GOVT. OF INDIA

BULLETIN OF THE EXPLORATORY
FISHERIES PROJECT

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RESULTS OF EXPLORATORY FISHING CONDUCTED DURING 1975-76

JUNE 1976

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

A historic and organisational perspective of the Exploratory Fisheries Project was furnished in the second issue of the bulletin. A brief description of the important activities and functions of the Project was also given in the first issue of the bulletin. I thought it would, therefore, be appropriate to examine in this issue as to how best the results of the work done by this organisation can be utilised by the actual users viz., the fishermen, the fishing industry, etc., and as to how best the results could be disseminated to them.

Exploratory fishing is a multidisciplinary subject and it embraces various disciplines of science and technology. Although science and technology are interlinked there is clear distinction between them. While science provides the 'know-why', technology provides the 'know-how'. In Exploratory fishing a strong linkage is to be established between the various disciplines of science including management and technology. Obviously the task of this Project is, therefore somewhat different from those organisations which are engaged in pure research. Transfer of technology seems to be one of the important tasks of the Project.

Broadly speaking, exploratory fishing should serve three main purposes. Firstly, it has to indicate to fishermen, the areas of rich concentration of fish at a given time and to demonstrate the best techniques by which this resource can be exploited. In the second place, exploratory fishing should provide information on short term (i.e. during periods of six to 12 months) fluctuations in the abundance of fishery resources both in time and space. The third and perhaps the most important purpose of exploratory fishing is to provide a system, for collection, storage and retrieval of information for continuous and long term monitoring of the resources position, which is very essential, for scientific management and regulation of fisheries development.

In order to make exploratory fishing an effective tool in the development of marine fisheries, it is necessary to establish a communication system between the agency which carries out the surveys and the actual users. I have seen Extension experts breaking their heads especially over the matter of dissemination of information regarding day to day changes in the fishing ground etc., to fishermen. Field experience has shown me that this particular aspect of fisheries extension needs little or no effort at all. It is common knowledge that, if a vessel strikes a good fishing ground in our coastal and offshore fisheries, before the information is radioed to the shore by the Skipper of the vessel concerned, the news is spread often like wild fire among the fishermen in the area through word of mouth, sight, etc., and that all the boats in the vicinity would soon converge on to the ground. In the case of distant water fishing, this function is served by a scouting vessel which radioes the information to the catcher vessels in near by areas.

There seems to be an urgent need, however, for increasing our effort on dissemination of information of the second type mentioned above especially in the case of our near water fisheries, as it would help vessel owners and fishermen in their short term planning with regard to deployment of fishing vessels, etc. This bulletin, which is the fourth issue of the bulletin of the Exploratory Fisheries Project, is an attempt in this direction. I hope that this bulletin would act as an effective vehicle in carrying the results of the exploratory and experimental fishing conducted by the Project from its 11 bases during the year 1975-76, to the users. The first and third issue of the bulletin, which carried the results of demersal fisheries resources survey done by the

Project since its inception along the West Coast, were brought out to serve the third objective of exploratory fishing mentioned above, viz., provision of information for long term planning. We expect to bring out bulletins carrying the results of survey covering still shorter durations in the near future. It is hoped that the information contained in this bulletin, particularly those related to our lesser known areas of Orissa - West Bengal coast, etc., would be of considerable use to the industry.

I take this opportunity to thank the Masters and the crew of all our fishing vessels and the officers and staff of various bases for the commendable work they have done during 1975-76. I am also grateful to Shri S.P.Balasubramaniam, Joint Secretary(Fisheries) and Prof. P.C.George, Joint Commissioner(Fisheries) for their help and encouragement in all matters concerning the Project and particularly in the publication of this bulletin. I also thank all other officers and staff of this Project, particularly those in the extension unit, for the speed with which they have brought out this bulletin.

K.M. JOSEPH
D I R E C T O R.

30th June, 1976 0

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1. INTRODUCTION

The Exploratory Fisheries Project, Bombay, began publishing annual report since 1973-74 and in fact the Bulletin No.2 of the Exploratory Fisheries Project carried the annual report for the year 1974-75. Although an annual report gives a lot of information about the programme of surveys, results obtained, etc., it is doubtful, whether it would act as an effective vehicle in carrying the results of the surveys to the users. Afterall, an annual report has its own limitations as it has to cover atleast some administrative aspects also. It is, therefore, thought desirable to treat the results of exploratory fishing conducted by the Project during the year 1975-76 as a scientific study distinct from an annual report. This bulletin, which is fourth in the series of bulletins published by the Exploratory Fisheries Project, is devoted for this purpose.

It is needless to say that the main tool for the conduct of exploratory and experimental fishing is fishing vessels. One of the simplest means for gauging the effectiveness of exploratory fishing during a particular period is to assess the efficiency of the fishing vessels which conducted the surveys. Conclusions on resources availability etc., can be drawn on the basis of fishing conducted by a vessel during one day, a few days, 100 or more days in a year. Obviously the reliability or quality of such conclusion is very much dependent on the fishing effort of the vessel on which it is based. In this context it may be recalled that National Commission on Agriculture (1976) in its report mentioned that the vessels of this Project were operating only to the extent of about 30% of the expected number of days in a year. This works out to about 50 days/annum. It is not known the period to which the Commission has referred to. It is therefore felt that some

information on indices of utilisation of the fishing vessels available with the Project during the past few years and on correlated factors would enable a more realistic appreciation of the results presented. The most important indices of fishing vessel utilisation are, perhaps, the days and the hours fished/annum. Although the catch landed and the value realised by sale of catch during exploratory fishing, are purely incidental, they furnish some useful indices in the economic evaluation/projection of the fisheries resources.

Figs. 1 to 4 give a comparative study of these indices during the last four years i.e. 1972-73, 1973-74, 1974-75 and 1975-76. The fact that the Project has been able to make rapid strides in the implementation of its exploratory fishing programme especially during the last two years is revealing from the figures. It may be noted that the average number of days operated/vessel/annum has increased from 59 in 1972-73 to 146 during 1975-76 while the number of hours of actual fishing have increased from about 5000 hours during 1972-73 to about 15,000 hours during 1975-76. The area surveyed has increased from about 19000 sq.km during 1972-73 to over 50,000 sq.km during 1975-76. Similarly the catch landed by the vessels has shown a more than two fold increase while the value has shown a four fold increase during the same period.

The bulletin has 10 chapters dealing with the programme of survey during 1975-76 as approved by the Central Advisory Committee on Exploratory Survey of Marine Fisheries, the fishing gear and methods employed for survey, the results of demersal fisheries resources survey which would inter alia include relative abundance, relative abundance by area and depth, seasonal variation, species composition, etc., and the results of pelagic resources survey including the results of mid-water

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Report of the National Commission on Agriculture, Part VIII Fisheries (1976), p.174.

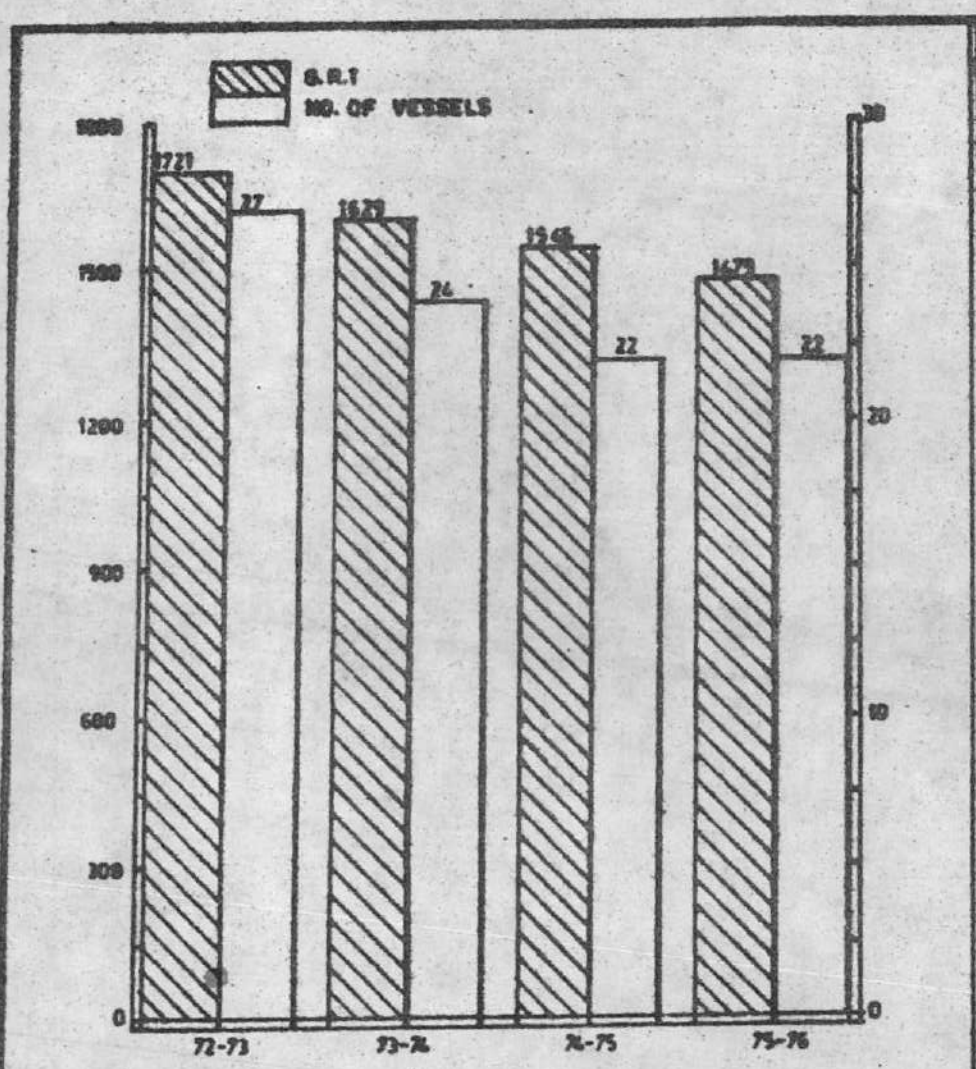


FIG.1. RELATIVE AVAILABILITY OF EXPLORATORY FISHING VESSELS DURING 1972-73 TO 1975-76.

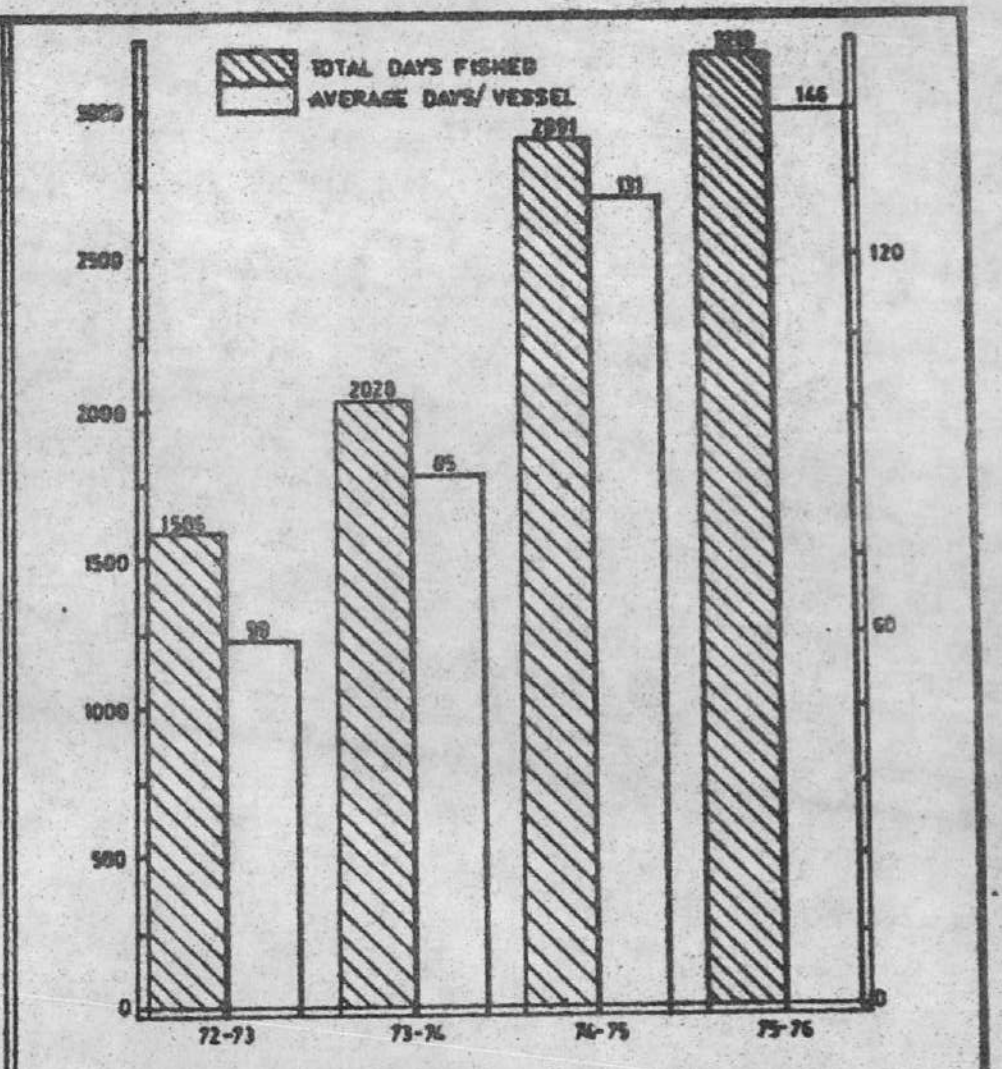


FIG.2. NUMBER OF DAYS OPERATED AND AVERAGE DAYS OPERATED/ VESSEL DURING 1972-73 TO 1975-76.

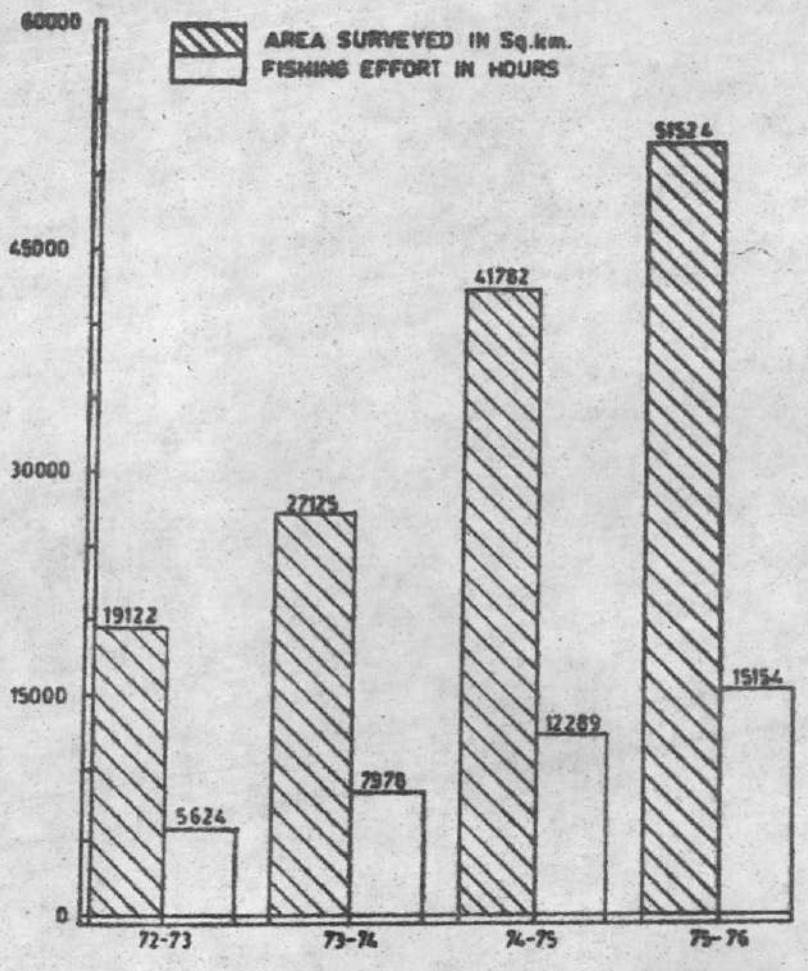


FIG. 3. ACTUAL FISHING HOURS EXPENDED AND AREA SURVEYED DURING 1972-73 TO 1975-76.

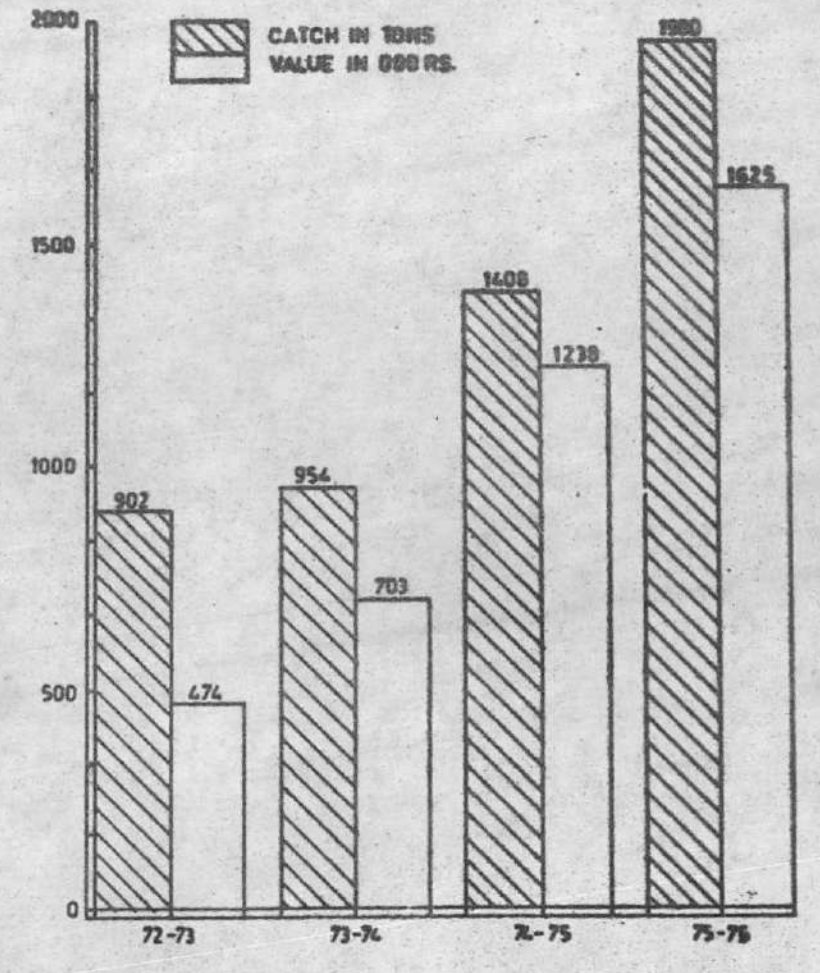


FIG. 4. CATCH LANDED AND VALUE REALISED DURING 1972-73 TO 1975-76.

trawling, purse seining, tuna long lining, trolling, etc., carried out by the Project. A chapter is specially devoted for a comparative study of the trawl fisheries in different areas along our coasts on the basis of the results obtained by a selected few vessels. Similarly another chapter deals with the results of special shrimp survey conducted from some selected bases. The chapters are profusely illustrated for purpose of clarity. It is, hoped, that the bulletin will unfold some useful information on the availability of fisheries resources, particularly of the demersal fisheries, in different areas along our coasts during 1975-76.

2. AREA AND FISHING PROGRAMME

The area of investigation is shown in Fig. 5 which also shows the shelf area available within 50 fm and 100 fm depth belts. It also gives a broad indication of the areas earmarked for survey for each base. The shelf area available along the east coast is considerably less than that on the west coast. About 70% of the shelf area available along the west coast comes in the north west zone, comprising Gujarat, Maharashtra and Goa.

The fishing programme for the vessels of the Project for the year 1975-76 was chalked out taking into consideration of the recommendations of various sub-committees of the Central Advisory Committee on Exploratory Survey of Marine Fisheries attached to the bases. These included the extension of survey into unexplored areas and intensification of survey in the underexplored areas within the 40 fm depth belt, special survey for shrimp, survey for pelagic resources by purse seining, mid-water trawling, trolling, tuna long lining, etc. The programme thus chalked out was got approved by the Central Advisory Committee on Exploratory Survey of Marine Fisheries held at Goa on 12th and 13th August 1975. The approved programme is given in Table I.

Base	Vessel	Type of operation	Area	Depth m
KANDLA	Kalyani V	Exploratory demersal trawling	20-70,21-69 & 22-68	50-100
	Meena Udyog	Experimental trawling/gill netting	22-68 & 22-69	20- 80
BOMBAY	Meena Bharati	Exploratory demersal trawling	16-72,17-71,17-72, 18-71,18-72,19-69, 19-70,19-71 & 19-72	80-200
	Meena Sachetak	Experimental demersal trawling/ mid-water trawling	16-72,17-72,17-73, 18-71,18-72,19-71 & 19-72	40- 80
	Meena Prapi	Experimental demersal trawling/ mid-water trawling	16-72,17-72,17-73, 18-72, 19-71 & 19-72	40- 80
GOA	Meena Netra	Experimental demersal trawling	15-73 & 16-73	20- 80
	Meena Ayojak	Exploratory purse seining/shrimp survey	14-73,14-74 & 15-73	20- 50
MANGALORE	Meena Tarangini	Experimental demersal trawling	12-74 & 13-74	20- 80
	Meena Anaveshak	Exploratory purse seining/shrimp survey	12-74 & 13-74	20- 50
COCHIN	Meena Utpadak	Experimental demersal trawling	9-75,9-76,10-75 & 10-76	50- 80
	Meena Sangrahak	Exploratory shrimp survey	8-76,9-75,9-76, 10-75 & 10-76	50- 80
TUTICORIN	Meena Nirayantak	Exploratory demersal trawling/Pelagic trawling	8-77,8-78,9-78 & 9-79	50- 80
	Meena Saudagar	Experimental demersal trawling	8-77,8-78,9-78 & 9-79	50- 80

Base	Vessel	Type of operation	Area	Depth m
MADRAS	Meena Sitara	Experimental demersal trawling	12-80,13-80 & 14-80	20- 80
	Meena Gaveshak	Exploratory shrimp survey	12-80,13-80 & 14-80	20- 80
VISAKHAPATNAM	Meena Jawahar	Experimental demersal trawling	17-82,17-83, 18-83 & 18-84	50- 80
	Meena Shodhak	Exploratory shrimp survey	17-83,18-83, 18-84 & 19-85	50- 80
PARADEEP	Meena Grahi	Exploratory demersal trawling	19-86,20-86 & 20-87	20- 60
	Meena Prasarak	Experimental demersal trawling	19-86,20-86 & 20-87	20- 60
CALCUTTA	Matsyavigyani	Exploratory demersal trawling	19-86,20-86, 20-87 & 20-88	40-200
PORT BLAIR	Meena Prayas	Exploratory tuna long lining/trolling	11-92 & 11-93	40-100
	Meena Khojini	Exploratory hook and line fishing for 'kalava'/demersal trawling	11-92 & 11-93	20-100

Table I. Exploratory and experimental fishing programme 1975-76

It may be seen from the fishing programme that first priority was given to exploratory demersal trawling required to fill in the gap in the investigation within 40 fm depth belt along the east and west coast of India. For this purpose 12 vessels including the larger vessels viz., Matsyavigyani, Kalyani V and Meena Bharati were employed from the eleven bases of the Project. The larger vessels were also deployed for survey in deeper waters beyond 40 fm depth from bases such as Calcutta, Bombay and Kandla. Some of these vessels were also programmed for purse seining, 'kalava' hand lining, mid-water trawling, etc., during certain months of the period under study.

The second priority was given to experimental demersal trawling with 17.5 m indigenously constructed steel trawlers to find out the economic viability of demersal trawling with these vessels from different bases along the east and west coast. Nine 17.5 m trawlers were utilized for this purpose from bases such as Kandla, Bombay, Goa, Mangalore, Cochin, Tuticorin, Madras, Visakhapatnam and Paradeep. Of these vessels, one vessel viz., Meena Sachetak carried out two boat mid-water trawling from Bombay for a period of about two months.

Special emphasis was given to introduction of purse seining and survey of pelagic resources from Mangalore and Goa as part of the follow up action of acoustic survey conducted by Pelagic Fisheries Project, Cochin. Purse seining was conducted from two 17.5 m trawlers using indigenous technology. Mid-water trawling was programmed from Bombay using 17.5 m trawlers. 'Kalava' hand lining, trolling and tuna long lining were continued from Port Blair from two 17.5 m trawlers.

Special shrimp survey was programmed from bases such as Goa, Mangalore, Cochin, Visakhapatnam and Paradeep to establish the bathymetrical distribution and abundance, seasonal variation, etc., of penaeid prawns.

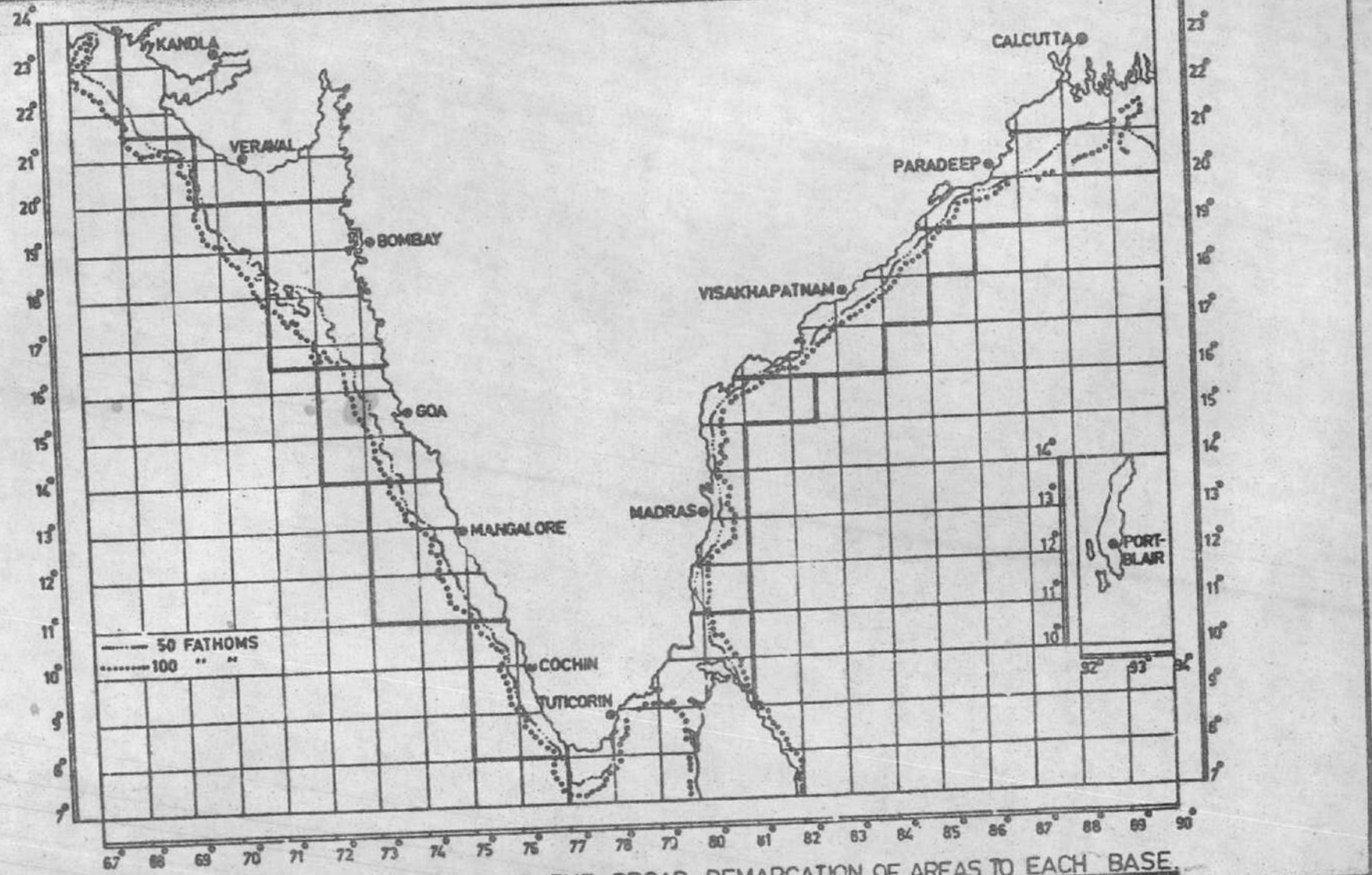


FIG.5. AREA OF INVESTIGATION INDICATING THE BROAD DEMARCATION OF AREAS TO EACH BASE.

3. FISHING VESSELS

During this period of investigation 22 vessels of the Project have operated from different bases. Of these 19 vessels were 17.5 m indigenously constructed steel trawlers and the remaining three were imported larger trawlers of 23-32 m length. Two vessels were operated from each base except in the case of Calcutta and Bombay. From Calcutta, only Matsyavigyani was operated while besides Meena Bharati, two 17.5 m trawlers were also operated from Bombay. The major specifications of these vessels such as length, breadth, horse power, gross tonnage etc., are given in Table II.

4. FISHING GEAR AND METHODS

The important fishing methods employed for the survey were demersal trawling, purse seining, mid-water trawling, 'kalava' hand lining, tuna long lining and trolling. Of these only the details of bottom trawl gear, which is the mainstay of the demersal fishing gear, are discussed in this section. Details of other types of gear are dealt with elsewhere in this bulletin.

The important varieties of demersal trawls used during this investigation were 24 m, 30 m, 35 m and 45 m fish trawls and 28 m shrimp trawl. The designs of these trawls are given in Figs.6-10. The 17.5 m trawlers operated 24 m fish trawl and 28 m shrimp trawl with oval otter boards of 180 kg. weight having an area of 1.6 sq.m. Meena Bharati and Kalyani V operated 30 m and 35 m fish trawls with oval otter boards of 240 kg. weight having an area of 2.2 sq.m. Matsyavigyani operated 45 m fish trawl with rectangular otter boards of 450 kg. weight having 2.2 m length and 1.2 m breadth.

Sl. No.	Name of vessel-	Place built	O.A.L. (m)	B.H.P.	G.R.T.	Make of engine	Crew strength	Year built
1.	Kalyani V	Japan	30.96	300	123.0	Hayashikane	14	1954
2.	Meena Bharati	India	22.50	262	69.2	M.A.N.	13	1965
3.	Matsyavigyani	G.D.R.	32.28	578	182.6	New Schwema Cohenen	14	1969
4.	Meena Prayas	India	17.5	200	56.8	Kirloskar M.A.N.	10	1969
5.	Meena Khojini	India	17.5	200	56.8	Kirloskar M.A.N.	10	1969
6.	Meena Utpadak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1969
7.	Meena Sangrahak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1969
8.	Meena Udyog	India	17.5	200	56.8	Kirloskar M.A.N.	10	1970
9.	Meena Nirayantak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1970
10.	Meena Sitara	India	17.5	200	56.8	Kirloskar M.A.N.	10	1970
11.	Meena Gaveshak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1970
12.	Meena Jaychark	India	17.5	200	56.8	Kirloskar M.A.N.	10	1970
13.	Meena Shodhak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1970
14.	Meena Tarangini	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
15.	Meena Saudagar	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
16.	Meena Sachetak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
17.	Meena Netra	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
18.	Meena Anaveshak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
19.	Meena Grahi	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
20.	Meena Prasaksk	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
21.	Meena Ayojak	India	17.5	200	56.8	Kirloskar M.A.N.	10	1971
22.	Meena Prapi	India	17.5	200	56.8	Kirloskar M.A.N.	10	1975

Table II. Major specifications of the vessels employed for exploratory fishing 1975-76

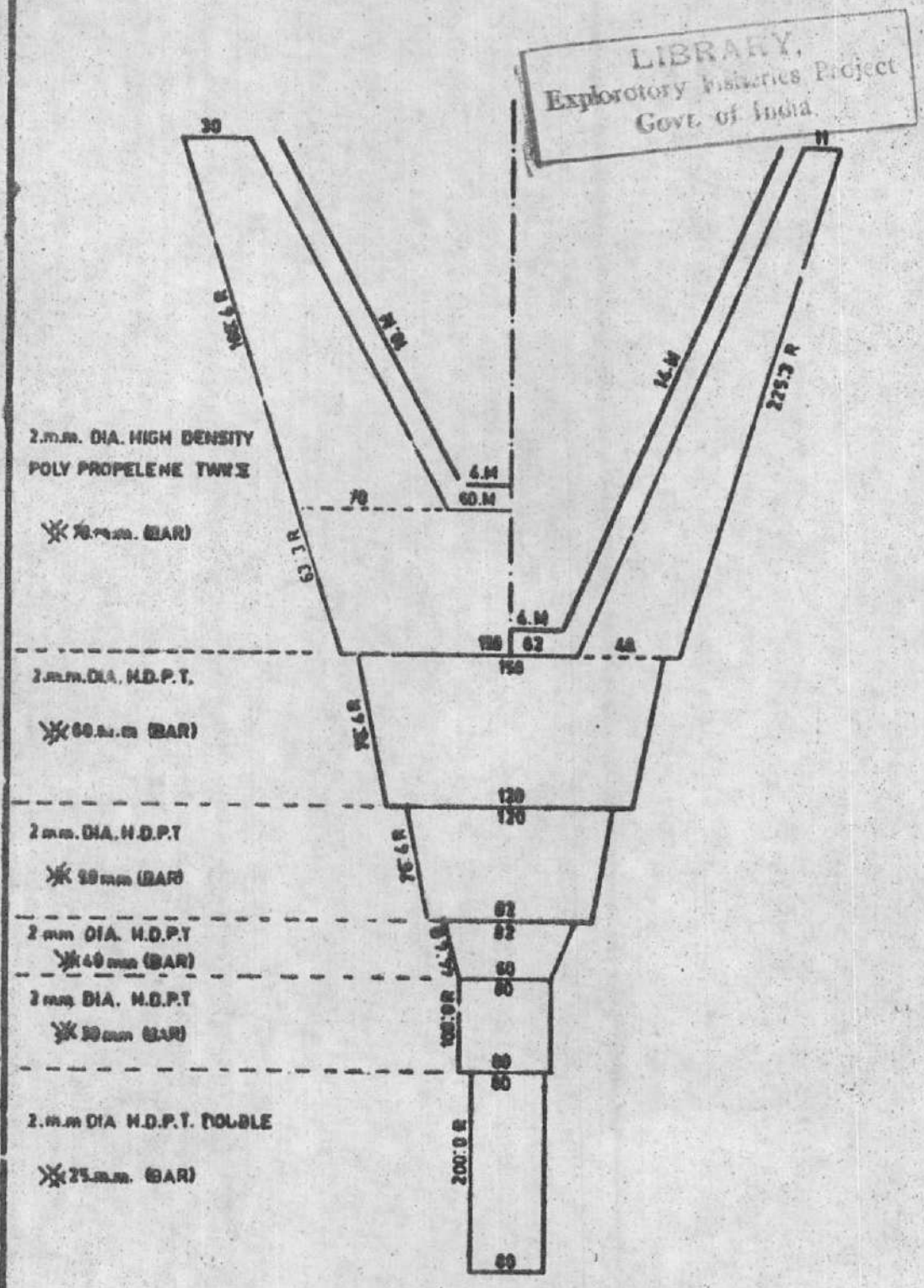


FIG.6 DESIGN OF 24.M. FISH TRAWL

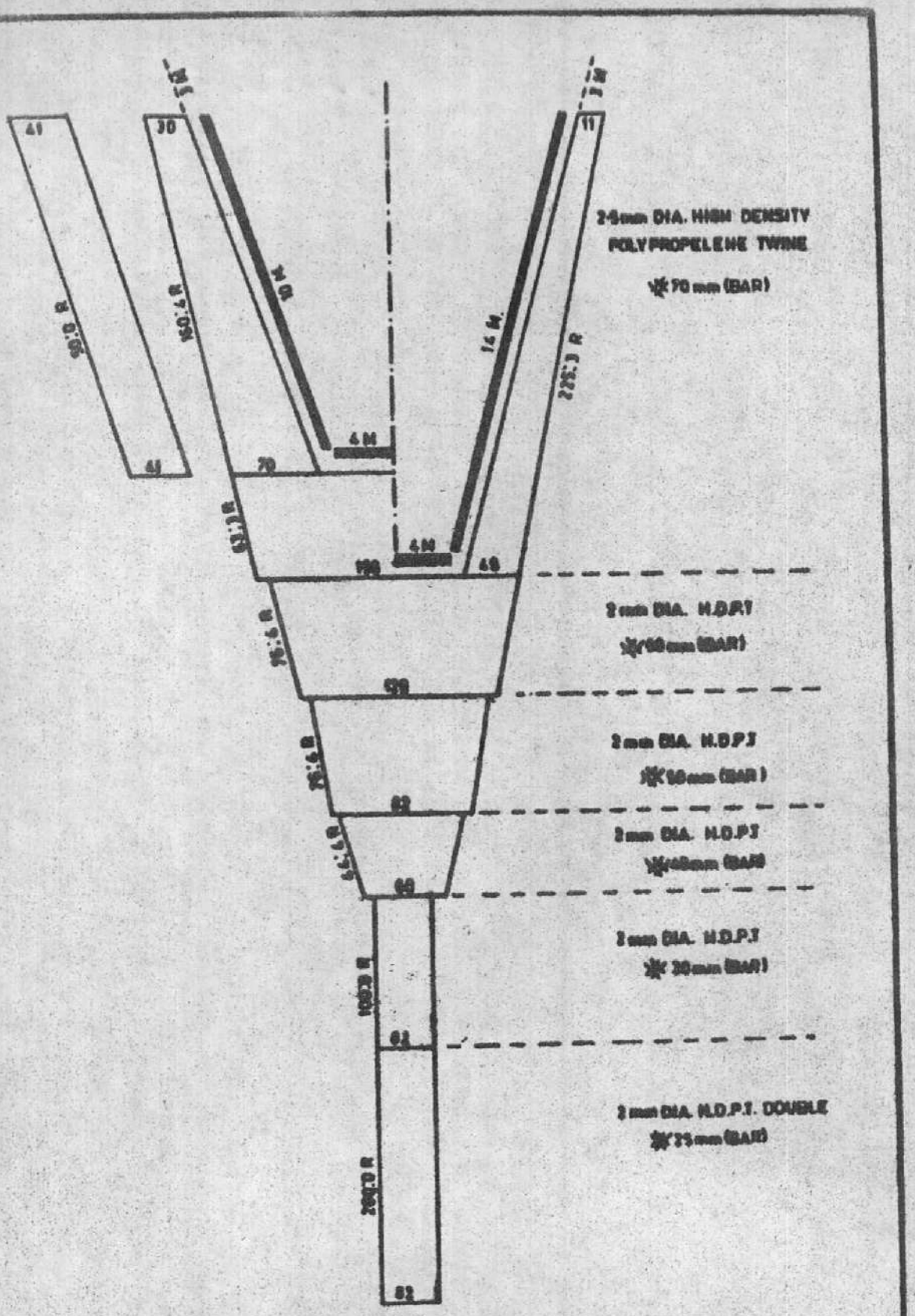


FIG. 7. DESIGN OF 30.M. FISH TRAWL.

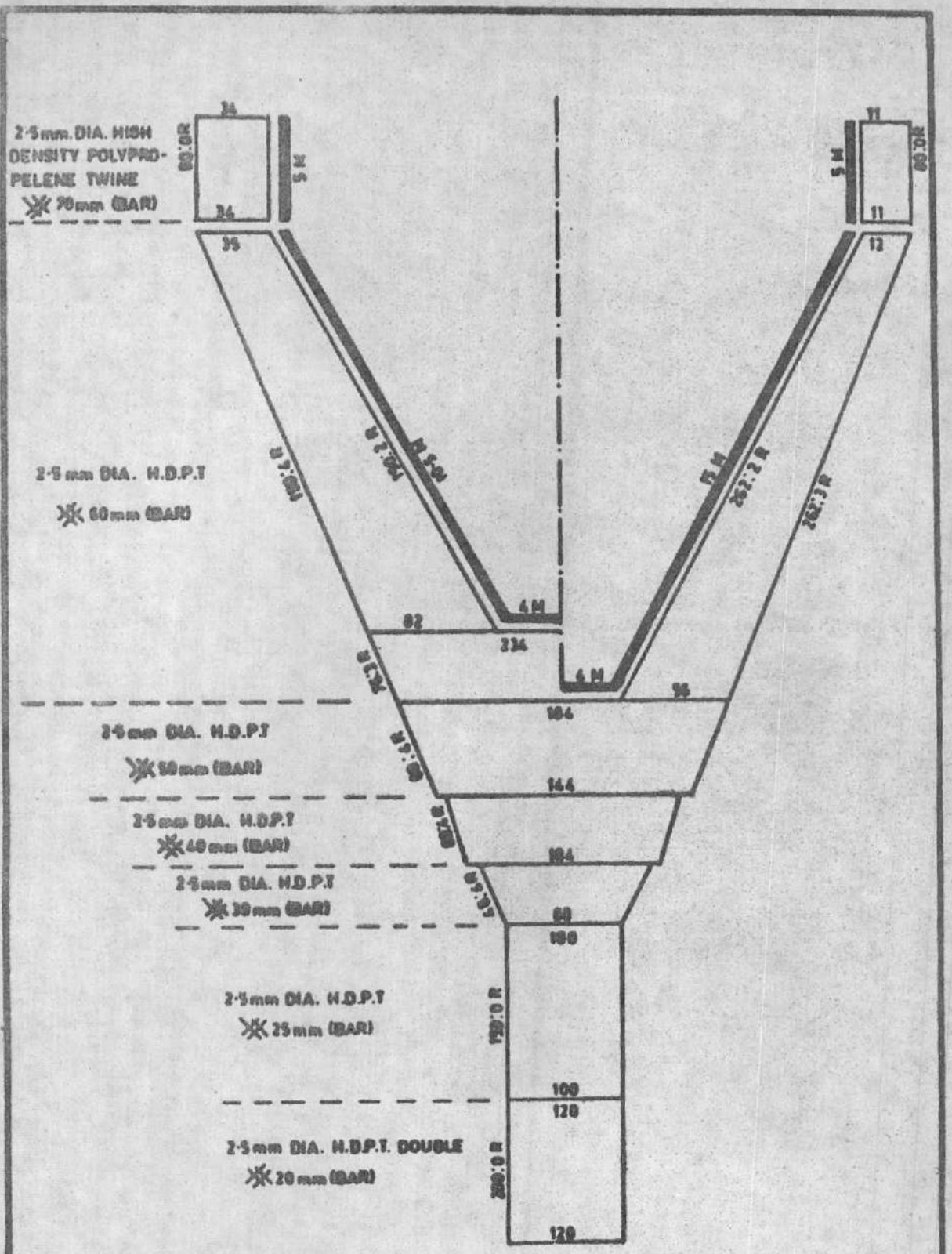


FIG. 8. DESIGN OF 35.M.FISH TRAWL.

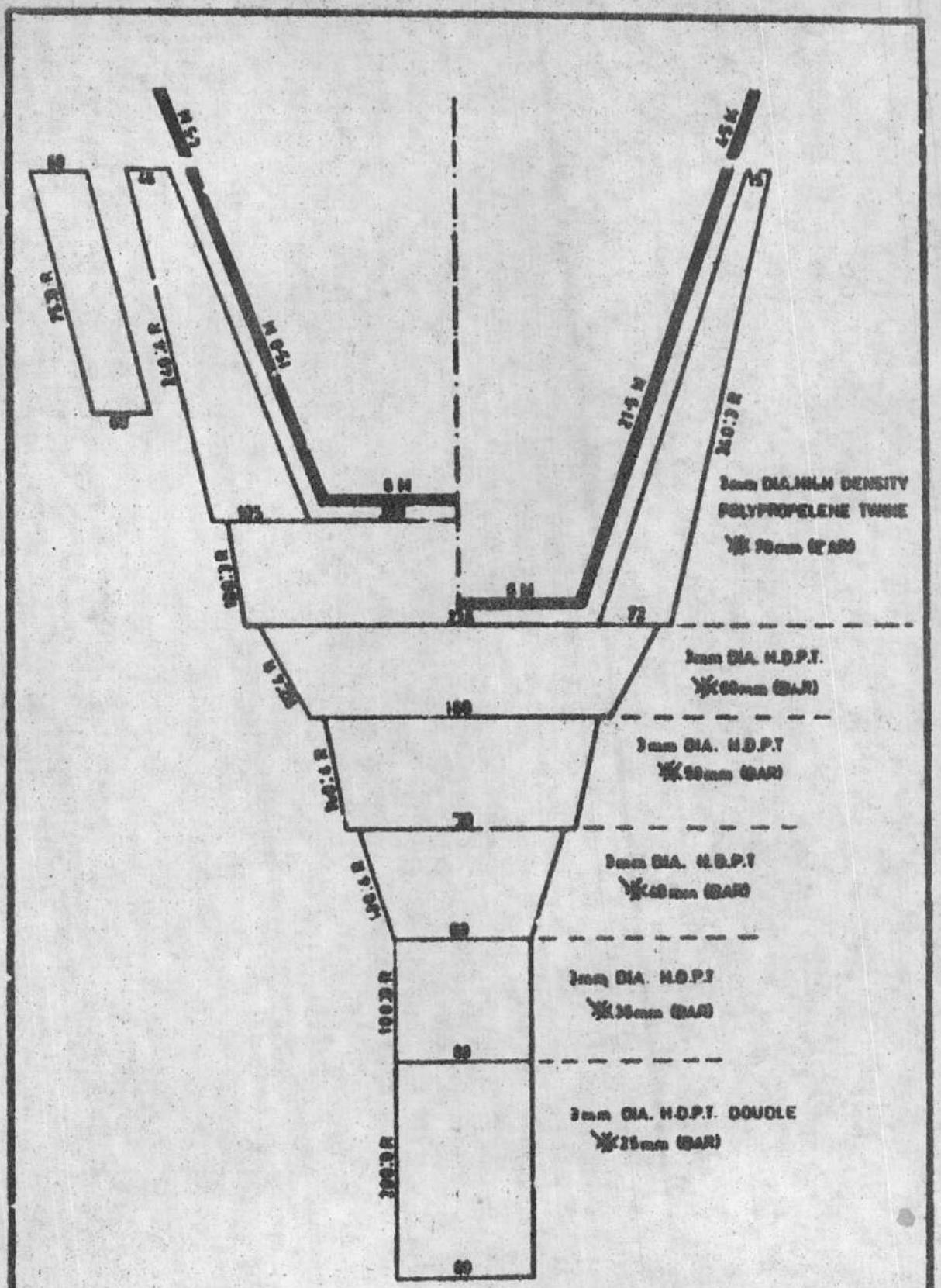


FIG.9. DESIGN OF 45.M. FISH TRAWL.

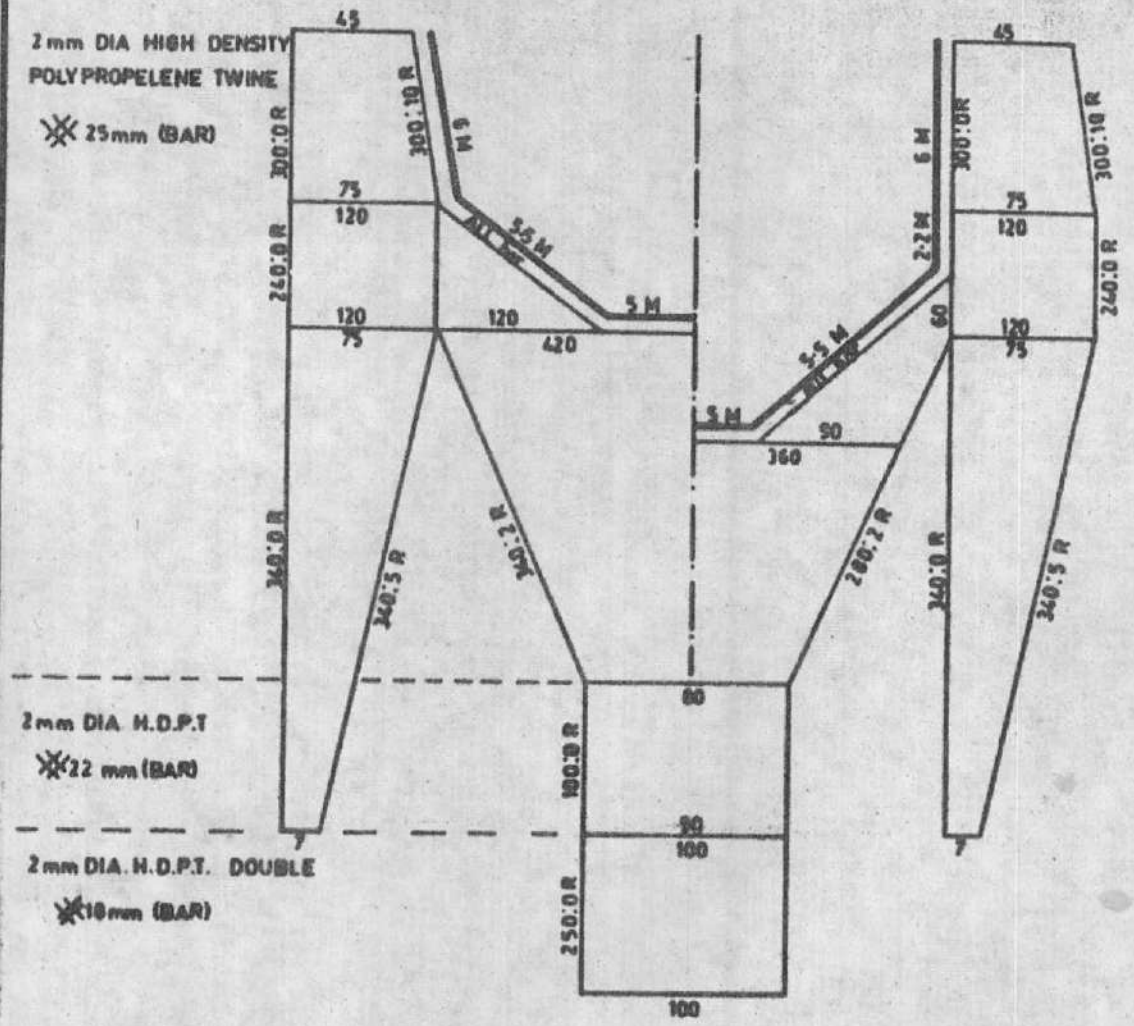


FIG.10. DESIGN OF 28 M. SHRIMP TRAWL.

5. RESULTS OF DEMERSAL FISHERIES RESOURCES SURVEY

As already mentioned, during the period under investigation 12 vessels of the Project including the three larger vessels have conducted exploratory demersal trawling in different areas from the 11 bases. Nine 17.5 m trawlers conducted experimental demersal trawling from bases such as Kandla, Bombay, Goa, Mangalore, Cochin, Tuticorin, Madras, Visakhapatnam and Paradeep. The 17.5 m trawlers were mainly surveying the unexplored or underexplored areas within 70 m depth belt while the larger vessels were utilised for surveying areas beyond 70 m depth. The larger vessels viz., Kalyani V, Meena Bharati and Matsyavigyani operated in areas off Gujarat, Maharashtra and Orissa-West Bengal respectively. The vessels have surveyed an area of about 45,000 sq.km of unsurveyed and partially surveyed areas by demersal trawling during the year under study. During the course of this survey they landed about 1800 tons of fish and prawns.

The results of the survey is summarised in Table III. A scrutiny of the results may give a picture of the demersal fishery resources position along the west and east coast of India. This is clearly discernable from the catch/hour obtained by the 17.5 m trawlers from different regions. It may be seen from the table that the highest catch rates of 282 kg. and 238 kg./hour were obtained by the vessels Meena Prasarak and Meena Grahi operated from the Paradeep base. The areas off Madras and Cochin stood next in the abundance of demersal fishery resources where the catch rates were 170 kg. and 168 kg./hour respectively. Of the ten bases from where 17.5 m trawlers were operated all except Visakhapatnam and Tuticorin have yielded an average catch/hour of more than 100 kg. In the case of Visakhapatnam and Tuticorin the average catch/hour were 66 kg. and 72 kg. respectively.

Base	Vessel	Area of survey	Fishing effort (hrs.)	Extent of area surveyed (sq.km.)	Catch /hour (kg.)
NDLA	Meena Udyog	20-70,21-69 & 22-68	434	1476	131
	Kalyani V	22-68 & 22-69	288	979	163
OMBAY	Meena Bharati	16-72,17-71,17-72, 18-71,18-72,19-70, 19-71 & 19-72	870	2958	192
	Meena Sachetak	16-72,17-72,17-73, 18-71,18-72,19-71 & 19-72	606	2060	113
	Meena Prapi	16-72,17-72,17-73, 18-72,19-71 & 19-72	249	847	157
OA	Meena Netra	15-73 & 16-73	1277	4342	118
	Meena Ayojak	15-73	363	1234	83
G/LORE	Meena Tarangini	12-74 & 13-74	1105	3757	95
	Meena Anaveshak	12-74 & 13-74	190	646	117
OCHIN	Meena Utpadak	9-75,9-76,10-75 & 10-76	786	2672	168
	Meena Sangrahak	8-76,9-75,9-76,10-75 & 10-76	797	2710	117
UTICORIN	Meena Nirayantak	8-77,8-78,9-78 & 9-79	643	2186	65
	Meena Saudagar	8-77,8-78,9-78 & 9-79	750	2550	77
ADRAS	Meena Sitara	12-80,13-80 & 14-80	581	1975	170
	Meena Gaveshak	12-80,13-80 & 14-80	554	1884	147
ISAKHAPATNAM	Meena Jawahar	17-82,17-83,18-83 & 18-84	922	3135	70
	Meena Shodhak	17-82,17-83,18-83, 18-84 & 19-85	778	2645	60
ARADEEP	Meena Grahi	19-86,20-86 & 20-87	683	2322	238
	Meena Prasarak	19-86,20-86 & 20-87	677	2302	282
LCUTTA	Matsyavigyani	19-86,20-86,20-87 & 20-88	435	1479	234
T BLAIR	Meena Khojini	11-92	288	979	105

Table III. Catch/hour, area surveyed, etc., by the Project vessels during demersal trawl survey.

Among the larger vessels Matsyavigyani operating from Calcutta along the Orissa-West Bengal coast recorded a catch rate of 234 kg./hour while Meena Bharati operating from Bombay recorded 192 kg./hour. Kalyani V operating from Kandla has obtained a catch rate of 163 kg./hour. The average catch rate obtained by all the eighteen 17.5 m trawlers during 1975-76 was about 137 kg./hour.

5.1. Relative abundance

The relative abundance of the total resources and of the important species in a region can be determined from the catch rates obtained. Generally speaking, in trawl fishing the catch/hour is taken as the index of abundance. In the present study the type of vessels and the types of gear operated are more or less same except in the case of the three larger vessels operated from Kandla, Bombay and Calcutta. 17.5 m trawlers are operated from all the bases of the Project except Calcutta and their catch rates are therefore statistically comparable. Hence it can be said that the catch rates obtained by these vessels during the period under observation would give a more or less realistic picture of the relative abundance of demersal fisheries resources in different areas along both our coasts.

The area of survey is divided into five zones viz., north west coast, south west coast, lower east coast, upper east coast and the Andaman and Nicobar Island waters. For the study of bathymetrical distribution of the resources, the shelf area is divided into 20 m depth belts.

5.2. Relative abundance by area

2.1. North west coast

Three types of vessels viz., Kalyani V (300 H.P.) Meena Bharati (262 H.P.) and 17.5 m trawlers (200 H.P.) were operated in this zone during the period under study. The catch/hour obtained by these vessels from different areas are shown in Table IV. It also shows the catch rates of prawn and important varieties of fish obtained by these vessels from different areas of this zone.

It may be seen from the table that Kalyani V operating mainly along the Gujarat coast, registered the highest catch rate of 210 kg. from area 21-69. The average catch/hour of trawling obtained by this vessel from Gujarat coast was about 170 kg. The vessel Meena Bharati operating mainly along the Maharashtra coast recorded comparatively high catch rates from four areas viz., 17-71, 17-72, 18-71 and 18-72. The catch/hour from these areas ranged between 205-268 kg. The average catch rate was about 192 kg./hour.

The 17.5 m trawlers recorded the highest catch rate of 153 kg./hour from area 17-72 off Maharashtra. They recorded 111 kg./hour from area 15-73 off Goa while 146 kg. from 22-68 off Saurashtra waters. The average catch rate of 17.5 m trawlers from this zone was 119 kg./hour.

Vessel	Area	Fishing effort (hrs.)	Catch/hour in kg. Elasmo-branchs	Cat fish	Dhoma	Ghol	Pom-fret	Wam	Lacta-rius	Prawn	Other quality fish	Misc. fish	All species
Meena	16-72	8	20.6	53.1	-	5.6	2.5	-	-	-	18.5	16.3	117
Bharati	17-71	74	47.0	109.8	19.0	1.9	0.6	49.5	-	-	33.8	8.2	270
	17-72	129	18.9	126.7	11.0	16.8	3.1	-	-	-	12.5	15.0	204
	18-71	192	15.0	155.2	9.9	5.3	1.5	0.3	-	-	10.7	9.0	207
	18-72	289	37.5	124.1	15.4	10.9	0.9	0.4	-	1.0	10.1	17.3	218
	19-69	18	9.5	41.1	-	7.5	-	-	-	-	0.4	0.6	59
	19-70	13	12.3	9.2	1.5	3.8	-	-	-	-	6.3	2.7	36
	19-71	126	26.7	9.8	25.4	1.2	-	0.4	-	3.8	12.3	35.7	115
	19-72	19	1.7	1.8	30.0	-	-	-	-	18.7	1.6	12.1	66
Kalyani	18-72	4	5.0	5.0	-	-	-	-	-	-	-	55.0	65
V	19-71	2	7.0	5.0	-	-	-	-	-	-	-	43.0	55
	19-72	15	1.3	4.0	-	-	-	-	-	0.2	-	19.7	25
	20-70	8	25.0	8.8	75.0	3.8	4.4	3.8	-	-	13.8	32.3	167
	21-69	13	16.6	15.3	96.7	4.9	9.3	4.8	-	-	15.1	47.2	210
	22-68	234	38.2	10.7	49.5	15.9	13.5	11.1	-	-	31.5	9.3	180
17.5 m	15-73	1632	11.7	56.6	-	-	-	-	2.3	2.4	21.8	15.9	111
trawlers	16-73	8	-	18.8	-	-	-	-	6.6	-	-	-	25
Meena	17-72	76	27.8	85.6	11.8	3.0	0.1	-	-	0.6	2.0	21.9	153
Udyog	18-71	97	9.9	13.2	9.6	0.4	0.7	-	-	1.2	6.8	5.1	47
Meena	18-72	693	23.6	62.9	17.2	3.2	0.7	0.8	-	3.1	5.4	14.9	132
Prapi Meena	19-71	6	-	-	-	-	-	-	-	-	-	-	-
Sachetak Meena	19-72	8	29.4	19.1	18.8	1.9	0.6	4.4	-	-	6.3	15.4	96
Ayojak Meena	22-68	112	47.9	7.9	51.7	6.5	4.2	7.7	-	0.2	14.9	7.4	148
Netra	22-69	273	32.0	4.1	34.2	9.4	14.9	3.6	-	4.0	28.8	11.6	143

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

The dominant species netted from this zone were elasmobranchs, cat fish, 'dhoma', 'ghol', pomfret, 'wam', etc. Prawn recorded a relatively high catch rate of 19 kg./hour from area 19-72 by the vessel Meena Bharati while in the case of 17.5 m trawlers the area 22-69 recorded the highest catch rate of four kg./hour, followed by three kg./hour from 18-72. The average catch rate of prawn was about two kg. from Goa. Among the different species of fish, cat fish was the most dominant species in the north west coast. Meena Bharati and 17.5 m trawlers operated along the Maharashtra coast recorded high catch rates of this species from areas 18-71, 17-72, 17-71 and 18-72 and the catch rates obtained by Meena Bharati ranged between 110-155 kg./hour. It is noticed that there is a decreasing trend in the catch rates of cat fish from Bombay to further north. In contrast to this 'dhoma' recorded comparatively high catch rates in areas off Saurashtra by all the three classes of vessels and the highest catch/hour of 97 kg. was recorded from area 21-69 by the vessel Kalyani V. In the case of elasmobranchs, the area 22-68 yielded the highest catch rate whereas along the Maharashtra coast Meena Bharati recorded high catch rates from areas 17-71 and 18-72 and 17.5 m trawlers from areas 17-72 and 18-72. Based on the catch rates of all the vessels it can be said that the abundance of 'ghol' was relatively high in areas 17-72, 18-72, 22-68 and 22-69. Compared to the Maharashtra and Goa waters the occurrence of pomfret was relatively high along the Gujarat waters. A high catch rate of 50 kg./hour was recorded by Meena Bharati in the case of 'wam' from area 17-71. Lactarius was recorded from Goa coast only.

5.2.2. South west coast

This zone includes the coast of Karnataka and Kerala and was surveyed entirely by 17.5 m trawlers. Fishing was conducted in seven divisions of this zone (Table V). Of these areas 9-75 and 9-76 off Kerala registered the highest catch rates viz., 161 kg. and 146 kg./hour respectively. The area 13-74 off Karnataka recorded the next highest catch rate of 115 kg./hour. In all the remaining areas surveyed in this zone the catch rates were below 100 kg./hour. The average catch rate was 122 kg./hour.

The important varieties of fish caught from this zone were cat fish, elasmobranchs, 'kilimeen', lizard fish, Lactarius, barracuda etc. The highest catch rate of prawn viz., seven kg./hour was recorded from area 10-75 followed by six kg., three kg., and two kg./hour from areas 9-75, 10-76 and 9-76 respectively. The catch rates of prawn from areas off Karnataka were comparatively less. Cat fish was the dominant species of fish in this zone as in the case of north west coast and areas off Karnataka yielded comparatively high catch rates of this species. In the case of elasmobranchs high catch rates were recorded from areas 9-76 and 8-76. Two areas viz., 9-76 off Kerala and 12-74 off Karnataka yielded relatively high catch/hour of 'kilimeen'. The occurrence of barracuda and caranx was more in areas off Kerala while that of Lactarius was more in areas off Karnataka. The catch/hour of miscellaneous species of fish ranged between 15-104 kg./hour while that of the quality fishes comprising pomfret, 'wam', perch, etc., ranged between 1- 18 kg./hour.

Area	Fishing effort (hrs.)	Catch/hour in kg. Elasmo-branchs	Cat fish	Prawn	Lizard fish	Kili-meen	Barra-cuda	Lacta-rius	Caranx	Ribbon fish	Other quality fish	Misc. fish	All spe-cies
8-76	13	10.5	0.4	-	5.0	-	2.3	-	4.2	-	0.9	15.0	38
9-75	175	8.5	16.0	5.6	3.5	0.3	4.3	0.2	0.9	-	17.9	103.8	161
9-76	1297	14.8	10.7	2.0	4.9	11.4	1.2	0.4	0.7	-	11.1	88.7	146
10-75	58	5.3	5.2	7.3	0.1	-	6.4	0.3	0.4	-	2.5	60.2	88
10-76	42	5.5	-	3.0	-	6.3	0.5	0.1	-	-	1.1	24.2	41
12-74	781	3.9	26.6	0.7	1.5	10.0	-	1.0	-	2.5	2.3	38.1	87
13-74	512	7.3	20.0	0.7	0.7	0.4	-	2.3	-	0.8	5.1	78.1	115

Table V. Area-wise and species-wise catch/hour of trawling south west coast.

5.2.3. Lower east coast

In this zone only 17.5 m trawlers conducted survey. The catch/hour of prawn and important species of fish obtained from different areas in this zone are given in Table VI. It can be seen from the table that out of seven areas surveyed, three areas off Madras viz., 14-80, 13-80 and 12-80 recorded relatively high catch rates and the catch/hour ranged between 120 kg. and 214 kg. The areas off Tuticorin yielded relatively poor catch rates and based on the present investigation it can be said that along the lower east coast the areas off Madras is more productive than the areas off Tuticorin. The average catch rate for this zone worked out to about 111 kg./hour.

The catch from this zone comprised mainly perch, sciaenids, leiognathids, elasmobranchs, lizard fish and pomfret. The catch rate of prawn was negligible in almost all areas surveyed except area 9-78 where the catch/hour was about six kg. Among the different species of fish perch showed relatively high catch rates in all areas. The highest catch/hour of 42 kg. was recorded from area 14-80 and areas 13-80 and 8-78 yielded 35 kg. and 34 kg./hour respectively. In the case of leiognathids, sciaenids and Lactarius area 14-80 registered the highest catch rate, while areas 13-80 and 12-80 stood next in the order of abundance in respect of these species. Areas 8-77, 8-78 and 9-79 of this zone recorded relatively high catch rates of elasmobranchs. The occurrence of cat fish in this zone was rather insignificant, compared to the other zones. Pomfret, lizard fish, 'kilimeen' and Lactarius recorded comparatively high catch rates from areas off Madras whereas the occurrence of these varieties were negligible in the catches from areas off Tuticorin. The catch rate of miscellaneous species of fish ranged from 2 - 51 kg./hour while that of quality fishes comprising caranx, flat fish, seer fish, moon fish, etc., ranged from 4 - 10 kg./hour. It is interesting to note that this zone showed relatively very high catch rates of perch, sciaenids and leiognathids as compared to the west coast where cat fish and elasmobranchs were the dominant groups.

Area	Fishing effort (hrs.)	Catch/hour in kg.												
		Elasmo-branchs	Perch	Leiogna-thids	Sciaenids	Lacta-rius	Cat fish	Lizard fish	Pom-fret	Ki-limeen	Prawn	Other quality fish	Misc. fish	All spe-cies
8-77	14	27.0	16.6	-	-	-	0.3	-	-	-	-	8.1	2.1	54
8-78	1200	20.7	34.1	-	0.6	-	0.3	-	-	-	0.4	9.8	7.4	73
9-78	154	15.1	17.4	-	1.3	-	1.1	-	-	-	6.2	6.6	10.3	58
9-79	26	16.7	10.3	-	3.0	-	9.4	-	-	-	-	4.4	33.6	77
12-80	273	3.6	24.4	25.6	12.9	4.7	-	6.5	0.6	3.4	-	6.5	31.5	120
13-80	764	6.2	35.3	42.8	20.9	5.1	-	4.8	7.2	1.4	0.2	8.7	31.4	164
14-80	130	7.7	42.3	58.6	28.6	8.4	-	1.4	3.0	1.9	0.3	10.0	50.8	214

Table VI. Area-wise and species-wise catch/hour of trawling lower east coast.

5.2.4. Upper east coast

This zone comprises a major part of the Andhra coast, Orissa and West Bengal coasts. Among the vessels fished in this zone, the vessel Matsyavigyani operated from Calcutta while two 17.5 m trawlers each operated from Paradeep and Visakhapatnam. The catch rates obtained by these vessels from various areas are shown in Table VII.

It can be seen that the catch/hour of Matsyavigyani ranged between 203 and 556 kg. and area 19-86 registered the highest catch/hour of 556 kg. Catch rates of 345 kg. and 259 kg./hour were obtained from areas 19-86 and 20-86 respectively by the 17.5 m vessels operated from Paradeep. Area 19-86 appeared to be more productive than any other areas along the Orissa-West Bengal coast. Among the different areas surveyed along the Andhra coast the area 18-83 registered the highest catch/hour of 113 kg. while the area 18-84 recorded the second highest catch/hour of 110 kg. The average catch/hour obtained by the four 17.5 m trawlers operated in the upper east coast was about 152 kg. which incidentally was the highest among the five zones. The average catch rate obtained by Matsyavigyani was 234 kg./hour. The average catch/hour obtained by the 17.5 m trawlers from the Orissa-West Bengal coast was about 260 kg./hour as against 62 kg. obtained by the vessels operated from Visakhapatnam.

Elasmobranchs, cat fish, 'wam', pomfret, etc., were the important species of fish in the catch. It may be seen from the table that areas 20-86 and 19-86 recorded the highest catch/hour of prawn viz., 20 kg. and seven kg. respectively in the case of 17.5 m vessels while in the case of Matsyavigyani area 20-87 yielded about three kg./hour. Along the Andhra coa st 17.5 m trawlers recorded four kg. and two kg./hour of prawn from areas 17-82 and 17-83 respectively. Among the different species of fishes elasmobranchs was the dominant group and it recorded very high catch rates from Orissa-West Bengal coast in the case of both the types of vessels. In the case of cat fish the highest catch rate was observed from area 19-86 by 17.5 m trawlers. Based on the catch rates recorded by these vessels it can be said that the Andhra coast is more productive for this species. 'Wam' also registered the highest catch rate from area 19-86 by 17.5 m vessels. Quality fishes like 'ghol', 'karkara', pomfret and 'dhoma' were abundant along the Orissa - West Bengal coast.

Vessel	Area	Fishing effort (hrs.)	Catch/hour in kg.												
			Elasmo-branchs	Cat fish	Wam	Pom-fret	Prawn	Perch	Karka-ra	Dhoma	Ghol	Sciae-nids	Other quality fish	Misc. fish	All spe-cies
Matsya-vigyani	19-86	7	35.0	14.3	-	5.0	-	-	12.9	-	-	-	-	489.0	556
	20-86	15	36.3	18.0	12.0	10.7	-	-	35.7	-	18.3	-	-	72.1	203
	20-87	10	61.0	4.0	-	3.0	2.6	-	-	-	-	-	12.5	177.0	260
	20-88	403	54.9	4.1	2.5	1.3	0.7	-	1.3	-	0.9	-	8.8	154.2	229
17.5 m trawlers	17-82	17	2.2	9.5	-	1.8	4.3	1.8	-	-	-	1.5	-	42.9	64
Meena Jawaher	17-83	1317	2.0	10.5	0.4	0.2	2.4	0.2	-	-	-	0.1	0.2	37.3	53
Meena shodhak	18-83	119	7.1	17.2	4.5	1.2	0.8	4.0	-	-	-	2.4	-	76.0	113
Meena Grahi	18-84	244	13.7	15.8	7.5	1.7	0.7	4.3	-	-	-	1.4	-	64.8	110
Meena Prasarak	19-85	3	1.8	-	9.3	-	0.9	2.7	-	-	-	0.9	-	58.0	74
	19-86	22	52.6	35.7	19.6	10.1	7.0	-	9.6	81.0	14.3	-	7.7	107.0	345
	20-86	1366	21.9	4.5	4.4	7.9	20.3	-	1.9	42.9	0.7	-	1.5	152.7	259
	20-87	3	46.0	-	2.0	-	-	-	-	21.3	-	-	1.0	49.7	120

Table VII. Area-wise and species-wise catch/hour of trawling upper east coast.

5.2.5. Andaman and Nicobar waters

During the period one area viz., 11-92 was surveyed using 24 m fish trawl expending about 300 hours of fishing effort. An average catch/hour of 104 kg. was observed. The important species were elasmobranchs, leiognathids, sciaenids, upeneoids, etc.

5.3. Relative abundance by area and depth

5.3.1. North west coast

As stated elsewhere in this bulletin three sizes of vessels operated in this zone. Fig. 11 shows the catch per hour recorded from different depth zones of various areas by these three classes of vessels. Along the Gujarat coast the shelf area upto 80 m was surveyed by the vessels Kalyani V and Meena Udyog. On the basis of the catch rates recorded by these vessels, the depth belt 40-59 m appeared to be the best productive zone. The depth zone 60-79 m surveyed in area 22-68 and 22-69 also recorded relatively high catch rates.

Along the Maharashtra coast survey was made upto 120 m depth by Meena Bharati and upto 100 m by 17.5 m trawlers. In two areas viz., 18-72 and 17-72 almost all the depth zones upto 100 m were covered by both the types of vessels. Based on the catch rates of Meena Bharati and 17.5 m trawlers, the area between 20-59 m appeared to be the most productive zone. The depth belt 20-39 m in areas 18-72 and 17-72 recorded the highest catch rates of 668 kg. and 393 kg./hour by Meena Bharati. Generally speaking, a decrease in the catch rate was noticed from the shallow to deeper waters in this area.

Along the Goa coast the area 15-73 was intensively surveyed upto 60 m depth belt by 17.5 m trawlers. The depth zones 20-39 m and 40-59 m recorded more or less similar catch rates i.e. about 128 kg./hour.

Table VIII shows the depth-wise catch rates of prawn and important varieties of fish obtained by 17.5 m trawlers operated from Kandla, Bombay and Goa whereas Table IX indicates the same details in respect of Kalyani V and Meena Bharati operated from Kandla and Bombay respectively.

It can be seen from the Table VIII that from Kandla region the 17.5 m trawlers recorded a catch rate of about 11 kg. of prawn/hour from the depth belt 20-39 m. Both the types of vessels recorded comparatively high catch rates of elasmobranchs from the depth range 40-79 m. Species like 'dhoma', 'ghol', 'karkara' and pomfret recorded relatively high catch/hour from the depth zone 40-79 m by the 17.5 m trawlers. A high catch/hour of 'dhoma' i.e. about 70 kg. was recorded from the depth zone 20-39 m by the vessel Kalyani V.

From Bombay region about seven kg. of prawn/hour was recorded by 17.5 m trawlers from the depth zone 20-39 m while Meena Bharati recorded about two kg. from the depth zone 40-59 m. The depth zone 20-59 m appeared to be more productive than other zones in the case of elasmobranchs and 'dhoma' on the basis of the catch rates of both the types of vessels. In the case of cat fish the highest catch rate viz., 514 kg./hour was recorded by Meena Bharati from 20-39 m depth zone whereas a high catch rate of about 200 kg./hour was obtained by 17.5 m trawlers from depth zone 0-19 m. Generally speaking it can be said that the depth belt 20-59 m was the best productive zone for this species in the Bombay area. The depth-wise variations in the abundance of remaining varieties were not so remarkable.

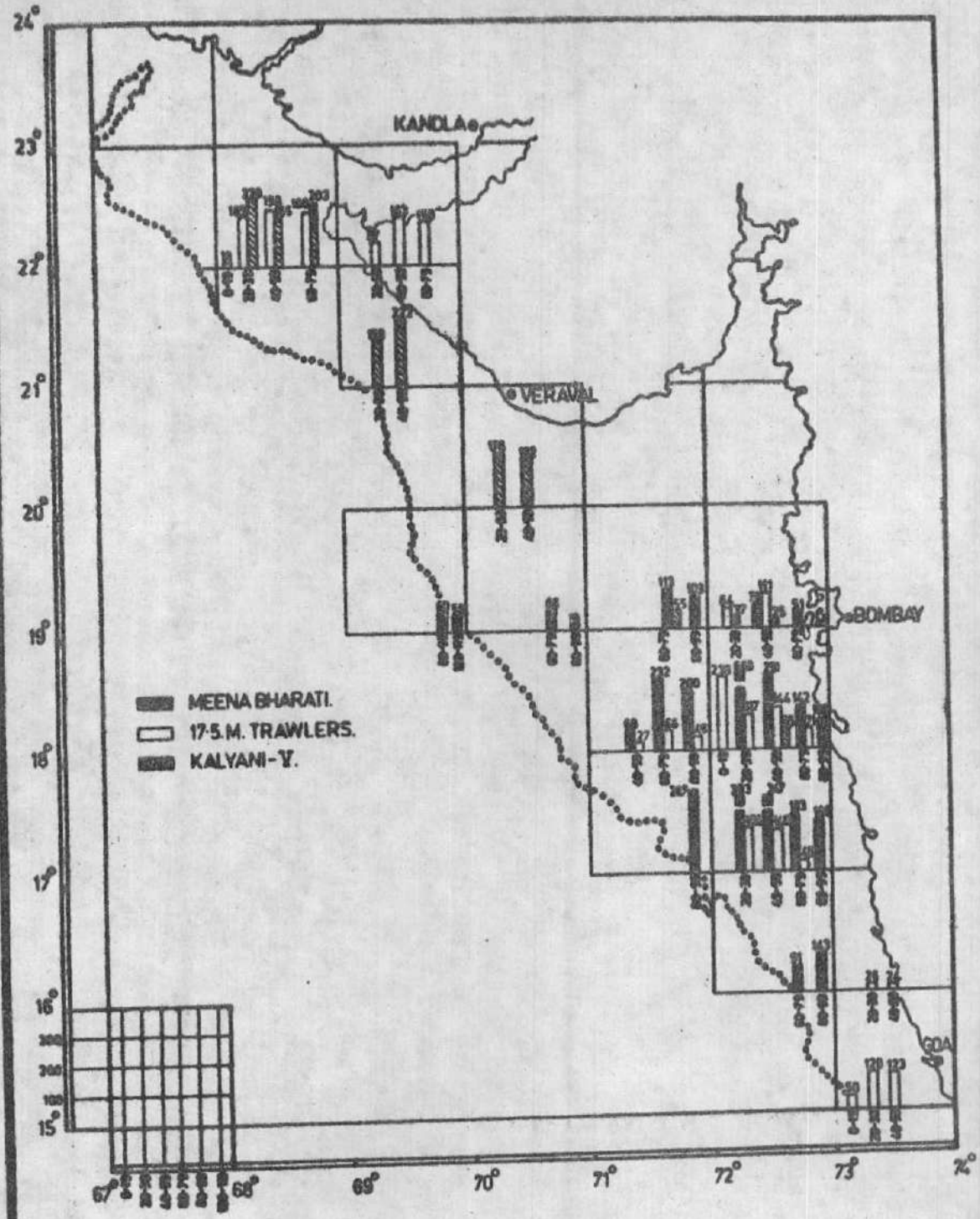


FIG.11. CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE NORTH WEST COAST.

Species	Depth range (m)											
	0-19	20-39	40-59	60-79	0-19	20-39	40-59	60-79	80-99	0-19	20-39	40-59
	KANDLA				BOMBAY					GOA		
Prawn	-	10.7	1.2	0.7	-	6.5	0.3	-	-	6.5	1.4	0.2
Elasmobranchs	13.4	21.0	50.0	36.5	17.5	21.0	26.7	16.7	12.1	3.7	14.7	7.1
Cat fish	-	8.5	3.8	5.9	200.0	44.8	81.1	28.0	10.6	0.9	77.1	30.9
Dhoma	0.2	24.8	47.5	46.9	-	18.7	15.4	9.1	10.7	-	-	-
Ghol	-	3.6	12.9	8.6	10.0	2.8	3.3	1.6	0.5	-	-	-
Wam	1.7	9.3	6.4	3.6	-	1.4	0.3	0.2	0.8	-	-	-
Karkara	-	3.7	6.3	11.5	-	0.3	0.5	4.0	0.5	-	-	-
Pomfret	-	4.4	14.5	15.7	-	0.4	0.7	0.8	-	-	-	-
Ribbon fish	-	-	-	-	-	-	-	-	-	1.7	12.0	45.6
Kilimeen	-	-	-	-	-	-	-	-	-	-	1.3	2.1
Lactarius	-	-	-	-	-	-	-	-	-	1.7	1.7	7.7
Perch	-	-	-	-	-	-	-	-	-	1.0	2.8	8.8
Lizard fish	-	-	-	-	-	-	-	-	-	-	0.8	0.1
Other quality fish	-	18.1	19.6	18.7	-	3.2	5.5	3.5	4.9	0.9	4.3	5.1
Misc. fish	2.2	4.3	13.5	12.4	10.0	25.3	9.4	8.5	4.7	33.0	11.0	12.9

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

Species	Depth range (m)							
	20-39	40-59	60-79	20-39	40-59	60-79	80-99	100-119
	KANDLA			BOMBAY				
Prawn	-	-	-	0.2	1.6	1.2	0.4	-
Elasmobranchs	45.1	31.7	52.7	35.3	37.5	29.3	12.4	25.0
Cat fish	11.3	12.4	2.9	514.0	155.2	69.7	107.7	25.0
Dhoma	66.9	50.0	50.5	5.2	23.2	14.0	7.3	-
Ghol	13.3	17.2	5.6	27.6	13.1	6.7	7.2	3.8
Wam	17.4	9.8	7.1	-	0.1	0.5	0.1	-
Karkara	2.6	2.9	5.4	-	1.5	1.3	0.7	-
Pomfret	17.4	8.9	8.8	-	2.7	0.6	0.7	-
Other quality fish	45.1	26.9	32.5	9.4	11.9	8.7	10.1	-
Misc. fish	1.3	8.2	17.9	51.1	13.9	22.2	12.4	2.5

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

From Goa region prawn recorded the highest catch/hour from 0-19 m depth belt while elasmobranchs and cat fish registered high catch rates from 20-39 m depth belt. In the case of ribbon fish, 'kilimeen', Lactarius and perch, the abundance appeared to be relatively more in 40-59 m depth belt than in other belts.

5.3.2. South west coast

Fig. 12 shows the depth-wise catch rates obtained from the south west coast. The vessels operated from the Mangalore region obtained the highest catch rates of 137 and 122 kg./hour respectively from the depth zone 40-59 m in areas 12-74 and 13-74. Along the Kerala coast also the same depth zone viz., 40-59 m recorded the highest catch/hour from areas 8-76, 9-76 and 9-75.

Table X shows the catch/hour of prawn and major species of fish obtained from different depth belts in this zone. It may be seen from the table that along the Karnataka coast the highest catch rate of prawn viz., two kg./hour was obtained from 0-19 m depth belt. The catch rate of elasmobranchs, 'kilimeen' and lizard fish were relatively high in 40-59 m depth belt while cat fish and ribbon fish were more abundant in 20-39 m depth belt than in other depth zones. No significant variation was noticed in the depth-wise distribution of Lactarius in this region. In areas off Kerala. prawn registered the highest catch rate of 11 kg./hour from 0-19 m depth belt. In the case of cat fish the depth zone 40-59 m yielded comparatively high catch rate. No remarkable fluctuation was noticed in the catch/hour of elasmobranchs, 'kilimeen', perch, lizard fish and Lactarius from different depth zones in this region.

Species	Depth range (m)						
	0-19	20-39	40-59	0-19	20-39	40-59	60-79
	MANGALORE			COCHIN			
Prawn	1.9	0.6	0.6	10.7	3.0	1.4	5.0
Elasmobranchs	3.9	5.0	10.1	-	14.1	12.2	16.0
Cat fish	0.5	27.4	12.4	-	7.3	19.0	-
Perch	-	-	-	-	0.3	0.3	-
Ribbon fish	1.2	2.0	0.3	-	-	-	-
Kilimeen	-	3.9	42.6	-	9.6	9.4	-
Lizard fish	-	1.1	3.7	-	4.7	3.9	-
Barracuda	-	-	-	-	1.8	1.5	5.0
Pomfret	-	-	-	-	0.9	2.3	-
Lactarius	0.5	1.7	1.0	-	0.4	0.2	0.5
Other quality fish	0.9	3.9	2.1	4.3	11.0	8.4	-
Miscellaneous fish	38.4	54.9	62.8	23.3	83.2	97.1	50.0

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

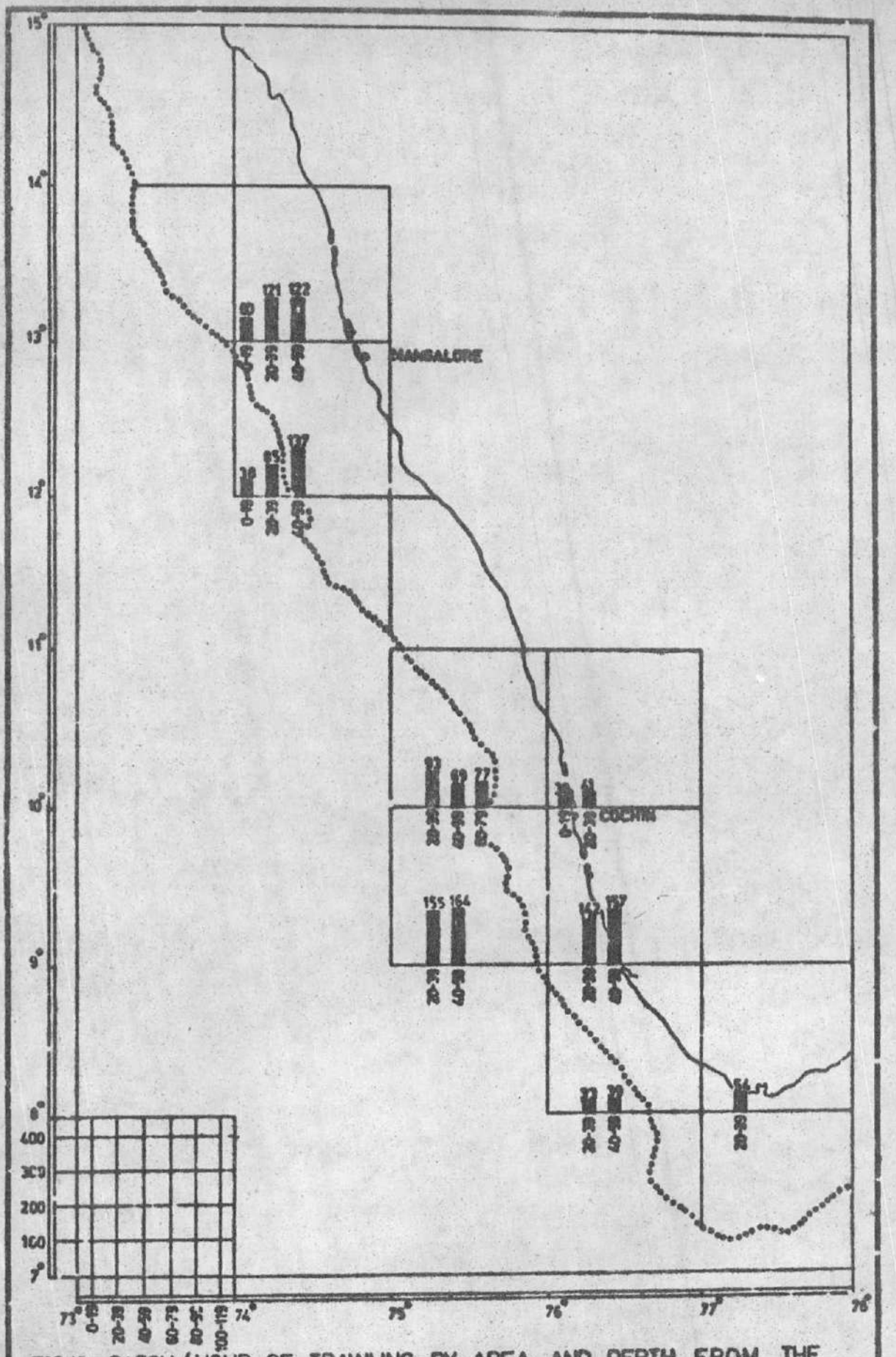


FIG.12. CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE SOUTH-WEST COAST.

5.3.3. Lower east coast

Fig. 13 shows the average catch rates obtained from different depth zones in the lower east coast. It can be seen from the figure that survey was done upto 60 m depth in this zone. In the Tuticorin region only one area viz., 8-78 was surveyed covering the three depth zones viz., 0-19 m, and 20-39 m and 40-59 m. The catch rates obtained from these depth zones did not exhibit any significant variation. In the Madras region the depth belt 20-39 m appeared to be more productive than other depth zones and recorded the highest catch rate of 224 kg./hour from area 14-80.

Elasmobranchs and perch were the dominant species in areas off Tuticorin and they did not exhibit any significant changes in their occurrence in different depth belts during the period under study (Table XI). The catch rate of prawn was about two kg./hour from 20-39 m depth zone. Along the Madras coast elasmobranchs, leiognathids and Lactarius showed a progressive decrease in their abundance from shallow to deeper waters. The catch rate of prawn was negligible from all the depth zones surveyed. In the case of sciaenids, perch and pomfret the abundance appeared to be the highest in 20-39 m depth zone, while in the case of lizard fish and 'kilimeen' the depth belt 40-59 m recorded the highest catch rates.

5.3.4. Upper east coast

Andhra coast was surveyed by the 17.5 m trawlers while the Orissa - West Bengal coast was surveyed by the 17.5 m trawlers as well as Matsyavigyani. From Fig.14 it may be seen that in areas off Visakhapatnam the depth zone 20-39 m recorded the highest catch rates of 125 and 127 kg./hour from areas 18-83 and 18-84 respectively.

Species	Depth range (m)					
	0-19	20-39	40-59	0-19	20-39	40-59
	TUTICORIN			MADRAS		
Prawn	-	1.5	-	0.1	0.2	0.1
Elasmobranchs	21.7	19.4	20.7	8.3	5.9	3.6
Cat fish	0.1	0.7	0.8	-	-	-
Leiognathids	-	-	-	49.0	46.7	14.2
Perch	35.2	30.1	36.8	24.9	38.9	13.6
Sciaenids	0.4	0.8	0.6	9.3	23.5	7.3
Lizard fish	-	-	-	3.8	3.1	12.1
Pomfret	-	-	-	1.2	6.5	0.5
Lactarius	-	-	-	7.6	6.1	2.1
Kilimeen	-	-	-	2.0	1.2	4.7
Other quality fish	10.1	8.2	6.3	6.9	8.5	8.4
Miscellaneous fish	10.1	8.8	2.9	32.0	34.2	31.2

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

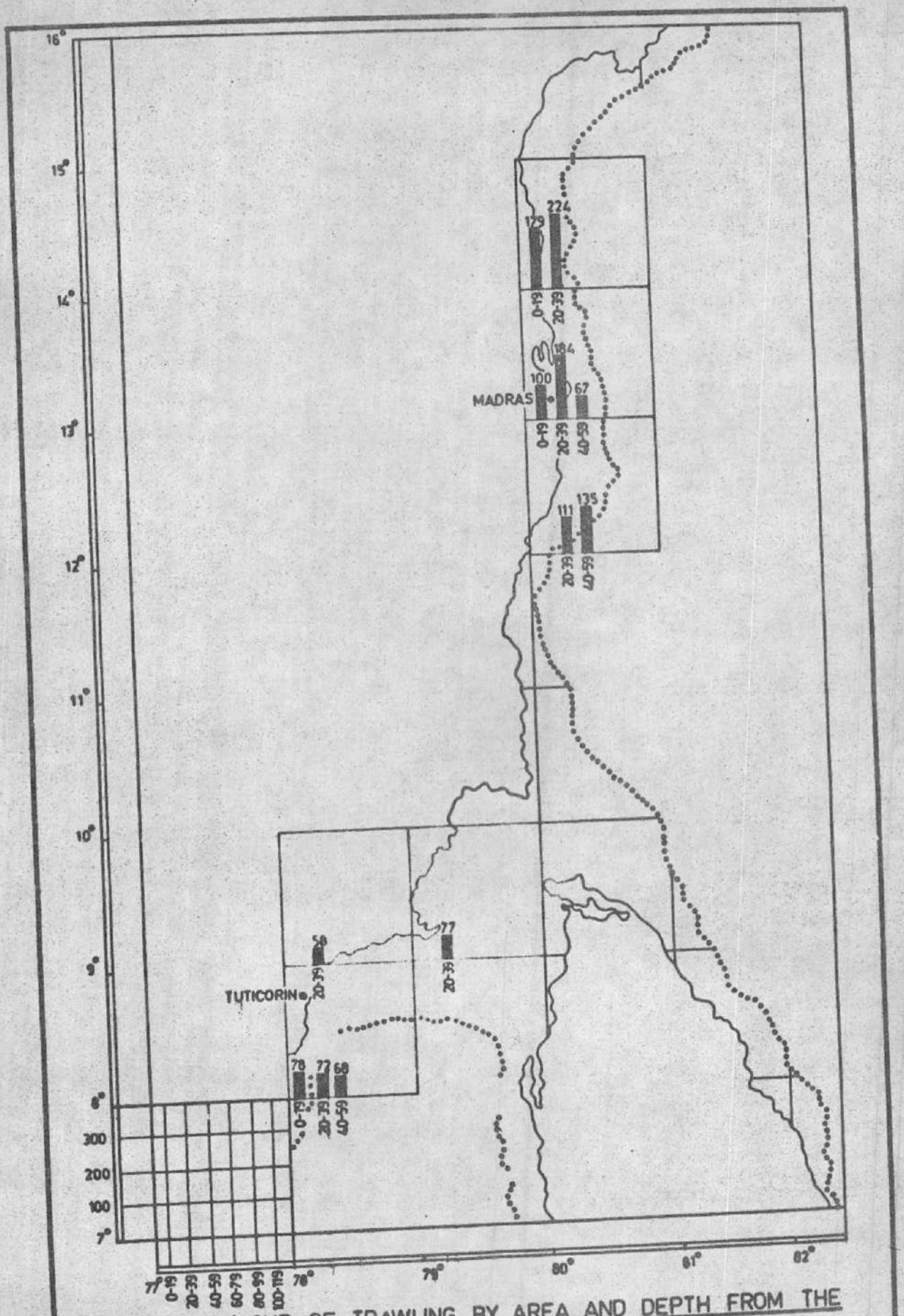


FIG.13. CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE LOWER EAST COAST.

Along the Orissa coast the area 20-86 was surveyed by 17.5 m trawlers upto 40 m depth. Catch rates of 265 and 250 kg./hour were recorded from 20-39 m and 0-19 m depth belts of this area respectively. Depth zone 20-39 m in area 19-86 recorded the highest catch rate of 344 kg./hour. The fishing effort expended in 40-59 m depth belt of area 19-86 was inadequate to draw valid conclusions on the high catch/hour viz., 1004 kg. obtained from this area by the vessel Matsyavigyani.

Along the Andhra coast, the catch rate of prawn, cat fish and sciaenids were more or less same from different depth belts (Table XII). Elasmobranchs, perch, pomfret and 'wam' recorded relatively high catch rates from 60-79 m depth belt. Of the two depth zones viz., 0-19 m and 20-39 m surveyed along the Orissa coast the depth zone 20-39 m can be regarded as more productive than the other zone. The high catch rates of prawn viz., 12 and 25 kg./hour respectively from 0-19 m and 20-39 m depth zones obtained from Orissa coast deserves special mention. In the case of Calcutta region elasmobranchs, recorded comparatively high catch rate from 40-59 m depth belt while the remaining varieties showed no significant variation in the catch rates.

Species	Depth range (m)							
	20-39	40-59	60-79	0-19	20-39	20-39	40-59	
	VISAKHAPATNAM			PARADEEP		CALCUTTA		
Prawn	1.9	2.3	-	11.8	25.2	0.8	0.2	
Elasmobranchs	2.7	5.8	15.5	18.4	25.0	53.3	74.6	
Dhoma	-	-	-	34.7	49.0	-	-	
Pomfret	0.5	0.6	5.0	7.3	8.3	1.8	0.9	
Cat fish	10.9	12.8	-	1.4	7.3	4.8	4.0	
Wam	1.1	1.9	8.5	1.1	6.9	2.8	2.0	
Ghol	-	-	-	0.7	1.1	1.6	-	
Karkara	-	-	-	0.2	3.2	-	-	
Sciaenids	0.6	0.4	-	-	-	-	-	
Perch	1.3	0.8	5.0	-	-	-	-	
Other quality fish	0.1	-	-	1.0	1.9	11.2	5.5	
Miscellaneous fish	50.1	36.4	115.0	172.2	139.0	156.5	186.6	

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

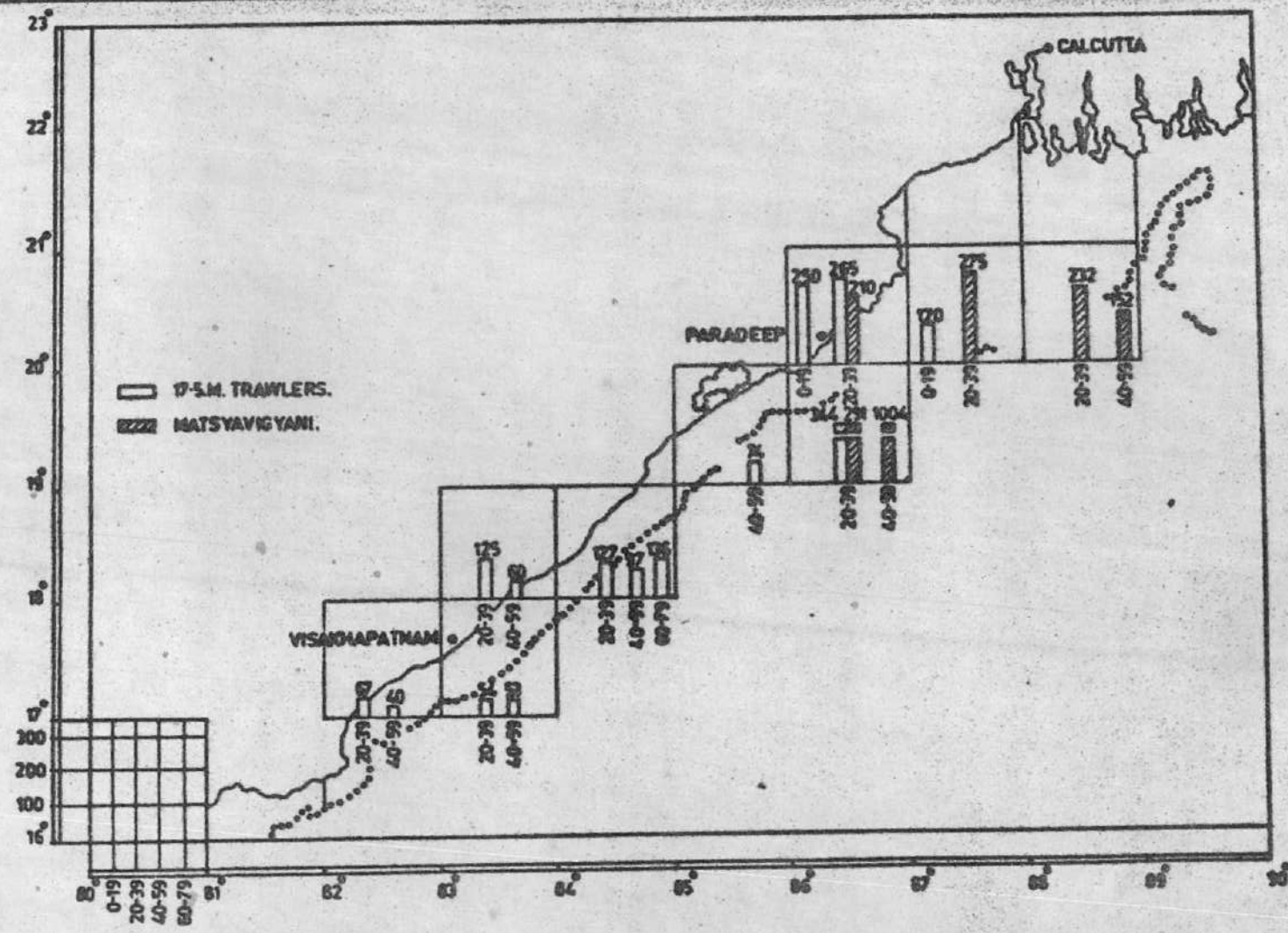


FIG.14. CATCH/HOUR OF TRAWLING BY AREA AND DEPTH FROM THE UPPER EAST COAST.

5.3.5. Andaman and Nicobar waters

The results obtained by trawling from the Andaman and Nicobar waters is summarised below:

Species	Depth range (m)		
	20-39	40-59	60-79
Elasmobranchs	17.3	25.7	25.4
Leiognathids	-	35.6	33.1
Sciaenids	-	12.9	18.3
Upeneoids	-	11.8	12.0
Cat fish	3.3	3.8	3.2
Kilimeen	-	3.0	3.1
Perch	-	1.5	0.8
Lizard fish	-	0.7	1.7
Other quality fish	1.0	0.9	0.2
Misc. fish	90.1	11.3	2.2
Total:	111.7	107.2	100.0

It may be seen that the highest catch rate of all fish viz., 111.7 kg./hour was obtained from 20-39 m depth belt. The catch from 20-39 m depth zone consisted mainly of miscellaneous fish. Elasmobranchs, leiognathids, upeneoids, cat fish, perch, lizard fish, etc., showed no significant variations in their catch rates from 40-59 m and 60-79 m depth belts where these varieties were predominant.

5.3.6. 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 (m)	Region — Catch/hour in kg.				
	Andaman & Nicobar waters	North west coast	South west coast	Lower east coast	Upper east coast
0-19	-	48	47	79	249
20-39	112	126	119	119	163
40-59	107	140	153	92	61
60-79	100	131	77	-	136
80-99	-	49	-	-	-

It may be seen that in the north west and south west coast 40-59 m depth belt recorded the highest catch rates. In the north west coast 60-79 m depth strata recorded the next highest catch rate while in the south west zone 20-39 m depth zone registered the second highest catch rate. Depth zone 20-39 m in the lower east coast yielded the highest catch rate viz. 119 kg. while in the upper east coast depth zone 0-19 m recorded the highest catch rate viz., 249 kg./hour. If Orissa coast alone is considered the best productive zone was 20-39 m belt. It is noteworthy in this context that in all other regions viz., north west coast, south west coast and lower east coast, depth zone 0-19 m recorded the lowest catch rates as compared to the other depth belts. It is very likely that this is due to the relatively low pressure of commercial fishing effort in the coastal waters of upper east coast comprising Orissa and West Bengal coast as compared to the other three regions. In the Andaman and Nicobar waters depth zone 20-39 m registered the highest catch/hour viz., 112 kg. and no significant variation is noticed in the catch rates from other depth zones in this area.

5.4. Seasonal variation in the catch

5.4.1. Quantitative variation

Fig. 15 shows the monthly catch rates of Kalyani V and Meena Bharati operated from Kandla and Bombay respectively. Kalyani V operated for six months viz., April and May and December to March. Of these, the period March-April appeared to be the best productive months. From Bombay Meena Bharati operated round the year except the months of August and November. This vessel has recorded the highest catch rate of about 325 kg./hour during the month of December. The period December-April was the best fishing season while the months May and June recorded the lowest catch rates.

Figs. 16 & 17 show the monthly catch rates of 17.5 m trawlers from different regions along the west coast viz., Kandla, Bombay, Goa, Mangalore and Cochin. The vessel Meena Udyog conducted fishing from Kandla during the periods April and November to March. As in the case of Kalyani V the month of March recorded the highest catch rate. The 17.5 m trawlers surveyed the Bombay region during the periods April-July, November and January-March and relatively high catch rates were recorded during the months of March and November.

Along the Goa coast relatively high catch rates were recorded during the period November-April and the highest catch/hour of 204 and 201 kg. were recorded during the months of March and December respectively. The period May-October registered comparatively low catch rates.

Two peak productive seasons were noticed from Mangalore viz., December and March-April. The period July-September was the least productive period. From Cochin also two peak productive periods were noticed viz., September- November and January-March. Of these, the period September-November registered relatively high catch rates with a catch rate of 240 kg./hour during the month of September. The monsoon period viz., June-August yielded the lowest catch rates.

Figs. 18-19 furnish the month-wise catch rates obtained from different regions of the east coast. It may be seen from the figure that from Tuticorin the highest rates of 197 kg. and 105 kg./hour were obtained during the months of January and August respectively. In all the remaining months the catch rates were below 100 kg./hour and there were no remarkable fluctuations in the monthly catch rates. Two peak seasons were observed in the monthly catch rates from Madras viz., July-September and February-April. Of these, the period February-April registered comparatively high catch rates and the highest being 326 kg./hour during the month of February.

Survey was made round the year along the areas off Visakhapatnam. The month of January registered the highest rate with a catch/hour of about 140 kg. Generally speaking, the period December-February can be regarded as the best season in this region. Compared to the other regions of the east coast the areas off Paradeep yielded high catch rates in almost all the months of the year barring the period July-August. Catch rates of 404 kg. and 376 kg./hour were obtained during the months of November and December respectively. In all the remaining months the catch/hour ranged between 155 kg. and 289 kg. In the case of the Calcutta region, the periods March-April and November-December appeared to be the best productive periods. The highest catch rate of 329 kg./hour was observed during the month of March. The month of August recorded the lowest catch rate and no fishing was conducted during June and July. Along the Andaman and Nicobar waters the months of July and December recorded relatively high catch rates while the month of June yielded the lowest catch rate.

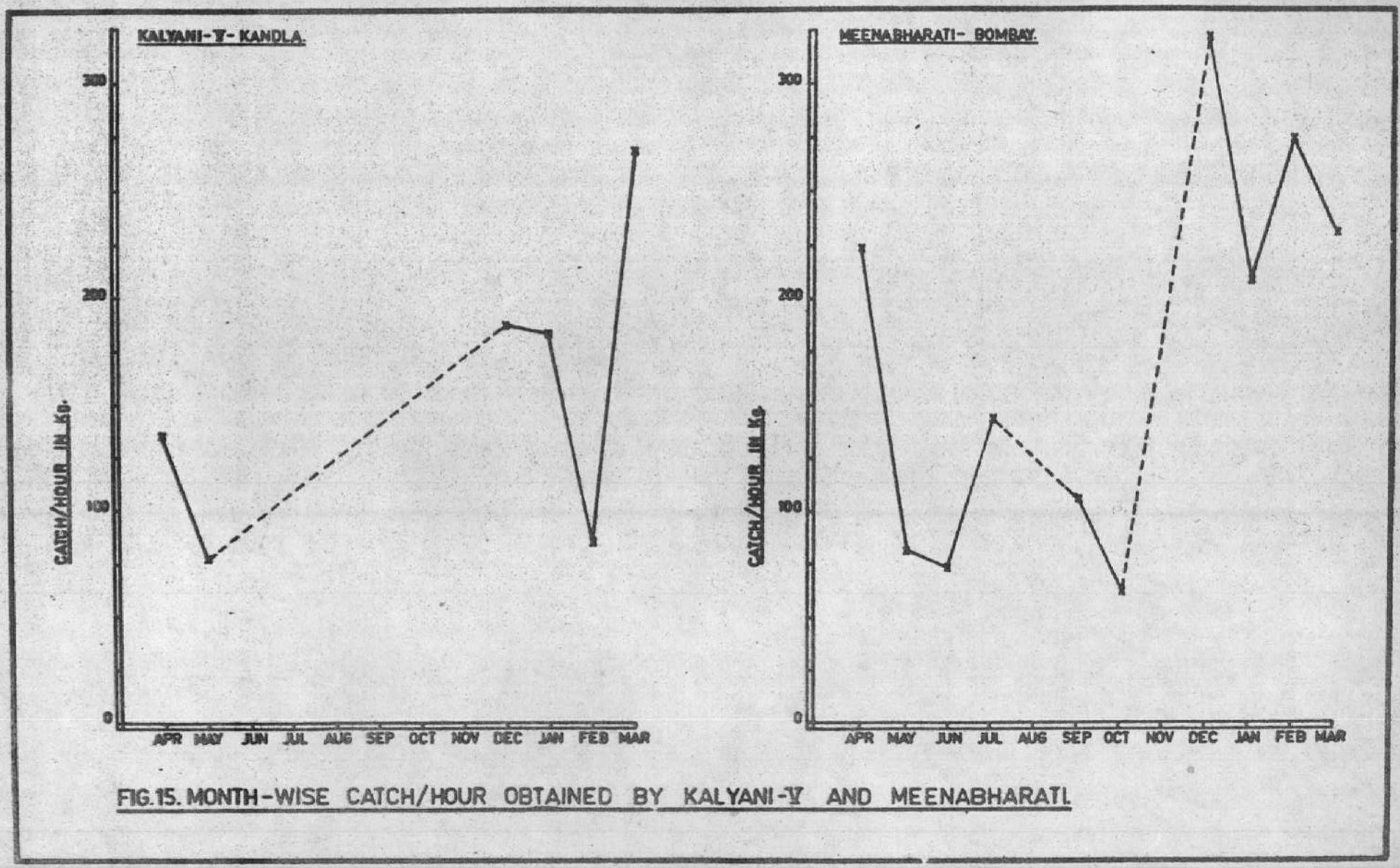


FIG.15. MONTH-WISE CATCH/HOUR OBTAINED BY KALYANI-V AND MEENABHARATI.

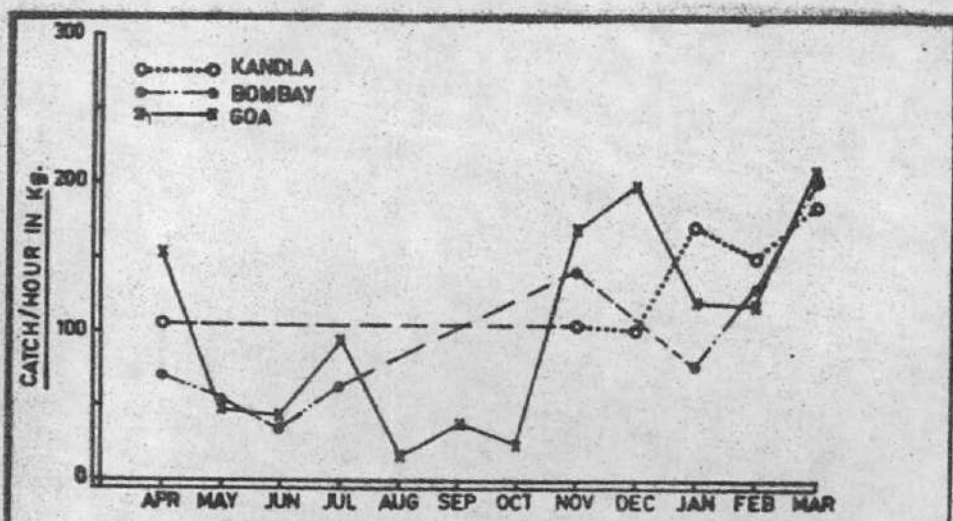


FIG.16. MONTH-WISE CATCH/HOUR OF 17·5.M.TRAWLERS FROM THE NORTH WEST COAST.

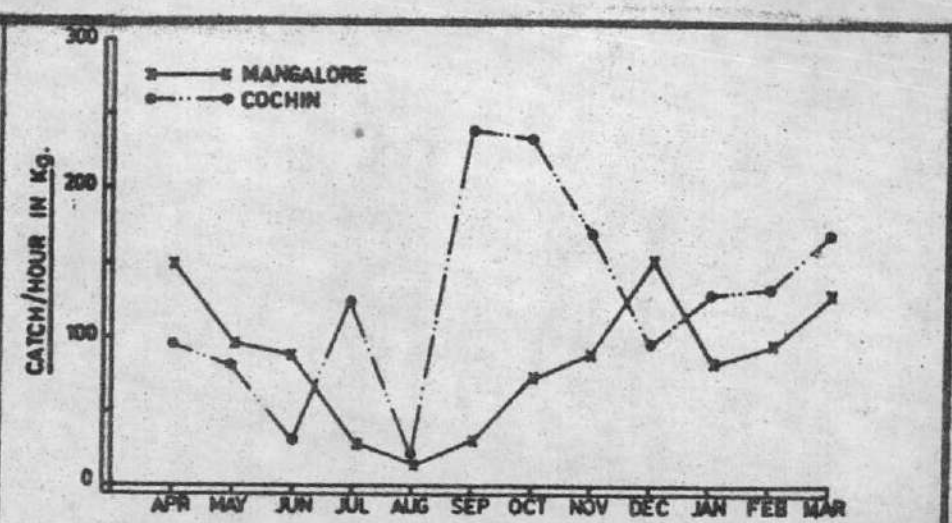


FIG.17. MONTH-WISE CATCH/HOUR OF 17·5.M.TRAWLERS FROM THE SOUTH WEST COAST.

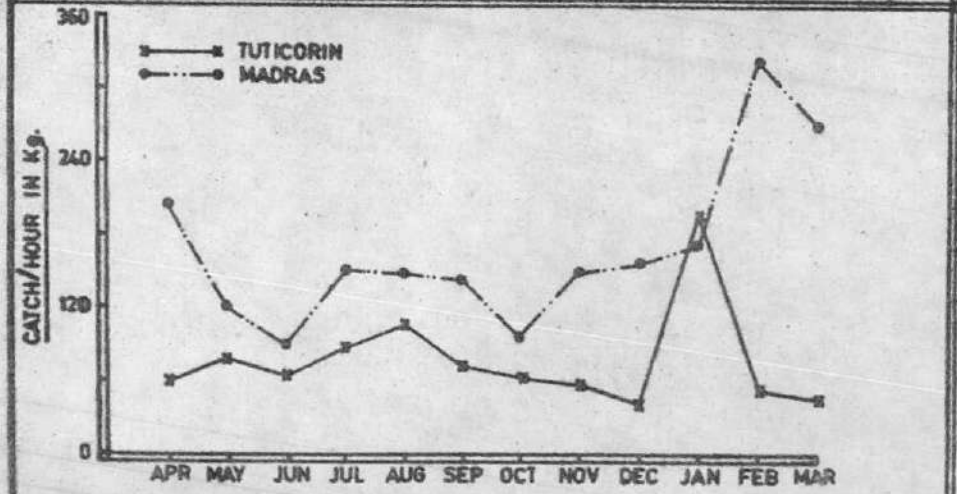


FIG.18. MONTH-WISE CATCH/HOUR OF 17·5.M.TRAWLERS FROM THE LOWER EAST COAST.

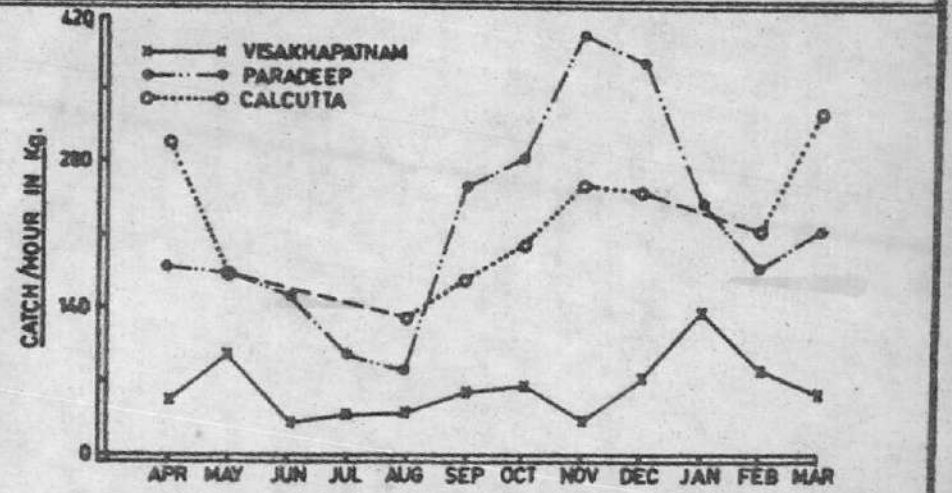


FIG.19. MONTH-WISE CATCH/HOUR OF 17·5.M.TRAWLERS AND MATSYAVIGYANI FROM THE UPPER EAST COAST.

5.4.2. Qualitative variations

An attempt has been made to study the monthly variations in the catch rates of prawn and important varieties of fish. Fig. 21 gives the monthly catch rates recorded by 17.5 m trawlers from Kandla and Bombay while Fig. 20 gives the catch rates obtained by Kalyani V from Kandla and Meena Bharati from Bombay. It may be seen from the figures that the period September-December was probably the best period for prawns. In the case of elasmobranchs the periods March-April and November appeared to be more productive in areas off Kandla while in the Bombay region the periods June-July and December-February were the best periods. The month of April recorded the highest catch rate of cat fish from Kandla by the 17.5 m trawlers. The highest abundance of cat fish was during the months of December to April in the Bombay region. Species like 'wam', 'karkara', 'dhoma', 'ghol', pomfret, etc., yielded relatively high catch rates during the period January-March from Kandla region. The periods May-June and December-March can be regarded as the best season for 'ghol' and 'dhoma' in the Bombay region.

From Fig. 22 it may be seen that the months of June and July recorded the highest catch rates of prawn from Goa while its catch rates were relatively high during June and August from Mangalore. In the case of elasmobranchs the period December-January appeared to be the best period in areas off Goa and February-April in the Mangalore region. Cat fish yielded the highest catch rate of 160 kg./hour from Goa during the month of March and the period November-December also appeared to be good season while from Mangalore two seasons viz., October-November and March-April were observed as the best periods for this species. The period January-April registered high catch rates of ribbon fish from

Goa while the catch rates of this species were relatively high during the months of June and November from Mangalore. 'Kilimeen' registered relatively high catch rates from Mangalore during the months of November and December.

Fig. 23 shows the seasonal abundance of various groups viz., prawn, elasmobranchs, cat fish, 'kilimeen', etc., from Cochin. In this region prawn was more abundant during the period July-September than other months. Elasmobranchs recorded high catch rates during the period December-March. The periods July and October-December appeared to be the best productive seasons for cat fish. 'Kilimeen' recorded high catch rates during the months of September and October while the period January-March was the best season for lizard fish. Barracuda was present in the catch in almost all months and the highest catch rate was noticed during the month of April.

Fig. 24 shows the monthly variations in the catch rates of prawn and important varieties of fish from areas off Tuticorin and Madras. It can be seen from the figure that from Tuticorin region perch and elasmobranchs were obtained throughout the year and the highest catch rates of perch were noticed during the periods August-September and May, while the period June-August recorded high catch rates of elasmobranchs. Prawn showed relatively high catch rate during December and in all other months the catch rates were negligible. From Madras region the catch rates of prawn were negligible throughout the year. It is seen that in the case of elasmobranchs, the monthly variations were insignificant while leiognathids were relatively abundant during the months February, March and November to December. In the case of sciaenids also the period February-March and December can be regarded as the best productive periods

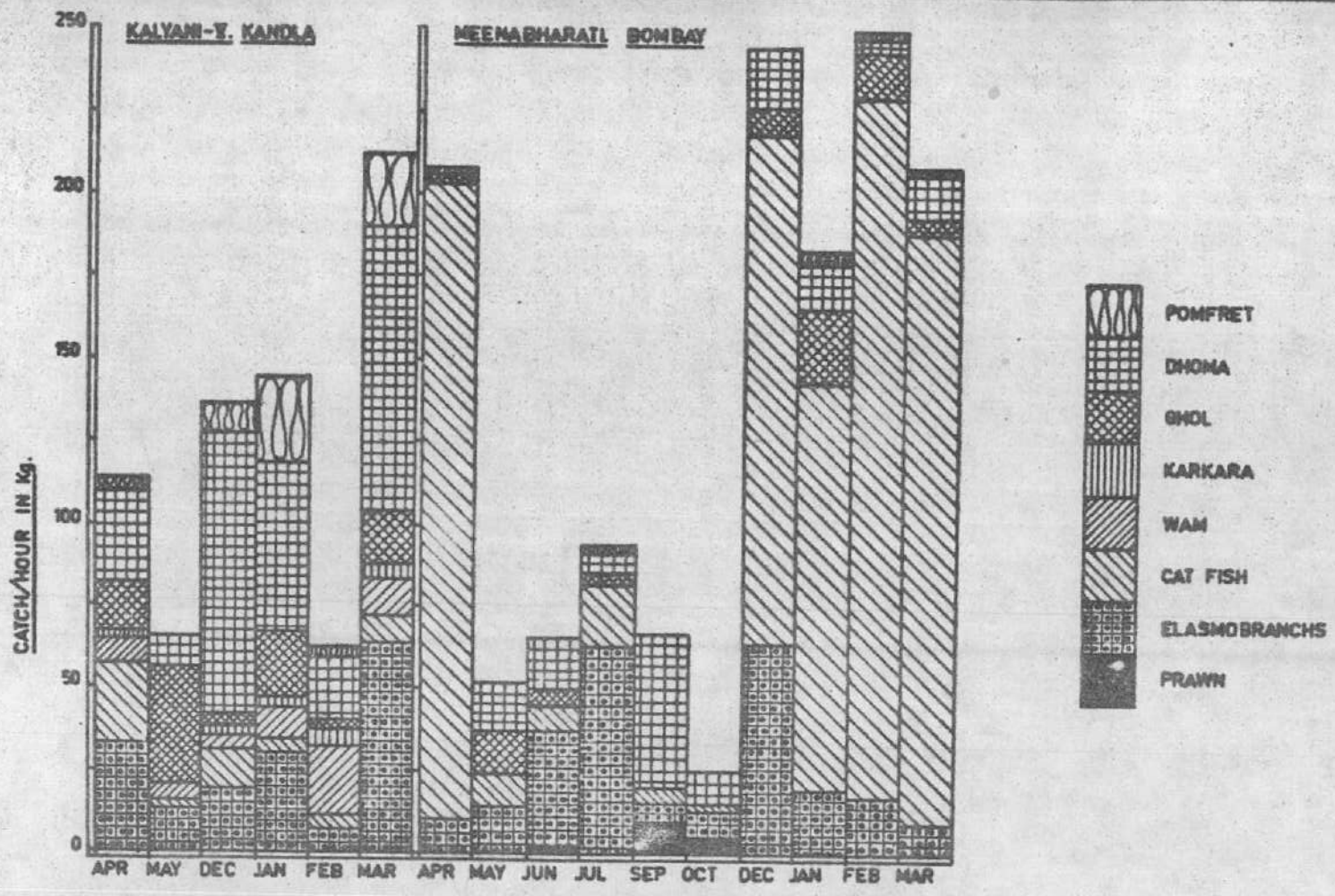


FIG.20. MONTH-WISE CATCH/HOUR OF MAJOR VARIETIES BY KALYANI-V AND MEENABHARATI.

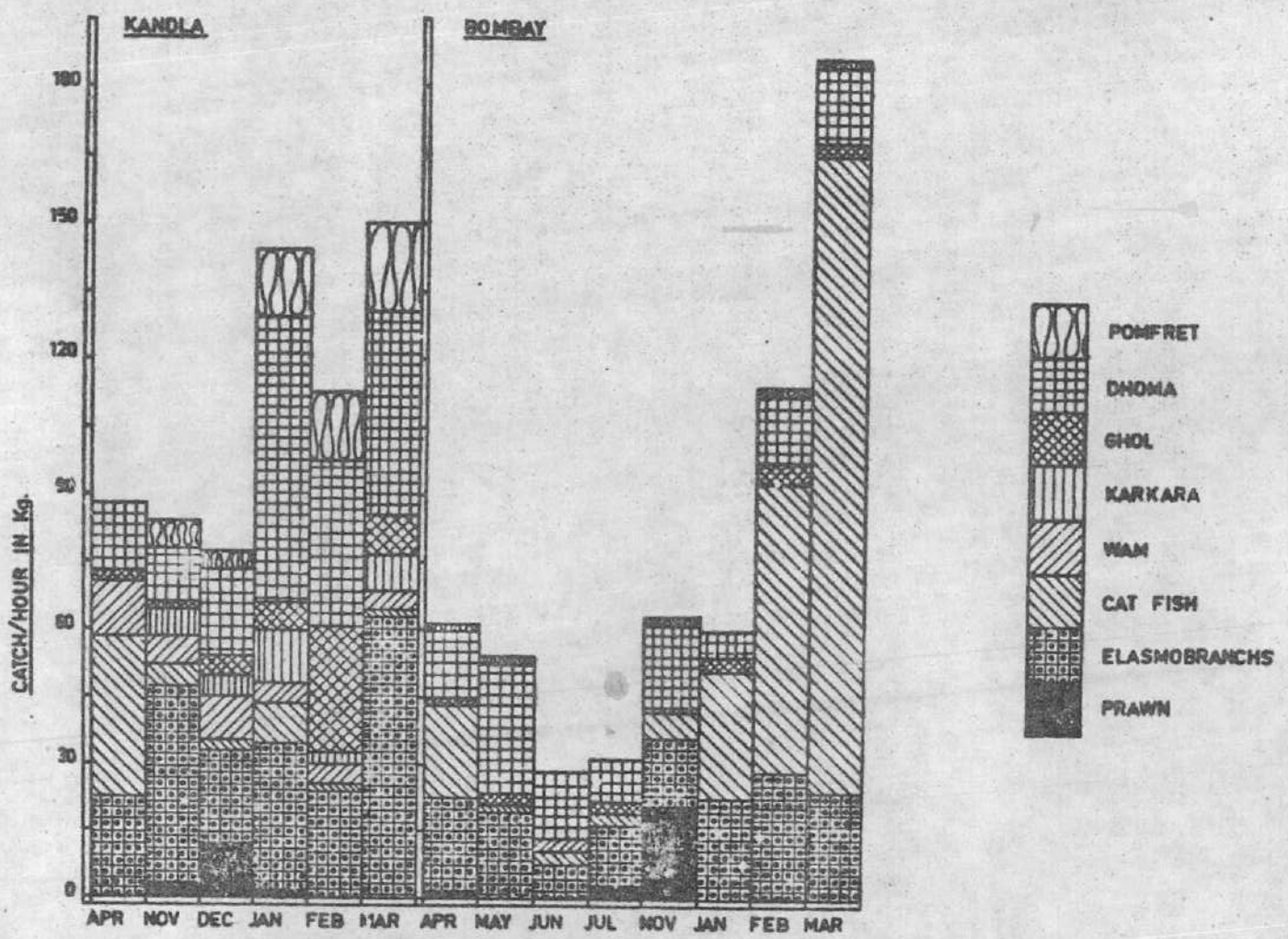


FIG.21. MONTH-WISE CATCH/HOUR OF MAJOR VARIETIES BY 17.5.M.TRAWLERS FROM KANDLA AND BOMBAY.

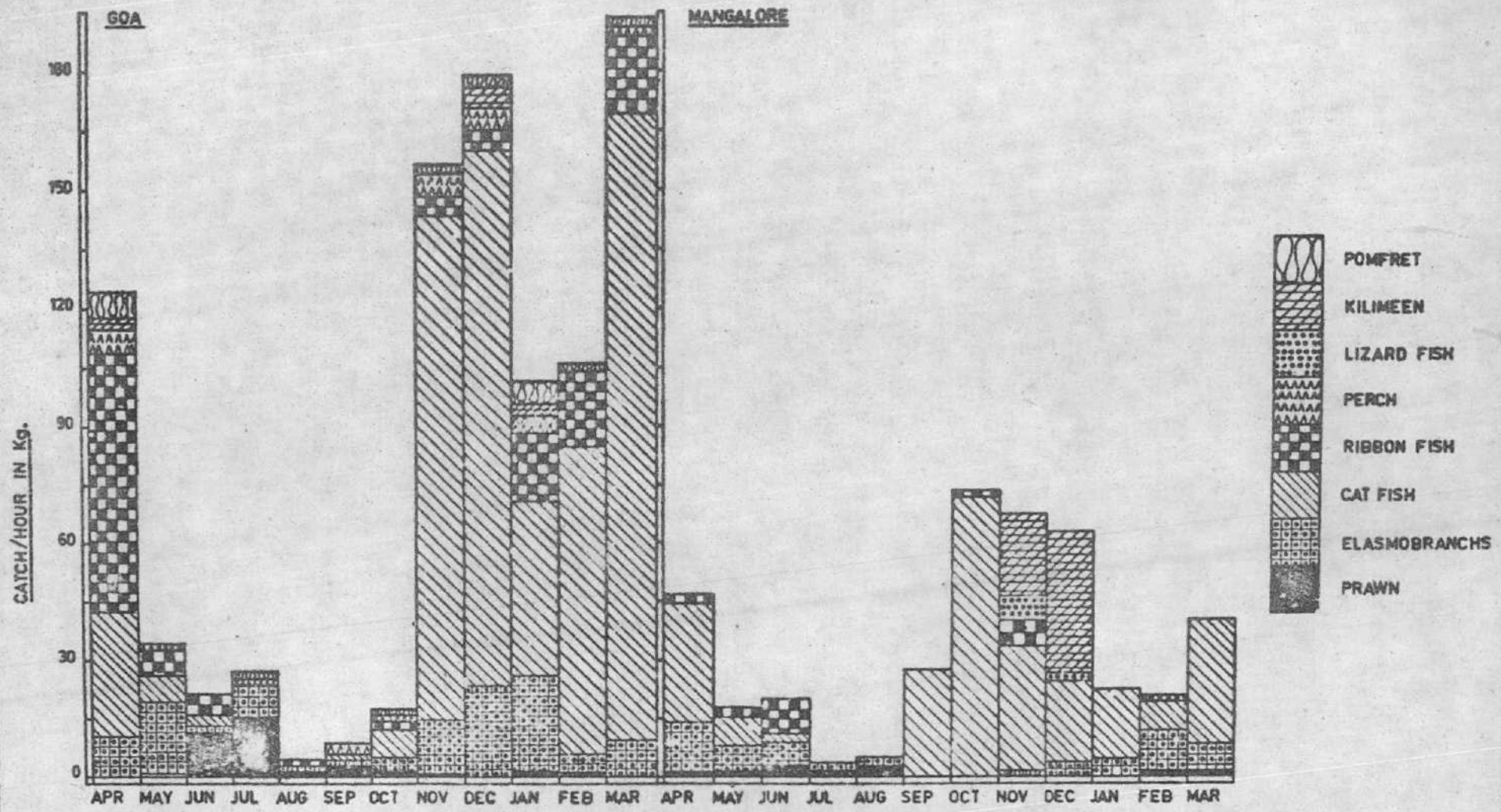


FIG.22. MONTH-WISE CATCH/HOUR OF MAJOR VARIETIES BY 17·5 M. TRAWLERS FROM GOA AND MANGALORE.

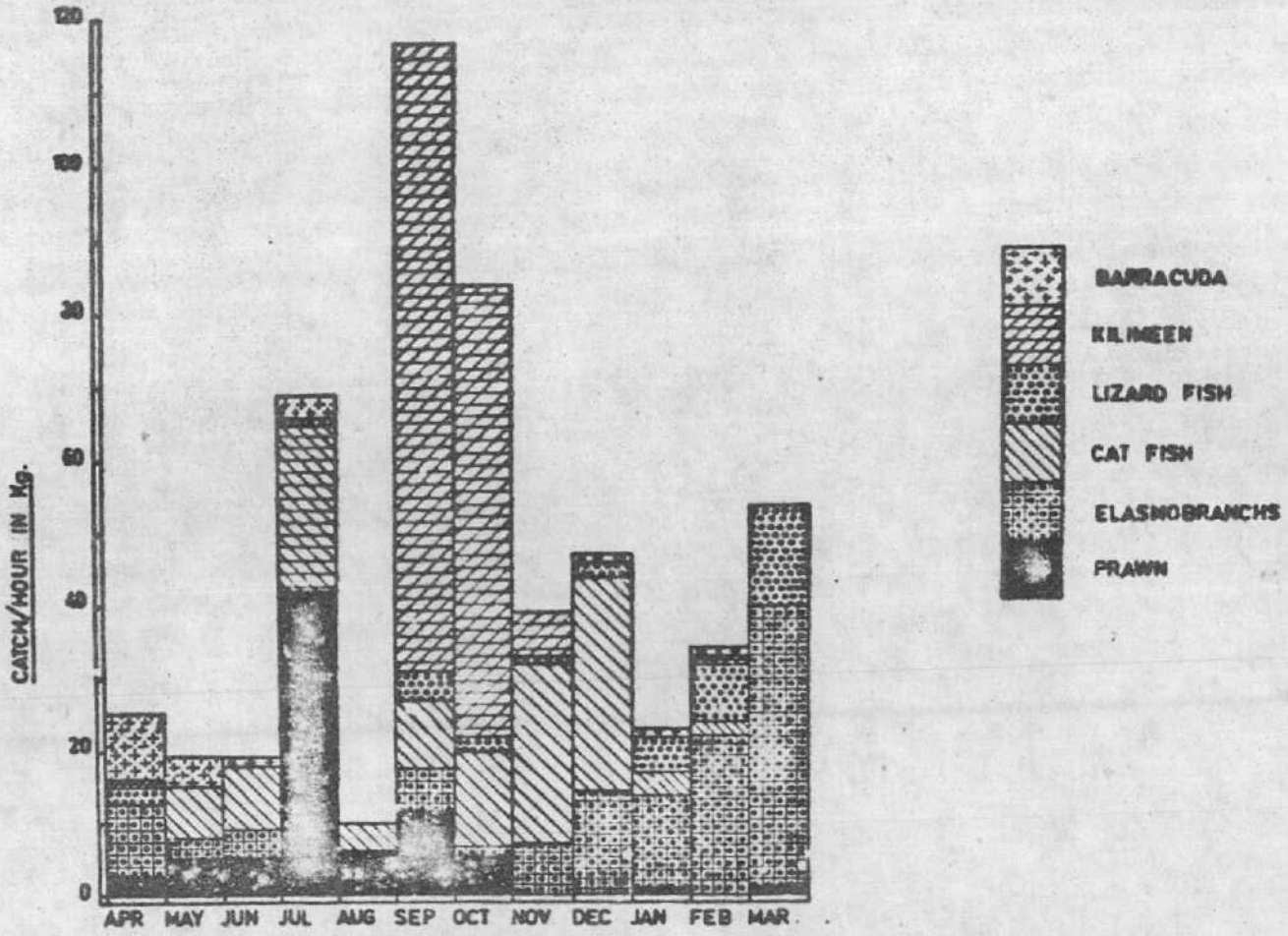


FIG. 23. MONTH-WISE CATCH/HOUR OF MAJOR VARIETIES BY 17·5 M. TRAWLERS FROM COCHIN.

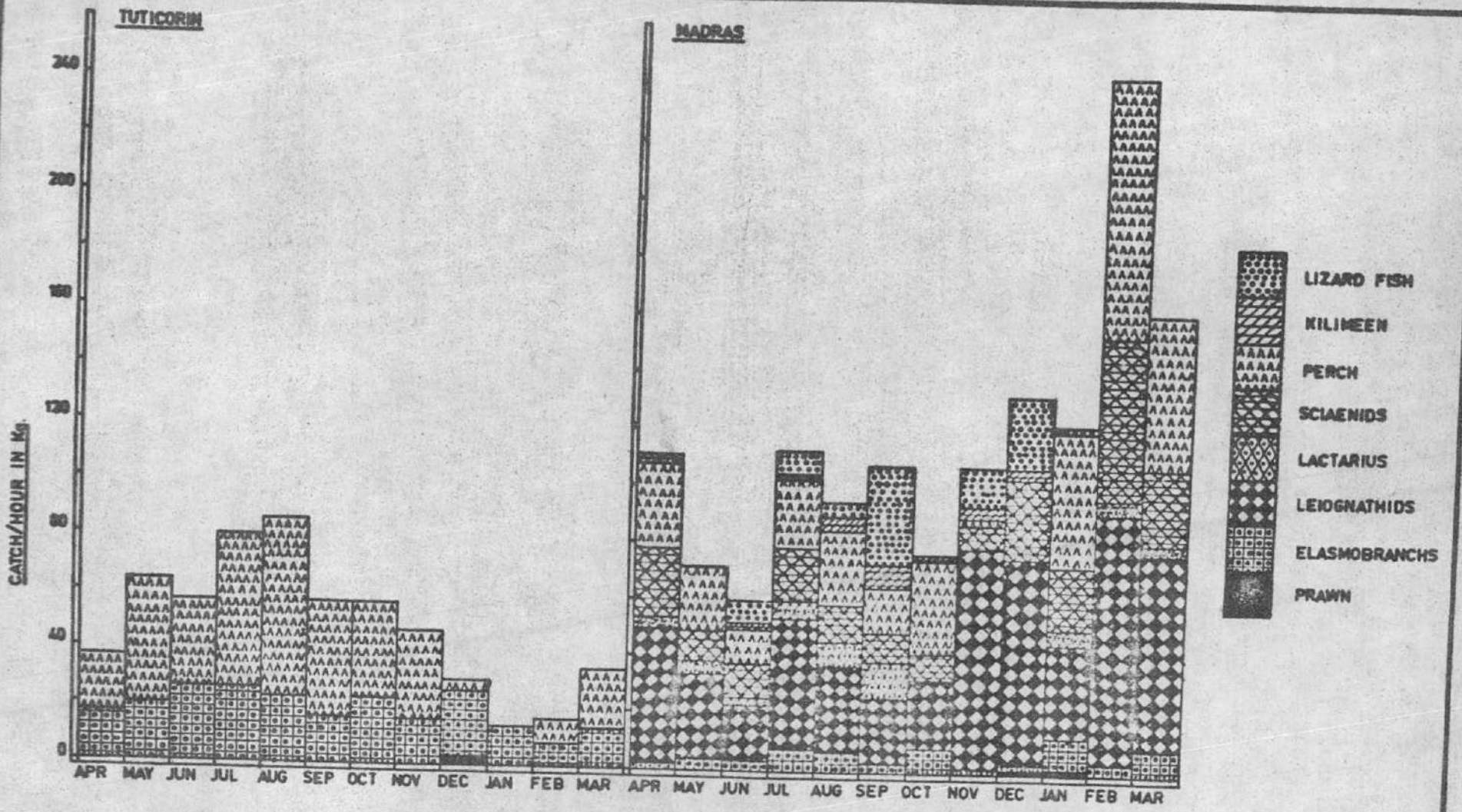


FIG.24. MONTH-WISE CATCH/HOUR OF MAJOR VARIETIES BY 17·5.M. TRAWLERS FROM TUTICORIN AND MADRAS.

in the Madras region. As in the case of Tuticorin perch was obtained throughout the year from Madras also. Its catch rates were relatively high during the period January-March. Lactarius and 'kilimeen' recorded comparatively high catch rates during the months of August and September, while in the case of lizard fish the months of September and December appeared to be the best productive months.

From Fig. 25 it may be seen that prawn recorded comparatively high catch rates during the period July-October from areas off Visakhapatnam. The months July, September and October recorded about four kg./hour. In the case of elasmobranchs the period January-March was the best fishing season while it was the months of May, February and March for cat fish. 'Wam' and perch yielded relatively high rates during the months of January and February. It may be seen from the Fig. 25 that in areas off Paradeep, prawn recorded high catch rates during the period October-December and the highest rate of 60 kg./hour was observed during the month of November. The periods May-June and September-November appeared to be good season for elasmobranchs while it was the periods September-November and January for cat fish. 'Dhoma' and pomfret were abundant during the period October-January while 'wam' recorded high catch rates during the months of October and November.

Fig. 26 shows the month-wise catch/hour of various important species of fish obtained from Calcutta and Port Blair regions. As seen from the figure, in the Calcutta regich prawn recorded relatively high catch rates during the months of November and December. No remarkable changes in the monthly catch rates of elasmobranchs were observed from this region. Clupeids recorded high catch rates during the months of May, November and December while 'wam' was abundant during the months of

September and April-May. The netting of cat fish, 'ghol' and 'karkara' were rather high during the month of April from this region.

Elasmobranchs yielded high catch rates during the months of September and March while cat fish recorded high catch rates during the months of July and October-November from Port Blair region. Leiognathids were abundant during the months of December and July while upeneoids and sciaenids recorded high catch rates during the month of July. The period January-March recorded comparatively high rates of 'kilimeen'. It is noteworthy that prawn was not caught from this region.

6. A COMPARATIVE STUDY OF THE TRAWL FISHERIES OF DIFFERENT REGIONS

The results obtained by a selected few 17.5 m trawlers which operated more or less round the year from bases such as Goa, Mangalore, Cochin, Tuticorin, Madras, Visakhapatnam and Paradeep are presented below for a comparative study of trawl fisheries from these regions. The trawling operations of the vessels especially the ones operated from bases such as Kandla, Bombay, etc., were interrupted for other studies etc. Since 17.5 m trawlers are identical in all respects and since the gear operated by them are of the same type and size, the results are comparable. The data may also give an idea about the economic viability of trawling using this type and size of trawlers from these regions.

Base	Vessel	Fishing effort		Total catch (kg.)	Value realised (Rs.)	Catch /day (kg.)	Catch /hour (kg.)
		Days	Hours				
Goa	Meena Netra	220	1277	150665	84626	685	118
Mangalore	Meena Tarangini	204	1105	104495	44392	512	95
Cochin	Meena Utpadak	206	786	131814	72834	640	168
Tuticorin	Meena Saudagar	176	750	57888	50399	329	77
Madras	Meena Sitara	118	581	99029	104808	839	170
Visakhapatnam	Meena Jawahar	181	922	64921	48000	359	70
Paradeep	Meena Prasarak	170	677	190951	242244	1123	282

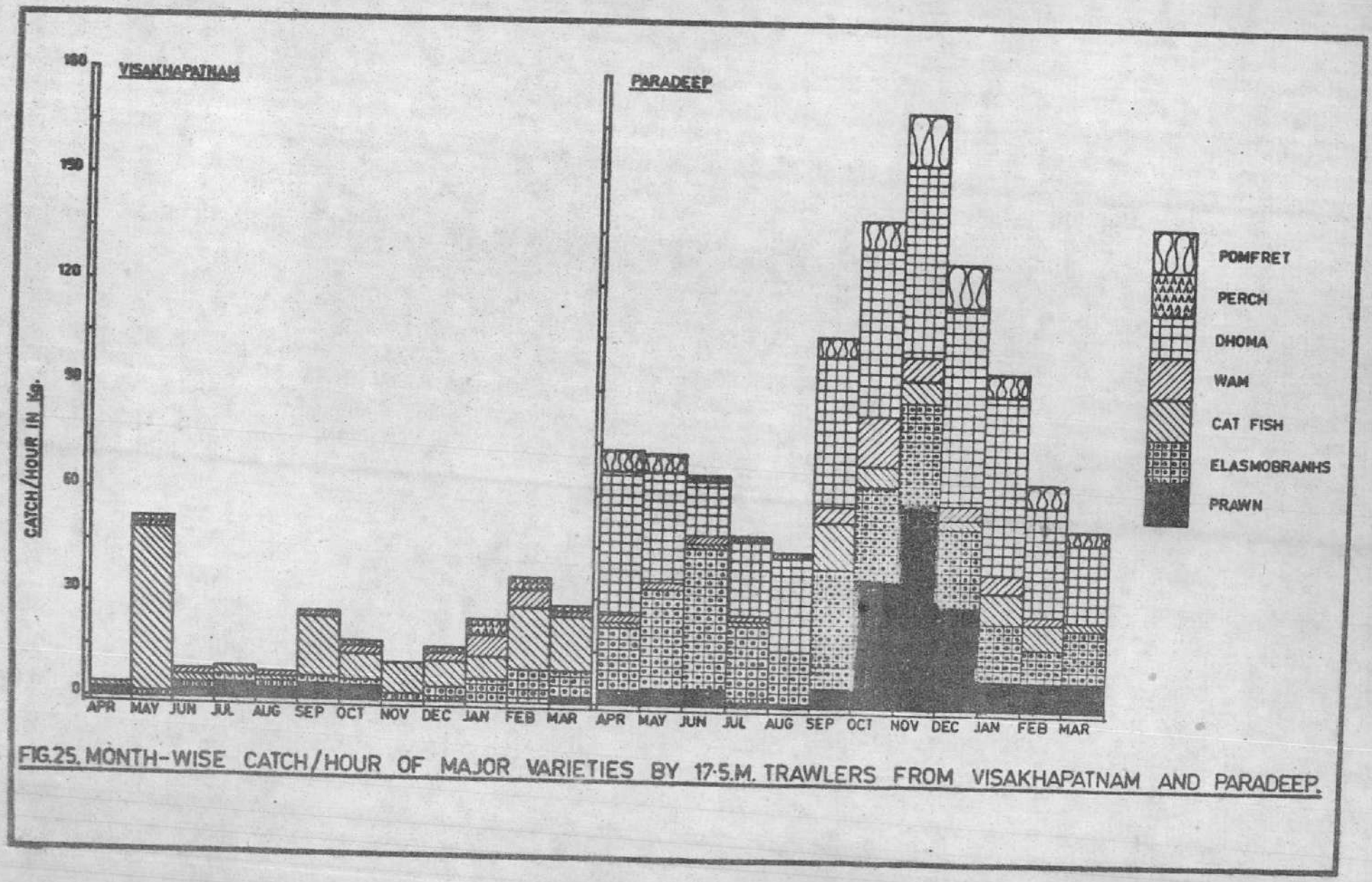


FIG.25. MONTH-WISE CATCH/HOUR OF MAJOR VARIETIES BY 17·5.M. TRAWLERS FROM VISAKHAPATNAM AND PARADEEP.

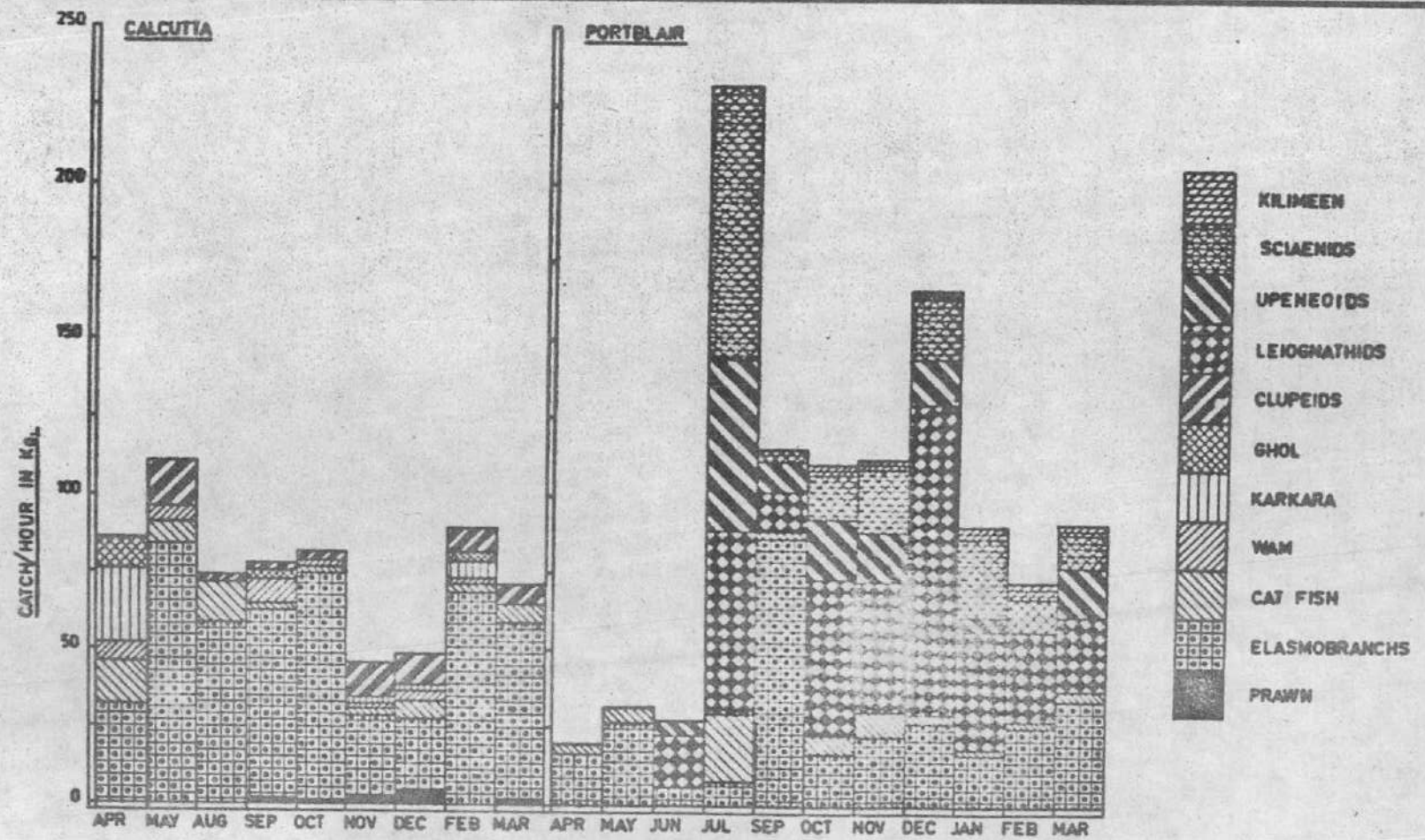


FIG.26. MONTH-WISE CATCH/HOUR OF MAJOR VARIETIES BY MATSYAVIGYANI FROM CALCUTTA AND 17-5.M. TRAWLERS FROM PORTBLAIR.

It may be seen that the highest average catch/hour viz., 282 kg. was obtained by the vessel Meena Prasarak operated along the Orissa coast. During 170 days of operation the vessel landed about 191 tons of fish, the average catch/day being 1.12 tons. The percentage of prawn in the catch was about 10%. The average fishing effort per day was about 4 hours as the vessel was doing daily fishing due to non-availability of ice etc. It may be possible for this vessel to fish between 6-8 hours a day if the vessel is sent on long voyages, whereby it can extend its operation to the rich unexploited areas and land about three tons of catch/day. The second highest catch rate was noticed from Madras region which is about 170 kg/hour. The vessel landed about 105 tons of fish during 118 days of fishing, the average catch per day being little less than one ton. Here there is scope to increase both the catch/day by increasing the fishing effort/day and the days of operation/annum. The vessel should be able to land about 300 tons of catches/annum. From Cochin and Goa the vessels registered about 0.7 ton/day. Earlier studies (Joseph, 1973) made at Cochin showed that the same type of vessel had obtained about one ton catch per day. On the basis of results obtained during the period under study it can be said that the areas off Orissa coast is having the best trawl fisheries among the different regions. The catch rates recorded from Tuticorin, Visakhapatnam and Mangalore were below 100 kg./hour.

Joseph, K.M. 1973. Economics of operation of the 17.5 m indigenous steel trawlers along the Kerala coast. Seafood Export Journal, V(7). 25-32.

7. HAND LINE FISHING FOR 'KALAVA' (PORT BLAIR)

'Kalava' hand line fishing was carried out from Port Blair during the period April-November from Meena Khojini using five rollers at a time. Three areas viz., 11-92, 11-93 and 12-93 were surveyed within the depth belt 10-100 m. A total of 126 hours of actual fishing was done in these areas and about 700 kg. of 'kalava' was landed. The average weight of the 'kalava' was about 3 kg.

Area/ sub-area	Depth range (m)	Fishing effort (hrs.)	Quantity of 'kalava' caught		Catch/line /hour (kg.)
			Number	Weight (kg.)	
11-92/2E	15-60	2.25	1	1	0.09
3E	16-52	11.67	1	10	0.17
4E	10-68	19.58	17	56	0.57
5E	20-80	14.92	33	65	0.87
6E	26-95	24.92	24	66	0.53
11-93/1A	10-20	4.75	45	125	5.26
5A	10-36	12.17	25	43	0.71
12-93/1A	10-19	35.17	95	315	1.79
Total:	10-95	125.43	246	681	1.09

Table XIII. Results of 'kalava' hand line fishing.

The results of this operation is furnished in Table XIII. Among the eight sub-areas surveyed the area 11-93/1A recorded the highest catch/line/hour of 5.3 kg. The average catch/line/hour was about 1.1 kg.

8. RESULTS OF SHRIMP RESOURCES SURVEY

Special attention was given to survey of Penaeid shrimp resources. Shrimp survey was conducted from Goa, Mangalore, Cochin, Visakhapatnam and Paradeep using 28 m shrimp trawl. The results were already discussed in earlier parts of this bulletin. But it seems appropriate to summarise the findings of this survey considering the economic importance of this species.

Tables IV to VII show the catch rates of prawn obtained by 17.5 m trawlers from different areas along the east and west coast. From the tables it may be seen that the highest catch rate of 20 kg./hour was obtained from area 20-86 off Orissa. The areas 10-75 and 9-75 off Cochin also yielded relatively high catch rates. The catch/hour obtained from various depth zones of different regions are furnished below:

Region	Depth range (m) Catch/hour (kg.)			
	0-19	20-39	40-59	60-79
Goa	6.5	1.4	0.2	-
Mangalore	1.9	0.6	0.6	-
Cochin	10.7	3.0	1.4	5.0
Visakhapatnam	-	1.9	2.3	-
Paradeep	11.8	25.2	-	-

From areas off Goa, Mangalore and Cochin the depth zone 0-19 m recorded relatively higher catch rates, while along the Orissa coast the depth zone 20-39 m yielded comparatively high catch rates. From areas off Visakhapatnam the depth zone 40-59 m registered high catch rates. From the data it may be said that prawn is available in relatively larger concentrations in areas within 40 m depth. From Cochin the depth belt

60-79 m recorded a high catch rate of 5 kg./hour, but a detailed analysis show that this was based on limited fishing effort.

The monthly variations in the catch rates of prawn from different regions are furnished below:

Month	Region Catch/hour in kg.				
	Goa	Mangalore	Cochin	Visakhapatnam	Paradeep
April	0.3	0.8	2.4	2.3	4.4
May	0.5	1.4	5.3	0.3	5.2
June	11.4	2.8	5.1	2.1	4.6
July	15.8	0.8	42.2	4.0	0.6
August	1.6	2.5	5.5	3.0	1.0
September	3.6	-	11.5	4.4	6.2
October	1.2	-	5.5	4.3	37.3
November	0.4	-	-	-	59.7
December	0.2	-	-	0.4	30.0
January	0.5	0.3	0.4	0.3	8.8
February	0.4	0.9	0.1	-	9.4
March	0.2	1.0	0.6	2.3	8.5

It can be seen that along the Goa and Mangalore coast the period June-August appeared to be the best prawn fishing season. A high catch rate of about 42 kg./hour was obtained from areas off Cochin during the month of July. It can, however, be said that the period May-October was the best season for prawn in this region. The period July-October recorded relatively high catch rates along the Andhra coast. Prawn was present in the catch in all the months of the year along the Orissa coast and the catch rates were much higher than from all other regions. The month of November registered a high catch/hour of 60 kg. and the period October-December was the best prawn fishing season.

9. SURVEY OF PELAGIC FISHERIES RESOURCES

Till recently the marine fisheries resources survey in our waters has been confined mainly to the survey of demersal fisheries resources. The fact that about 70% of our total marine fish landings is constituted by pelagic/mid-water species of fish such as sardines, mackerel, anchovies, bombay duck, etc., has strengthened the case for intensifying our effort in the matter of survey and assessment of pelagic fisheries resources. This awareness has created the necessary climate for the establishment of the Pelagic Fisheries Project at Cochin in 1972 with the assistance of the United Nations Development Programme. The acoustic, aerial and fishing surveys conducted by this Project it is reported, have revealed the occurrence of resources like sardine, mackerel, anchoviella, etc., in considerable magnitude along the South west coast of India.

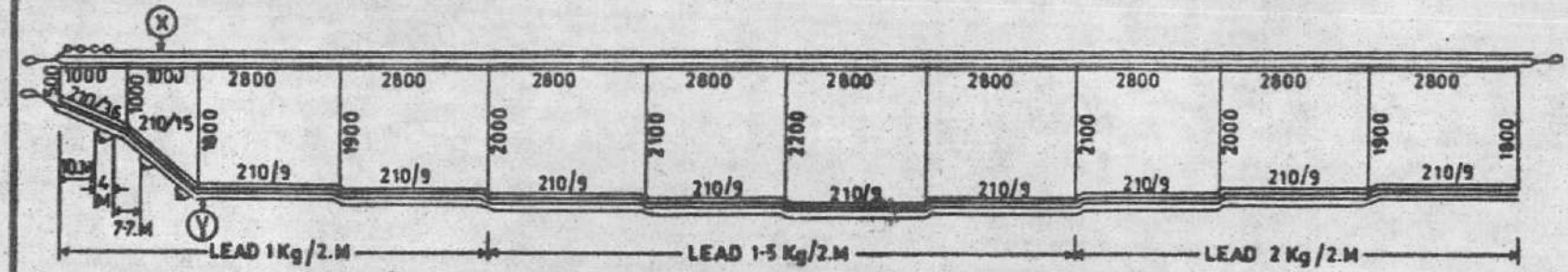
As a follow up of the programme of the work of this Project and also with a view to diversifying the methods of survey, the Exploratory Fisheries Project commenced purse seining from Mangalore and Goa during the year 1974-75. The results obtained from these bases during 1975-76 are very encouraging. Pair boat mid-water trawling was also attempted from Bombay. In addition tuna long lining and trolling were conducted from Port Blair. The results of these studies are discussed below.

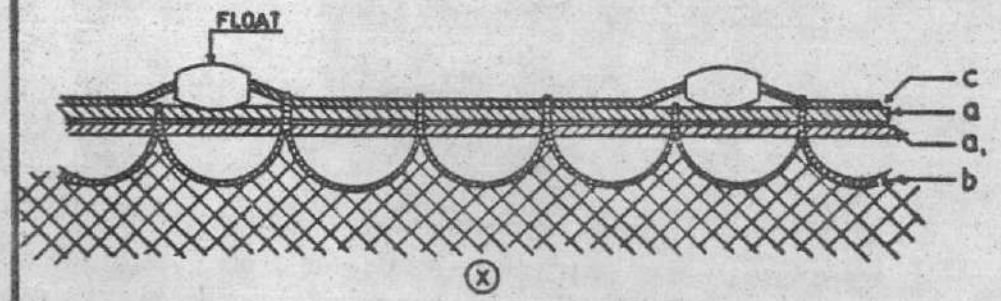
9.1. Purse seining

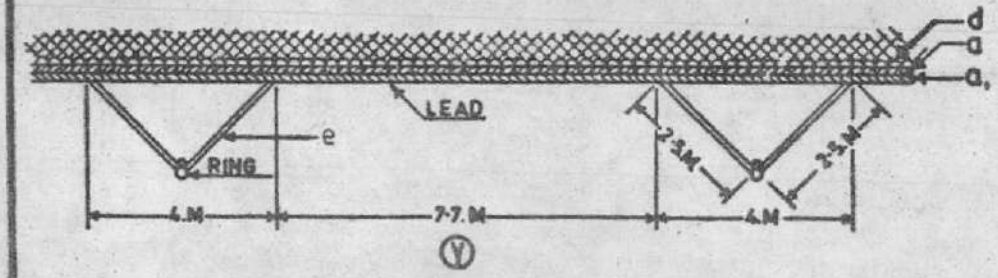
Purse seining was carried out from two bases viz., Mangalore and Goa from two 17.5 m trawlers, Meena Anaveshak and Meena

Ayojak. A purse seine net made of nylon twine having 330 m length and 35 m depth with 20 mm stretched mesh was operated from Mangalore. The net operated from Goa was also made of nylon twine having a length of 408 m and a depth of 55 m with 25 mm stretched mesh. The design and specifications of the net used from Goa is given in Fig. 27. The net operated from Mangalore is one imported while that operated from Goa is indigenously made.

From Mangalore the vessel Meena Anaveshak commenced purse seining during the month of September and continued upto March. The fishing started one month before the commencement of the conventional pelagic fishing season which is usually during the period October. During the period under study the vessel made 95 sets and expended about 600 hours of fishing effort including the time spent in searching for shoals. Two areas viz., 12-74 and 13-74 were surveyed between the depth range 10-20 m(Fig. 28). The results obtained from these two areas are furnished in Table XIV. It may be seen from the table that of the two areas the area 13-74 yielded the highest catch rate of 1608 kg./set. The average catch/set was about 1422 kg. During the course of this survey the vessel landed about 135 tons of fish comprising sardines, catfish, mackerel and other miscellaneous species of fish. Sardines formed about 86% of the total catch while cat fish formed about 12%. The percentage of mackerel was not significant in the catch.







WEBBING						
MESH SIZE	25.mm. (STRETCHED)					
LENGTH	680 M.					
AFTER HANGING	408 M.					
DEPTH	55 M.					
HANGING HEAD ROPE	40%					
HANGING FOOT ROPE	39%					
SELVEDGES	DEPTH	TWINE	MESH SIZE			
UPPER	20 MESHS	2 mm. ø OR 1·5 mm	40 mm. (stretched)			
LOWER	20 MESHS	— DO —	55 mm. (stretched)			
FLOAT	EACH FLOAT AT 0·83 M (32") APART. TOTAL NO: 510. approx					
RING	34 NOS					
TWINE AND ROPE						
	a	a,	b	c	d	e
MATERIAL	— NYLON OR POLYPROPELENE —					
DIA. IN mm/UNIT	14	14	6	10	6	14
TWIST	S	Z				S
LENGTH IN M.	450	450	680	—	—	5/EACH

FIG. 27. DESIGN OF THE 408 M. PURSE SEINE OPERATED FROM GOA.

Base	Area	Sets made No.	Sets made Time (Hrs.)	Time spent for searching	Total fishing effort (Hrs.)	Total Catch (kg.)	Species composition (kg.) Mackerel	Sardine	Cat fish	Carangids	Misc. fish	Catch/set (kg.)
Mangalore	12-74	28	45	135	180	27,407	1464	8515	16585	-	843	979
	13-74	67	90	330	420	1,07,713	320	107070	261	-	62	1608
Total:		95	135	465	600	1,35,120	1784	115585	16846	-	905	1422
Goa	14-73	1	2	10	12	58	-	-	-	-	58	58
	14-74	2	3	13	16	187	-	187	-	-	-	94
	15-73	53	85	353	438	41488	15412	21902	1255	2486	433	783
Total:		56	90	376	466	41733	15412	22089	1255	2486	491	745

Table XIV. Area-wise results of purse seining from Goa and Mangalore

The month-wise details of fishing effort, catch, catch rates, etc., are given in Table XV. It may be seen that the highest catch rate viz., a catch/set of 4175 kg. was obtained during the month of October. Mention may be made of the catching of about 16.5 tons of cat fish in one haul during October. As mentioned earlier sardine was the main constituent of the catch and the highest average catch/set of sardine was obtained during December. On the basis of the present study, it can be said that the sardine fishery along the Mangalore coast starts by December and extends upto April.

Purse seining was carried out from Goa base during the period October-February. The details of vessel, net etc., have already been discussed. During this period altogether 56 sets were made and 466 hours of fishing effort was expended including the time spent for searching of shoals. Three areas viz., 14-73, 14-74 and 15-73 were surveyed between the depth belt 15-70 m (Fig.28). The total catch, catch rate, species caught, etc., from these areas are shown in Table XIV. It is seen that the fishing was concentrated in area 15-73 and that this area yielded a catch rate of about 783 kg./set. The average catch/set for the whole area was 745 kg. The vessel landed about 42 tons of fish and the catch consisted of sardines, mackerel, carangids, cat fish and other miscellaneous fish. Sardine comprised about 53% of the catch while mackerel formed about 37%.(The high catch rate of mackerel from Goa is note-worthy. The highest catch rates were noticed during the months of November and December (Table XV).

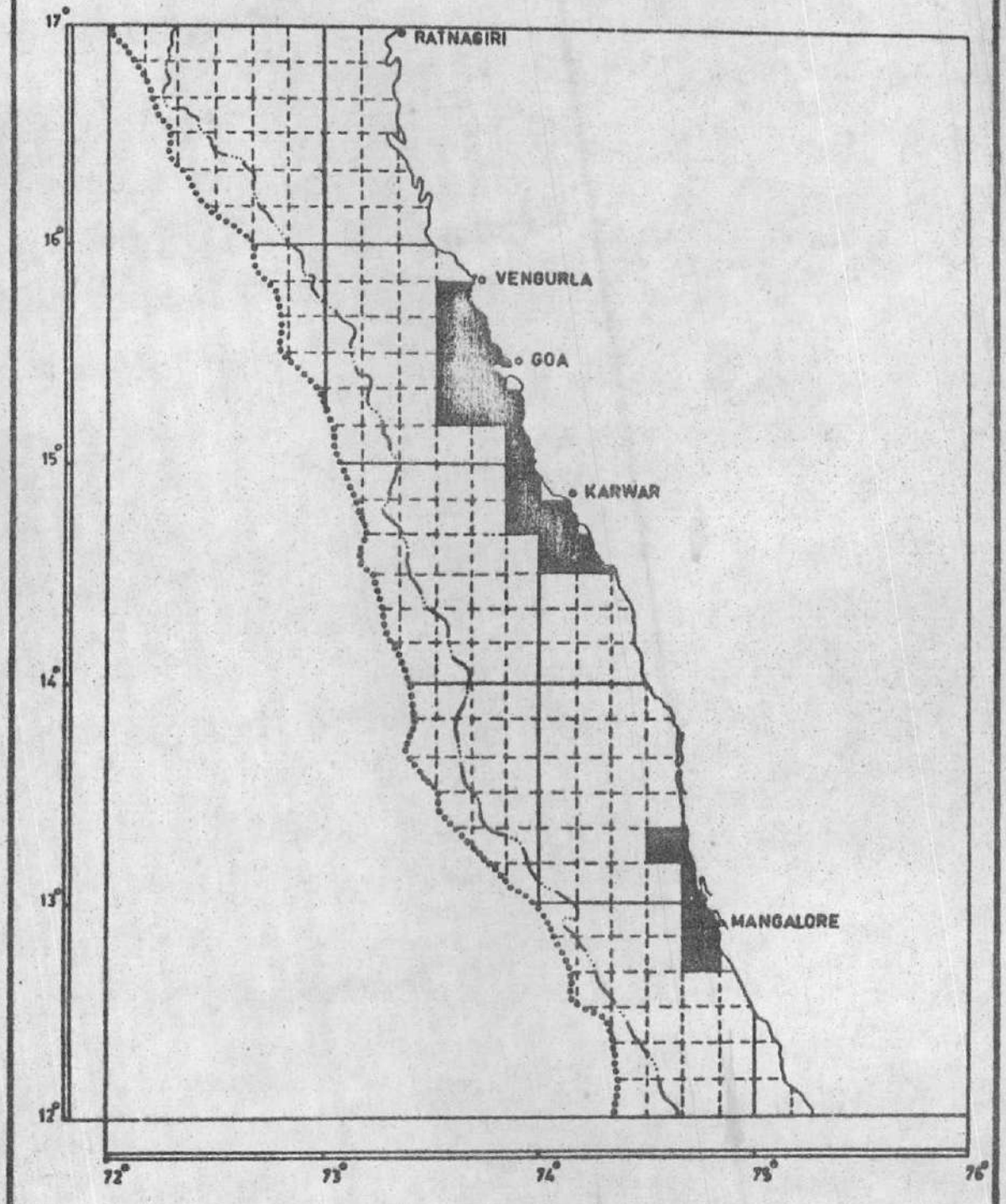


FIG. 28. AREAS COVERED BY PURSE SEINING FROM GOA AND MANGALORE.

Base	Month		Sets made No.	Sets made Time (hrs.)	Time spent for searching	Total fishing effort (hrs.)	Total catch (kg.)	Species composition (kg.) Mackerel	Sardine	Cat fish	Caran-gids	Misc. fish	Catch/ set (kg.)
Mangalore													
	September	'75	7	11	52	63	1022	525	457	-	-	40	146
	October		4	8	22	30	16701	-	-	16500	-	201	4175
	November		14	23	57	80	3046	939	1418	85	-	604	218
	December		5	8	57	65	11480	-	11480	-	-	-	2296
	January	'76	17	22	127	149	26980	120	26860	-	-	-	1587
	February		29	43	80	123	42583	62	42200	261	-	60	1468
	March		19	20	70	90	33308	138	33170	-	-	-	1753
	Total:		95	135	465	600	135120	1784	115585	16846	-	905	1422
Goa	October	'75	3	5	10	15	9	-	-	-	9	-	3
	November		13	22	103	125	14740	9942	2915	1255	416	212	1134
	December		15	24	48	72	19515	5470	13668	-	334	43	1301
	January	'76	16	24	108	132	6499	-	4711	-	1690	98	406
	February		9	15	107	122	970	-	795	-	37	138	108
	Total:		56	90	376	466	41733	15412	22089	1255	2486	491	745

Table XV. Month-wise results of purse seining from Goa and Mangalore

While comparing the catch composition, fishing season etc. of Mangalore and Goa regions it can be seen that from both the regions sardine was the main constituent species in the catch. Mackerel was abundant in areas off Goa and formed about 37% of the catch while from Mangalore it formed only about one percent of the catch. The pelagic fishing season starts during the month of October in both the regions. The data obtained during this survey is not adequate to draw valid conclusions about the migration of shoals, fishing season etc. which needs probably several years of investigation of the type under discussion.

9.2. Mid-water trawling

An attempt was made to introduce two boat mid-water trawling from Bombay using two 17.5 m trawlers viz. Meena Prapi and Meena Sachetak during the period under study. A 14 x 14 fm mid-water trawl was designed and got fabricated using indigenous materials for this purpose. The design and details of the net are shown in Fig. 29.

This study was initiated utilising the expertise gained by one of our skippers who was sent for training in Norway. The skipper returned from training only in August and hence the preparation including fabrication of net etc. could be completed only during December/January i.e. towards the fag end of the main fishing season for pomfret, 'ghol', etc. Nevertheless the vessels carried out a number of trial fishing trips which enabled the crew to gain the necessary skills for this type of fishing.

Studies will be continued during the ensuing fishing season commencing from September '76.

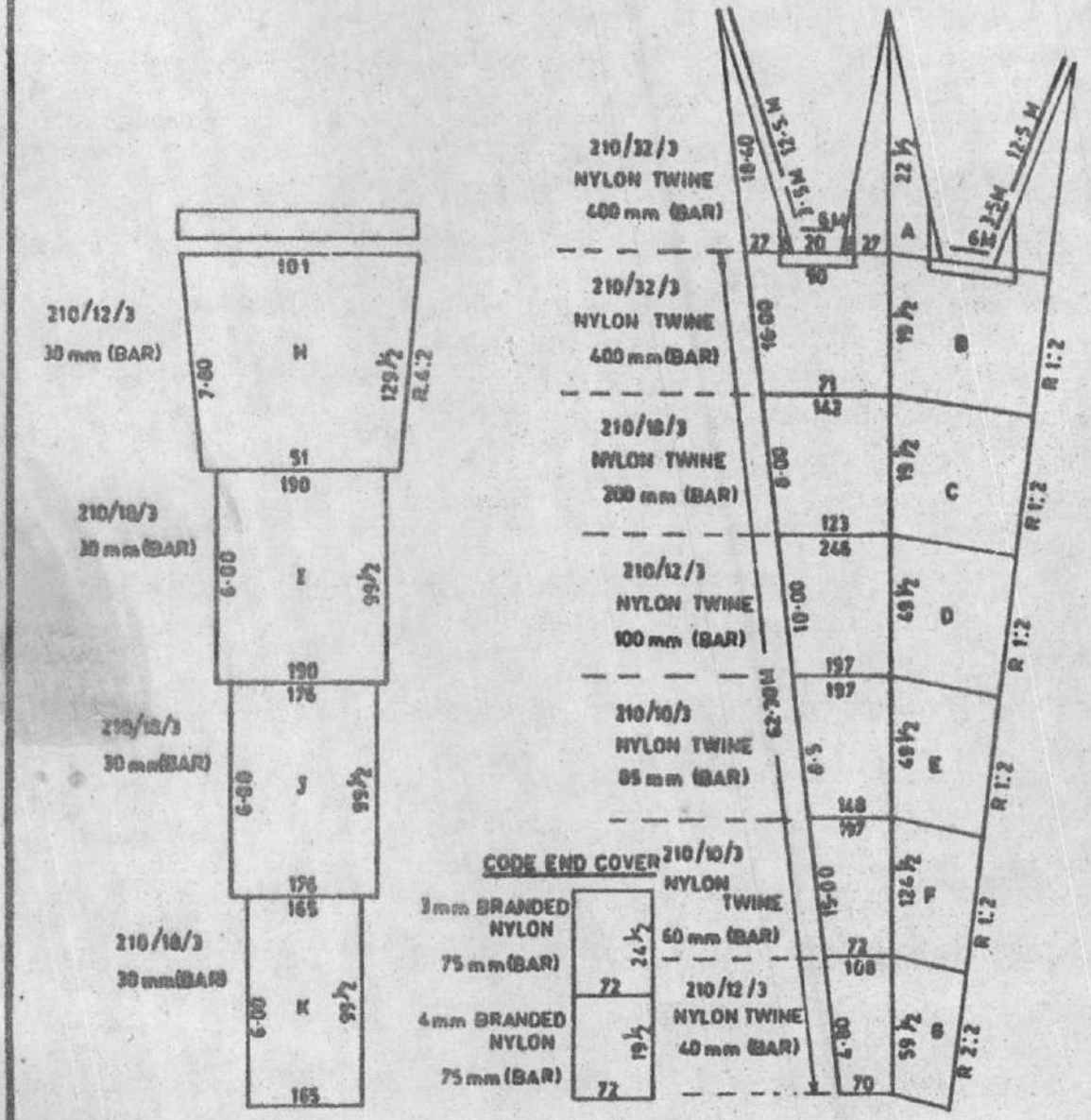


FIG. 29. DESIGN OF THE 14 x 14 FATHOM TWO BOAT MID-WATER TRAWL.

9.3. Tuna long lining (Port Blair Base)

Tuna long lining was conducted from Port Blair by the vessel Meena Prayas during the period February-April in area 11-92. A total of 5800 hooks were operated and about 8 tons of fish comprising mainly sharks and tuna was landed during this period. The results are summarised below:-

Area/ sub-area	No.of hooks ope-rated	No.of fish caught	No.of shark	No.of scombroid	No.of other fishes	Hooking rate (% Shark	Scombroid	Others	Total
11-92/3E	75	1	1	-	-	1.3	-	-	1.3
11-92/4E	870	30	25	2	3	2.9	0.2	0.3	3.4
11-92/4F	1575	38	22	11	5	1.4	0.7	0.3	2.4
11-92/5E	275	6	3	1	2	1.1	0.4	0.7	2.2
11-92/5F	2990	98	66	23	9	2.2	0.8	0.3	3.3
Total:	5805	173	117	37	19	2.0	0.7	0.3	3.0

The hooking rate for all species worked out to about 3.0. The hooking rate of shark, tuna and other species were 2.0, 0.6 and 0.3 respectively. There is no significant variation in the hooking rate of these groups from different areas.

9.4. Trolling (Port Blair Base)

Table XVI furnishes the results of trolling conducted from Port Blair. It may be seen from the table that nine sub areas of 11-92 and 11-93 were surveyed during the period. The catch/line/hour for the whole area worked out to less than 0.1 kg. Tuna, seer fish and carangids were the dominant species.

Area/ sub-area	Lines operated	Fishing effort (hrs.)	Total catch (kg.)	Tuna		Carangids		Perch		Other species		Catch/line /hour (kg.)
				No.	Weight	No.	Weight	No.	Weight	No.	Weight	
11-92/2D	10	8.75	11	1	2	1	5	-	-	5	4	0.126
11-92/3E	31	16.00	1	-	-	-	-	1	1	-	-	0.002
11-92/4E	40	24.33	10	-	-	-	-	-	-	1	10	0.010
11-92/4F	5	1.20	68	23	68	-	-	-	-	-	-	11.33
11-92/5E	19	11.55	-	-	-	-	-	-	-	-	-	-
11-92/5F	10	6.25	-	-	-	-	-	-	-	-	-	-
11-93/5A	51	34.67	47	3	23	2	7	1	4	4	13	0.027
11-93/5F	76	47.42	46	2	15	4	12	1	2	3	17	0.013
11-93/6A	10	6.40	11	2	4	-	-	-	-	2	7	0.172
Total:	252	156.57	194	31	112	7	24	3	7	15	51	0.005

Table XVI. Results of trolling from Port Blair

10. SUMMARY

The results of exploratory survey conducted by the Project during 1975-76 are dealt with in this bulletin. During this period of study the Project operated 22 steel trawlers, out of which 19 were indigenously constructed 17.5 m trawlers. These vessels were operated from the eleven bases of the Project viz., Kandla, Bombay, Goa, Mangalore, Cochin, Tuticorin, Madras, Visakhapatnam, Paradeep, Calcutta and Port Blair.

The programme of survey included demersal fisheries resources survey by conducting exploratory and experimental bottom trawling and 'kalava' hand line fishing and pelagic resources survey employing purse seining, mid-water trawling, tuna long lining and trolling. In addition special shrimp survey programmes were also conducted from Goa, Mangalore, Cochin, Visakhapatnam and Paradeep. The details of the fishing methods and gear employed for the survey are discussed in detail.

During the course of the year the vessels of the Project surveyed an unsurveyed/partially surveyed area of about 45,000 sq. km by bottom trawling and landed about 1800 tons of fish and prawns. The results obtained by the 17.5 m trawlers from different regions/bases are compared. The vessels Meena Prasarak and Meena Grahi operated along the Orissa coast recorded the highest catch rates of 282 kg. and 238 kg./hour respectively. The vessel Meena Sitara operated from Madras and Meena Utpadak operated from Cochin recorded 170 kg. and 168 kg./hour respectively. The areas off Visakhapatnam, Tuticorin and Mangalore recorded relatively low catch/hour.

An attempt was made to study the relative abundance of resources in general and of the commercially important species in particular

with special reference to area, depth and time. The areas 21-69 and 22-68 off Gujarat, 17-71, 17-72, 18-71 and 18-72 off Maharashtra, 13-74 off Karnataka, 9-75 and 9-76 off Kerala, 13-80 and 14-80 off Tamil Nadu, 18-83 and 18-84 off Andhra and 19-86, 20-86 and 20-88 off Orissa - West Bengal coast appeared to have been relatively more productive than other areas surveyed.

Varieties like elasmobranchs, cat fish, 'dhoma', 'ghol', pomfret and 'wam' were relatively abundant in the north west coast and upper east coast as compared to the other two zones. 'Kilimeen' and barracuda registered comparatively high catch/hour from the south west coast while perch, leiognathids and sciaenids were the predominant groups in the lower east coast.

Along the north west and south west coast the depth belt 40-59 m was productive, while in the lower east coast and in the Andaman and Nicobar waters the depth belt 20-39 m yielded higher catch rates. Although the depth zone 0-19 m registered the highest average catch rate in respect of the upper east coast, 20-39 m depth belt was found to be more productive along the Orissa coast. The depth-wise abundance of important varieties of fish from different regions is also discussed in detail.

The monthly variations in the catch rates of important groups like prawn, elasmobranchs, perch, Lactarius, 'kilimeen', 'ghol', etc., obtained by different classes of vessels from various regions have also been discussed and the period of abundance of different groups in various regions are indicated.

The results of special shrimp survey conducted from Goa, Mangalore, Cochin, Visakhapatnam and Paradeep showed that the areas off Paradeep (20 kg./hour) and Cochin (seven kg./hour) were more productive for prawn than other areas. The abundance of prawn appeared to be more in areas below 40 m depth and a declining trend in the catch rate of prawn was noticed from shallow to deeper waters. Generally the period June - September was the best season for prawn in Goa, Mangalore and Cochin while along the Orissa coast October - December (30 to 60 kg./hour) was the best period.

A comparative study of the trawl fisheries of different regions was made on the basis of results obtained by 17.5 m trawlers. This has indicated that the average catch/day from Orissa coast was more than a ton, from Madras little less than a ton, from Cochin and Goa about 0.6 ton and from Mangalore about 0.5 ton. Tuticorin and Visakhapatnam registered the poorest average catch/day viz., about 300 kg. among the areas studied.

'Kalava' hand line fishing was conducted from Port Blair and among the various areas surveyed the area 11-93/1A yielded the highest catch/line/hour of 5.3 kg. The average catch/line/hour was about 1.1 kg.

Purse seining was done from Goa and Mangalore while mid-water trawling from Bombay and trolling and tuna long lining from Port Blair. The results of purse seining from Goa and Mangalore were very encouraging. The areas off Mangalore recorded an average catch/set of 1423 kg. while areas off Goa recorded about 745 kg./set. The period November-March was found to be the best fishing period in both the regions. Among the different species obtained sardine formed about 86% from Mangalore and 53% from Goa. Mackerel constituted 37% of the catch from Goa.