.1	9.7	9.8	0.2	9.7	3.0	7.4	-	9.2	245.5
	23-67	6	5.7	-	7.8	3.7	-	-	19.3	23.7	-	6.7	-	-	-	1.8	-	-	68.7
17.5 m trawler	21-68	24	32.1	-	5.9	1.9	0.7	-	32.3	6.1	4.2	10.4	0.4	-	-	2.4	-	-	96.4
	21-69	199	11.1	0.3	2.6	0.6	2.0	0.3	14.3	3.3	4.4	5.7	0.3	1.0	2.5	9.0	-	5.6	63.0
	22-67	27	22.4	-	3.0	116.0	0.6	-	23.0	15.1	1.3	11.5	-	8.1	-	-	-	0.8	201.8
	22-68	585	26.8	0.1	4.3	17.0	3.1	0.4	54.4	8.3	6.0	9.5	0.3	1.8	0.2	5.8	-	2.8	140.8
	22-69	5	95.4	-	32.0	-	-	-	18.0	-	-	-	-	-	-	-	-	-	145.4
Meena Bharati	17-71	4	3.8	-	-	-	-	8.8	2.5	-	-	-	-	-	-	3.8	-	-	18.9
	17-72	95	32.8	-	0.1	173.4	5.1	4.1	21.5	3.1	19.9	0.3	0.6	-	0.1	-	24.7	7.3	289.9
	18-71	28	15.2	-	-	6.8	1.1	7.5	9.1	2.9	4.1	-	-	-	-	-	2.9	5.5	55.1
	18-72	542	40.7	0.1	1.1	43.5	1.9	1.7	18.8	5.9	7.1	1.1	1.4	1.1	0.3	-	36.4	6.3	167.4
	19-71	39	39.1	0.3	19.9	-	-	1.2	61.8	8.9	-	-	-	14.6	-	-	0.1	-	145.9
	19-72	57	48.9	-	4.2	3.1	0.4	2.8	27.3	6.6	4.1	5.2	0.4	6.3	6.9	-	8.0	-	124.2
17.5 m trawlers	17-72	105	34.9	0.1	-	22.6	0.5	0.8	25.8	1.7	1.0	1.5	0.2	3.1	-	-	13.3	9.6	111.1
	18-72	1130	26.0	0.8	0.8	35.2	0.9	0.6	27.6	2.3	1.7	0.4	0.2	1.5	-	-	13.3	7.9	119.2
	19-71	23	1.4	0.2	7.6	1.7	0.3	0.5	3.0	-	1.7	-	0.2	-	-	-	8.4	21.3	46.3
	19-72	22	2.2	-	1.4	17.0	0.1	0.1	21.8	-	0.2	-	-	-	-	-	1.9	14.1	58.8
	15-73	1294	7.5	0.7	0.2	47.3	-	-	-	-	2.1	-	-	-	0.5	-	*46.1	25.1	130.2
	16-73	16	17.0	-	-	3.4	-	-	-	-	0.6	-	-	-	-	-	5.0	7.6	33.6

Table III Area-wise and species-wise catch/hour of trawling North west coast

*includes Ribbon fish 17.6, Horse mackerel 0.5 caranx 0.5, perch 3.3, butter fish 2.4, 'kilimeen' 18.5, flat fish 0.7 and lizard fish 0.4.

The table gives the catch/hour of prawn and important varieties of fishes recorded from these areas.

It can be seen from the table that the vessel Kalyani V operating along Gujarat coast put maximum fishing effort of 193 hours in area 22-68. The area 21-68 was also intensively surveyed by putting an effort of 154 hours. In the remaining areas the effort put in was less than 50 hours. The highest catch rate obtained by Kalyani V was 246 kg/hour from the area 22-68. The next highest catch rate of 179 kg/hour was recorded from the area 21-68. The yield from the remaining areas was less than 100 kg/hour. While comparing the results obtained by Kalyani-V during 1975-76 (Bull. Expl. Fish. Proj. 4) with that of the current year, it can be seen that the yield from the area 21-69 which recorded the highest catch rate (210 kg/hour) during the previous year has diminished almost to half, whereas the area 22-68, which was comparatively poorer during 1975-76 has recorded a considerable increase in the catch rate. Incidentally it may be mentioned that the results of operation of the Indo-Pdish Industrial Survey vessel M.T.Murena operating along north west coast also fortifies the productivity of the area 22-68 (Indo Polish Industrial Survey - preliminary report No.2). The average catch/hour obtained by this vessel from Gujarat coast has shown a marked increase from 170 kg/hour (1975-76) to 202 kg/hour.

The vessel Meena Bharati operated only along Maharashtra coast and carried out survey operations in six major areas expending about 770 hours of actual fishing. As can be seen from the table, maximum fishing effort was put in area 18-72(542 hours). In the rest of the areas the effort put in was less than 100 hours. The highest catch rate obtained by Meena Bharati was about 290 kgs/hour from area 17-72. The area 18-72 recorded a catch rate of 167 kg/hour. Only two

more areas viz. 19-71 and 19-72 recorded catch rates above 120 kg/hour. It can be seen that there is an upward trend in the catch rates of Meena Bharati from that of the previous year. Eventhough the results of operation of Meena Bharati during January to March 1977 have been elaborately discussed in the preliminary report Nos. 1 and2 of Indo-Polish Industrial Fisheries Survey, these results are incorporated in the present bulletin also, in order to give a clear picture of the year-round operation of the vessel. The average catch rate obtained by Meena Bharati was 198 kg/hour, which is slightly higher than that of the previous year (192 kg/hour).

As mentioned earlier, the 17.5 m vessels operated along Gujarat, Maharashtra as well as Goa regions. The highest catch rate in respect of these vessels were recorded from the area 22-67 (202 kg/hour) followed by the areas 22-69 (145 kg/hour) and 22-68 (141 kg/hour) all along Gujarat coast. The area 15-73 off Goa, 18-72 and 17-72 off Maharashtra also recorded comparatively better catch rates.

The main species netted from north west coast were elasmobranchs, dhoma, cat fish, pomfret, ghol, wam and perches. Kalyani V recorded the highest catch rate for the whole coast for elasmobranchs(74 kg/hour) and dhoma (64 kg/hour) from the area 22-68. Meena Bharati operating along Maharashtra coast obtainted the highest catch rate for dhoma from the area 19-71 (62 kg/hour). The highest catch rate for cat fish (173 kg/hour) was obtained by Meena Bharati from area 17-72 off Ratnagiri. The area 22-67 surveyed by 17.5 m vessels also recorded higher catch rate for this species (116 kg/hour).

Highest catch rate for pomfret (20 kg/hour) was obtained by Meena Bharati from the area 17-72. Kalyani V also recorded higher catch rate of 13 kg/hour from the area 21-68 off Gujarat. The highest catch rate of 24 kg/hour for ghol was recorded by Kalyani V from the area 23-67.

The highest catch rate for wam (32 kg/hour) was recorded by 17.5 m vessels from the area 22-69. About 20 kg/hour of wam was recorded by Kalyani V from the areas 22-67 and 22-68 and by Meena Bharati from 19-71 off Bombay.

Prawn was not represented in the trawl catches of Kalyani V. However, it was sparingly found in the catches of 17.5 m vessels and Meena Bharati.

Based on the results of all the three types of vessels, it may be mentioned that the areas off Gujarat is found to be richer than areas off Maharashtra and Goa regions in respect of elasmobranchs, wam, dhoma and ghol, while Maharashtra and Goa coasts gave better yields of cat fish and prawns. Both Maharashtra and Gujarat regions were found yielding good catches of pomfrets. It is noteworthy that ribbon fish and rani fish were present only along Goa coast.

5.3.2. South west coast

This zone comprising of Karnataka and Kerala coasts were surveyed exclusively by 17.5 m vessels. Table IV presents the total effort put in and the catch rates obtained for different species by these vessels. The highest catch rate of about 170 kg/hour was obtained from the area 9-75. All the remaining areas except 13-74 off Karwar recorded a catch rate above 100 kg/hour. It can be seen that the catch rate is showing an increasing trend towards south. The average catch/hour obtained by all the 17.5 m vessels operated in this region accounts to about 103 kg.

Area	Fishing effort	Catch/hour (kg)															
		Elasmo-branchs	Prawn	Kili-meen	Cat fish	Flat fish	Lizard fish	Lacta-rius	Horse mackerel	Per-ch	Bara-cuda	Ca-ranx	Ribbon fish	Pom-fret	Other quali-ty	Misc.	All spe-cies
13-74	1114	1.9	0.1	2.1	17.2	-	-	0.8	-	-	-	-	15.3	-	1.4	44.8	83.6
12-74	479	2.6	0.1	0.7	6.2	-	-	0.7	-	-	-	-	55.6	-	1.8	36.1	103.8
10-76	23	15.8	0.1	-	22.0	2.2	-	-	0.1	8.0	2.7	3.0	-	-	3.2	81.7	139.8
10-75	76	20.6	2.0	-	76.2	1.1	1.5	-	-	0.6	0.9	0.7	-	0.6	1.1	56.7	162.0
9-76	573	8.3	2.3	5.7	15.0	1.9	1.7	0.2	0.2	0.2	0.7	0.7	-	1.5	7.2	77.7	123.3
9-75	48	21.1	1.3	-	23.4	2.6	-	-	-	1.0	7.4	7.2	-	-	0.7	111.2	169.9

Table IV Area-wise and species-wise catch/hour of trawling South west coast

The important varieties of fishes caught from this region included cat fish, elasmobranchs, prawns, Lactarius, 'kilimeen', etc. Highest catch rate for cat fish (76 kg/hour) was recorded from the area 10-75. In all other areas the catch rate was less than 25 kg/hour. The highest catch rate of about 21 kg/hour for elasmobranchs was also recorded from the same region. Compared to north west coast, the catch rate of this variety is less in this region. The catch rate of prawns was higher in areas 9-76 (2.3 kg/hour) and 9-75 (2.4 kg/hour). In the remaining areas prawn was indicated in quantities less than 2 kg/hour. A fall in the catch rate from the previous year is observed in this region.

Flat fish, caranx, barracuda and perch were represented only along Kerala coast. It is to be mentioned that ribbon fish was caught along Karnataka coast only. In the north west coast, this variety was present only in Goa region. It appears that this variety is caught in bottom trawls between lat. 12° N and 16° N. The findings of 1975-76 also has indicated this phenomenon. Further investigations are required so as to throw some light on the spawning grounds and migratory pattern of this species. The catch/hour of miscellaneous fishes continued to be high during this year also, the rate ranging from 36-111 kg/hour. However a decrease in the catch rate of other quality fishes is noticed during this year.

5.3.3. Lower east coast

In this zone also only 17.5 m vessels were operating. However, the vessel Jheenga which was laid up for want of imported part, namely, gear-box housing, was commissioned towards the end of the year under report. She carried out 25 days' fishing operation, expending about 81 hours of actual fishing. The results of operation of this vessel has not been taken up for detailed analysis. The

catch/hour of prawn and important varieties of fish obtained from different areas in this zone are given in Table V. Out of the eight areas surveyed the area 14-80 recorded the highest catch rate of 171 kg/hour. Area 11-79 also recorded an appreciable catch rate of about 145 kg/hour. In all the other areas the catch rate was less than 100 kg/hour. Average catch rate for this zone worked out to 105 kg. It is observed that the yield from this zone is slightly poorer compared to that of the previous year.

The important varieties constituting the bulk of catch were elasmobranchs, perch, sciaenids, leiognathids and pomfret. The catch/hour of prawn was negligible and in none of the areas it exceeded one kg/hour. In contrast to the result obtained during 1975-76, the high catch rate of perches was found only along Tuticorin coast. The catch rate obtained for perches was much higher than that of the previous year from this area. Elasmobranchs also presented more or less the same trend yielding a catch rate of 16-28 kg/hour from the three areas off Tuticorin. In all the other areas the catch rate was less than 10 kg/hour. Sciaenid was distributed in almost all areas in small quantities. The highest catch rate of about 73 kg/hour for leiognathids was recorded from the area 11-79 off Madras. It may be mentioned that the catch/hour of this variety was much higher than that obtained during the previous year from this area. In areas off Tuticorin this variety was totally absent. Pomfret, flat fish and Lactarius were recorded only from the areas off Madras whereas carangids were present only in areas off Tuticorin. The total absence of nemipterids and cat fish in the trawl catches of lower east coast is a striking demarcation from the west coast catches.

Area	Fishing effort	Elasmo-branch	Prawn	Per-ch	Sciae-nids	Seer fish	Ca-ranx	Lacta-rius	Flat fish	Pom-fret	Moon fish	Syna-gris	Leio-gna-thids	Li-zard fish	Ri-bbon fish	Other quali-ty	Misc.	All spe cie
8-77	15	16.0	-	21.3	0.9	-	1.7	-	-		-	-	-	-	-	15.3	18.8	74
8-78	1580	28.1	-	35.5	2.8	0.1	1.8	-	-		-	-	-	-	-	12.6	10.3	91
9-78	125	22.7	-	23.1	3.4	-	0.9	-	-		-	-	-	-	-	19.8	11.6	82
10-79	12	5.4	-	-	1.7	0.5	-	2.5	0.3	0.8	5.4	-	-	-	-	6.2	8.7	31
11-79	87	8.8	0.4	1.7	0.3	0.4	-	0.9	0.3	1.8	1 [illegible]	0.5	72.8	-	-	6.4	49.2	144
12-80	303	8.8	0.2	2.6	2.9	0.1	-	0.5	0.2	0.4	0.9	3.2	16.9	1.1	1.0	6.0	43.7	88
13-80	413	7.7	0.1	3.1	1.1	0.1	-	0.3	0.2	0.3	0.7	3.9	21.3	1.3	0.1	6.1	50.8	97
14-80	458	8.2	0.4	2.3	4.1	0.2	-	4.4	1.2	5.4	2.6	0.4	1.4	2.4	4.0	6.0	128.1	171

Table V Area-wise and species-wise catch/hour Lower east coast

5.3.4 Upper east coast

Orissa and West Bengal coasts and upper part of Andhra coast constitute this zone. In addition to four 17.5 m trawlers, the vessel Matsyavigyani from Calcutta was also available for operation during the year. The results of operation of these vessels are shown in Table VI. The 17.5 m vessels recorded the highest catch per hour of 240 kg from area 20-86 off Calcutta. The area 18-84 off Andhra Pradesh also yielded an appreciable catch rate of 237 kg/hour. Areas 16-82 and 18-83 off Andhra coast and 19-86 off West Bengal coast yielded catch rates above 100 kg/hour. In all the four areas surveyed by Matsyavigyani, the catch rate obtained was above 200 kg/hour and the area 21-87 excelled among these with a catch rate of about 287 kg/hour. The average catch rates obtained by 17.5 m vessels and Matsyavigyani for the whole region were 152 kg/hour and 235 kg/hour respectively. Compared to the results obtained during the previous year, these figures do not show any marked increase.

Elasmobranchs, perch, pomfret, wam and cat fish were the major constituents of the catch. Matsyavigyani recorded the highest catch rate of 12.5 kg/hour for prawns from the area 20-88. There is an appreciable increase in the prawn catches of Matsyavigyani consequent of the location of a very productive prawn ground off Calcutta (Sudarsan et al 1976). The highest catch rate of prawn recorded by 17.5 m vessels were 9.5 kg/hour from the area 20-86. Appreciable catch rate for elasmobranchs were recorded from all the four areas surveyed by Matsyavigyani, the highest catch rate was recorded from area 21-87 (72 kg/hour). In the case of 17.5 m vessels the area 19-86 was found to be most productive for this variety with a catch rate of about 46 kg/hour. The catch/hour of perch ranged from 1-18 kg in the

	Area	Fishing effort (hrs)	Flasmo-branch	Prawn	Cat fish	Eel	Per-ch	Pom-fret	Big sciae-nids	Ribbon fish	Kar-kara	Ghol	Dho-ma	Ca-ranx	Lacta-rius	Other quali-ty fish	Misc.	Total
17.5 m trawlers	16-81	11	9.1	-	6.4	-	10.9	0.1	0.6	-	-	-	-	-	-	15.0	42.4	84.5
	16-82	87	22.3	-	8.1	0.1	17.8	0.3	1.7	-	-	-	-	-	-	19.0	72.0	141.3
	17-82	50	5.9	-	5.5	0.4	7.0	-	0.3	-	-	-	-	-	-	5.9	27.8	52.8
	17-83	1018	4.2	0.7	7.8	0.5	0.2	-	-	1.7	-	-	-	-	-	2.6	37.9	55.6
	18-83	127	18.7	-	18.6	3.9	5.9	1.1	0.6	0.6	-	-	-	-	-	7.9	95.1	152.4
	18-84	210	19.3	-	38.9	6.5	10.8	2.4	0.9	0.7	-	-	-	-	-	4.2	143.6	237.3
	19-86	16	45.5	1.7	14.1	11.3	6.5	3.0	-	5.4	-	-	16.3	2.7	4.5	1.3	58.6	170.9
	20-86	973	20.5	9.5	7.0	4.3	1.2	4.5	-	1.7	-	0.6	27.6	0.6	0.8	2.8	159.2	240.3
Matsya-vigyani	20-86	23	37.4	4.0	52.2	9.4	-	17.6	-	-	28.0	-	-	-	-	-	99.8	248.4
	20-87	76	51.8	1.7	5.8	1.2	-	4.7	-	-	6.6	0.6	-	-	-	0.3	133.4	206.1
	20-88	370	48.0	12.5	4.9	2.1	-	4.2	-	-	3.0	1.7	-	-	-	7.0	155.3	238.7
	21-87	12	71.7	4.2	0.8	-	-	3.7	-	-	-	8.3	-	-	-	-	197.8	286.5

Table VI Area-wise and species-wise catch/hour Upper east coast

case of 17.5 m vessels. Highest catch rate for this variety was recorded from the area 16-82. Perch was not represented in the trawl catches of Matsyavigyani. The highest catch rate for pomfret in the zone was 18 kg/hour obtained from the area 20-86 by Matsyavigyani. In all the other areas the catch rate was less than 5 kg/hour. Wam was present in almost all areas and 17.5 m vessels indentified the areas 18-84 and 19-86 as more productive with catch rates of about 7 kg/hour and 11 kg/hour respectively. Matsyavigyani obtained the highest catch rate of 9 kg/hour from the area 20-86.

It is observed that cat fish, which constituted one of the important varieties in the trawl catches of west coast and significant by its total absence in the trawl catches of lower east coast was fairly distributed along the upper east coast. Matsyavigyani recorded the highest catch rate of about 52 kg/hour from the area 20-86 while 17.5 m vessel recorded the highest catch rate of 39 kg/hour from the area 18-84.

5.3.5 Andaman and Nicobar waters

During the period three areas viz. 11-92, 12-92 and 12-93 were surveyed by two 17.5 m vessels. The highest catch rate of 102 kg/hour was obtained from area 11-92. The highest catch rates was obtained in respect of leiognathids (about 33 kg/hour) followed by upenoids (about 14 kg/hour), sciaenids (about 10 kg/hour) and miscellaneous fish.

5.4 Relative abundance by area and depth

5.4.1 North west coast

As stated earlier three different types of vessels were employed to survey this zone. Fig. 5 shows the catch/hour

recorded from different depth zones of various areas by these three classes of vessels. Along the Gujarat coast Kalyani V covered upto 100 m whereas Meena Udyog (17.5 m) surveyed upto 80 m depth. In the case of Kalyani V 20-39 m depth zone in area 21-68 and 40-59 m depth zone of area 22-68 were found to be more productive with a catch rate of 346 kg/hour and 278 kg/hour respectively. Meena Udyog recorded the highest catch rate from the depth zone of 60-79 m in the area 22-67.

Along Maharashtra coast Meena Bharati covered upto 100 m depth whereas 17.5 m vessels surveyed upto 80 m. Of all the areas surveyed by Meena Bharati, 60-100 m depth range of area 17-72 and 20-60 m depth range of 18-72 were found relatively more productive. In the case of 17.5 m vessels 20-39 m depth range of areas 17-72 and 18-72 were found to yield better catch rates.

Two areas viz. 15-73 and 16-73 off Goa were intensively surveyed by the 17.5 m vessels upto 60 m depth. Of these, 20-60 m depth range of 15-73 was found more productive.

Table VII and VIII gives the depth-wise catch rates of prawn and important varieties of fishes obtained by the three types of vessels viz. Kalyani V, Meena Bharati and 17.5 m vessels along Gujarat, Maharashtra and Goa regions.

It can be seen from these tables that the catch rate of prawn was very low from all the regions as compared to that obtained during the previous year. The catch rate of prawn obtained by 17.5 m vessels were better than that obtained by the bigger vessels viz. Kalyani V and Meena Bharati. The depth ranges 20-39 m off Bombay and 0-19 m depth range off Goa have shown some indications of prawns in the case of 17.5 m vessels where the catch rates varied from 1-2 kg/hour.

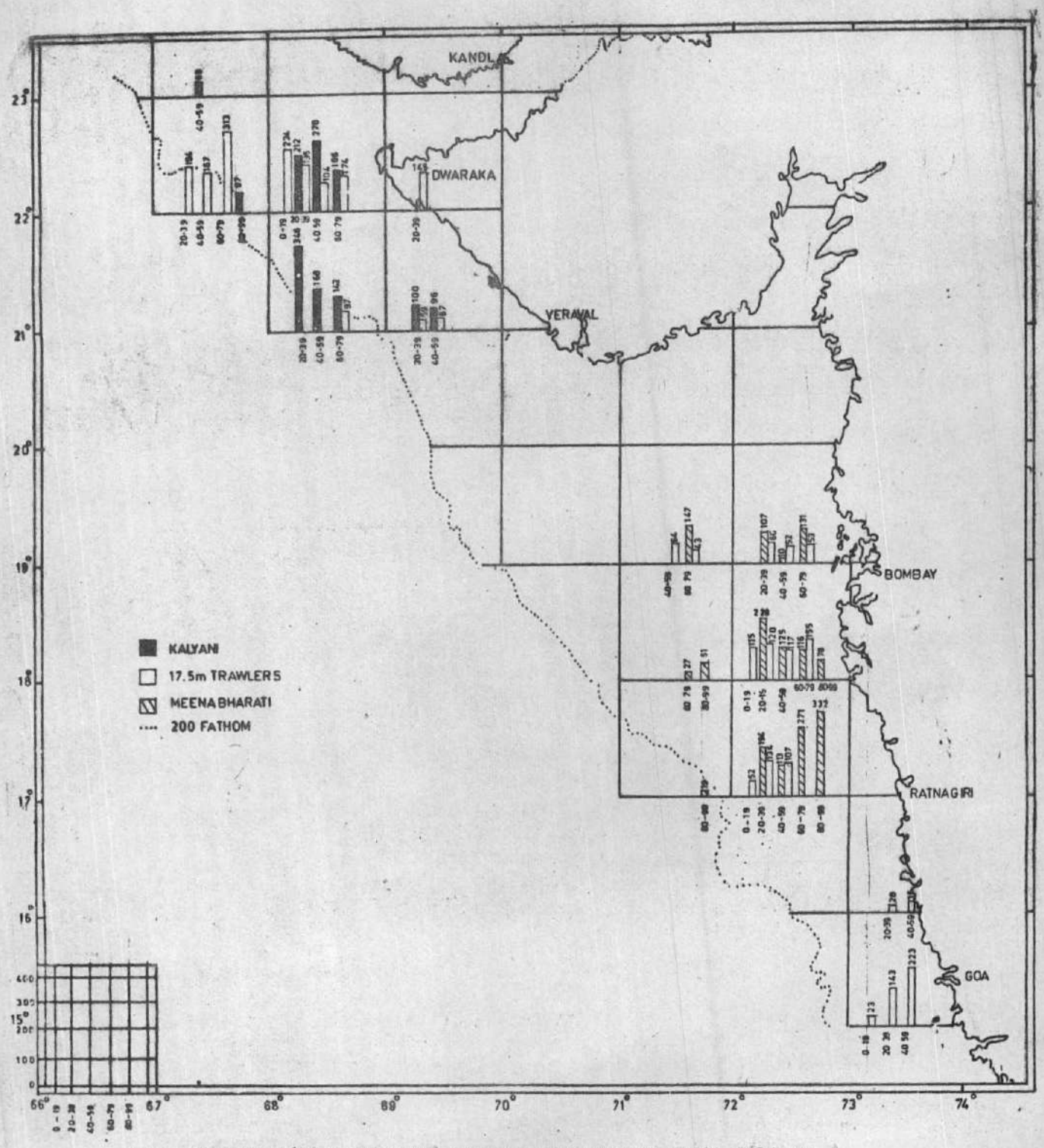


FIG.5 CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE NORTH-WEST COAST

Species	Depth range (m)							
	20-39	40-59	60-79	80-99	20-39	40-59	60-79	80-99
	KANDLA				BOMBAY			
Elasmobranch	40.4	59.0	39.1	23.0	58.2	20.4	37.9	31.5
Prawn	0.1	-	-	-	0.3	-	-	-
Wam	26.0	11.7	9.7	19.3	2.1	0.2	4.6	0.1
Cat fish	9.9	6.6	5.9	3.3	51.3	42.7	31.3	134.8
Karkara	12.9	10.2	8.6	1.7	4.7	0.7	0.9	0.9
Tam	0.4	1.1	-	-	0.3	1.2	3.9	5.8
Dhoma	74.5	49.6	25.1	10.0	24.7	15.3	25.2	17.2
Ghol	8.0	13.5	12.1	16.7	8.2	4.5	4.3	4.4
Pomfret	6.8	10.5	14.6	-	12.7	4.0	7.6	4.9
Kati	10.4	14.2	6.8	16.7	2.1	0.3	1.3	0.3
Surmai	0.4	0.4	0.2	1.7	1.2	1.0	1.4	0.4
Rawas	-	-	-	-	-	0.1	0.1	-
Dara	-	-	-	-	-	0.1	-	-
Koth	4.9	8.1	1.7	-	0.9	1.4	4.6	-
Caranx	1.9	4.5	6.8	-	0.6	0.2	1.8	-
Sea bream	8.0	9.2	15.6	5.0	-	-	-	-
Other quality*	-	-	-	-	52.6	25.2	14.6	10.2
Miscellaneous fish	18.6	7.6	8.4	-	6.1	5.8	5.3	5.4

Table VII Catch/hour of prawn and important varieties of fish by Kalyani V and Meena Bharati from Kandla and Bombay

Species	Depth range (m) 0-19	20-39	40-59	60-79	0-19	20-39	40-59	60-79	Depth range (m) 0-19	20-39	40-59
	KANDLA				BOMBAY				GOA		
Elasmobranchs	78.2	27.6	16.7	31.1	30.0	27.8	23.5	0.2	0.7	8.1	15.4
Prawn	-	0.3	0.1	-	0.4	1.0	0.2	-	1.6	0.5	0.3
Wam	8.8	5.9	2.9	4.0	-	0.8	1.0	3.5	0.3	0.1	-
Cat fish	26.5	6.9	20.1	17.0	21.1	40.2	25.4	1.9	0.5	64.1	33.4
Karkara	4.2	4.0	2.2	1.2	3.8	0.8	0.6	0.1	0.7	2.8	2.7
Tam	-	1.0	0.1	-	1.4	0.3	0.9	0.2	7.8	16.9	32.4
Dhoma	76.4	43.8	32.1	73.7	25.3	25.5	31.7	1.0	0.1	4.1	4.1
Ghol	9.4	7.6	5.1	13.1	2.6	2.8	1.0	-	-	0.1	0.6
Pomfret	-	10.0	2.4	7.0	7.1	1.6	0.8	0.3	-	0.8	-
Kati	6.5	1.6	5.9	11.7	1.0	0.3	0.7	-	-	14.0	61.5
Surmai	-	-	0.4	0.5	-	0.1	0.6	0.2	0.3	2.2	3.9
Rawas	-	-	-	-	-	-	-	-	-	0.3	1.4
Dara	-	-	-	-	-	-	-	-	-	0.3	2.9
Koth	-	0.9	2.5	0.8	1.4	1.8	1.4	-	1.2	0.4	-
Caranx	-	1.4	0.6	-	-	-	-	-	0.2	2.9	8.4
Sea bream	0.6	11.4	4.4	2.7	-	-	-	-	9.8	25.0	44.6
Other quality	-	-	-	-	7.9	10.3	17.3	30.1			
Miscellaneous fish	16.2	2.9	3.4	1.9	9.9	6.2	8.5	42.1			

Table VIII Catch/hour of prawn and important varieties of fish by 17.5 m trawlers from Kandla, Bombay and Goa

From Kandla region, the 17.5 m vessel obtained better catch rates for elasmobranchs, wam, cat fish, dhoma, etc. from the depth zone of 0-19 m. Pomfret was more abundant in 20-39 m depth zone, whereas in the case of ghol and pellona sp. better yield was obtained from 60-79 m depth. In the case of Kalyani V, 40-59 m depth zone was found more productive. The interesting phenomenon observed in the catch rate of this vessel was that for ghol and pellona sp. and pomfret yield was better from deeper zones.

The 17.5 m vessels operated from Bombay identified 0-19 m depth zone as more productive in the case of elasmobranchs, karkara and pomfrets, whereas the depth range of 20-39 m yielded highest catch rates for cat fish, ghol and koth. 40-59 m depth range gave better yields for dhoma. In the case of Meena Bharati, the 20-39 m depth range was found more productive for varieties like elasmobranchs, karkara, ghol and pomfret. Dhoma and koth gave better yield from 60-79 m depth zone. Highest catch rate of about 135 kg/hour for cat fish was recorded by Meena Bharati from 80-100 m depth zone.

Trawl catches of Goa present a different picture from that of Maharashtra and Gujarat. Presence of ribbon fish, butter fish, mackerel, horse mackerel etc. is noticeable. The depth range of 40-59 m is found generally more productive for all important varieties except for cat fish, which gave better yield from 20-39 m zone. Abundance of ribbon fish and kilimeen (Nemipterus sp.) and the total absence of wam, dhoma and ghol is distinct phenomenon of the trawl catches of Goa.

5.4.2. South west coast

Fig. 6 shows the catch rate obtained from different depth zones of the south west coast. The 17.5 m vessels based at Mangalore surveyed three depth zones viz. 0-19 m, 20-39 m and 40-59 m while the vessels of Cochin base restricted their operation to 20-59 m, belt. The highest catch rate from areas off Mangalore (137 kg/hour) was obtained from 0-19 m depth belt in area 12-74. Of the four areas surveyed along Kerala coast, the 40-59 m depth belt of 9-75 gave the highest catch rate of 173 kg/hour. Both 20-39 m and 40-59 m depth belts of area 10-75 also yielded better catch rates.

Table IX shows the catch rates of prawn and important varieties of fishes obtained from the different depth belts of this zone. It can be seen that prawn was indicated only in 20-39 m depth range of Karnataka region. In Kerala region, the 20-39 m and 40-59 m ranges yielded 2.5 kg/hour and 1.5 kg/hour of prawn respectively. The yield of 40-59 m range is slightly more than that of the previous year. Along Karnataka coast, 20-39 m depth range proved to be more productive for almost all important varieties of fish such as elasmobranchs, kilimeen, cat fish and ribbon fish. Except for ribbon fish, the catch rates of all other varieties are slightly lesser than that of the previous year. Along Kerala coast, the 40-59 m depth range yielded better catch rates for elasmobranchs, kilimeen, cat fish, lizard fish, caranx etc. The yield of cat fish and perch showed an improvement over the previous year.

5.4.3. Lower east coast

It can be seen from Fig. 7 that the 17.5 m vessels of this region surveyed upto 80 m depth. 20-39 m depth range was

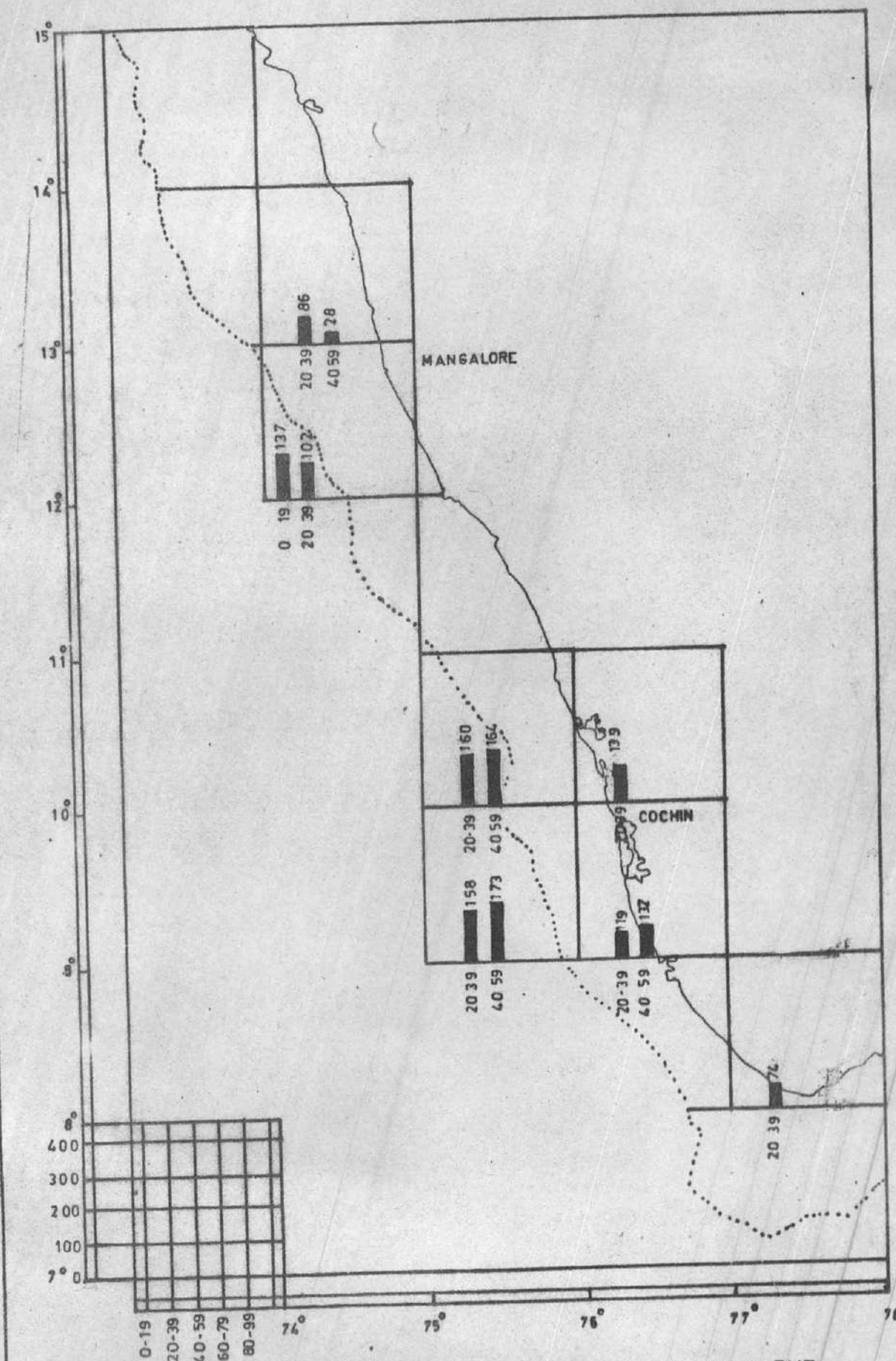


FIG.6 CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE SOUTH-WEST COAST

Species	Depth range (m) 0-19	20-39	40-59	20-39	40-59
		MANGALORE		COCHIN	
Elasmobranchs	-	2.2	1.0	8.7	14.0
Prawn	-	0.1	-	2.5	1.5
Kilimeen	-	1.8	-	1.8	8.9
Cat fish	-	14.4	4.5	13.1	37.1
Flat fish	-	-	-	1.9	1.9
Lizard fish	-	-	-	0.2	3.7
Lactarius	1.8	0.8	1.1	0.2	-
Ribbon fish	-	28.6	-	-	-
Jew fish	-	0.3	-	-	-
Horse mackerel	-	-	-	0.2	-
Perch	-	-	-	0.7	0.5
Barracuda	-	-	-	1.1	0.5
Caranx	-	-	-	0.7	2.0
Other quality	1.3	1.2	1.3	7.9	2.9
Miscellaneous fish	134.1	41.8	20.4	83.1	69.4

Table IX Catch/hour of prawn and important varieties of fish from the south west coast

covered fairly well. Of the three areas surveyed along Tuticorin, 0-19 m depth range of area 9-78 gave the highest catch rate of 212 kg/hour. 40-50 m depth range of area 8-78 also gave better catch rates. Off Madras, 20-39 m depth zone of area 14-80 yielded the highest catch rate of 177 kg/hour followed by 0-19 m depth range of area 13-80. The depth range of 20-39 m of area 11-79 also yielded appreciable catch rate.

The catch rates of prawn and important varieties of fish obtained from different depth ranges of lower east coast are furnished in Table X. It can be seen that prawns were indicated at the rate of less than 1 kg/hour from 20-60 m depth belt off Madras only. In the case of Tuticorin region, 40-59 m depth belt was found more productive for varieties like perches, sciaenids and other quality fishes, while better yields of elasmobranchs and carangids were obtained from 20-39 m depth zone. Pomfrets, flat fish and moon fish were not indicated in the trawl catches from this region in appreciable quantities. In Madras region, 20-39 m depth range was found more productive for most of the varieties of fishes such as perches, sciaenids, Lactarius, pomfrets and leiognathids. It can be seen that better catch rates for elasmobranchs, moon fish and other quality fishes were obtained from 0-19 m depth zone.

5.4.4. Upper east coast

Matsyavigyani and four 17.5 m vessels surveyed upto 80 m depth in this zone. It may be seen from Fig. 8 that off Andhra Pradesh, the 17.5 m vessels operated in 20-70 m depth belt, while the 17.5 m vessels and Matsyavigyani surveyed 10-80 m along Orissa and West Bengal coast. From Andhra coast, two depth ranges viz. 20-39 m and 40-59 m in the area 18-84 yielded more than 200 kg/hour. The areas 20-88 (surveyed by Matsyavigyani) and 19-86 and 20-86 (surveyed by 17.5 m vessels) gave

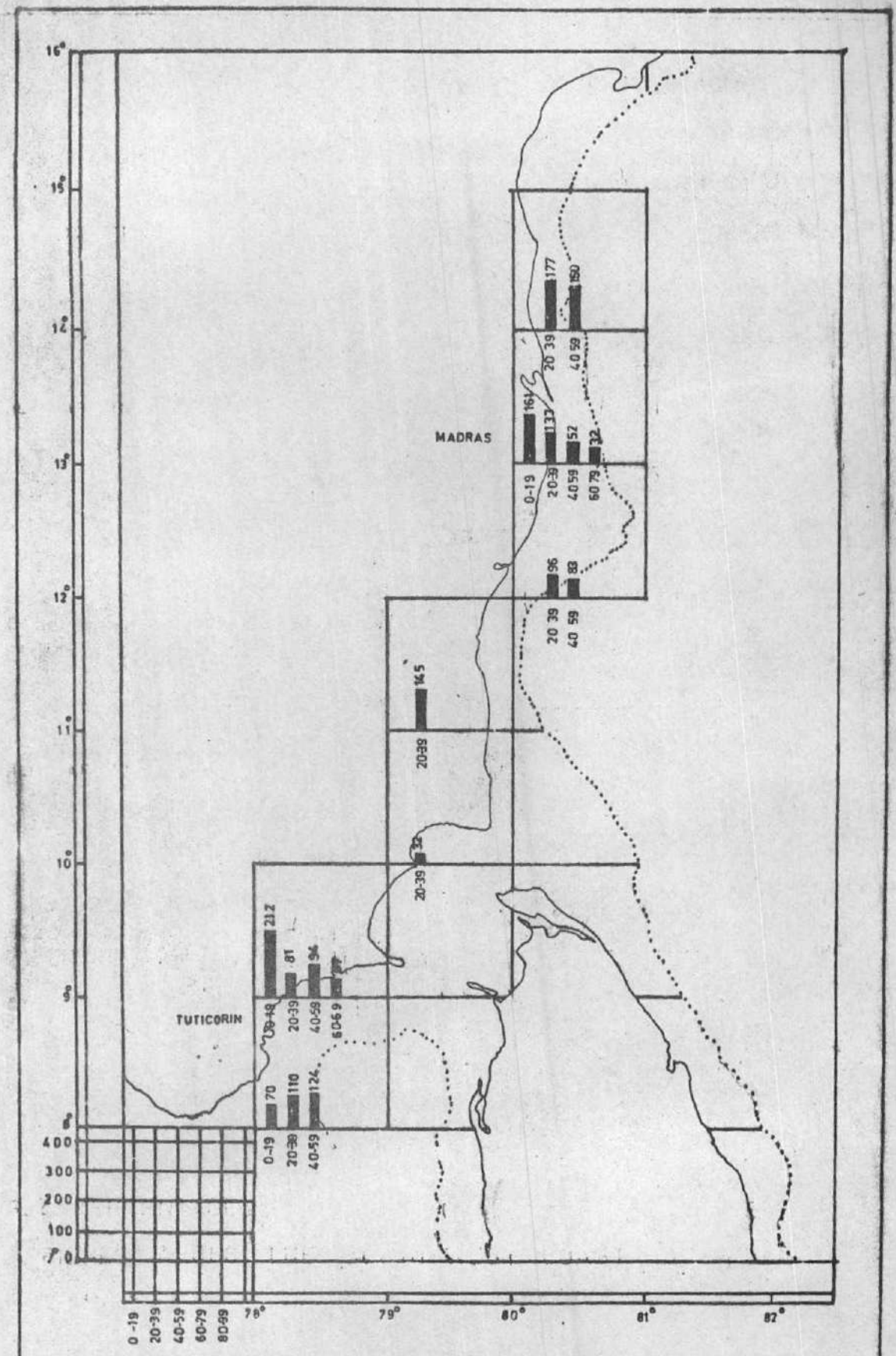


FIG. 7 CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE LOWER EAST COAST

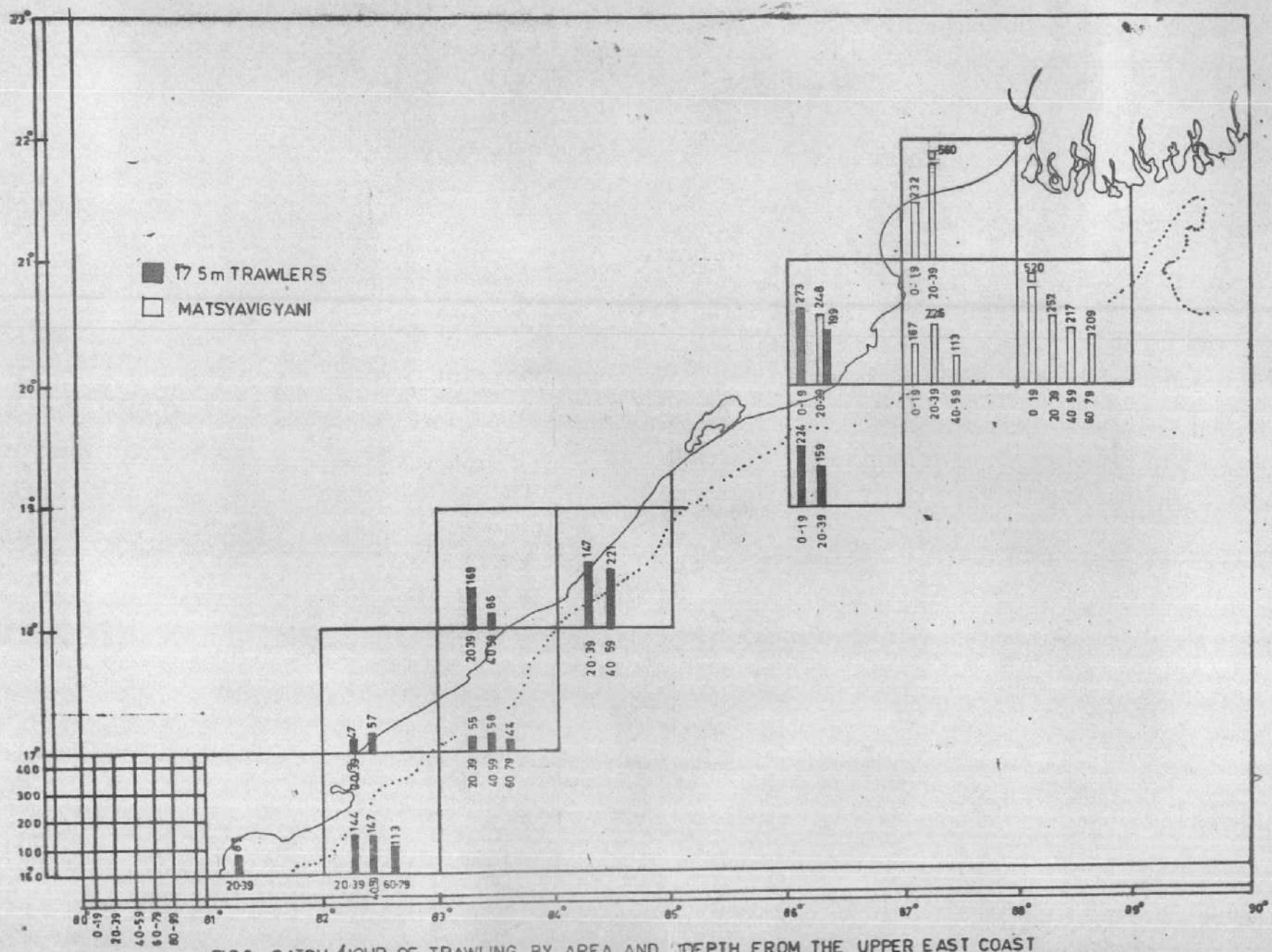


FIG.8 CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE UPPER EAST COAST

Species	Depth range (m)							
	0-19	20-39	40-59	60-79	0-19	20-39	40-59	60-79
	TUTICORIN				MADRAS			
Elasmobranchs	25.9	31.1	19.9	20.7	42.3	10.5	3.6	4.8
Prawn	-	-	-	-	-	0.3	0.1	-
Perch	20.7	45.0	51.5	4.6	2.5	3.8	0.3	-
Cat fish	0.2	1.0	-	-	-	-	-	-
Sciaenids	1.8	3.6	6.3	-	-	3.4	1.1	-
Seer fish	0.1	0.1	-	-	-	0.2	0.1	-
Caranx	0.7	2.7	0.5	-	-	-	-	-
Lactarius	-	-	-	-	1.0	2.5	0.8	-
Flat fish	-	-	-	-	1.5	0.7	0.3	-
Pomfret	-	-	-	-	1.3	3.0	1.0	-
Moon fish	-	-	-	-	12.0	2.2	0.1	-
Synagris	-	-	-	-	-	1.7	3.3	3.7
Leiognathids	-	-	-	-	-	18.7	12.9	-
Lizard fish	-	-	-	-	-	2.0	0.7	-
Ribbon fish	-	-	-	-	2.2	2.1	1.1	-
Other quality	9.2	15.0	21.3	12.5	10.2	7.1	4.1	1.5
Miscellaneous fish	11.3	9.8	8.9	29.5	87.7	88.1	55.2	22.3

Table X Catch/hour of prawn and important varieties of fish from the lower east coast

better yields from 0-19 m depth belt. The highest catch rate of 560 kg/hour in the case of Matsyavigyani was recorded from 20-39 m depth range in the area 21-87. Generally speaking, this vessel obtained encouraging results from 20-39 m depth belt of all areas surveyed. Amongst the 4 areas surveyed by this vessel, the area 20-88 was found more productive giving a catch rate ranging from 200-500 kg/hour from depth ranges upto 80 m.

Table XI gives the catch rates of prawns and important varieties of fishes obtained from different depth zones along upper east coast. It can be seen from the tables that of all the five zones, the upper east coast gave better catch rates for prawns. Along Andhra coast the catch rate of prawns were however poorer than that of the previous year, the yield being less than 1 kg/hour. Orissa region also showed a slight decline in the catch rate of prawns in comparison to that of last year. However, catch rate of about 8 kg/hour in 0-19 m and 1 kg/hour in 20-39 m depth ranges is appreciable.

Important varieties of fishes such as elasmobranchs, perches and big sciaenids were abundant in 60-79 m depth range in Andhra region. Cat fish was more abundant in 40-59 m depth range in this region, while better catch rate for other quality fishes was obtained from 20-39 m depth zone.

In Paradeep region 0-19 m yielded better catch rates for pomfret, Lactarius and Bombay duck while 20-39 m depth zone was found to be more productive for elasmobranchs, eel and dhoma.

Species	Depth range (m)								
	20-39	40-59	60-79	0-19	20-39	0-19	20-39	40-59	60-79
	VIZAG			PARADEEP		CALCUTTA			
Elasmobranchs	8.7	8.6	11.4	17.7	25.0	132.8	56.0	34.2	10.3
Prawn	0.6	0.3	0.2	7.9	11.4	3.7	1.3	26.2	21.6
Cat fish	12.2	14.9	6.9	4.0	11.0	4.1	11.6	1.6	0.5
Eel	1.4	2.0	-	3.1	5.9	4.3	3.4	0.3	0.1
Perch	3.6	2.9	10.4	1.0	1.7	-	-	-	-
Pomfret	0.4	0.6	-	6.2	2.3	2.3	8.2	0.3	-
Big sciaenids	0.4	0.2	0.9	-	-	-	-	-	-
Ribbon fish	0.3	3.2	-	1.8	1.8	-	-	-	-
Tam	-	-	-	-	-	-	4.6	-	-
Karakara	-	-	-	-	0.1	-	7.5	1.7	-
Ghol	-	-	-	0.9	0.2	3.8	2.4	-	-
Dhoma	-	-	-	18.4	38.5	-	-	-	-
Seer fish	-	-	-	0.1	0.5	-	-	-	-
Caranx	-	-	-	0.4	1.0	-	-	-	-
Lactarius	-	-	-	1.0	0.8	-	-	-	-
Bombay duck	-	-	-	4.3	-	-	-	-	-
Other quality	6.7	4.4	5.4	0.2	9.9	-	4.8	0.5	-
Miscellaneous	65.1	48.6	35.4	205.6	79.9	122.3	148.6	144.8	178.5

Table XI Catch/hour of prawn and important varieties of fish from the upper east coast

In West Bengal region, 0-19 m depth range gave better catch rates for elasmobranchs, cat fish, eel and ghol. Higher catch rates for pomfret, tam, karkara and other quality fishes were obtained from 20-39 m depth range. The catch rate of elasmobranchs is found to increase northwardly from Vizag and highest catch rate of about 133 kg was obtained from 0-19 m depth range off Calcutta region.

5.4.5 Andaman and Nicobar waters

The details of depth-wise catch rates obtained by bottom trawling from Andaman and Nicobar waters is furnished below:

Species	20-39	40-59	60-79
Elasmobranchs	-	17.9	14.1
Cat fish	-	3.4	2.0
Leiognathids	-	35.0	17.5
Nemipterus	-	5.5	2.4
Lizard fish	-	3.2	2.4
Upeneoids	-	14.0	9.2
Sciaenids	-	10.0	7.1
Perches	4.0	1.7	0.1
Carangids	-	1.6	0.5
Gerrids	-	1.2	0.9
Miscellaneous	50.0	10.5	10.8

It may be seen from the table that catch rate was highest from 40-59 m depth range. The catch rate for miscellaneous small fish was highest in 20-39 m depth range. The catch rates from all the three depth ranges were slightly lesser than that obtained during the previous year. However, the 40-59 m depth range can be identified as the most productive zone in this region.

5.4.6 Regional abundance by depth

The catch/hour obtained by 17.5 m trawlers from different depth zones of various regions are furnished below:

Depth range	North west coast	South west coast	Lower east coast	Upper east coast	Andaman & Nicobar
0-19	51	137	71	273	-
20-39	132	97	125	130	54
40-59	126	125	86	86	104
60-79	149	-	46	71	67

In the case of North west coast, there is a slight increase in the catch rate over that of the previous year. Another interesting feature is that during the period under report the deeper layer of 60-79 m range have yielded the highest catch rate in this region. South west coast on the other hand showed a decline in the catch rates in respect of the different depth zones, except the 0-19 m depth range, which showed a three fold increase in the catch rate from that of the previous year. Lower east coast has not shown much variation from the yield pattern of 1975-76. During this period the depth range of 60-79 m has also been surveyed, which has not been done during the previous year. As in the previous year, the 20-39 m depth range proved to be the most productive zone in this region.

In the upper east coast, a marked increase was noticed in the catch rate obtained from 0-19 m zone. The highest catch rate of 273 kg/hour was obtained from this zone. This is the highest catch rate obtained from all the depth zones of the five regions surveyed. The other regions, however, showed a decline in the catch rate. The highest catch rate of 104 kg/hour from the Andaman and Nicobar waters was obtained from 40-59 m depth range. A decreasing trend is noticed in the catch rates of this region also.

5.5 Seasonal variation in the catch

5.5.1 Quantitative variation

Monthwise catch rates obtained by Kalyani V and Meena Bharati are given in Fig. 9. Kalyani V operated from Kandla base throughout the year except for May to August. March and April are found to be the most productive months. Meena Bharati was operating all the months except during the month of August. The highest catch rate of 323 kg/hour was obtained during the month of March. During November and December also, the vessel recorded a catch rate above 225 kg/hour.

Fig. 10 and 11 give the monthwise catch rates obtained by 17.5 m vessels operated from the five bases along the west coast of India, viz. Kandla, Bombay, Goa, Mangalore and Cochin. The vessel Meena Udyog operated from Kandla during April, May and September - March. The highest catch rate of 225 kg/hour in the case of this vessel was obtained during September. The months of November and February also yielded a catch rate above 150 kg/hour. The 17.5 m vessel operated from Bombay throughout the year except July. The highest catch rate of 203 kg/hour was obtained during February. During January and November, the yield was above 150 kg/hour. The period from June - September, recorded poor catch rates.

Along the Goa coast the 17.5 m vessels operated during all months except October. The highest catch rate was obtained during the month of February (253 kg/hour). A catch rate of above 200 kg/hour was recorded during the months of March and December also. December - March can be identified as comparatively more productive period for this region. The period June - October registered lower catch rates.

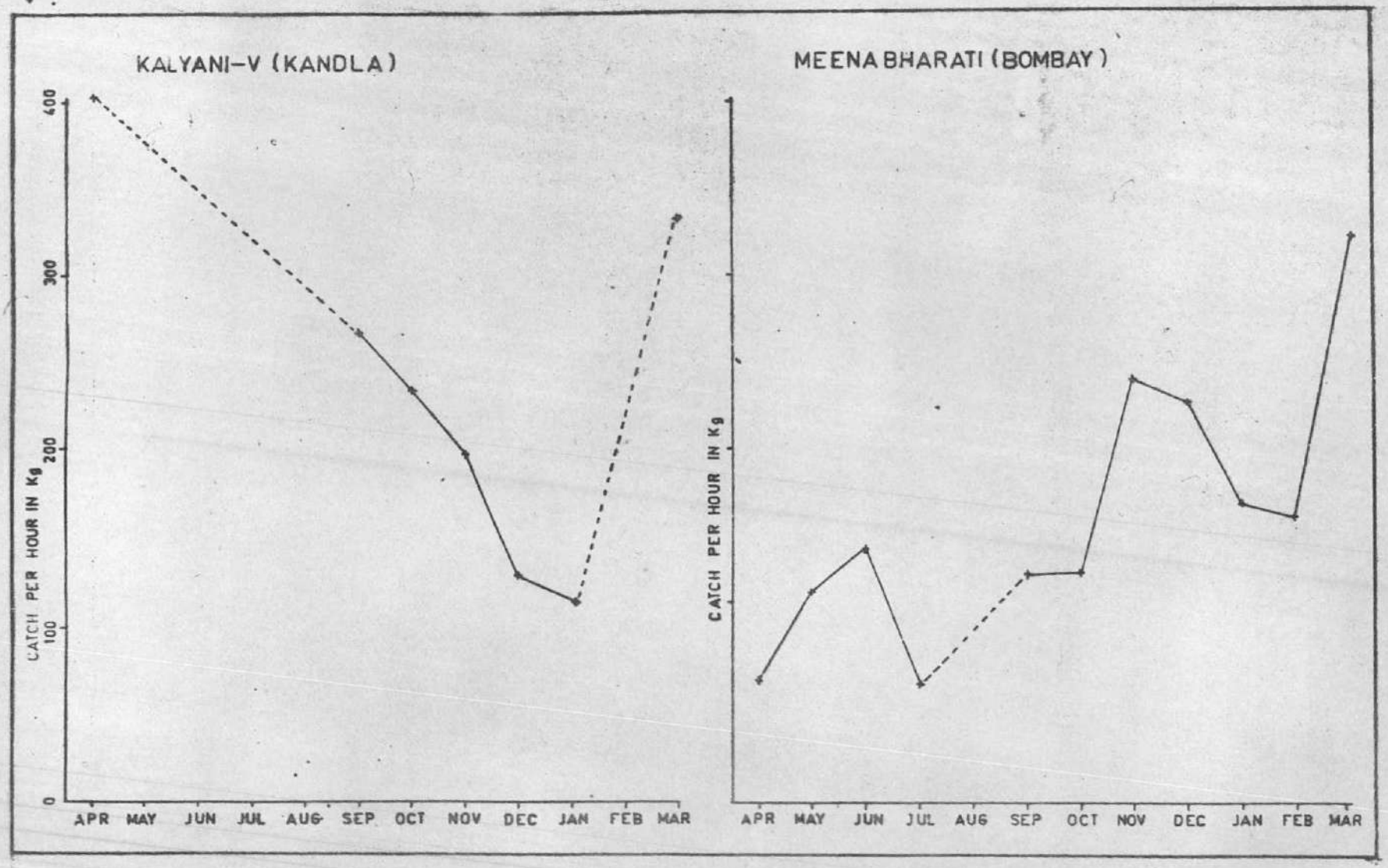


FIG. 9 MONTH-WISE CATCH PER HOUR OBTAINED BY KALYANI-V AND MEENA BHARATI

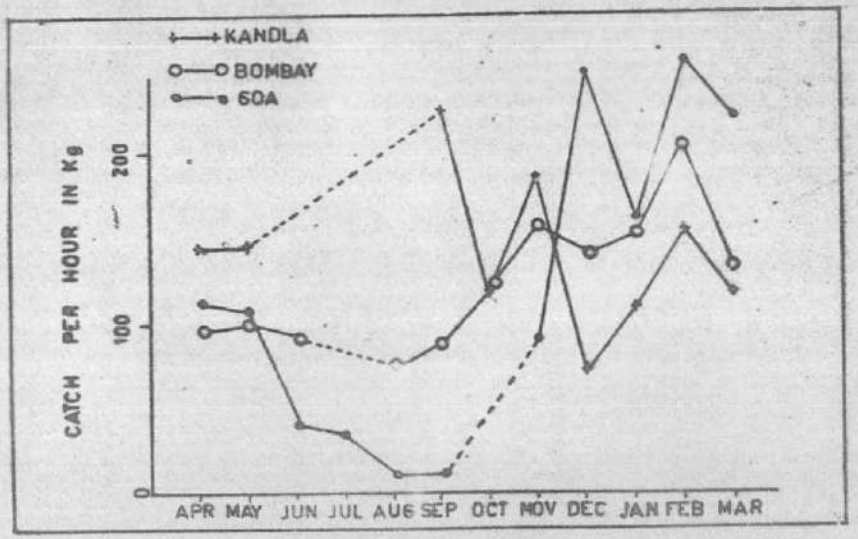


FIG.10 MONTH-WISE CATCH PER HOUR OF 12.5m. TRAWLERS FROM THE NORTH-WEST COAST

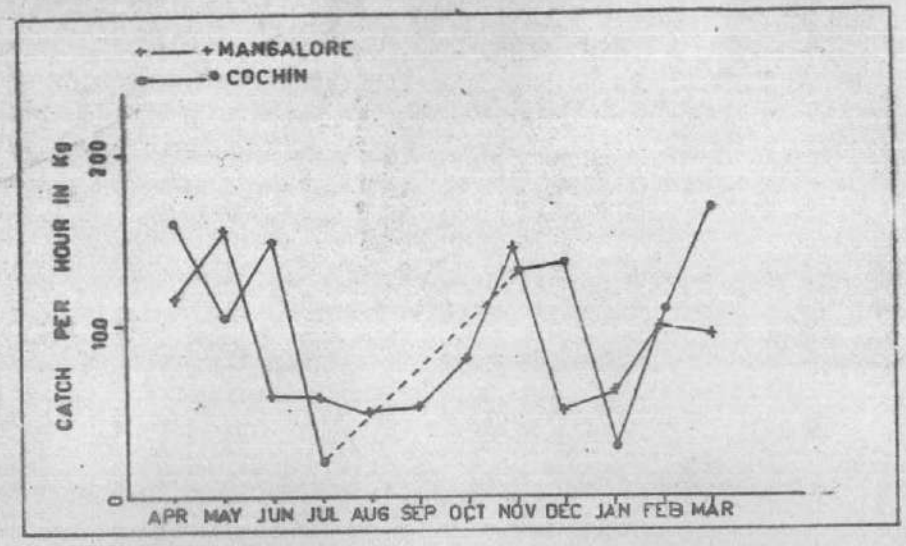


FIG.11 MONTH-WISE CATCH PER HOUR OF 17.5m TRAWLERS FROM THE SOUTH-WEST COAST

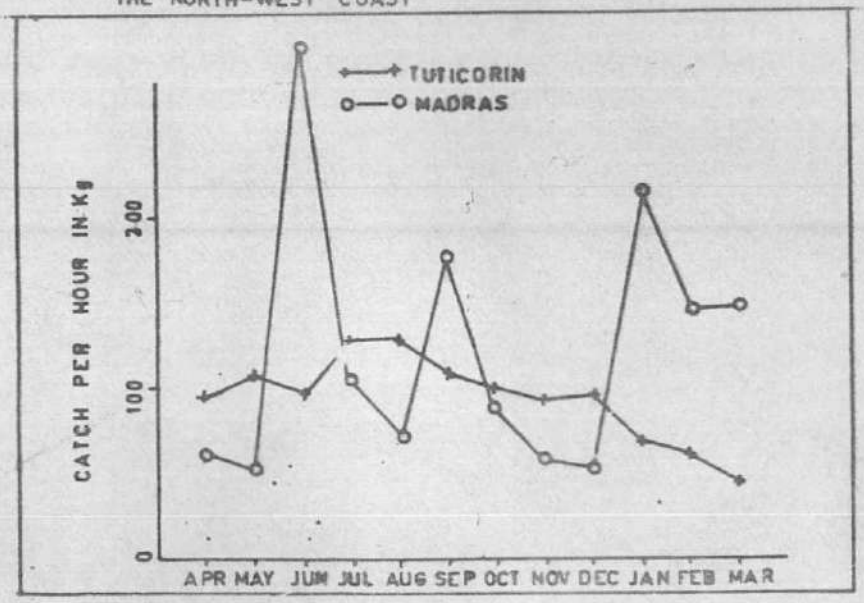


FIG.12 MONTH-WISE CATCH PER HOUR OF 17.5m TRAWLERS FROM THE LOWER EAST COAST

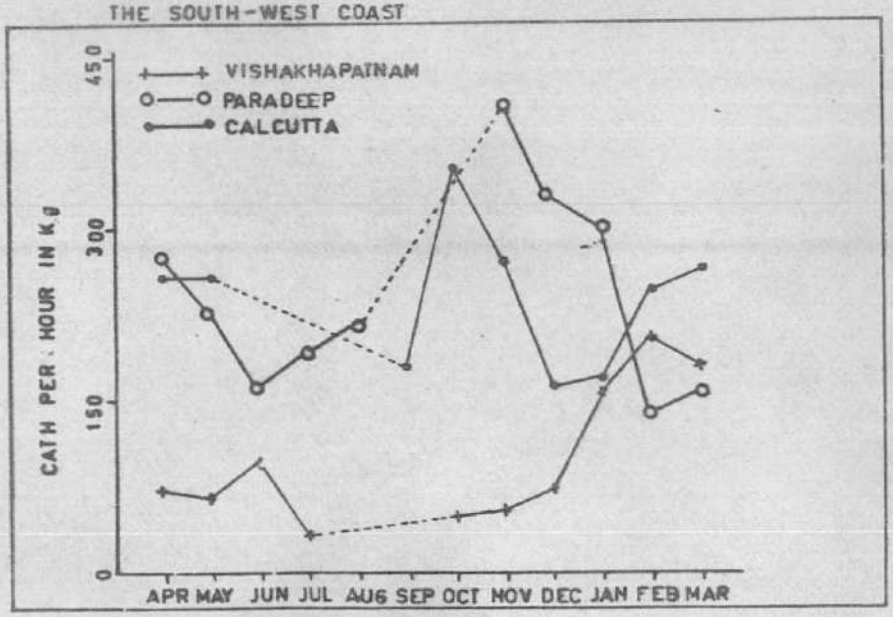


FIG.13 MONTH-WISE CATCH PER HOUR OF 17.5m TRAWLERS AND MATSYAVIGYANI FROM THE UPPER EAST COAST

The pattern of monthly fluctuation observed in the catch rates obtained from Mangalore and Cochin during the previous year was more or less repeated during the period under report also. Two peak seasons - during April - May and October - November were observed from Mangalore. The period July-September was the poorest fishing season. Similarly from Cochin, better catch rates were recorded during March-April and November-December. The period July to October is found less productive.

Fig. 12 and 13 give the monthwise catch rates obtained from different regions of the east coast. It can be seen that the highest catch rate from Tuticorin was obtained during July. The period June-October proved to be better fishing season for this region, with catch rates varying between 100-130 kg/hour. Survey was carried out throughout the year from Madras base. Two peak seasons were observed in the monthly catch rates from Madras viz. during June and January. The highest catch rate of 302 kg/hour was registered during June. The period November-December and April-May were comparatively poorer months.

Except during August and September, survey was carried out during all other months from Visakhapatnam. January-March proved to be the best fishing season. The highest catch rate of 202 kg/hour was obtained during the month of February. The 17.5 m vessels operated from Paradeep during all months except September and October and the catch rates were very high during almost all months in comparison to other regions of the east and west coasts. The period November-January were the most productive, the highest catch rate of 409 kg/hour being obtained during the month of November. During the months of April, May and August also, a catch rate above 200 kg/hour was registered.

In the case of Calcutta region, the vessel Matsyavigyani identified the periods February - May and October - November as the more productive seasons. The highest catch rate of 349 kg/hour was obtained during October. During May-August, the vessel did not operate. In the Andaman & Nicobar waters, survey was conducted by 17.5 m vessels throughout the year except during the months of September and October. The highest catch rate of 159 kg/hour was recorded during the month of May. During the months of December and January also better catch rates were obtained.

5.5.2 Qualitative variation

An examination on the monthwise fluctuation of some of the important varieties of fish in each region was undertaken so as to study the trend of the fishery and to draw conclusions on the peak fishing season for each of these varieties during the year. The data on the above have been analysed and presented in this chapter.

Fig. 14 gives the monthwise variation in the catch rates of seven important varieties of fishes in Kandla region obtained by 17.5 m vessel. It can be seen that the highest catch rate for elasmobranchs was obtained during the month of May. Better catch rate for this variety was obtained during September also. Highest catch rate for Kati(Pellona spp) was obtained during the month of November. During the months of October, January and March, the yield was rather poorer. The month of May was the best fishing season for 'wam' and that for 'dhoma' was the months of September - November and February. Better catch rates for pomfrets was recorded during the month of November, cat fish was more abundant during March and September. Appreciable catch rates for ghol was recorded during the month of April.

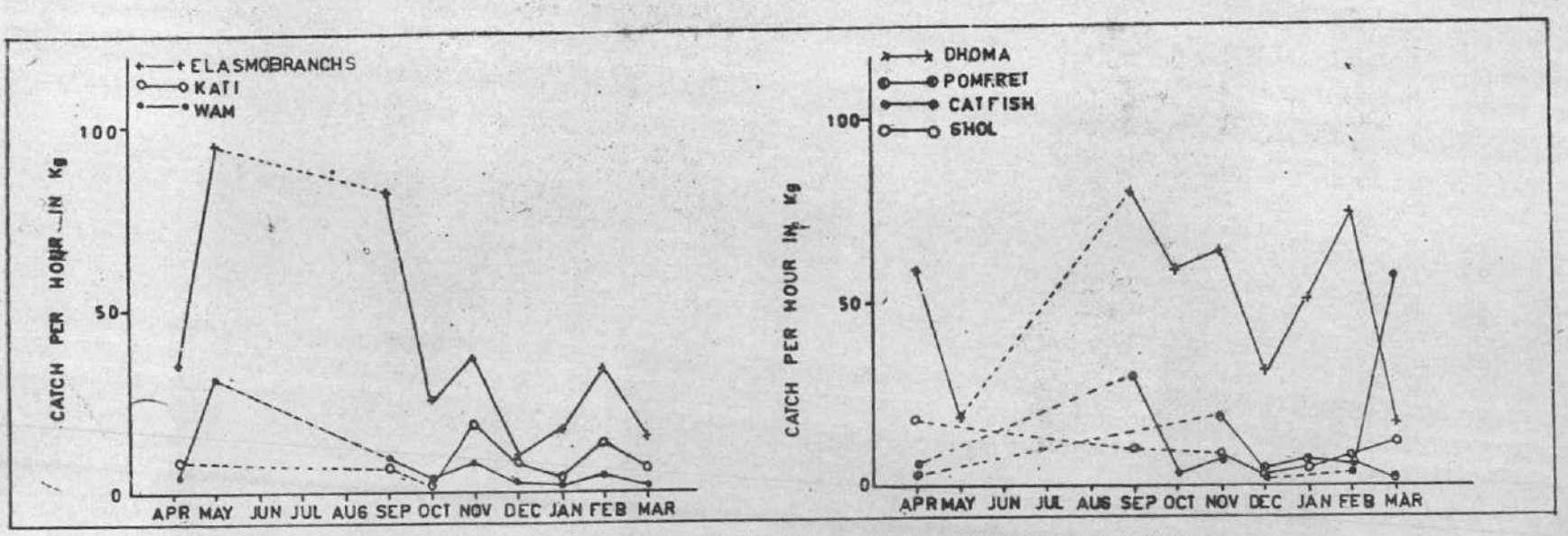


FIG. 14 MONTH-WISE CATCH PER HOUR OF IMPORTANT VARIETIES BY 17.5m TRAWLER FROM KANDLA.

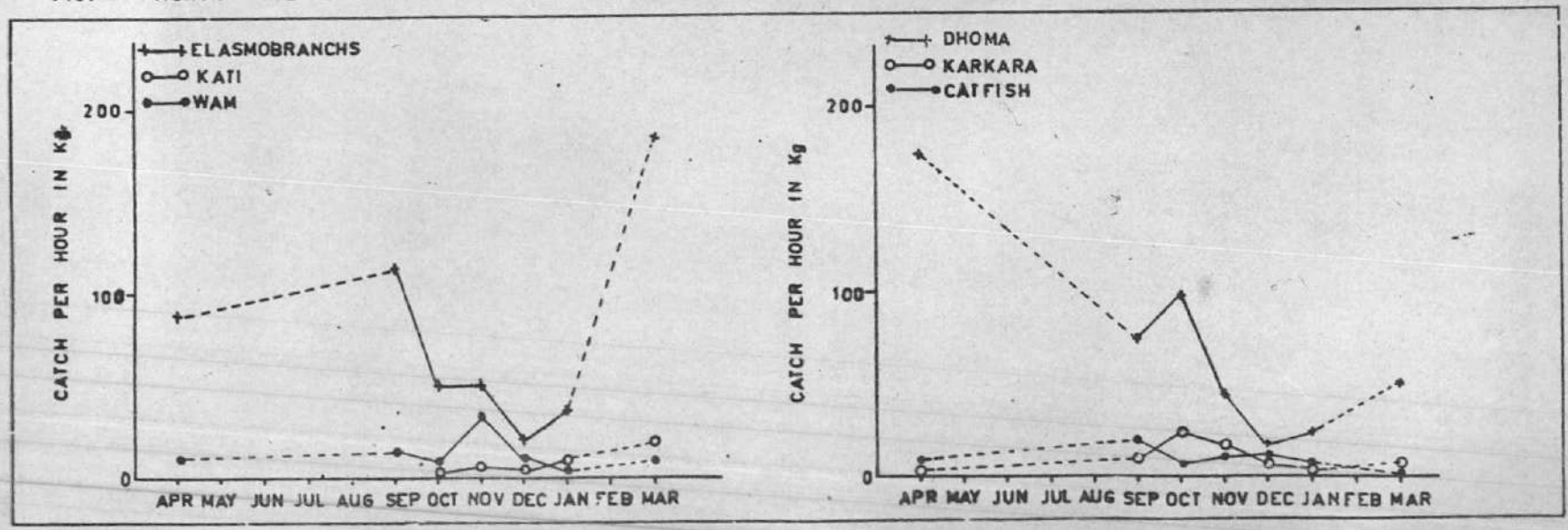


FIG.15 MONTH-WISE CATCH PER HOUR OF IMPORTANT VARIETIES BY KALYANI-V. FROM KANDLA

In the case of Kalyani V (Fig. 15) better catch rates for elasmobranchs were recorded during the months of February and September. Kati was more abundant during March and highest catch rates for 'wam' was obtained during the month of November. Highest catch rates for 'dhoma', karkara and cat fish were obtained during the months of April, October and September respectively.

Fig. 16 gives the monthwise catch rates of important varieties of fishes obtained from Bombay region by 17.5 m vessels as well as Meena Bharati. The period November - January has been identified by both types of vessels as the best season for elasmobranchs. Similarly May - June was the best period for 'dhoma'. Better catch rates for cat fish was obtained by 17.5 m vessel during the months of February and March, while Meena Bharati obtained better catch rate for this variety during March and December. Generally speaking, post-monsoon period is found to be the most productive period for cat fish in this region.

From Fig. 17 it can be seen that better catch rates for elasmobranchs and ribbon fish was obtained from Goa during March-April. Better catch rates for rani fish was obtained during the months of March and May. Highest catch rates for cat fish and perches were obtained during February.

Fig. 18 gives the monthwise catch rate of different species obtained from Mangalore and Cochin regions. It may be seen that the peak months for ribbon fish and cat fish were May and September respectively in Mangalore region. The catch rate of elasmobranchs was steady throughout the twelve month period. In Cochin region highest rate for elasmobranchs was obtained during April - May. Better catch rates for cat fish were obtained during June and March. Maximum catch

rates for 'kilimeen' was obtained during the month of June. Better catch rates for prawns were recorded during April - June and in June it reached the peak. It may be stated that the pre-monsoon period viz. March - June is the best fishing season of this region.

Fig. 19 presents the monthwise fluctuation in the catch rates of important varieties of fishes obtained from Tuticorin and Madras. It can be seen that the peak season for perches in Tuticorin region was July and August. Elasmobranchs showed two peak periods - one during the month of May and the other during the month of November. July and October were the peak periods for sciaenids. In Madras region leiognathids were more abundant during June and August-September whereas elasmobranchs were abundant during the month of September. Synagris recorded the highest catch rate during the month of June. The period June-August seems to be more productive in the lower east coast region.

Fig. 20 gives the monthwise fluctuation in the catch rate of some important groups of fishes obtained from Vizag and Paradeep. In Vizag region, the period January-March was found to be good fishing season for elasmobranchs. During the period January-March highest catch rates for cat fish and perches were also obtained. March is found to be the peak month for these two varieties. In Paradeep region, elasmobranchs represented two peak periods, one in May and the other in January. Dhoma was more abundant during the month of April. Cat fish showed an increasing trend from June onwards and the highest catch rate was obtained during the month of August. Better catch rates for prawn were obtained during the months of April, July and August.

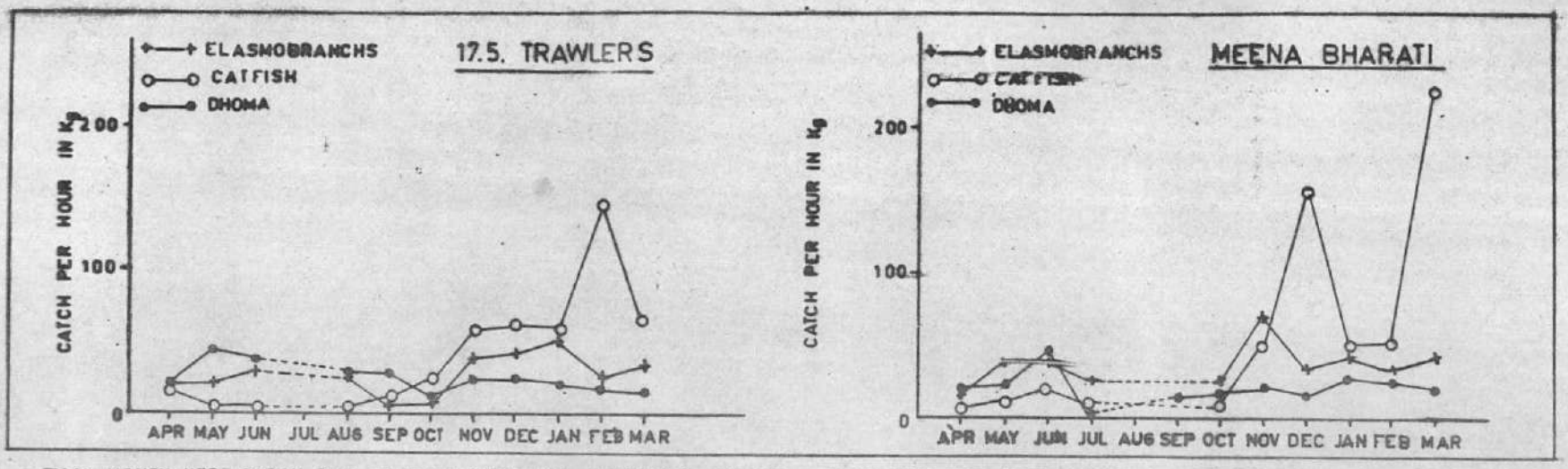


FIG.16 MONTH-WISE CATCH PER HOUR OF IMPORTANT VARIETIES BY 17.5m TRAWLERS AND MEENA BHARATI FROM BOMBAY

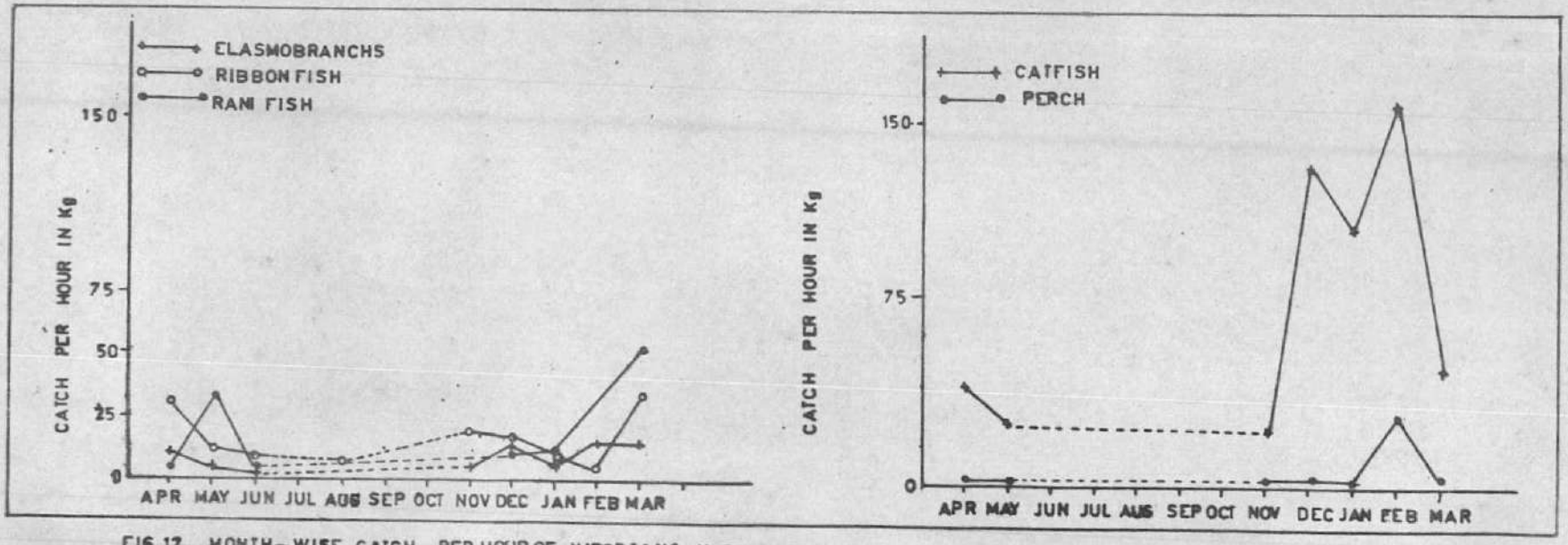
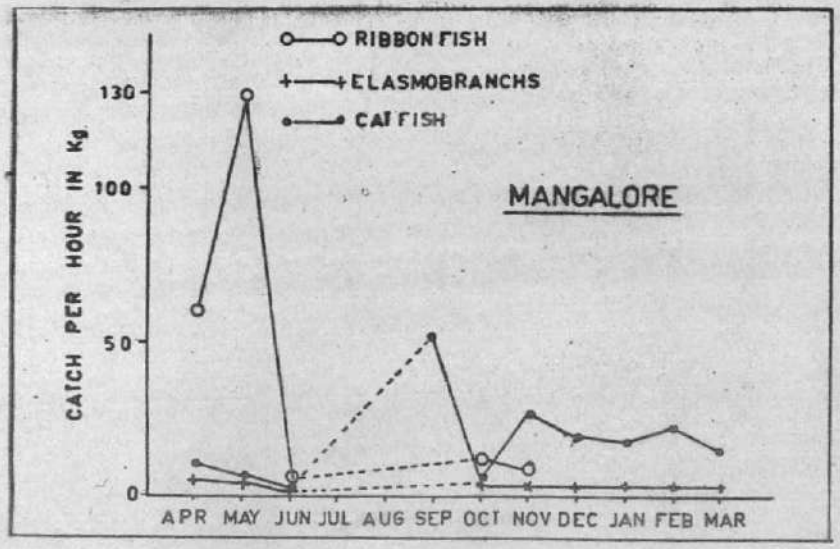


FIG.17 MONTH-WISE CATCH PER HOUR OF IMPORTANT VARIETIES BY 17.5m TRAWLERS FROM BOA



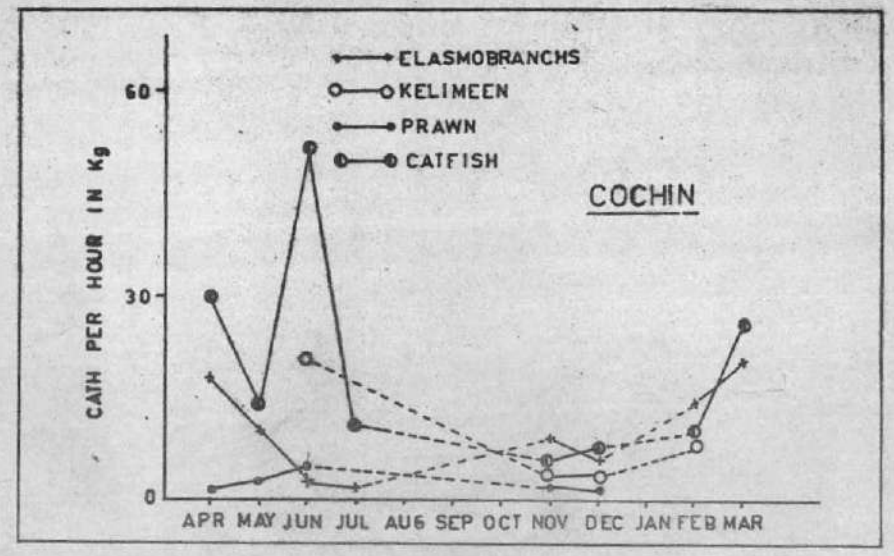
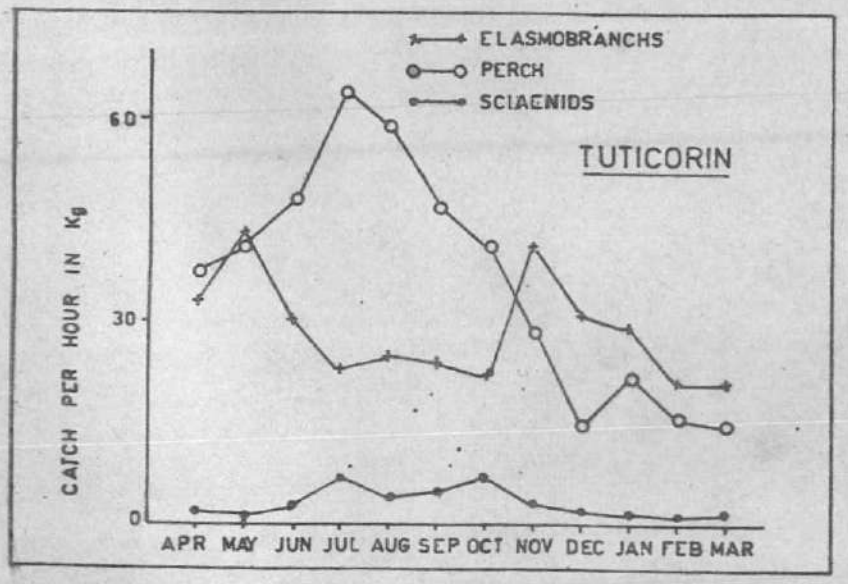


FIG.18 MONTH-WISE CATCH PER HOUR OF IMPORTANT VARIETIES FROM MANGALORE AND COCHIN



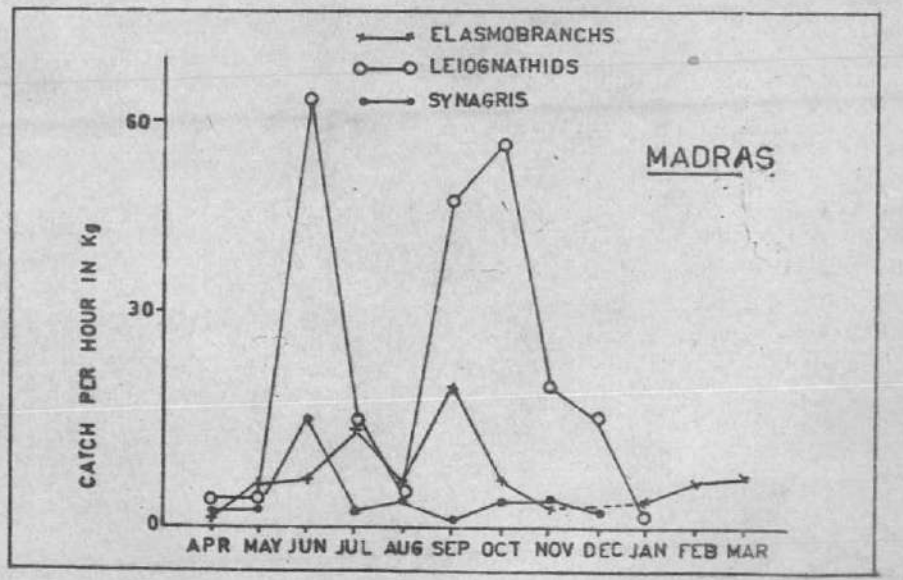
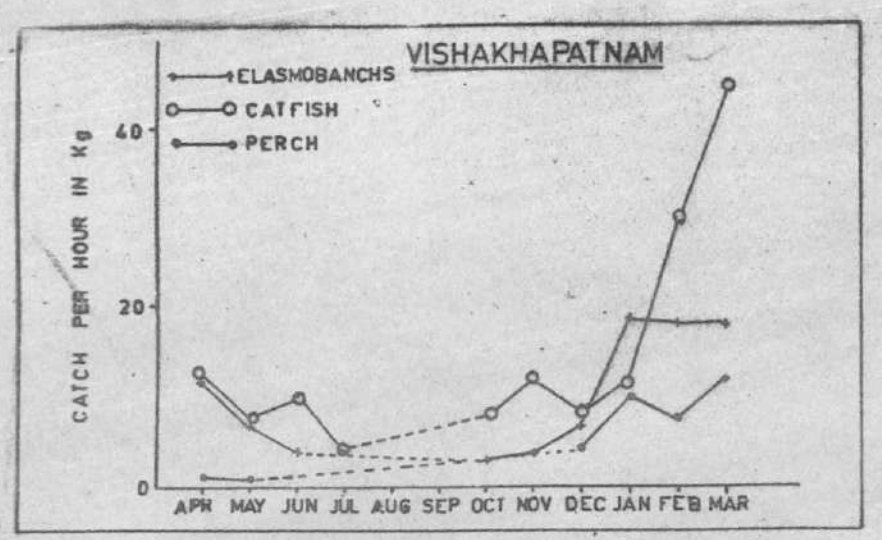


FIG.19 MONTH-WISE CATCH PER HOUR OF IMPORTANT VARIETIES FROM TUTICORIN. AND MADRAS



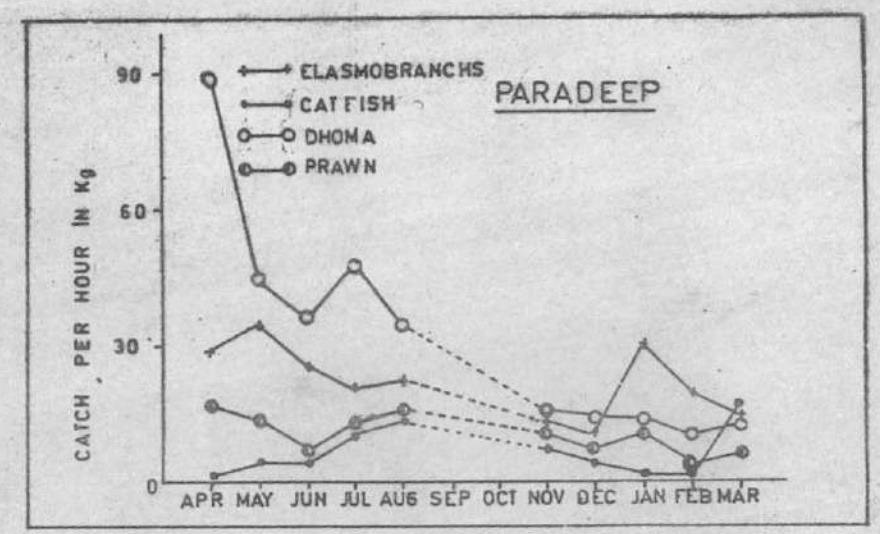
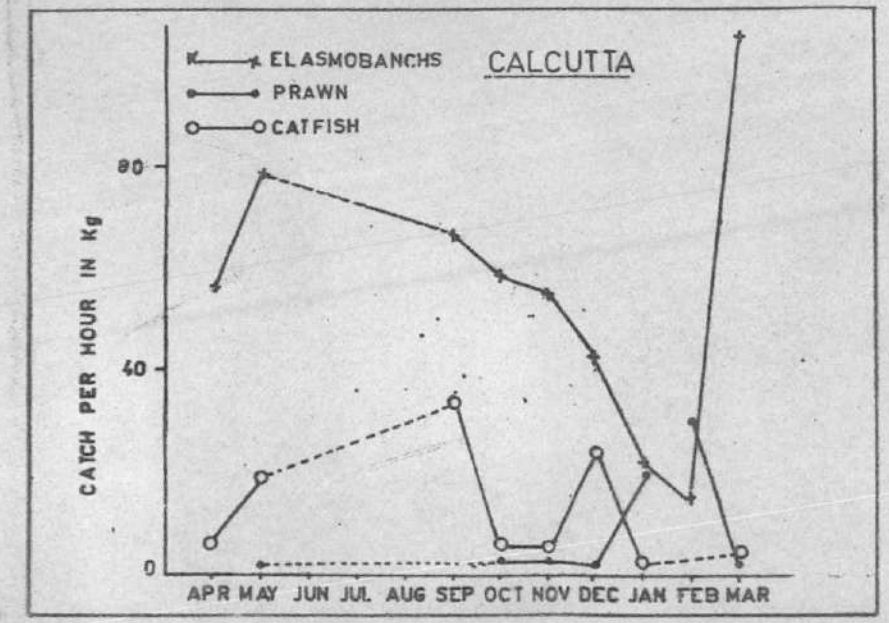
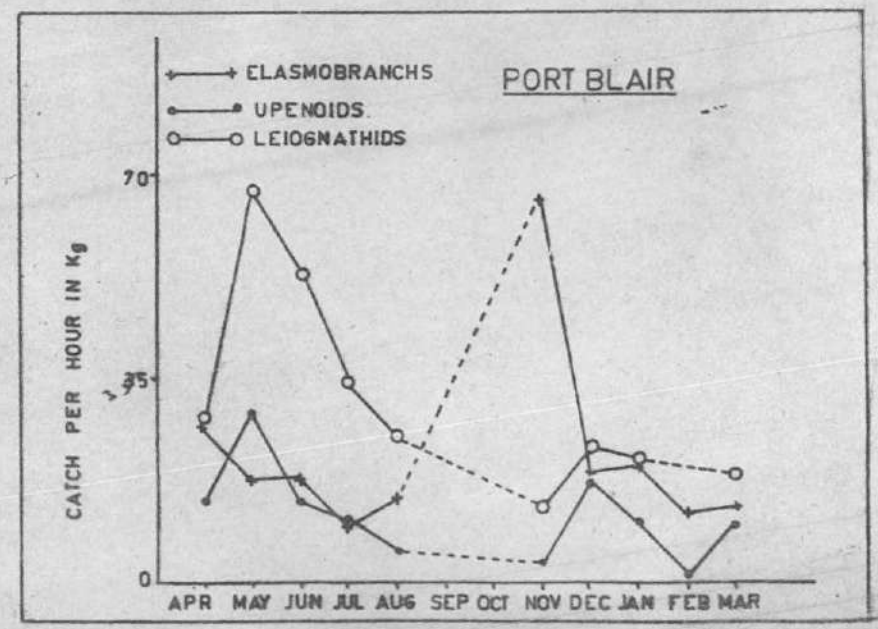


FIG.20 MONTH-WISE CATCH PER HOUR OF IMPORTANT VARIETIES FROM VISHAKHAPATNAM AND PARADEEP





From Fig. 21 it can be seen that in Calcutta region, the highest catch rate for elasmobranchs was obtained during the month of May. September was identified as the most productive month for cat fish. The highest catch rate for prawns were obtained during the month of February. In Port Blair region the highest catch rates for leiognathids and upeneoids were obtained during the month of May whereas elasmobranchs were more abundant during the month of November.

6. RESULTS OF SHRIMP RESOURCES SURVEY

The availability of shrimp in the bottom trawl catches from Goa, Cochin, Vizag, Paradeep and Calcutta were analysed and the findings were discussed in earlier chapters of this bulletin. Tables VIII to XI shows the catch rates of prawn obtained by 17.5 m vessels from different regions along the east and west coast. However, for convenience of reference the findings on the availability of shrimps in the above regions have been summarised and presented below:

Region	Depth range (m)			
	0-19	20-39	40-59	60-79
Goa	1.6	0.5	0.2	-
Cochin	2.5	1.5	-	-
Visakhapatnam	0.6	0.3	0.2	-
Paradeep	7.9	11.4	-	-
Calcutta	3.7	1.3	26.2	21.6

It can be seen from the above table that from Paradeep, Cochin and Vizag regions better catch rates for shrimp were obtained from the 0-19 m depth belt. In the case of Paradeep region better catch rates were obtained from 30-39 m depth. This is in

conformity with the observation made during the previous year. In Calcutta region prawns were more abundant in deeper waters, in the 40-80 m depth. Catch rates were appreciably high in this range.

Monthwise catch rates for shrimp obtained from the above mentioned five regions are furnished in the table below:

Month	Goa	Cochin	Vizag	Paradeep	Calcutta
April	-	-	1	16	-
May	-	3	-	13	1
June	3	5	1	6	-
July	3	-	2	12	-
August	-	-	-	14	-
September	3	-	-	-	-
October	-	-	1	-	2
November	-	2	-	12	2
December	-	1	-	8	1
January	-	-	-	12	21
February	-	-	-	3	29
March	-	-	-	6	2

It can be seen from the table that catch rate in Goa region did not show any variation and prawn was indicated in the trawl catches only during the months of June, July and September. In the case of Cochin region prawn catch was found to increase from April to June. In Vizag region shrimp was only sparingly available in the catches during April, June and July. From Paradeep region the highest rates for prawns were obtained during April. May and August were also found to yield better catch rates. Generally speaking, the months April to August can be said as the most productive period for shrimp fishery in this region. In the case of Calcutta region, the highest catch rate for prawn was obtained during the month of February.

One significant event during the year under report was the location of a productive prawn ground off West Bengal by the vessel Matsyavigyani during January 1977. The area 20-88 was extensively surveyed by the vessel with a 43.6 m shrimp trawl net. A total of 95 hours of fishing effort was expended in the above area and a catch of about 3.5 tons of prawns were landed. The average catch per hour works out to 36.3 kg. Of the 14 sub-areas of the major area 20-88 surveyed by the vessel, three sub-areas namely 20-88/6F, 5B and 6C yielded a catch rate of 40 to 50 kg/hour. Three sub-areas viz. 20-88/5C, 5D and 6E yielded about 37-40 kg/hour of prawns. Depth-wise, the maximum catch was obtained from the depth range of 60-80 m. Even though the highest catch rate was recorded during the month of February, this cannot be taken for granted, since this productive ground was located only in late December. Detailed studies on the fluctuation in the catch rates during other months have therefore to be undertaken before attempting any generalisation.

The main species of prawns caught were Penaeus monodon, P. semisulcatus, P.penicillatus, P.indicus, Metapenaeus dobsoni, M. monoceros, M. ensis etc. It is reported by Sudarsan et al that about 50% of the catch obtained in one of the cruises of Matsyavigyani (total catch 1.74 tons) was constituted by M. ensis.

Sudarsan D. and P.J.Joseph (MSS) 1977, Prawn resources of the West Bengal coast., Exploratory Fisheries Project, Calcutta.

7. SURVEY OF PELAGIC FISHERY RESOURCES

The survey of pelagic resources were conducted using purse seine, tuna long lines and trolling lines from Mangalore, Goa and Port Blair bases.

7.1 Purse seining

Purse seining was carried out from Mangalore and Goa bases from two 17.5 m vessels viz. Meena Ayojak and Meena Anaveshak. The specification and design of gear used has been given in the previous bulletin (Bull. Expl. Fish. Proj. No. 4).

From Mangalore, the vessel Meena Anaveshak conducted purse-seining operations during April, November and December '76 and January to March '77. The areas 12-74 and 13-74 were explored by the vessel and a total of 33 sets were made expending about 44 hours of actual fishing effort. About 35 tons of fish was landed from these two areas. It can be seen from the ensuing table that the area 13-74 yielded better catch rate compared to the other area (Table XII). The monthwise details of fishing effort, total catch, catch composition etc. obtained from Mangalore and Goa are given in Table XII. Maximum number of sets were made during the month of December. Maximum catch per set (about 2.5 tons) was obtained during the month of April. December and January also proved to be productive months for purse-seining. Sardine constituted about 80% of the total catch. Percentage of mackerel in the total catch was about 12%.

From Goa purse seining was conducted from September '76 to February '77. Though scouting had been done in three areas viz. 14-73, 14-74 and 15-73 sets were made only in the area 15-73. An actual fishing effort of 51 hours was spent in this area and a catch of about

Particulars		Area				
		12-74	13-74	14-73	14-74	15-73
Sets made: No.		9	24	-	-	32
Time	(hrs)	10.75	33.25	-	-	51.07
Time spent for searching	(hrs)	162.00	253.00	3.5	5.5	392.90
Total fishing effort	(hrs)	172.75	286.25	3.5	5.5	443.97
Total catch	(kg)	2,979	31,803	-	-	34,763
Species	(kg)					
Mackerel		-	4,299	-	-	9,219
Sardine		2,820	27,374	-	-	6,075
Horse mackerel		-	-	-	-	4,374
Pomfret		-	-	-	-	13,922
Misc. fish		159	130	-	-	1,173
Catch/set	(kg)	331	1,325	-	-	1,086

Table XII Area-wise results of purse-seining

Region	Month	Sets made		Time spent for searching (hrs)	Total fishing effort (hrs)	Total catch (kg)	Species composition (kg)					Catch/set (kg)
		No.	Time (hrs)				Mackerel	Sardine	Horse mackerel	Pomfret	Misc. fish	
MANGALORE	April '76	4	5.50	28	33.50	9860	-	9860	-	-	-	2465
	November '76	6	8.50	54	62.50	4747	4283	464	-	-	-	791
	December '76	11	14.50	101	115.50	12335	16	12030	-	-	289	1121
	January '77	7	10.25	111	121.25	7560	-	7560	-	-	-	1080
	February '77	3	3.25	83	86.25	-	-	-	-	-	-	-
	March '77	2	2.00	38	40.00	280	-	280	-	-	-	140
Sub-total		33	44.00	415	459.00	34782	4299	30194	-	-	289	1054
GOA	September '76	3	4.92	14.5	19.42	3461	2869	-	2	-	590	1154
	October '76	13	23.50	80.50	104.00	21898	6350	475	1040	13820	213	1684
	November '76	5	7.7	34.10	41.80	3760	-	3180	580	-	370	752
	December '76	7	9.6	105.30	114.90	2892	-	2420	-	102	-	413
	January '77	4	5.35	139.25	144.60	2752	-	-	2752	-	-	688
	February '77	-	-	28.25	28.25	-	-	-	-	-	-	-
Sub-total		32	51.07	401.90	452.97	34763	9219	6075	4374	13922	1173	1086

Table IIII Monthwise results of purse seining

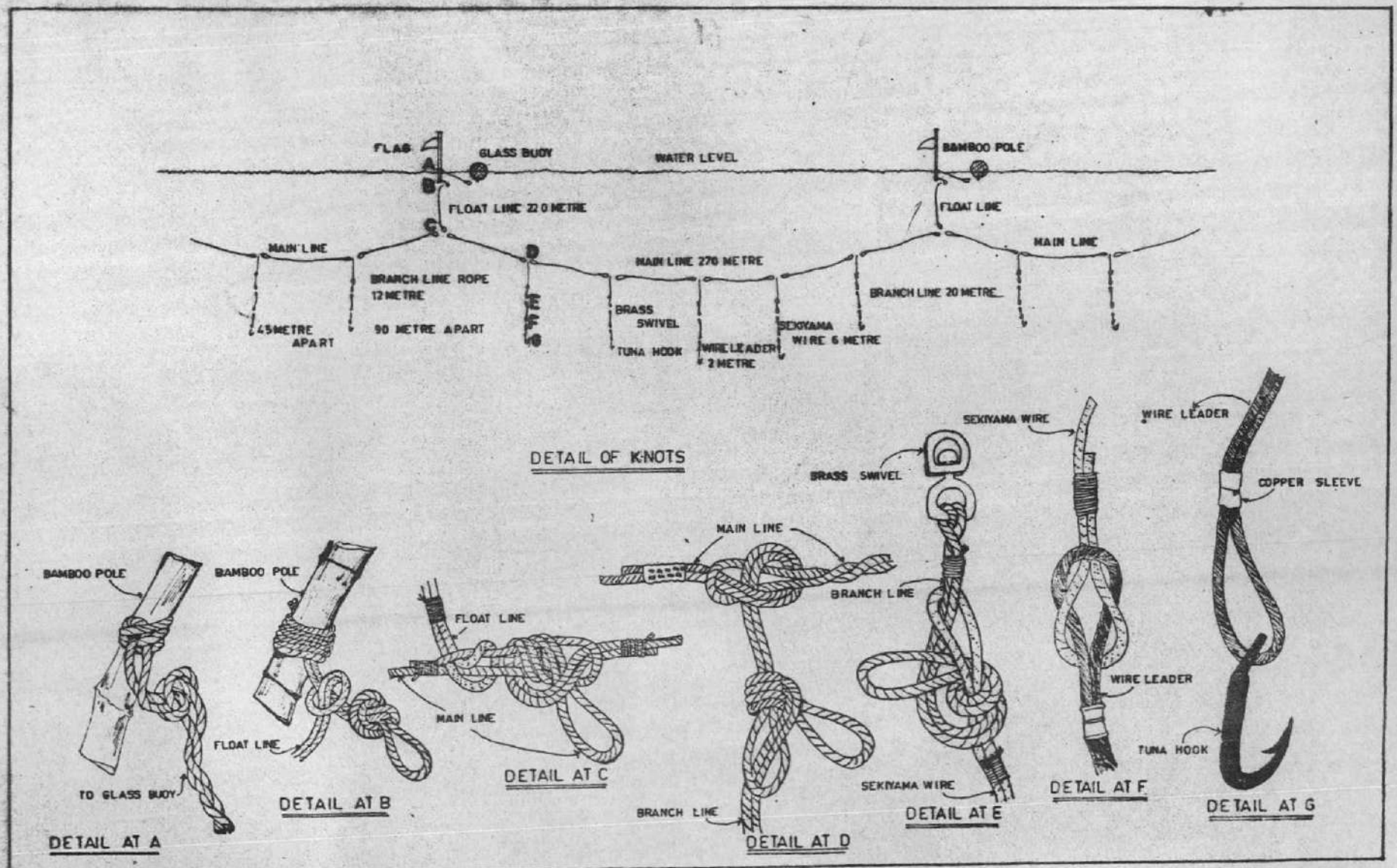
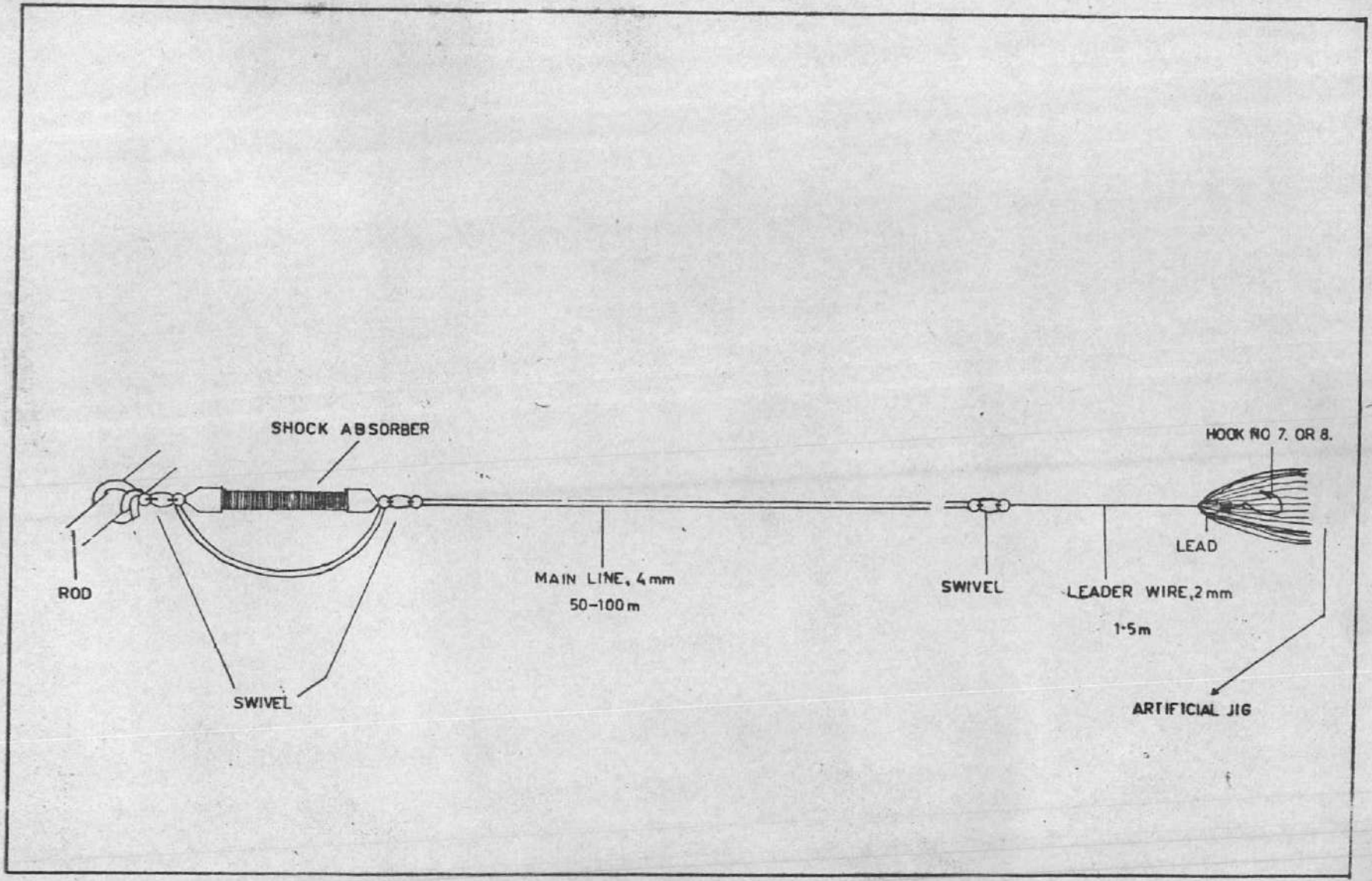


FIG. 22 TUNA LONG LINE



FIG, 23 TROLLING LINE

35 tons was landed. The yield was maximum during the month of October during which a catch of about 1.7 tons per set was realised. The next higher catch of 1.2 ton per set was obtained during the month of September (Table XIII).

Mackerel, sardines, horse mackerel, pomfret and miscellaneous fish constituted the catch from this region. It can be seen from the table that about 40% of the catch was constituted by pomfret which was caught only during the months of October and December. Mackerel was the next abundant species accounting for about 27% of the catch which was caught only during September and October. Sardines constituted 17%. This variety was caught during October to December. About 12% of horse mackerel and 3% of miscellaneous fish were also recorded.

7.2 Tuna long lining

Tuna long lining was conducted from Port Blair from the vessel Meena Prayas throughout the year except October and November. The survey was conducted in 5 sub-areas of 11-92 as in the previous year. A total number of 15,750 hooks were operated and about 22 tons of fish comprising mainly sharks and tuna were landed during this period. The results are summarised below:

Area/ sub-area	No.of hooks operated	No.of fish caught	No.of shark	No.of Scombroid	No.of other fishes	Hooking rate(%)			
						Shark	Scom-broid	Others	Total
11-92/									
3E	300	7	3	3	1	1.0	1.0	0.3	2.3
4E	705	17	13	3	1	1.8	0.4	0.1	2.3
4F	3020	98	79	14	5	2.6	0.5	0.2	3.3
5E	1135	34	19	8	7	1.7	0.7	0.6	3.0
5F	10280	427	258	119	50	2.5	1.2	0.5	4.2
6F	310	18	11	3	4	3.5	1.0	1.3	5.8
Total	15750	601	383	150	68	2.4	1.0	0.4	3.8

There is an increase in the hooking rate of all the varieties caught from that of the previous year. The hooking rate for all species works out to about 4.

7.3 Trolling

Trolling was conducted from Port Blair base from the vessel Meena Prayas. This method was used as an ancillary method, while steaming to the fishing round and back. Five sub areas of 11-92 and one sub-area of 11-93 were surveyed during this year, expending about 154 hours. The species caught were tuna, barracuda, seer fish, carangids and perches. The catch/line/hour worked out to less than 0.1 kg. The results are given in Table XIV.

8. SUMMARY

Results of exploratory survey conducted during 1976-77 are analysed and presented in this bulletin. During the period 23 steel trawlers were available for operation from 11 bases. Out of these , 19 were indigenously constructed 17.5 m vessels, one was 23 m trawler and the remaining three were imported, 16.5 m, 30.9 m and 32.3 m vessels.

Bottom trawling was the main method employed for resources survey. Purse seining, tuna long lining and trolling were the other methods employed. In addition, special shrimp resources survey was taken up from selected bases.

During the course of the year, the project vessels surveyed/resurveyed an area of about 46,000 sq. km by bottom trawling and landed about 1806 tonnes of fish and prawns. The vessels Meena Prasarak and Meena Grahi operated from Paradeep base recorded the highest catch rate of 242 kg and 238 kg/hour respectively. In addition Kalyani V of Kandla base and Matsyavigyani attached to Calcutta base also recorded

Area/sub-area	No.of lines operated	Fishing effort (hrs)	Total catch (kg)	Tuna		Barracuda		Seer fish		Carangid		Perch		Catch/line /hour (kg)
				No.	Wt.	No.	Wt	No.	Wt.	No.	Wt.	No.	Wt.	
11-92/2E	10	6.75	-	-	-	-	-	-	-	-	-	-	-	-
3E	61	41.42	21	4	14	-	-	1	4	1	3	-	-	0.008
4E	22	10.33	-	-	-	-	-	-	-	-	-	-	-	-
5E	16	13.08	8	-	-	2	4	-	-	1	4	-	-	0.038
5F	82	55.08	82	2	6	2	15	2	27	3	27	4	7	0.018
11-93/5A	35	26.92	3	-	-	1	2	-	-	-	-	1	1	0.003

Table XIV Area-wise results of Trolling from Port Blair

catch rates above 200 kg/hour. All the 17.5 m vessels except those attached to Mangalore, Tuticorin, Port Blair bases and one vessel attached to Vizag base recorded catch rates above 100 kg/hour. The average catch rate obtained by all the 17.5 m vessels engaged in bottom trawling was 102 kg/hour.

The percentage composition of commercially important species in the trawl catches obtained from different regions were analysed and presented. The important varieties in their order of abundance occurring in the trawl catches of Kandla were 'dhoma', elasmobranchs, cat fish, Pellona spp., ghol and pomfret. In Bombay region, the main bulk of catch was constituted by cat fish, elasmobranchs, 'dhoma', ghol and pomfret. In Goa region the percentage of cat fish was the highest in the trawl catches. Ribbon fish, rani fish and perches were the new varieties which were not represented in appreciable quantities in Bombay and Kandla region. The percentage of elasmobranchs was found decreasing from Kandla to south.

Of all the bases of west coast, the percentage of rani fish was the highest in Mangalore. Cat fish and elasmobranchs were the other major groups occurred in this region. Cat fish, elasmobranchs, ribbon fish, rani fish and prawns were the important varieties, in their order of abundance found in the trawl catches of Cochin. Perches and elasmobranchs constituted about two-thirds of the catch of Tuticorin region whereas leiognathids, elasmobranchs, perches and pomfret were the main groups netted from Madras.

Cat fish, elasmobranchs, perches and wam together constituted about one-third of the catch of Vizag. In addition to these varieties, 'dhoma', prawns and pomfrets were present in appreciable

quantities in the trawl catches of Paradeep. Elasmobranchs, prawn, cat fish, pomfret and perches were the important groups found in the trawl catches of Calcutta.

Relative abundance of resources of different areas were examined and presented. In the north west coast, three areas viz. 22-68, 22-67 off Gujarat and 17-72 off Maharashtra were found to yield more than 200 kg/hour. Two areas, one each along Gujarat and Maharashtra coast, 21-68 and 18-72 yielded a catch rate between 150-200 kg/hour. In the south west coast and lower east coast one area each viz. 9-75 and 14-80 respectively yielded catch rates between 150-200 kg/hour. Of the rest of the areas surveyed in these two regions, the yield was less than 100 kg/hour. In the lower east coast areas 8-78 and 9-78 off Tuticorin were identified as productive grounds for perches. In the upper east coast five areas viz. 18-84, 20-86, 20-87, 20-88 and 21-87 were found to yield a catch rate above 200 kg/hour. A catch rate between 150-200 kg/hour was obtained from two other areas viz. 18-83 and 19-86. All the areas of the four major regions mentioned above can sustain economic exploitation by medium type trawlers.

The relative abundance of demersal fisheries resources by depth along the east and west coasts including Andaman and Nicobar islands were studied in detail. Along the North west coast the depth belt of 60-79 m was found more productive whereas along the south west coast the depth ranges 0-19 m yielded highest catch rates. The catch rates were relatively high in 20-29 m depth along lower east coast and in 0-19 m depth belt along upper east coast. 40-59 m depth belt along the Andaman and Nicobar islands yielded higher catch rates.

The pattern of monthly fluctuation in

the catch rates of important species obtained from different regions is discussed in detail. It was generally observed that the period immediately after north west monsoon is comparatively more productive in the north west coast. In the case of south west coast the period just before the commencement of north west monsoon was found to be more productive. Higher catch rates in the case of lower east coast was noticed during June-August, when the north west monsoon is in its peak along the west coast of India. In the upper east coast, the areas around Vizag recorded better catch rates during January - March whereas November - January period was the most productive period in the case of Paradeep. October-November was the comparatively better season for Calcutta region. From Andaman and Nicobar waters highest catch rate was obtained during the month of May.

The results of special shrimp resources survey conducted from Goa, Cochin, Vizag, Paradeep and Calcutta were analysed and presented. Of all the above regions surveyed Paradeep and Calcutta excelled in their potentialities of shrimp. The most significant observation made during the year was the location of richest prawn grounds by Matsyavigyani off West Bengal (20-88 and 20-89). From the area 20-88 a catch of about 3.5 tonnes of prawn was landed by putting an effort of 95 hours. Better catch rate was obtained from these areas within the depth belt of 60-80 m. The highest catch rate of 52 kg/hour was obtained from the area 20-89/6A. The other areas in the order of abundance were 20-88/6F, 5B, 6C, 5D and 6E. The main species of prawn caught were P. monodon, P. semisulcatus, P. Penicillatus, P. indicus, M. dobsoni, M. ensis and M. monoceros. It has been reported that about 1.74 tonnes of M. ensis was caught in one of the cruises of Matsyavigyani.

Purse seining was conducted from Goa and Mangalore whereas tuna long lining and trolling was carried out from Port Blair base. The areas off Mangalore recorded an average catch/set of 1054 kg while along Goa it was 1086 kg. From Port Blair a total number of 15750 tuna hooks were operated and the average hooking rate obtained was 3.8.