BULLETIN NO. 10

comparative study of the demersal fishery resources of the indian waters as assessed by the 17.5m trawlers

GOVERNMENT OF INDIA
EXPLORATORY FISHERIES PROJECT
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comparative study of the demersal fishery resources of the indian waters as assessed by the 17.5m trawlers

By

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INTRODUCTION

As part of its programme for the development of deep sea fishing, the Govt. of India decided to construct 40 trawlers of 17.5 m overall length through Indian shipyards during the late sixties. Construction of these trawlers through Indian shipyards was expected to enhance the trawler building capability of the country. 20 out of the 40 trawlers were to be operated by the Exploratory Fisheries Project for collection of fisheries resources data by operating them from its various bases. The remaining 20 vessels were to be operated by the state government through their fisheries corporations, so as to assess the economic viability of deep sea fishing, which was required to create the necessary climate for the development of commercial deep sea fishing enterprises. One of the most important objectives of providing these vessels with the Exploratory Fisheries Project and State Fisheries Corporations appear to have been assessment of the offshore fisheries resources on the basis of the data furnished by these standardised vessels operated on exploratory basis and on commercial lines.

It may be recalled in this context that in the past, exploratory fishing was carried out by the different bases of the Project employing vessels of different sizes, designs, makes, types, etc. as discussed by Joseph (1974) and Joseph et al (1976 a, b). This appears to have made the

proper assessment of resources potential of different areas and their comparison difficult. It has therefore been decided that the Project would operate one or more of 17.5 m trawler from each of its 12 bases. It was further decided that all the vessels would employ trawls of identical design and construction.

The delivery of the vessels to the Project began in 1969. By 1973-74 almost all the bases were operating 17.5 m trawlers. The objective of this study is to present a comprehensive picture of the demersal fisheries resources along the Indian coasts as it emerges from the data gathered by the 17.5 m trawlers operated by the Projeot from its 11 bases during the period 1970-71 to 1979-80 i.e. a period of 10 years. The significance of the study lies in the fact that this is the first ever attempt to employ standardised fishing vessels and fishing gear from so many bases for resources assessment. Incidentally it may be mentioned that the need to bring out this bulletin was keenly felt as very little information is available on record about the results of the operation of the remaining 20 vessels operated by the public sector undertakings on commercial basis. The views/interpretations contained in this bulletin are of the author only and do not reflect the views of Govt. of India.

THE VESSEL

The design of the 17.5 m trawler with some modifications is similar to that of M.F.V. Jheenga operated by the Exploratory Fisheries Project from 1959. Fig. 1. gives the profile of the vessel. The principal particulars of the vessel are:

Length overall	17.50 m
B.H.P.	200
G.R.T.	56.8 tonnes

The detailed specifications of the vessel are given in Annexure I.

Damale and Paralkar (1970) have presented the details of the design of the vessel while the stability factors of the vessel under trial etc. have been discussed by Raghuram (1970). The vessels although built as typical stern trawlers were provided with booms to carry out outrigger trawling also.

The construction of the trawlers were entrusted with two consortia of shipbuilders. The lead yard of the west coast consortium was M/s Mazagon Dock Ltd., Bombay while that of the east coast consortium was M/s Garden Reach Workshop Ltd., Calcutta. Annexure II gives the details of construction of these vessels such as the name of the yard, year etc. The functioning of the west coast consortium is detailed by Samson (1970).

Out of the 20 vessels earmarked for the Project, the first vessel was delivered in 1969 for trial. Fig. 2 indicates the year of commissioning the vessels for exploratory survey by the Project as also their names. From the figure it may be seen that 19 out of the 20 vessels were taken over by the Project by 1975 while the last vessel was delivered only in 1979.

FISHING GEAR AND METHODS

Since the vessels were of the same design and construction in all respects, the Project decided to employ standardised fishing gear and methods from all the 20 vessels operated by the 12 bases in order to ensure comparability of data to the meximum extent possible. Two types of trawls viz. 24 m fish trawl and 28 m shrimp trawl were used. The designs of these trawls are furnished in Figs. 3 and 4. Although both types of trawls were operated, a study of the data reveals that the majority of hauls were taken using 24 m two seam trawl. One of the main reasons for the preference of the 24 m two seam trawl to the 28 m trawl is that the latter net was found a little too heavy for the vessel. The nets were made of high density polypropylene twine of 3 mm to 1.5 mm dia. The nets were operated with a pair of oval otter boards each weighing about 180 Kg and having a surface area of 1.25 sq. m.

The vessels were fitted out with three drum mechanical winch and were using 11 mm dia trawl warp. In some cases these winches were later replaced with two drum hydraulic winches. Although the vessel was provided with outriggers, outrigger trawling was found difficult due to a variety of reasons.

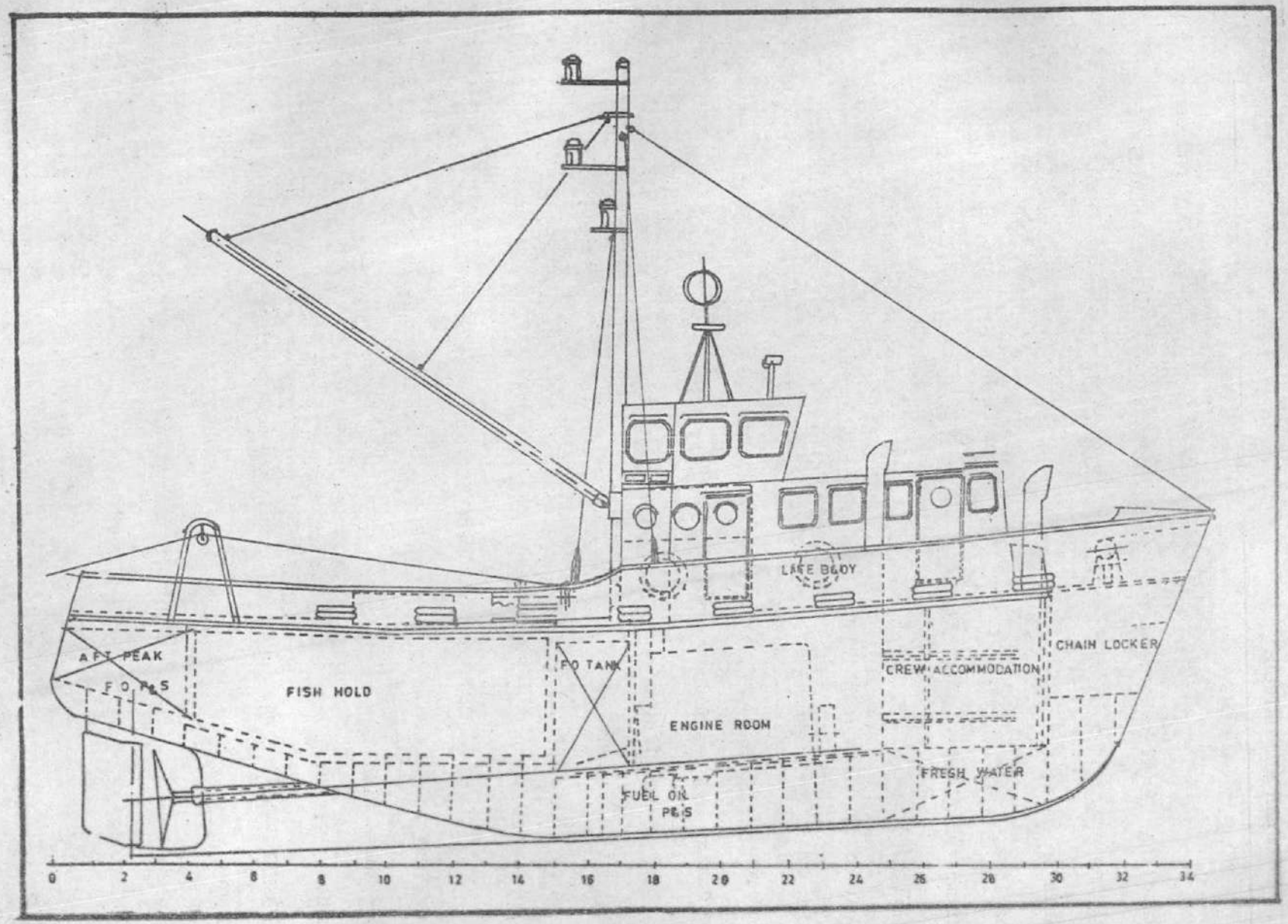


Fig 1. PROFILE OF 17·5m. TRAWLER

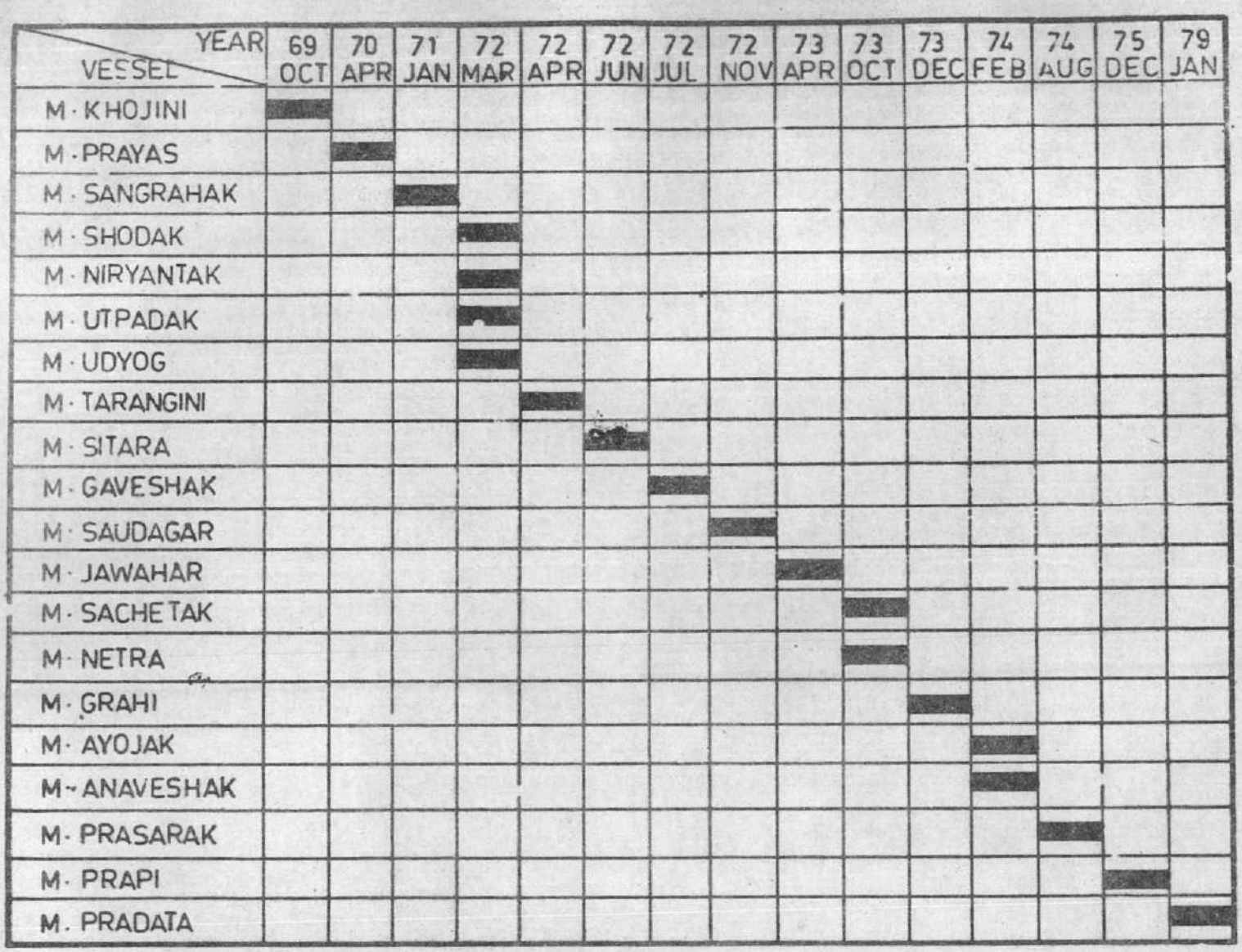


FIG:2 YEAR OF COMMISSIONING OF 17·5M VESSELS FOR EXPLORATORY FISHING

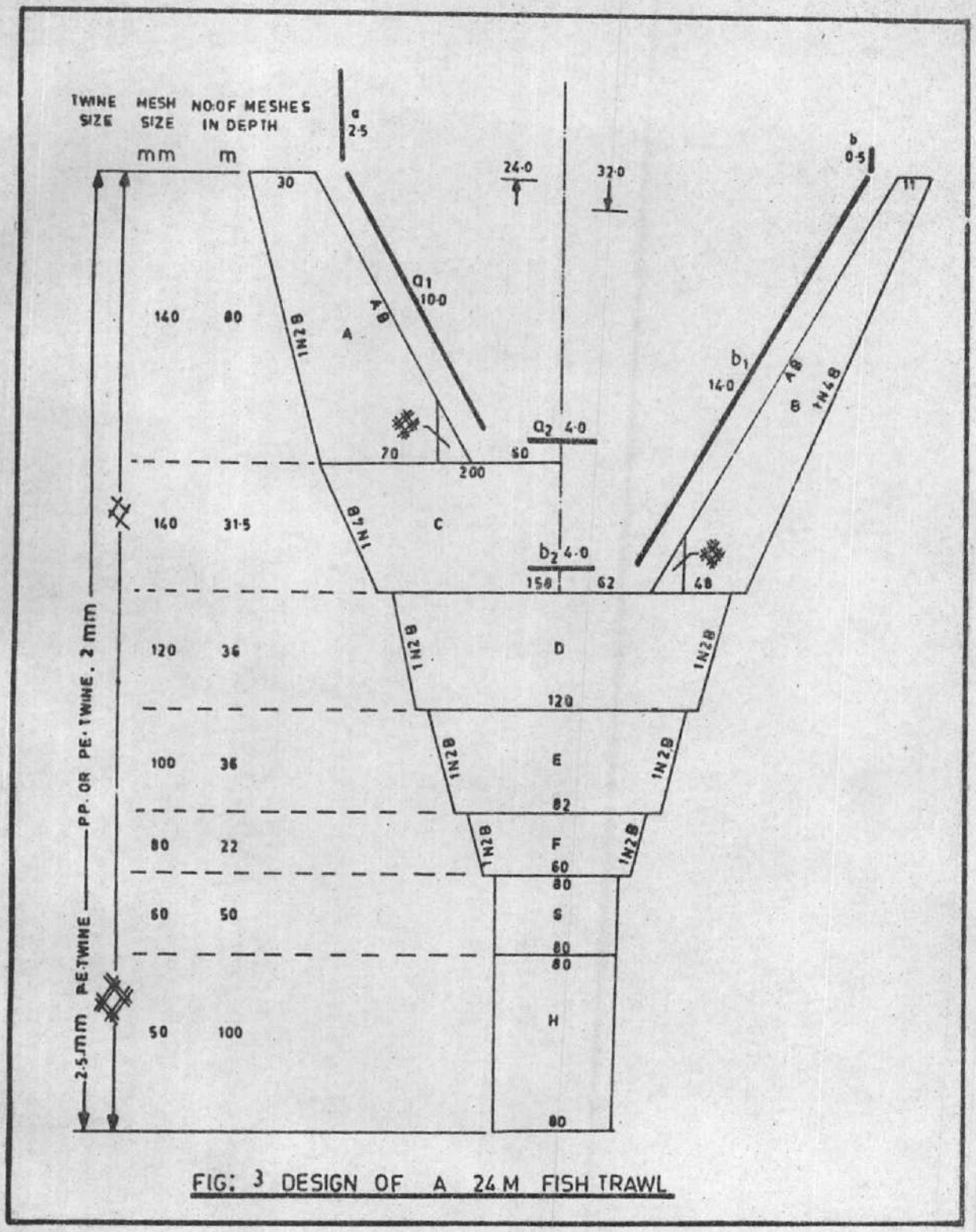


FIG: 3 DESIGN OF A 24 M FISH TRAWL

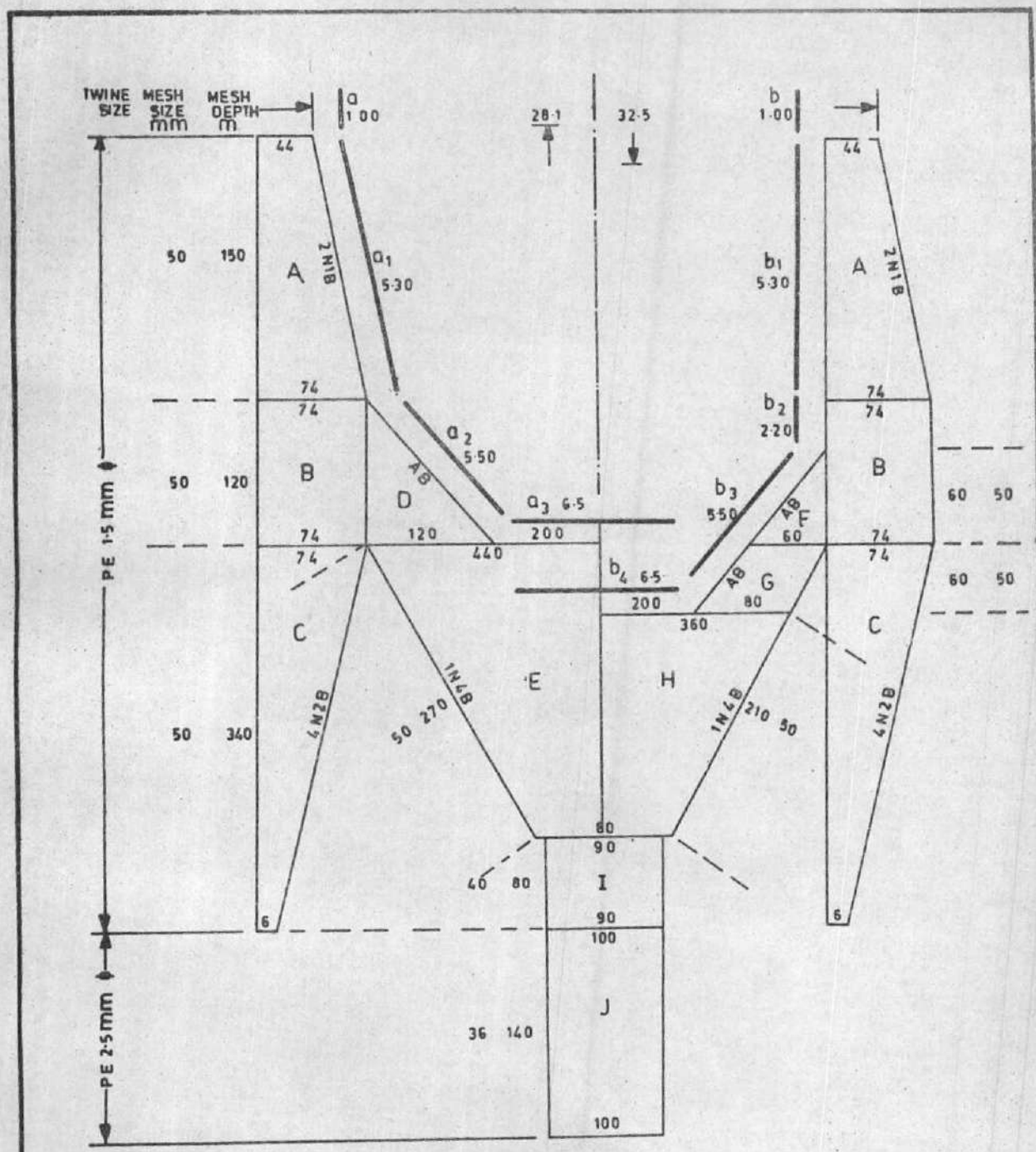


FIG: 4 DESIGN OF A 28·M SHRIMP TRAWL

AREA OF SURVEY

Fig.5 indicates the location of the 12 bases of the Project as also the area of operation of the vessels. The operation of the vessels extended along both the coasts of Indian peninsula from Lat. 24° N to Lat. 7°N and upto a depth of about 80 m. Fig. 5 also indicates the geographical divisions covered by each of the bases. It may be mentioned that the Kandla base of the Project was shifted to Porbandar during 1978. Fig. 6 indicates the different depth contours along the west coast while Fig. 7 shows the same information in respect of the east coast. Details of the continental shelf such as length, width at various places, bottom topography etc. have been discussed by Joseph and Joseph et al (op. cit.)

DATA AND ANALYSIS

Although the first vessel was taken over in 1969, the operation of the vessels on a systematic basis began only during 1972-73 with the taking over of six additional vessels as may be seen from Fig.2. Since the primary object of the present study is to compare the trawl fishery potential of the east and west coasts of the country, the Andaman and Nicobar area is excluded from the purview of this paper. Besides, Sudarsan (1977) has discussed the results of survey of the two 17.5 m vessels operated from Port Blair. The data utilised for the study therefore covers the information gathered by 18 out of the 20 vessels during the ten year period from April 1970 to March 1980. With the acquisition of these vessels the Project has been establishing new bases and consequently vessels were being moved from base to base. An attempt has been made to indicate the actual deployment of the vessels from time to time in Fig. 8.

From the figure it may be seen that these vessels were operated from Calcutta base only for a few months. Consequent of the shifting of Kandla base, the vessel attached to the base was shifted to Porbandar as already mentioned elsewhere in the paper. Veraval base has been operating one vessel from 1977-78. The Bombay base of the

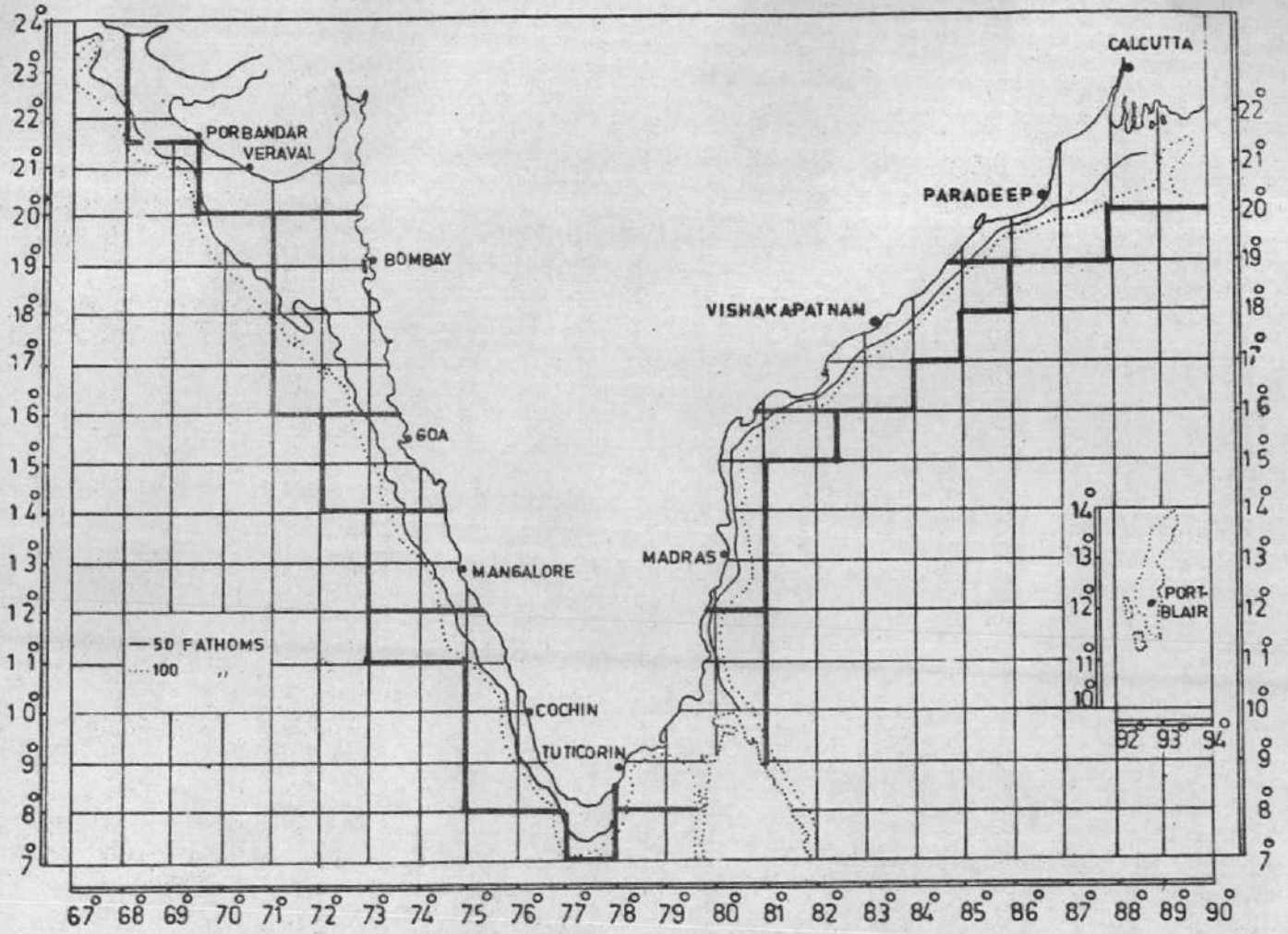


FIG: 5 CHART SHOWING THE DIFFERENT BASES OF OPERATION OF THE VESSELS AND THE GEOGRAPHICAL BOUNDARIES OF SURVEY OF EACH BASE

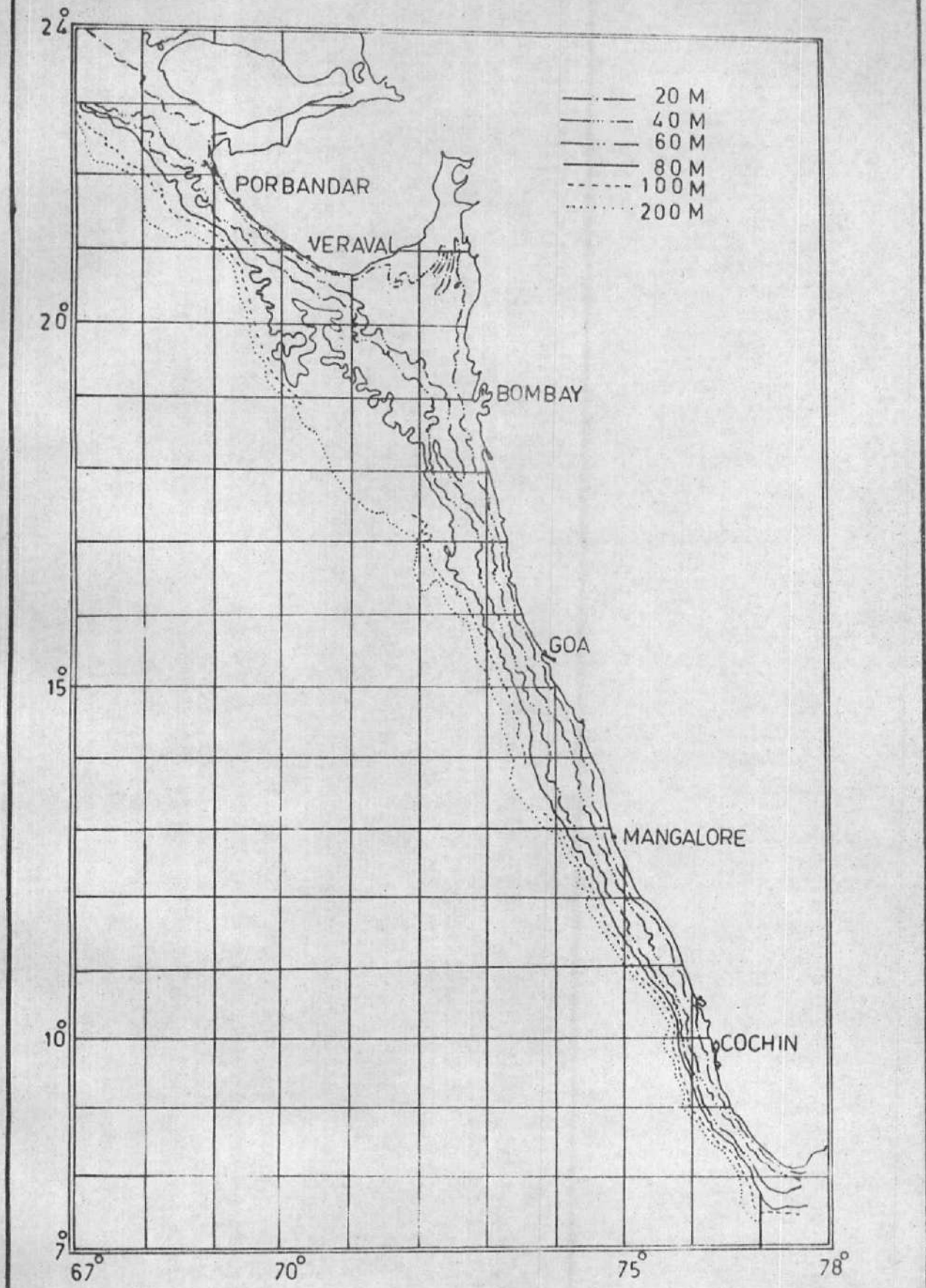


FIG:6 AREA OF SURVEY SHOWING DIFFERENT DEPTH CONTOURS WEST COAST.

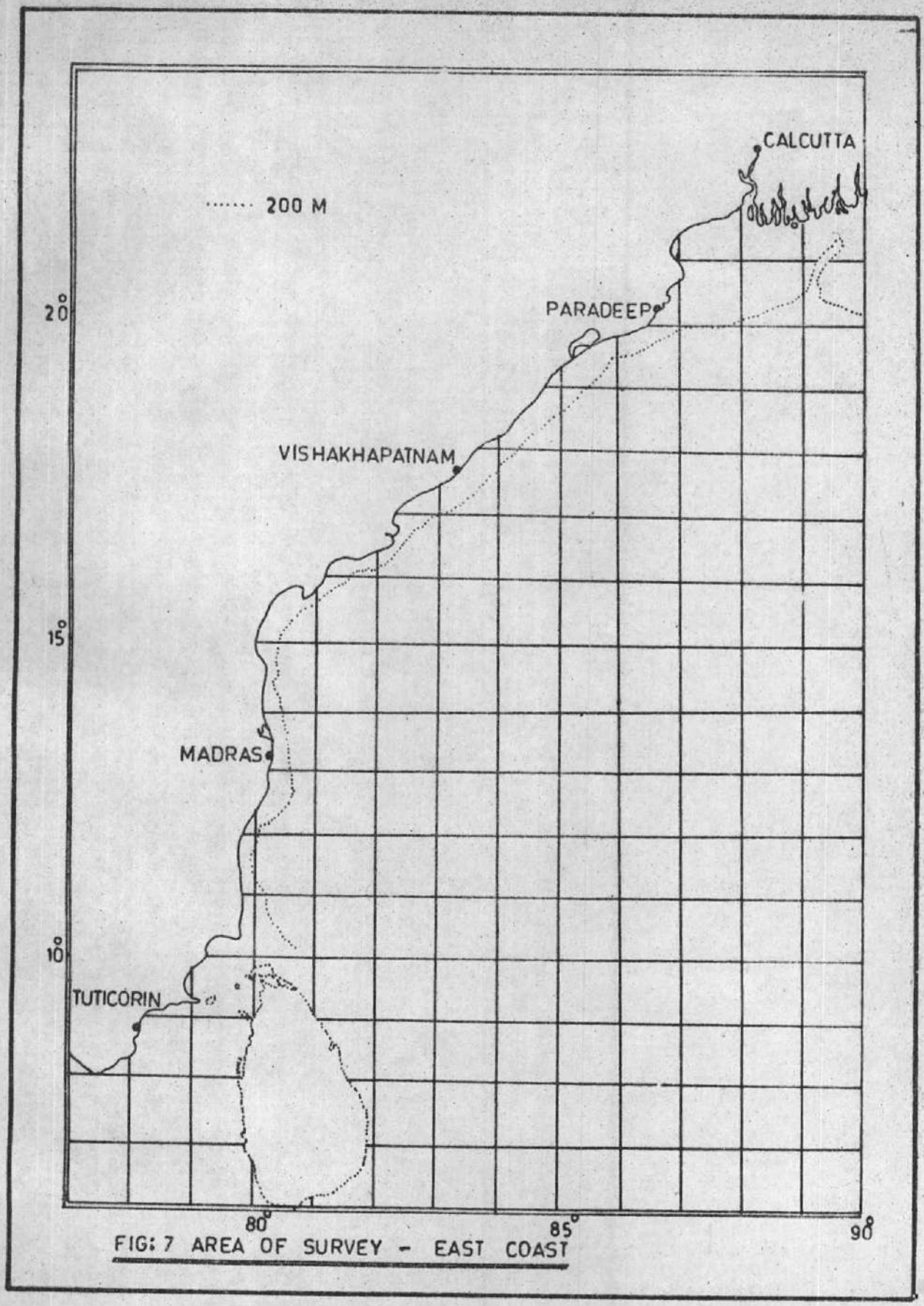


FIG: 7 AREA OF SURVEY - EAST COAST

BASE	VESSEL	YEAR									
		70—71	71—72	72—73	73—74	74—75	75—76	76—77	77—78	78—79	79—80
KANDLA/ PORBANDER	UDYOG			DEC ✓	✓	✓	✓	✓	✓	✓	✓
VERAVAL	PRAPI								APR ✓	✓	✓
BOMBAY	SANGRAHAK	✓	✓...	JAN TO SEPT'71				JAN ✓	✓	✓	✓
	SACHETAK					✓	✓	✓... JAN'75 TO OCT '76			
	UDYOG		✓	MARCH TO OCTOBER 1972							
	PRAPI						✓	✓... DEC'75 TO MARCH'77			
	AYOJAK				✓	✓	FEB TO AUG'74				
	ANAVESHAK				✓	✓	FEB TO JUL'74				
	PRAYAS	✓... APRIL ONLY									
	KHOJINI	✓...	OCT'69 TO MAR'71								
GOA	NETRA				OCT ✓	✓	✓	✓	✓	✓	✓
	AYOJAK					JAN ✓	✓	✓	✓	✓	✓
	SACHETAK				✓	✓	OCT TO DEC'74				
MANGALORE	TARANGINI				APR ✓	✓	✓	✓	✓	✓	✓
	ANAVESHAK					DEC ✓	✓	✓	✓	✓	✓
	SAUDAGAR				✓	✓	APR'73 TO DEC'74				
COCHIN	UTPADAK		MAR ✓	✓	✓	✓	✓	✓	✓	✓	✓
	SANGRAHAK		✓	✓	✓	✓	✓	✓....	OCT 71 DEC'76		
	SACHETAK								NOV ✓	✓	✓
	TARANGINI				✓... JAN TO MAR'73						
	SAUDAGAR				✓... JAN TO MAR'73						

(fig contd)

		YEAR										
BASE	VESSEL	70—71	71—72	72—73	73—74	74—75	75—76	76—77	77—78	78—79	79—80	
TUTICORIN	NIRYANTAK		MAR ✓	✓	✓	✓	✓	✓	✓	✓	✓	
	SAUDAGAR.					JAN ✓	✓	✓	✓	✓	✓	
	PRAYAS	✓	✓...JUN '70 TO AUG '71									
	SITARA			✓... JUN TO SEPT '72								
MADRAS	SITARA			OCT ✓	✓	✓	✓	✓	✓	✓	✓	
	GAVESHAK			OCT ✓	✓	✓	✓	✓	✓	✓	✓	
VIZAG	SHODAK		MAR ✓	✓	✓	✓	✓	✓	✓	✓	✓	
	JAWAHAR				APR ✓	✓	✓	✓	✓	✓	✓	
	PRADATHA										JAN ✓	
PARADEEP	GRAHI				JAN ✓	✓	✓	✓	✓	✓	✓	
	PRASARAK					NOV ✓	✓	✓	✓	✓	✓	
CALCUTTA	TARANGINI			✓... APRIL TO	NOV '72							
	SAUDAGAR			✓ NOV ONLY								
	GAVESHAK			✓...JUL TO SEPT '72								
	PRASARAK					✓... AUG TO OCT '74						
	PRADATHA									JAN TO ✓...	DEC '79 ✓	

Fig.8. DEPLOYMENT OF 17.5m VESSELS FROM DIFFERENT BASES FROM 1970-71 TO 1979-80

Project had the opportunity of operating one or more 17.5 m vessels during the entire period of study. From the figure it may be seen that barring Calcutta base, all other bases had the opportunity of operating these vessels for atleast 7 years from 1973-74 more or less on a regular basis and consequently these vessels could monitor the demersal fishery resources off the various maritime states on a continuous basis during the same period. Although the vessels did not operate on regular basis from the Calcutta base as mentioned above, the Paradeep based vessels had been operating off the Orissa and West Bengal coasts.

Figs. 9-12 indicate the intensity of sampling of these vessels by trawling during the ten year period in different areas. The details furnished in the figure will substantiate the statements already made with regard to the area of operation i.e. from Lat. 24° N to Lat. 7° N. The intensity of sampling beyond 79 m depth is insignificant. Although some of the hauls were made beyond 79 m depth and fairly large number of hauls below 20 m depth, maximum hours of fishing were carried out in the depth belt 20 to 79 m.

The Project has its own standard method of collection of data as detailed by Joseph (op. cit.). The data is presented in the form of charts, diagrams and tables as far as possible so as to make it easily discernible by the readers particularly industrialists.

A QUALITATIVE ANALYSIS OF THE CATCH BY REGION AND DEPTH

North west coast

Table I indicates the catch per hour of important varieties of fish obtained from Porbandar region by depth. From Fig.17 it may be seen that Elasmobranchs which contributed about 21 percent to the catch from the region, has registered the highest rate from 40 to 69 m depth range. "Dhoma" which also accounted 21 percent to the catch from the region recorded a catch rate of about 50 Kg per hour from the depth range 60 to 79 m. Among the quality fish "Ghol" and Pomfret have recorded the highest catch rate from the depth range 40 to 79 m. Maximum catch rate of cat fish was obtained from 80 to 99 m. depth belt. A close scrutiny of the data reveals the depth range 40 to 79 m. is perhaps the most productive depth belt in Kandla/Porbandar regions.

Table II shows that Elasmobranchs which accounted for about 23 percent (Fig.17) of the catch in the Bombay region has recorded the highest catch rate from below 60 m. depth unlike in the Porbandar area. Cat fish was found to occur between 26 to 40 Kg per hour from 20 to 79 m. depth. The highest catch rate of Cat fish was obtained from the depth range 40 to 59 m. In the case of "Dhoma" and Pomfret the highest catch rates were obtained from relatively shallow waters as compared to Porbandar. Prawn was not reported from waters deeper than 59 m.

A comparison of the data obtained from the Bombay region and Porbandar/Kandla region shows that relatively better catch rates were obtained from 0 to 59 m. depth range from the former area and 40 to 79 m. depth range from the latter region.

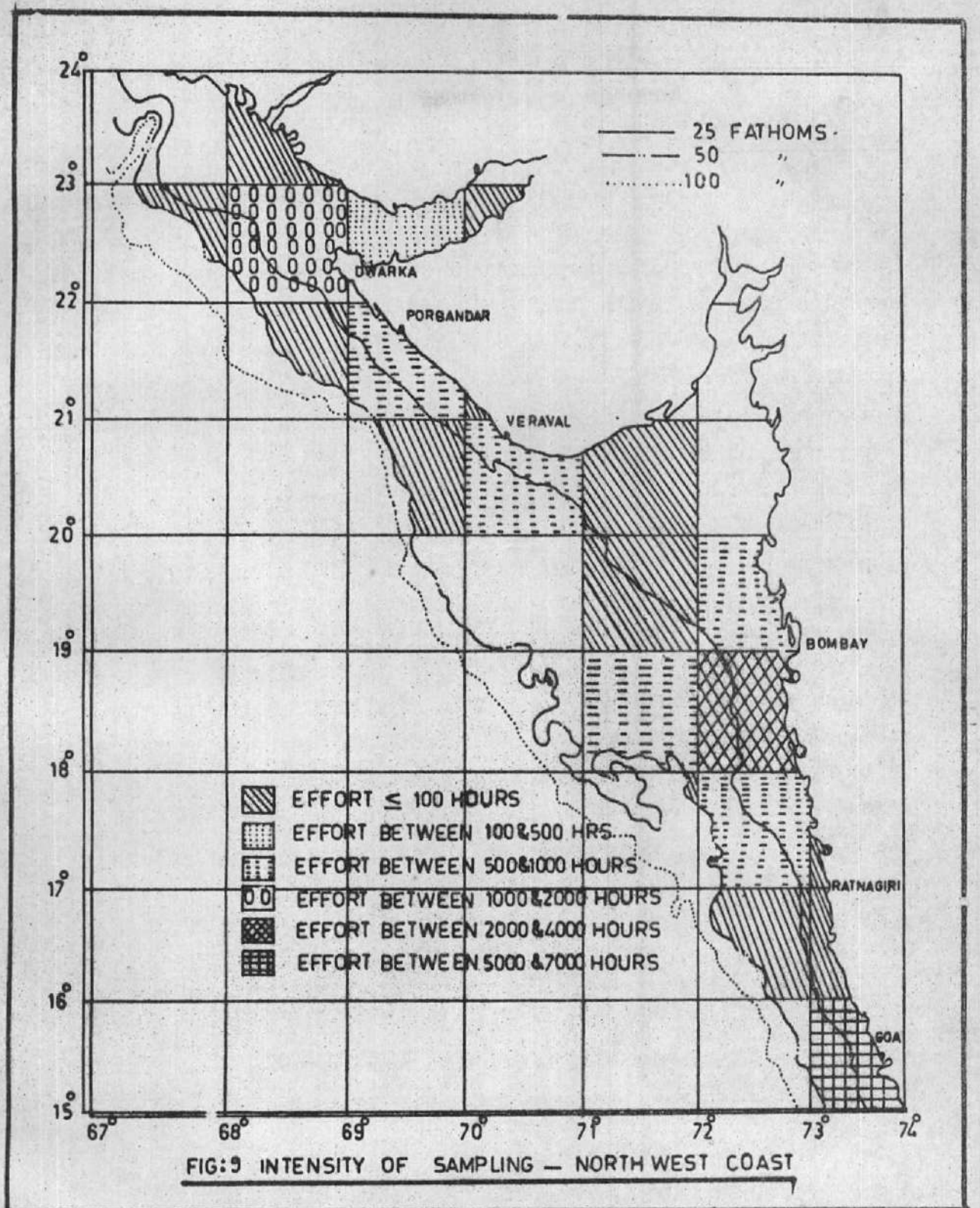


FIG:9 INTENSITY OF SAMPLING — NORTH WEST COAST

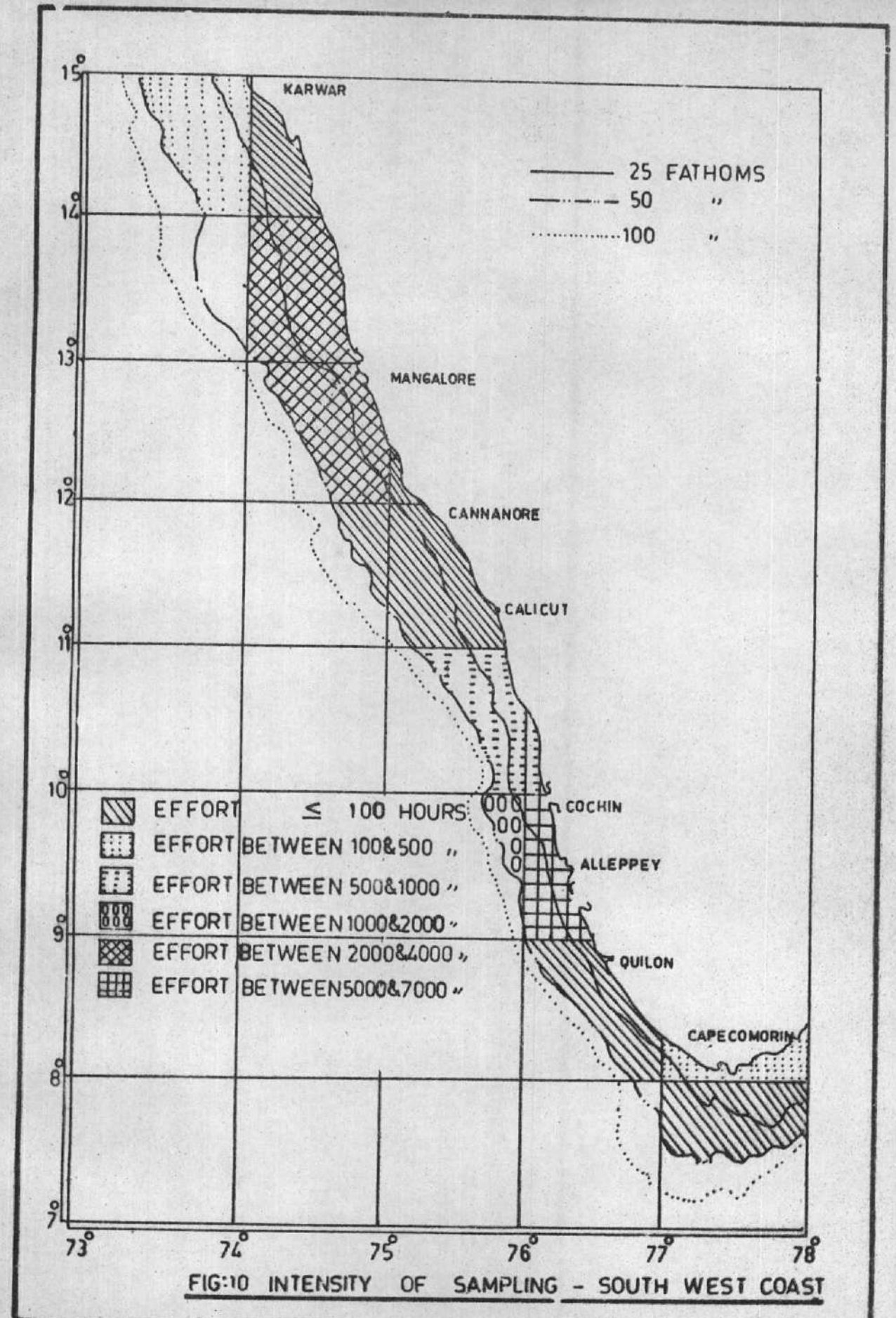


FIG:10 INTENSITY OF SAMPLING - SOUTH WEST COAST

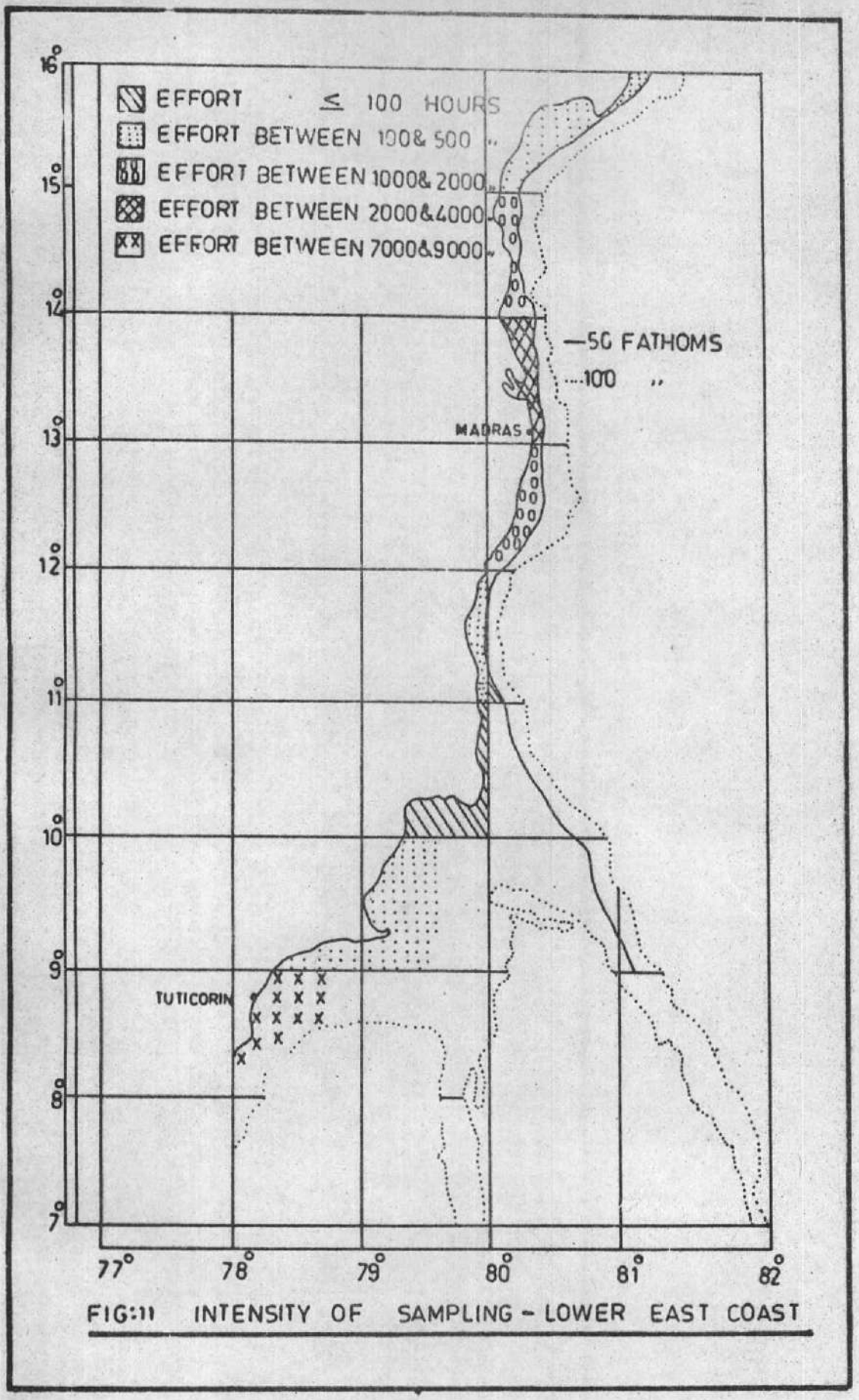


FIG:11 INTENSITY OF SAMPLING - LOWER EAST COAST

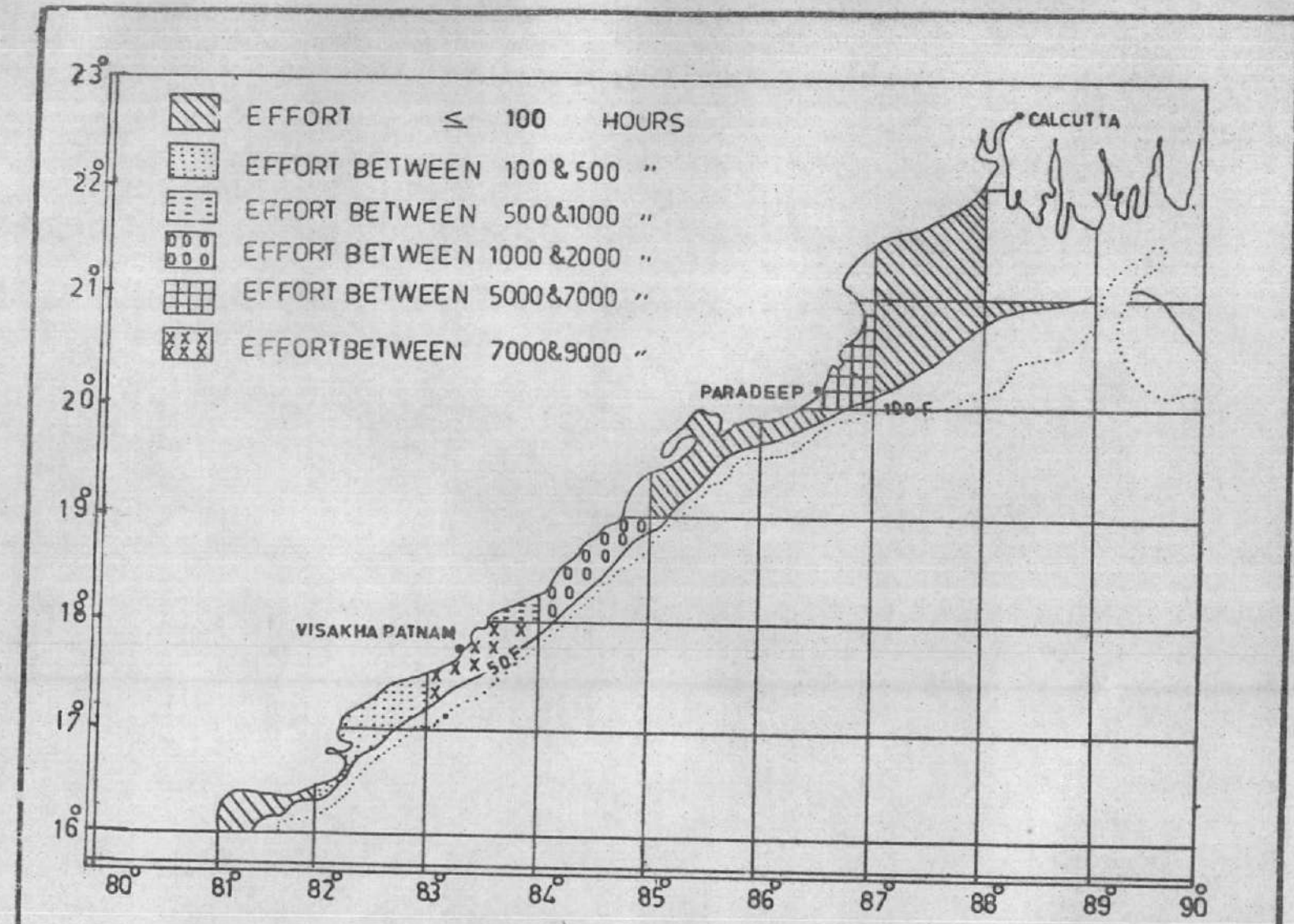


FIG:12 INTENSITY OF SAMPLING – UPPER EAST COAST

Particulars	Depth range (m)				
	0-19	20-39	40-59	60-79	80-99
Fishing effort(hrs)	107	1395	2292	347	5
Species					
Elasmobranchs	23.1	18.5	24.9	27.8	10.0
Dhoma	18.4	20.9	21.6	49.3	-
Cat fish	7.8	5.0	8.8	8.9	36.0
Ghol	3.5	4.5	8.6	9.0	11.0
Pellona Sp.	1.0	4.3	5.2	12.5	-
Ribbon fish	-	6.6	3.0	1.2	-
Wam	4.6	3.7	3.7	3.4	1.8
Karkara	2.3	2.3	2.5	5.0	-
Squid and cuttle fish	-	2.8	4.3	1.2	-
Sea bream	-	2.2	1.6	1.0	1.0
Koth	-	1.0	1.3	0.6	-
Carangids	-	0.2	0.2	-	-
Dorab	-	0.4	0.3	-	1.0
Perches	-	1.3	0.5	-	2.0
Prawn	-	0.9	0.2	0.2	-
Pomfret	0.1	2.8	3.4	8.9	6.0

TABLE I. Catch per hour(Kg) of important varieties of fish obtained from Porbandar region by depth

Particulars	Depth range (m)				
	0-19	20-39	40-59	60-79	80-99
Fishing effort(hrs)	222	2,753	2,058	721	276
Species					
Elasmobranchs	29.6	25.6	26.3	14.4	12.3
Wam	1.4	3.0	1.8	2.2	-
Cat fish	11.3	26.2	39.7	26.2	18.4
Karkara	1.6	1.3	0.7	1.4	1.0
Ghol	2.2	3.6	3.7	1.7	0.4
Koth	0.4	0.5	0.3	-	-
Dhoma	26.0	17.3	18.1	5.1	9.5
Pomfret	2.2	1.2	0.8	0.5	0.1
Seer fish	-	0.4	0.4	0.2	-
Kati	0.3	0.2	0.3	-	-
Perches	0.4	0.9	1.0	0.6	0.3
Ribbon fish	-	0.2	0.4	3.4	3.7
Prawn	3.4	3.2	0.2	-	-
Squid and cuttle fish	-	-	0.3	3.3	2.6

TABLE II. Catch per hour (Kg) of important varieties of fish obtained from Bombay region by depth

From Table III, which indicates the catch rate of important species obtained from Goa region, it may be seen that the highest catch rate of Cat fish which accounted for about 37 percent (Fig.17) of the catch from this region was obtained from 40 to 59 m depth range. "Rani fish" recorded 23 Kg per hour from depth belt 40 to 59 m. Elasmobranchs which accounted for about 9 percent of the catch had the highest catch per hour from 60 to 79 m depth range. The catch rate of prawn was higher from below 20 m depth than from deeper waters.

South west coast

Table IV furnishes the catch per hour of important varieties of fish from Mangalore region. Cat fish, which contributed 19 percent (Fig. 18) to the total catch, recorded the highest catch of about 35 Kg per hour from 60 to 79 m depth. Similarly "Rani fish" had also recorded 83 Kg per hour from 60 to 79 m depth range. Ribbon fish and Lizard fish too had recorded the highest catch from the above mentioned depth range. Prawns were not recorded from beyond 59 m depth. Elasmobranchs registered the highest catch rate from 40 to 59 m depth.

Table V gives the catch per hour of the important varieties of fish from Cochin region. From the table it may be seen that cat fish which accounted for 21 percent (Fig. 18) of the total catch was caught at the rate of 86 Kg from 80 to 99 m depth range while its catch rate ranged from 42 to 45 Kg from the depth range 40 to 79 m. "Rani fish" also recorded the highest catch rate of 82 Kg from 80 to 99 m depth. "Rani fish" appears to occur in large quantities from 40 to 99 m depth. Elasmobranchs while recording a catch rate of 31 Kg from 40 to 59 m depth had a catch rate of 17 to 22 Kg from the depth range 20 to 99 m. The catch rate of prawn was about 4 Kg per hour from 40 to 59 m depth range while it was less than one Kg from 0 to 19 m as well as 80 to 99 m depth ranges.

Particulars	Depth range (m)			
	0-19	20-39	40-59	60-79
Fishing effort (hrs)	899	4700	886	95
Species				
Elasmobranchs	3.9	13.8	14.1	14.8
Wam	0.4	0.2	-	-
Cat fish	6.6	53.0	84.7	67.8
Dhoma	-	0.2	0.6	0.3
Pomfret	0.1	1.8	3.0	3.6
Lactarius sp.	1.8	4.4	7.9	5.4
Carangids	0.3	2.6	-	-
Nemipterus sp.	0.1	6.4	22.7	11.4
Perches	0.9	2.8	5.2	3.3
Ribbon fish	4.6	17.2	54.4	22.0
Flat fish	-	0.1	0.6	0.7
Lizard fish	-	0.9	1.1	-
Prawn	4.0	2.0	0.5	1.3
Squids and cuttle fish	-	0.2	-	-

TABLE III. Catch per hour (Kg) of important varieties of fish obtained from Goa region by depth

Particulars	Depth range (m)			
	0-19	20-39	40-59	60-79
Fishing effort(hrs)	482	6,510	457	24
Species				
Elasmobranchs	1.0	5.7	17.9	3.9
Cat fish	8.2	19.8	23.4	34.7
Lactarius Sp.	0.6	3.7	5.1	2.7
Rani fish	1.0	4.6	15.6	83.3
Ribbon fish	0.7	11.3	1.1	28.9
Dhoma	-	0.8	0.1	1.0
Lizard fish	-	0.8	0.9	1.7
Prawn	2.5	0.8	0.1	-

TABLE IV. Catch per hour (Kg) of important varieties of fish obtained from Mangalore region by depth

Particulars	Depth range (m)					
	0-19	20-39	40-59	60-79	80-99	100-119
Fishing effort (hrs)	320	7,064	2,310	235	22	15
Species						
Elasmobranchs	2.4	20.5	31.4	17.7	21.9	8.6
Cat fish	1.6	26.0	42.0	45.0	86.2	8.6
Dhoma	1.7	0.4	-	1.5	0.3	-
Pomfret	-	0.3	0.5	-	-	-
Lactarius sp.	0.2	1.4	0.4	0.2	-	-
Carangids	-	0.6	1.5	1.5	1.3	0.5
Nemipterus sp.	0.8	16.2	24.4	56.2	82.0	-
Perches	-	1.0	0.9	0.8	-	10.7
Ribbon fish	4.7	2.7	4.8	0.2	0.2	-
Flat fish	-	0.3	0.6	0.9	1.6	-
Lizard fish	0.3	5.7	9.7	11.3	6.1	-
Horse Mackerel	-	0.7	0.5	0.4	0.1	-
Baracuda	-	1.0	1.6	0.6	1.3	1.3
Prawn	0.3	2.6	4.1	1.1	0.2	-
Squids & cuttle fish	-	0.2	0.7	1.2	0.4	0.5

TABLE V. Catch per hour (Kg) of important varieties of fish obtained from Cochin region by depth

Lower east coast

Table VI furnishes the catch rate of important varieties of fisn from Tuticorin while Table VII gives the same information for the Madras region. A catch of 42 Kg per hour was obtained in the case of Perches from the depth range of 20 to 39 m. It may be mentioned that Perches accounted for about 36 percent (Fig. 20) of the catch from Tuticorin region. Elasmobranchs which accounted for 26 percent of the total catch registered catch rates of 27 Kg and 26 Kg respectively from the depth range 20 to 39 m and 0 to 19 m depth.

Leiognathids which contributed for 21 percent (Fig.20) of the catch in Madras region recorded about 25 and 24 Kg per hour respectively from 20 to 39 m and 40 to 59 m depth ranges. About 16 Kg of catch per hour was obtained from the depth range of 20 to 39 m as against 2.2 Kg/ per hour from 40 to 59 m depth in the case of Perches. Elasmobranchs and Lactarius sp. registered relatively high catch rates from 0 to 39 m depth.

Particulars	Depth range (m)			
	0-19	20-39	40-59	60-79
Fishing effort (hrs)	4315	5151	229	10
Species				
Elasmobranchs	25.7	27.4	17.0	19.5
Cat fish	0.4	0.5	1.6	-
Seer fish	-	-	-	-
Carangids.	1.7	1.3	0.3	-
Baracuda	0.1	0.1	-	-
Perches	30.7	42.1	31.0	5.7
Upeneus	0.1	-	-	-
Sciaenids	1.8	1.4	2.3	-
Prawn	0.2	0.5	-	-

TABLE VI. Catch per hour (Kg) of important varieties of fish obtained from Tuticorin region by depth

Particulars	Depth range (m)			
	0–19	20–39	40–59	60–79
Fishing effort (hrs)	253	3778	3329	68
Species				
Elasmobranchs	11.6	9.2	4.1	3.3
Lactarius sp.	3.5	3.7	0.8	1.1
Synagris	1.8	1.1	2.5	0.6
Leiognathids	14.6	26.4	24.2	12.4
Sciaenids	13.2	11.5	5.4	7.9
Lizard fish	1.7	1.7	4.3	-
Perch	9.4	15.7	2.2	1.2
Flat fish	0.4	0.6	0.1	-
Pomfret	1.0	2.6	0.2	0.8
Carangids	1.2	1.1	2.1	-
Moon fish	0.4	0.4	-	-
Ribbon fish	-	-	0.2	-
Prawn	0.3	0.3	0.1	-

TABLE VII. Catch per hour(Kg) of important varieties of fish obtained from Madras region by depth

Upper east coast

Table VIII shows the catch rate of important varieties from Visakhapatnam. Cat fish which contributed to about 15 percent (Fig. 19) of the catch in the Visakhapatnam region recorded about 29 Kg per hour from 60 to 79 m depth as against 10 to 12 Kg from depth range 20 to 59 m. The catch rate of Prawns was found relatively even upto 59 m depth. Elasmobranchs which contributed to about 9 percent of the catch recorded more or less the same catch rate from 20 to 79 m depth range.

From Table IX, it may be seen that "Dhoma" which accounted for 13 percent (Fig. 19) of the catch in Paradeep/Calcutta areas recorded about 29 Kg per hour from depth range 20 to 39 m. In fact elasmobranchs was also registered the highest catch rate from the same depth range. A catch rate of 13 Kg of Prawns per hour was registered from 20 to 39 m depth. Incidentally it may be stated that the highest average catch rate of Prawns was obtained from Paradeep during the investigation. It may be seen that very little fishing has been done in this area beyond the depth of 39 m and as such it may not be proper to compare the catch rate with other areas or depth belts.

Particulars	Depth range (m)				
	0-19	20-39	40-59	60-79	80-99
Fishing effort (hrs)	8	4587	5315	43	2
Species					
Elasmobranchs	2.0	7.6	6.5	8.9	-
Wam	0.2	0.8	0.6	0.3	-
Cat fish	0.6	10.6	12.3	28.5	-
Pomfret	-	1.0	0.4	0.5	-
Perches	-	2.4	1.2	7.7	-
Sciaenids	-	0.9	0.2	0.4	-
Ribbon fish	3.8	0.5	0.7	-	-
Prawn	1.6	0.9	1.0	0.2	-
Squids and cuttle fish	-	-	0.1	-	-

TABLE VIII. Catch per hour (Kg) of important varieties of fish obtained from Visakhapatnam region by depth

Particulars	Depth range(m)		
	0-19	20-39	40-59
Fishing effort (hrs)	2647	3346	12
Species			
Elasmobranchs	16.6	20.1	2.8
Wam	2.2	3.2	2.9
Cat fish	2.6	5.4	0.7
Karkara	0.1	0.9	-
Ghol	0.3	0.3	-
Koth	-	0.8	-
Dhoma	21.6	28.9	0.9
Pomfret	4.2	3.9	-
Seer fish	1.9	0.5	-
Lactarius sp.	0.4	0.6	-
Carangids	0.1	0.2	-
Perches	2.1	0.3	0.7
Ribbon fish	0.5	0.5	-
Sciaenids	-	0.1	0.2
Prawn	8.8	13.1	0.4

TABLE IX. Catch per hour(K_h) of important varieties of fish obtained from Paradeep/Calcutta region by depth

QUANTITATIVE STUDY OF THE CATCH BY DEPTH AND GEOGRAPHICAL DIVISION

The relative abundance of the important species of fish on a regional and depth wise basis have been discussed elsewhere. This section deals with a detailed analysis of the catch per unit of effort obtained from various geographical and bathymetrical divisions.

North west coast

Fig. 13 indicates the catch per unit of effort obtained from different geographical divisions and depth ranges from the north west coast. From the figure it may be seen that catch per hour upto 166 Kg was obtained from the depth range 20 to 39 m while a catch per hour upto 234 Kg was obtained from 40 to 59 m depth belt. The highest catch per hour viz. 316 Kg was recorded off Ratnagiri along Maharashtra coast (area 16-72) in the depth range of 60 to 79 m whereas 283 Kg was recorded from the same depth range off Dwaraka. A catch rate of 214 Kg was obtained from areas (21-68) off Mangrol along Gujarat coast from 80 to 99 m depth range, while 165 Kg per hour was recorded off Ratnagiri from the same depth range. Contrary to the popular notion that there is relatively high productivity within the inshore waters, the present investigation shows that the catch rate is comparatively poor in the 0 to 19 m depth range.

From the data presented in Fig. 13 it may be seen that the depth belt 20 to 79 m is more productive than other depth ranges. The trawl fishery potential appears to be relatively better along Gujarat coast particularly between lat. 23° N

and lat. 21° N than along Maharashtra coast. The productivity seems to be rather uniform along the Maharashtra coast unlike in the case of Gujarat where it appears to be more pronounced along its northern areas. Having regard to the high concentration of the mechanised fishing activity around Veraval and Bombay areas, it is not surprising that the catch per hour from these two fishing grounds are relatively poor than those of other areas along the north west coast.

South west coast

Fig. 14 furnishes the catch per unit of effort in the case of south west coast on the basis of geographical divisions and depth. As in the case of north west coast the catch rate was relatively poor along the south west coast also in the depth range of 0 to 19 m. The catch rates ranged between 90-257 Kg in the depth belt 20 to 39 m in most of the areas while it varied from 130 to 380 Kg from majority of areas in the depth range of 40 to 59 m. The depth range 60 to 79 m in areas 15-74 and 9-75 recorded 460 Kg and 226 Kg of catch per hour respectively. The depth belt 80 to 99 m in area 10-75 yielded a catch per hour of 310 Kg while other areas south of Cochin recorded 130 to 269 Kg of catch from the same depth range.

It may be seen that the areas farther from Mangalore and Cochin were more productive than areas nearer to them. This may be attributed to the fact that the areas off Mangalore and Cochin are extensively exploited by smaller trawlers. The fishing carried out in the Wadge Bank appears to be inadequate to draw any conclusion about the productivity of this area on the basis of operation of these vessels.

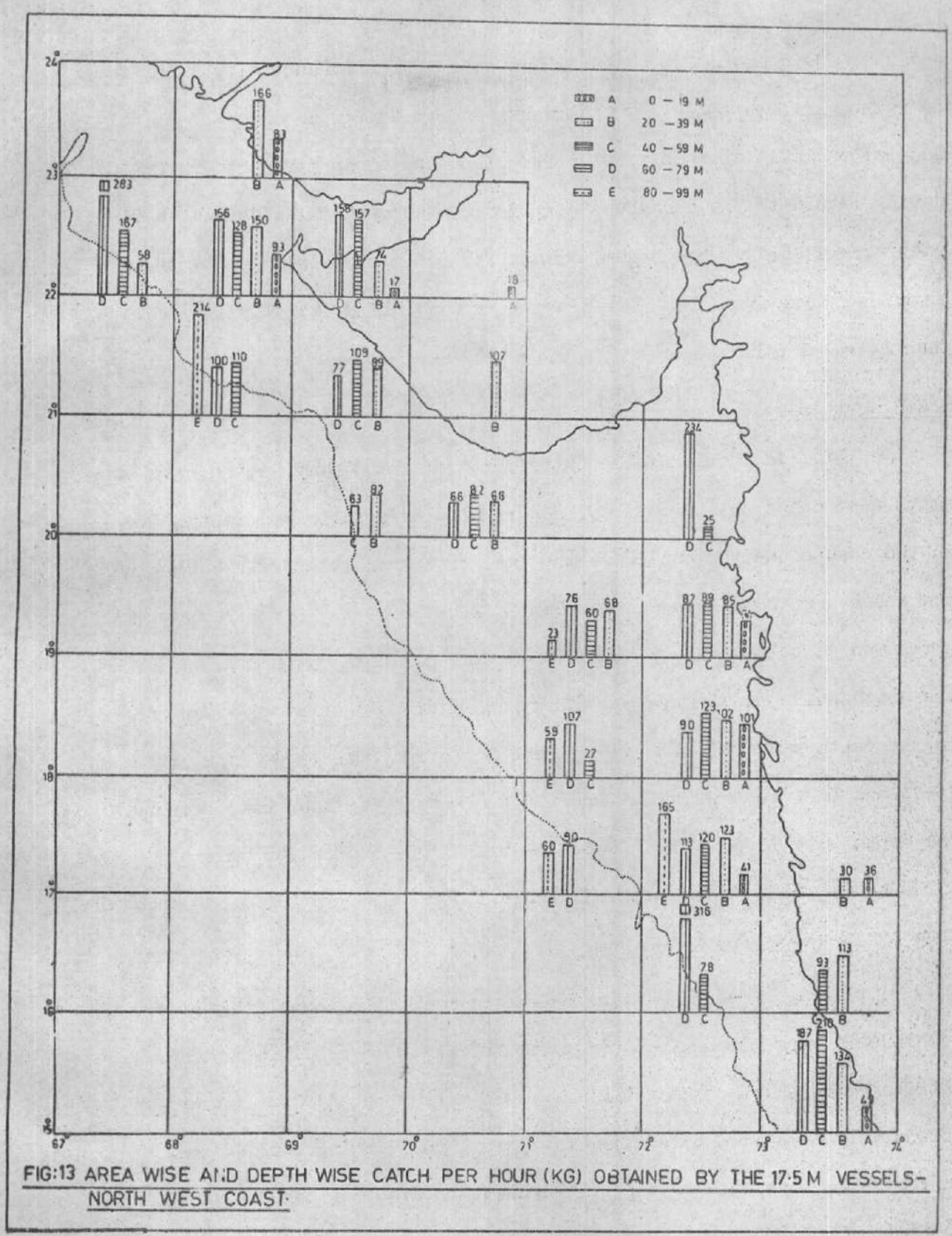


FIG:13 AREA WISE AND DEPTH WISE CATCH PER HOUR (KG) OBTAINED BY THE 17·5 M VESSELS– NORTH WEST COAST.

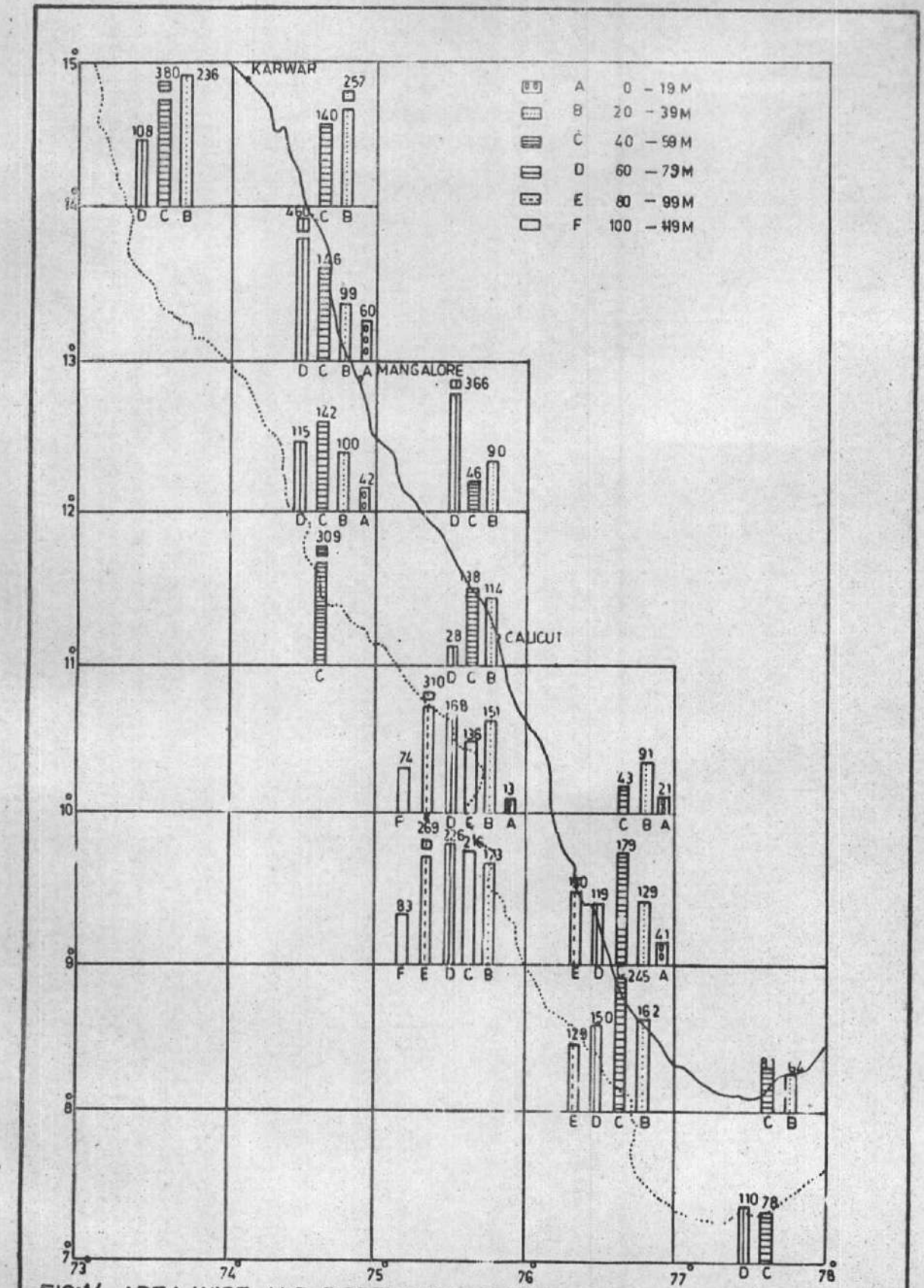


FIG:14 AREA WISE AND DEPTH WISE CATCH PER HOUR (KG) OBTAINED BY THE 17·5 M VESSELS:– SOUTH WEST COAST·

Upper east coast

Fig. 15 shows the catch per unit of effort from different geographical divisions and depth belts obtained from the upper east coast. Unlike in the case of the north west coast the catch rates were rather high in the depth range 0 to 19 m along the upper east coast. It ranged from 120 to 202 Kg per hour along the Orissa coast. The average catch rate obtained from the depth belt 20 to 39 m varied from 73 to 252 Kg along Orissa coast while it ranged from 52 to 170 Kg along the Andhra Pradesh coast. Judging from the catch per unit of effort obtained during the investigation, the depth belt 60 to 79 m appears to have been more productive than 40 to 59 m along the upper east coast. The catch rate from 40 to 59 m varied from 19 Kg to 142 Kg while that from the 60 to 79 m ranged from 113 to 159 Kg. It may be seen that the catch per hour is relatively poor along the Andhra Pradesh coast particularly in areas off Visakhapatnam as compared to Orissa coast. As compared to the north west coast also, the catch rate obtained from upper east coast appears to be generally poor.

Lower east coast

Fig. 16 furnishes the catch per hour obtained from the lower east coast. As in the case of upper east coast and unlike in the case of the west coast, in the lower east coast the highest average catch rate seems to have been obtained from below 20 m depth. Depth belt 20 to 39 m recorded catch rates ranging from 119 to 242 Kg from areas north of Madras. There appears to be no significant difference in the catch rates obtained from 20 to 39 m depth belt and 40 to 59 m depth range from the same region.

DEPTH AND REGIONAL ABUNDANCE - A COMPARATIVE STUDY

A comparative study of the depth and regional abundance of the demersal fisheries resources as it emerges from the data gathered by the 17.5 m trawlers (Table X) reveals certain interesting features. From the table it may be seen that in the

Region	Depth range(m)						To-tal
	0-19	20-39	40-59	60-79	80-99	100-119	
Porbandar	72	100	116	141	214	-	112
Bombay	95	103	117	102	68	-	106
Goa	49	136	232	156	-	-	137
Mangalore	48	100	142	252	-	-	160
Cochin	28	133	188	188	249	84	144
Tuticorin	100	107	74	63	-	-	103
Madras	155	148	92	61	-	-	122
Visakhapatnam	32	89	70	150	100	-	79
Paradeep	200	185	59	-	-	-	191

TABLE X. Regional abundance (catch per hour in Kg) by depth

case of Porbandar and Cochin regions the highest catch rates of 214 Kg and 249 Kg per hour were obtained from 80 to 99 m depth belt whereas in the case of Mangalore, the highest catch rate of 252 Kg per hour was obtained from the depth range 60 to 79 m. The highest catch rates of 232 Kg and 117 Kg per hour were obtained from 40 to 59 m belt in the case of Goa and Bombay regions respectively. It is noteworthy that among the highest catch rates from various regions along the west coast, the lowest rate viz. 117 Kg per hour

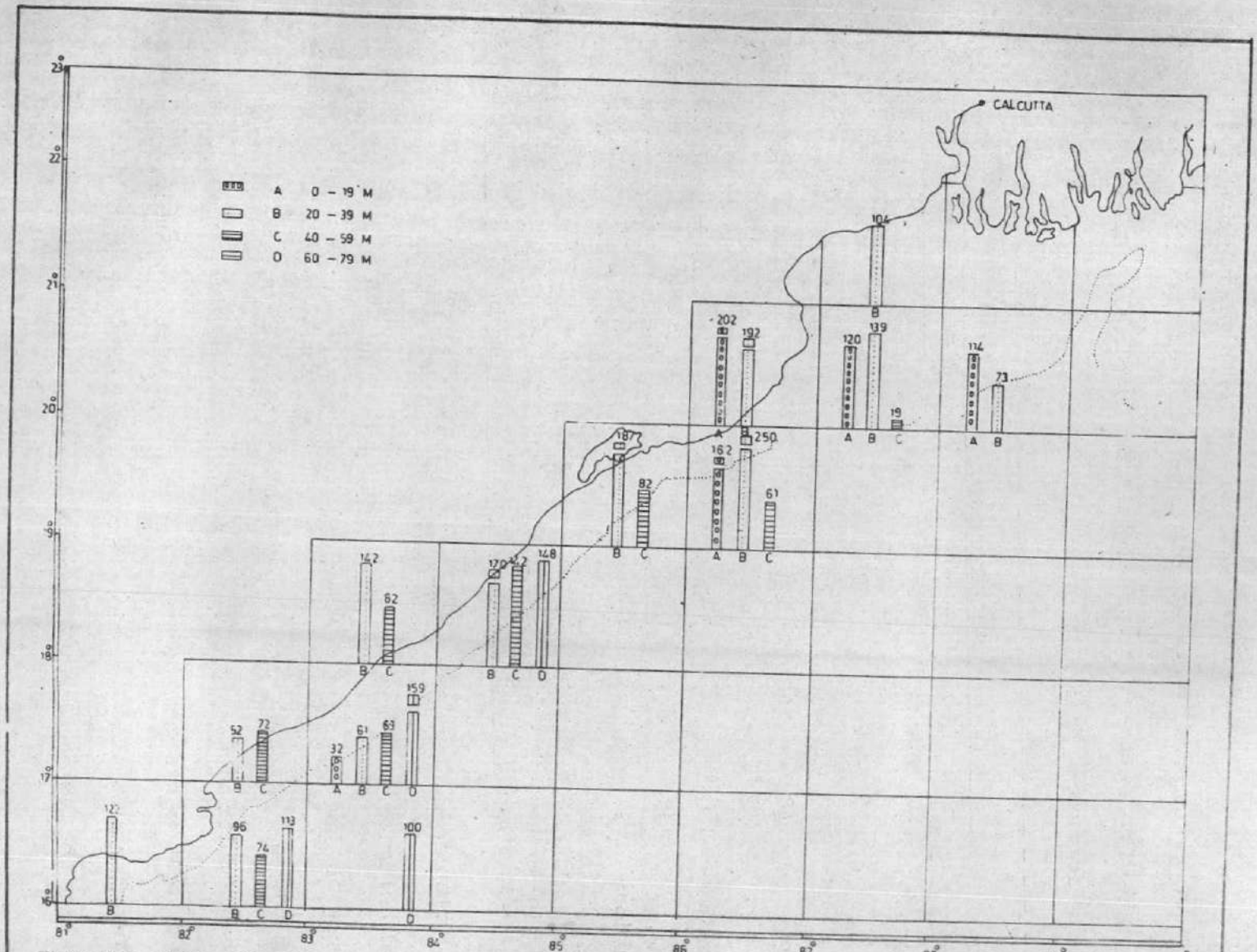


FIG:15 AREA WISE AND DEPTH WISE CATCH PER HOUR (KG) OBTAINED BY THE 17·5 M VESSELS — UPPER EAST COAST.

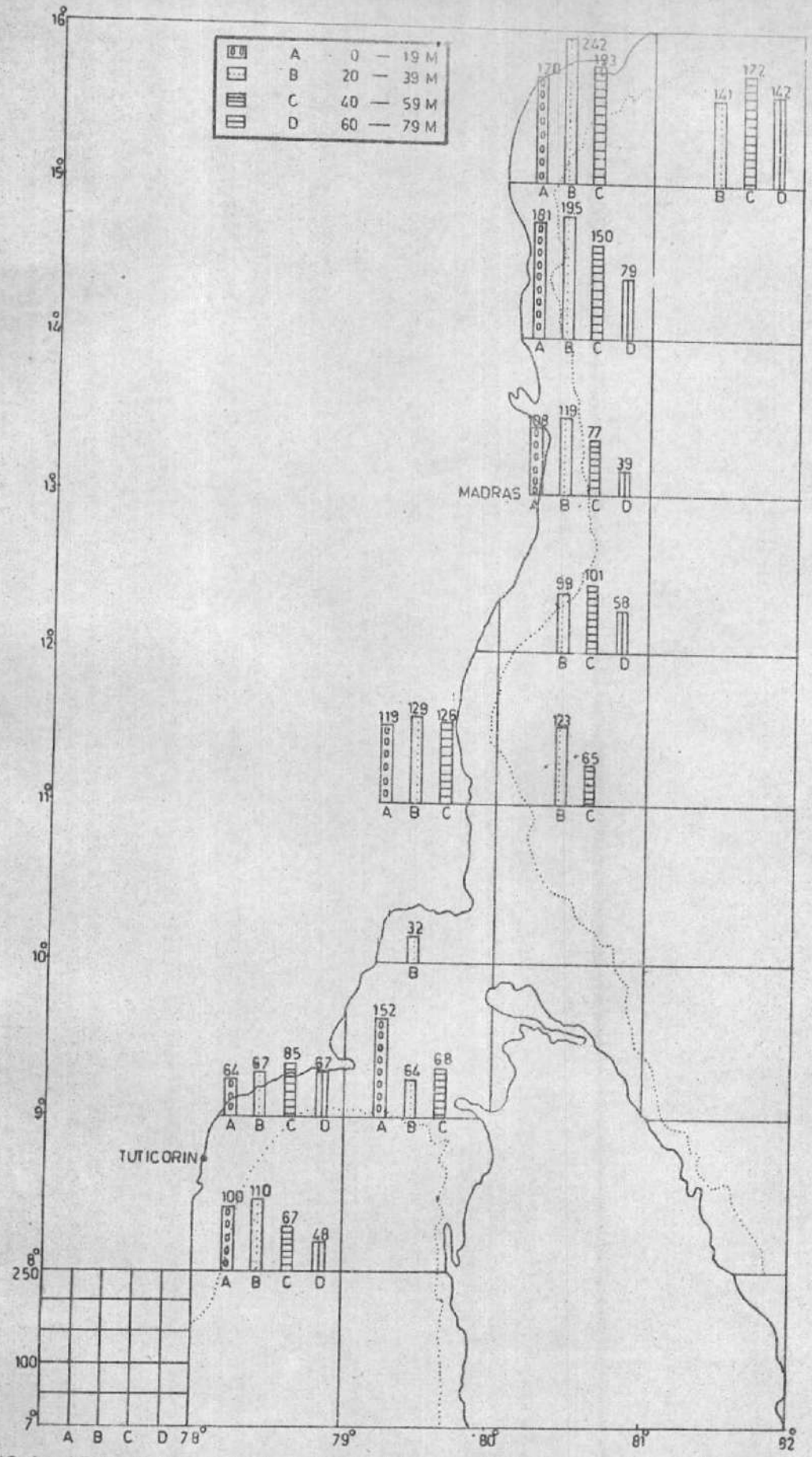


FIG:16 AREA WISE AND DEPTH WISE CATCH PER HOUR (KG) OBTAINED BY THE 17·5 M VESSELS - LOWER EAST COAST.

was recorded from the Bombay region. A close scrutiny of the data related to the west coast reveals that the depth range 40 to 79 m is relatively more productive than the depth belt 0 to 39 m. The highest average catch per hour of 144 Kg was obtained from Cochin region while the lowest catch rate of 100 Kg per hour was from Mangalore from among the various regions along the west coast.

In the case of east coast, the Tuticorin region has recorded the highest catch rate of 107 Kg per hour from depth range 20 to 39 m whereas the Madras region has recorded the highest catch rate of 155 Kg per hour from the depth belt 0 to 19 m. From the Visakhapatnam region, the highest catch rate of 150 Kg per hour was obtained from 60 to 79 m depth belt while from Paradeep region, the highest catch rate of 200 Kg per hour was recorded from 0 to 19 m depth belt. An evaluation of the data of the east coast will reveal that unlike in the case of the west coast, the depth belt 0 to 39 m has recorded relatively high catch rate than deeper waters except in the case of Visakhapatnam region. In this context, it is noteworthy that there is a progressive decrease in the fishing intensity from shallow to deeper waters along the east coast. In the case of Paradeep no fishing has been done beyond the depth of 59 m. It is well known that the continental shelf south of Visakhapatnam and especially in the lower east coast is rather narrow and steep as compared to the upper east coast and the west coast.

SPECIES COMPOSITION

Annex. III gives the list of commercially important species of fish occurring in the trawl catches along the east and west coasts of India. Fig. 17 indicates the percentage composition of the important species and varieties of fish in the trawl catches of the trawlers operated by the Kandla/Porbandar, Bombay and Goa bases. There appears to be a lot of similarity between the percentage composition of the catch of these regions in general and Porbandar and Bombay in particular. Elasmobranchs and "Dhoma" accounted for 42 percent of the catch from Porbandar/Kandla area while the same groups contributed to 38 percent of the catch in Bombay region. Cat fish accounted for 28 and 37 percent respectively of the catch from Bombay and Goa while the same contributed to only 7 percent of the catch at Porbandar. "Ghol", Perch, Pomfret and "Jam" are some of the important quality fishes obtained from both Bombay and Porbandar areas. Three groups viz. ribbon fish, cat fish and elasmobranchs accounted for 61 percent of the catch from Goa region while Elasmobranchs and cat fish alone accounted for 51 percent of the catch from Bombay region.

Fig. 18 shows the percentage composition of the catch from Mangalore and Cochin based vessels. Cat fish together with elasmobranchs, ribbon fish, Nemipterus sp. and Lactarius sp. contributed to 44 percent of the sorted out catch of the Mangalore based vessels whereas elasmobranchs, cat fish and Nemipterus sp. alone accounted for 50 percent of the catch from Cochin region. The unsorted varieties consisting of small ribbon fish, Nemipterus spp. soles, lizard fish etc. have made up of 56 percent of the catch from Mangalore and 41 percent from Cochin.

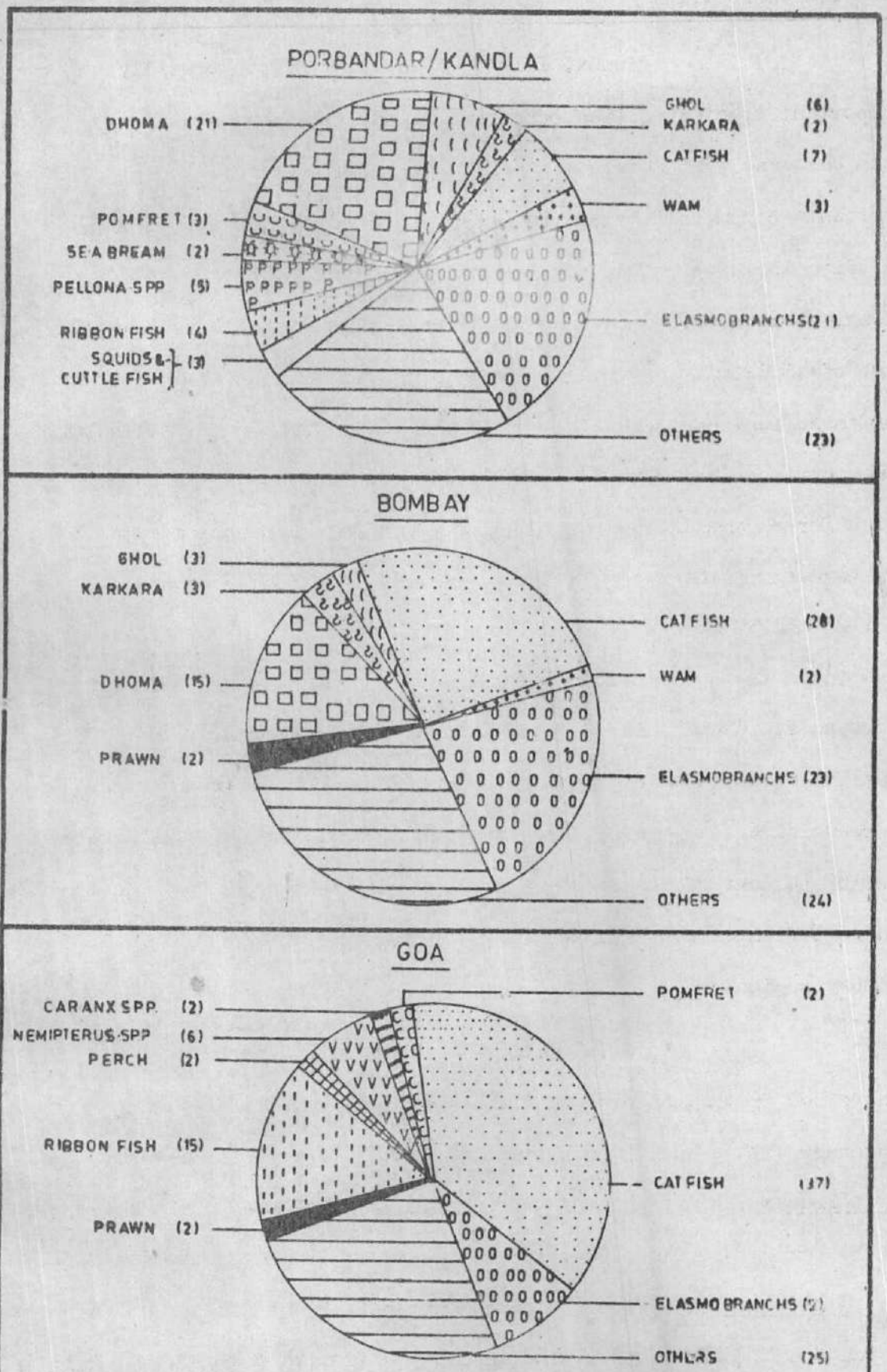


FIG:17 PERCENTAGE OCCURRENCE OF IMPORTANT VARIETIES OF FISHES FROM PORBANDAR, BOMBAY AND GOA REGIONS

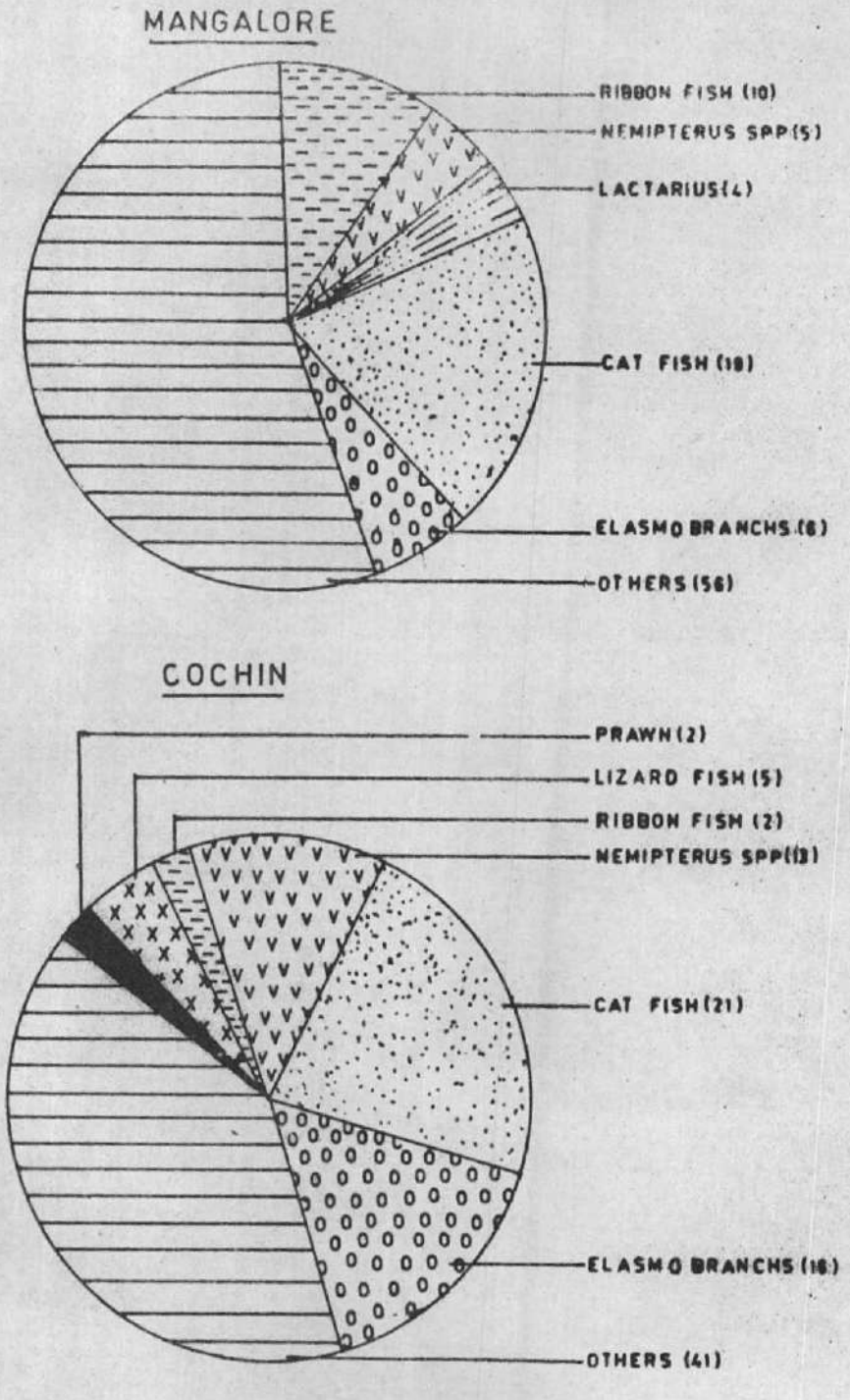


FIG-18 PERCENTAGE OCCURRENCE OF IMPORTANT VARIETIES OF FISHES FROM MANGALORE AND COCHIN REGIONS.

The percentage of cat fish seems to have been highest (37%) in Goa region followed by Bombay (28%), Cochin (21%), Mangalore (19%) and Porbandar (7%). The presence of 2 percent prawn in Bombay, Goa and Cochin and its negligible presence or total absence in Mangalore and Porbandar are noteworthy. Similarly the presence of lizard fish (5%) in Cochin and Lactarius spp.(4%) in Mangalore also appear to be remarkable. Another interesting feature is the high percentage of miscellaneous varieties of fish in the catch, as already stated above, from Mangalore and Cochin. The insignificant presence or absence of any popular varieties of quality fish in the catches from Mangalore and Cochin deserves special mention.

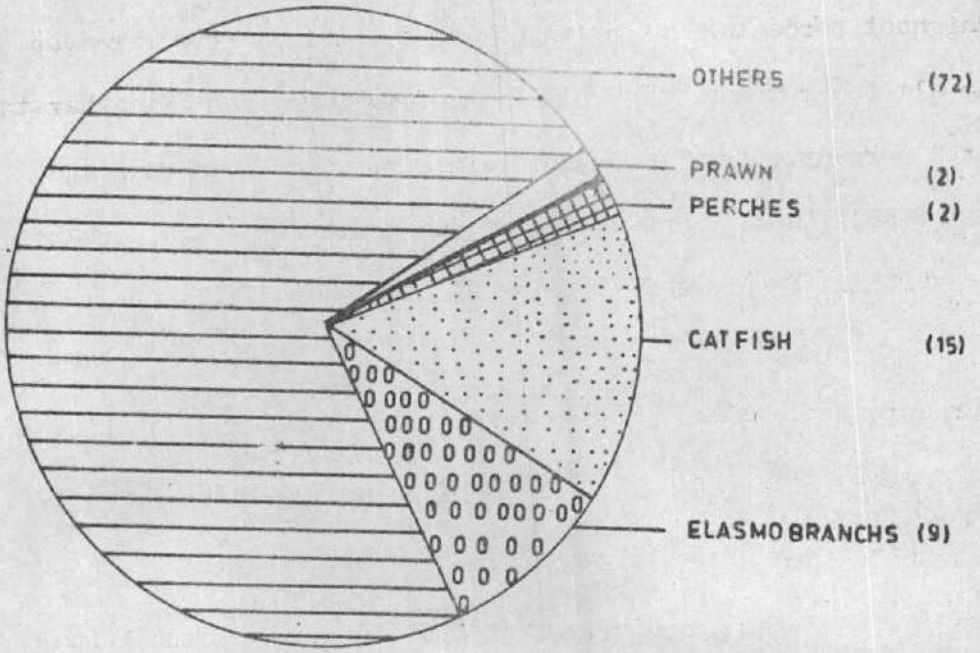
Fig. 20 indicates the percentage composition of the catches from Tuticorin and Madras. The percentage of perches (36%) from Tuticorin appears to be quite impressive and is the highest among all the areas. This is of significance as perches are one of the important groups of quality fishes. Leiognathids spp. (21%) is the only group which accounted for more than 10 percent of the catch from the Madras region. However, Madras catches had a rather high percentage (16%) of quality fishes comprising pomfrets, carangids, perches etc. There appears to be very little similarity between the catch composition from Madras and Tuticorin regions.

From Fig. 19 it may be seen that "Dhoma" accounted for 13 percent of the catch from Paradeep followed by elasmobranchs (10%). Cat fish on the other hand accounted for 15 percent of the catch from Visakhapatnam followed by elasmobranchs(9%).

The highest percentage of prawn (6%) was obtained from Paradeep among all the regions. The percentage of prawn from Visakhapatnam was about 2 percent. Except for some similarity in the percentage of cat fish, "Dhoma", and miscellaneous varieties there appears to be very little similarity between catch composition of Visakhapatnam region and the Paradeep/Calcutta areas. More than 60 percent of the catch in either areas are made up of by miscellaenous unsorted varieties of fish whereas the same was only less than 25 percent in the case of the north west coast.

A comparison of the percentage composition of the catch on regional basis shows that the trawl catches from upper east coast comprising Visakhapatnam and Paradeep regions shows more similarity than lower east coast comprising Tuticorin and Madras. Similarly the catch composition of Porbandar and Bombay regions indicate that there is considerable similarity in the percentage composition of the catch of these areas which constitute the north west coast. A comparison of the catch from Mangalore and Cochin regions which constitute the south west coast on the other hand indicates less similarity in the percentage composition. While it is not certain to what extend the sorting of the catch into various species has influenced the percentage composition from different areas, it is very likely that the sorting of the catch, which varies from base to base and from vessel to vessel, has influenced the percentage composition as this study is on the basis of the actual catch landed and sold.

VIZAG.



PARADEEP/CALCUTTA

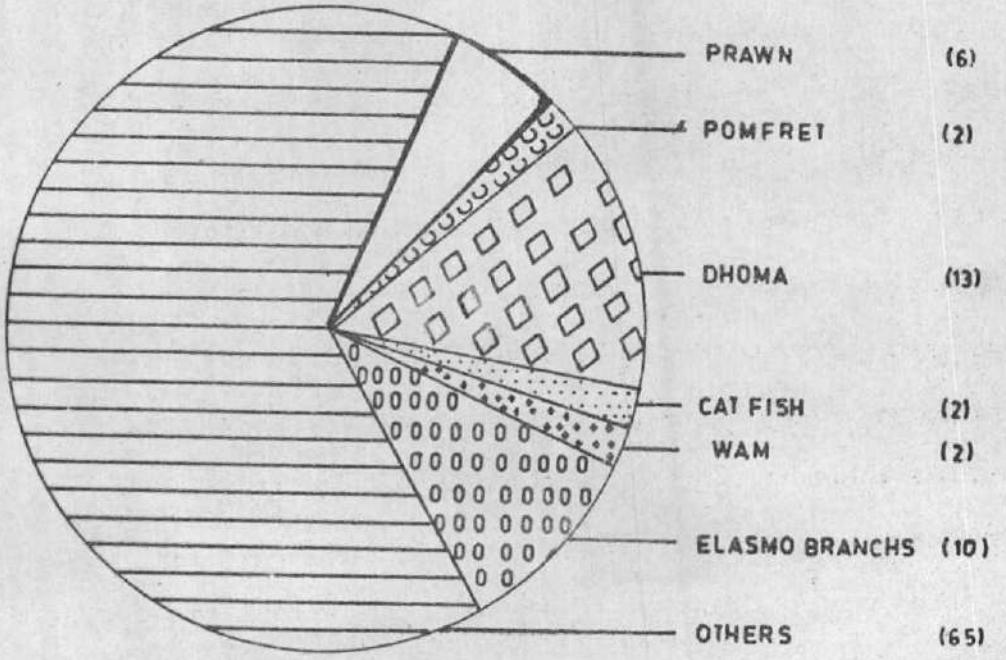
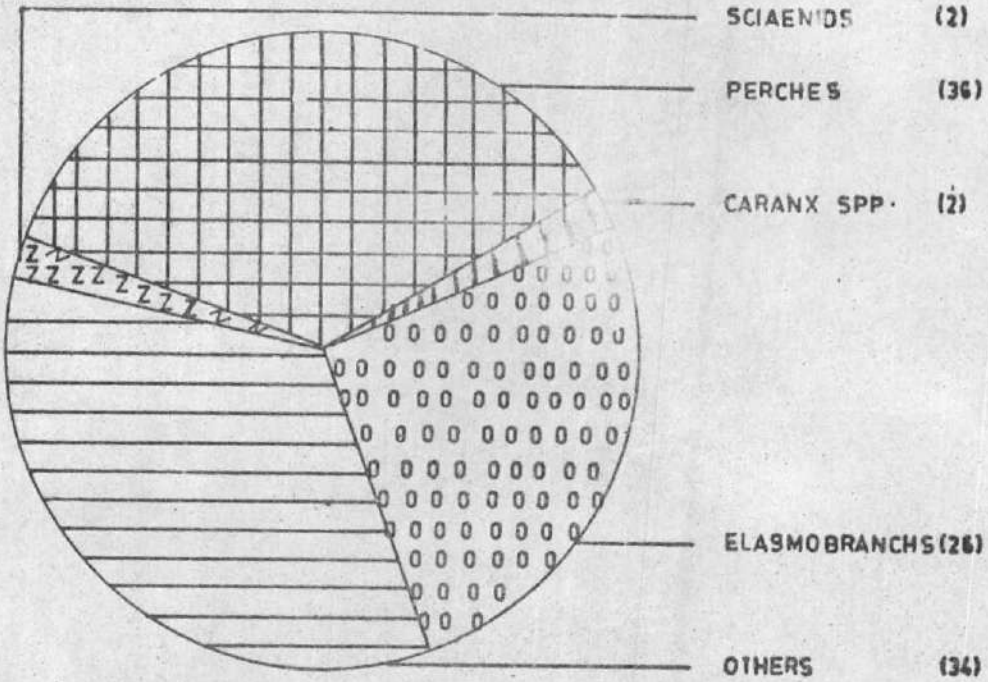


FIG:19 PERCENTANGE OCCURRENCE OF IMPORTANT VARIETIES OF FISHES FROM VIZAG AND PARADEEP/ CALCUTTA REGIONS.

TUTICORIN



MADRAS

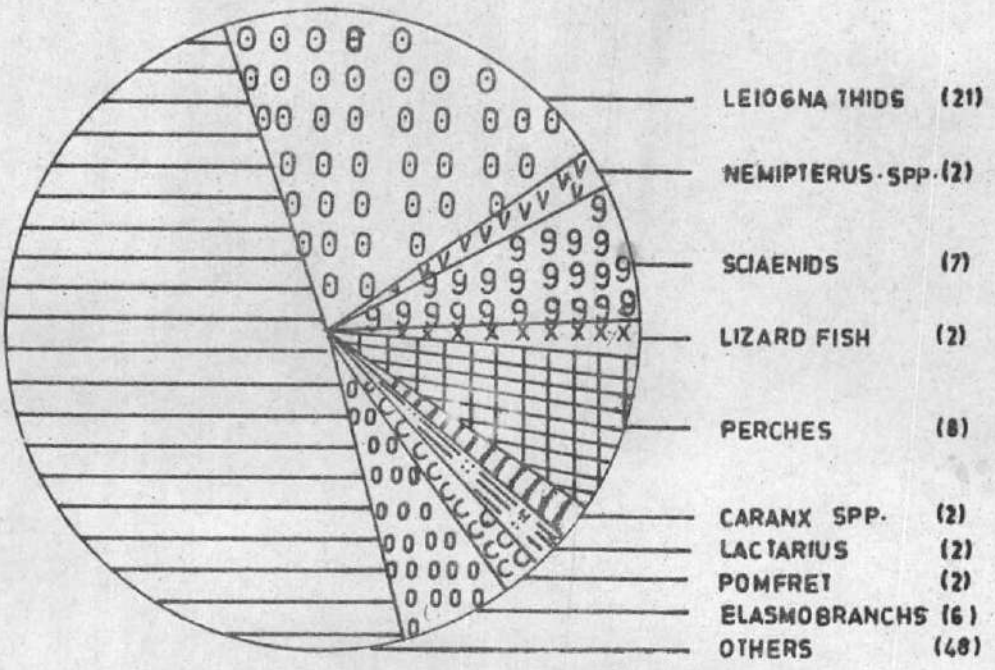


FIG:20 PERCENTAGE OCCURRENCE OF IMPORTANT VARIETIES OF FISHES FROM TUTICORIN AND MADRAS REGIONS.

SEASONAL VARIATION

An attempt has been made to study the seasonal variation in the catch from the different regions. Fig. 21 and 22 illustrate the monthly variations in the catch per hour of trawling in respect of the west coast whereas Figs. 23 and 24 give the same information for the east coast. From the figures it may be seen that the best productive season for Porbandar region is the period from September to November and the next best season is the period from January to March. November to March appears to be the best season for Bombay area while from February to April high catch rates were obtained from Goa. In the case of Mangalore region February to April besides December appears to be the best productive months.

In the case of Paradeep/Calcutta region the period from October to December appears to be more productive than other periods. An interesting aspect of the catch rates obtained from this region is that there was a progressive decline in the catch from February to June whereas from July there was progressive increase in the catch. The highest catch rate of 346 Kg per hour was recorded during November. In the Visakhapatnam region, the best period appears to be January to March. In the Madras region the best productive month was February and the next highest productive months were July and September. In the case of Tuticorin the period from August to September appears to be the best season and the highest catch rate obtained was 169 Kg per hour during September.

POTENTIAL YIELD

From a properly planned demersal trawl survey it is possible to obtain atleast an acceptable estimate of the likely size of the demersal fish stock vulnerable to the trawl. This is done mainly by converting the catch taken in a haul into an estimate of the abundance of fish per unit area on the basis of the area swept by the trawl. The product of the horizontal opening of a trawl and the distance by which it was towed is considered to be a reliable estimate of the area swept by it. Some authors (Krishnamoorthi,1974) have taken the length of the head rope of trawl as equivalent to its horizontal opening while others (Joseph, op. cit.) have taken a percentage of it as its horizontal opening. Antony Raja (1980) has raised certain doubts about this issue. The horizontal opening of a trawl is likely to be less than its head or foot rope length due to a variety of reasons including the herding effect of the sweeps. The horizontal opening of the trawl according to some authors (Oknoski, 1972) ranges from 50 to 70 percent of its head rope length. Recent tests (Tom Wray, 1980) conducted by the White Fish Authority on the North sea trawl and Kallut prawn trawl in its flume tank have shown that the head and foot rope spreads of these trawls range from 18 to 51 percent of their head and foot lines. The horizontal opening of the 24 m trawl for the purpose of this study has been estimated at about 40 percent of its head line length.

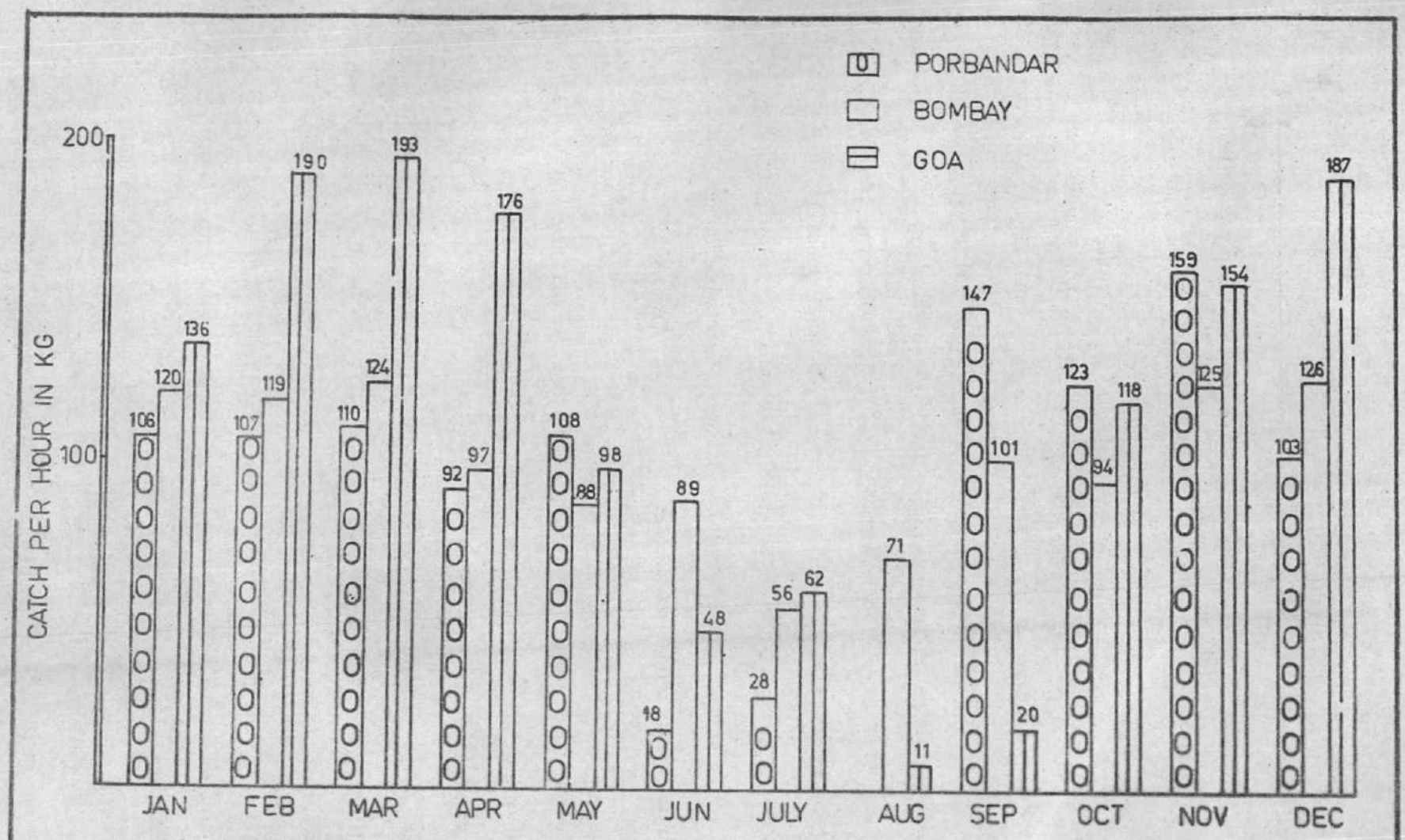


FIG:21- MONTH WISE CATCH PER HOUR (KG) OBTAINED BY THE 17·5 M VESSELS FROM PORBANDAR, BOMBAY AND GOA REGIONS.

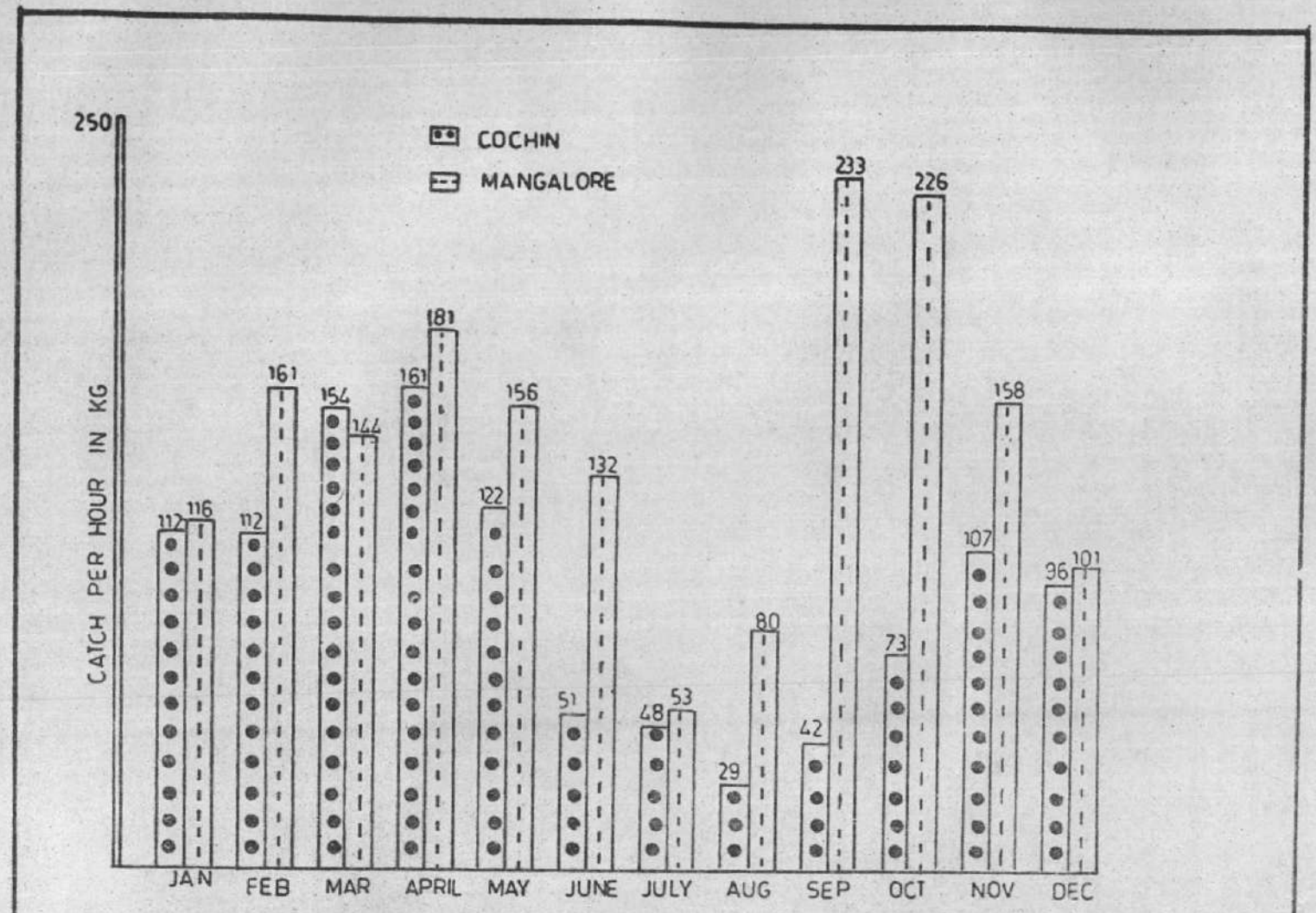


FIG: 22- MONTH-WISE CATCH PER HOUR (KG) OBTAINED BY THE 17·5 M VESSELS FROM COCHIN & MANGALORE REGIONS.

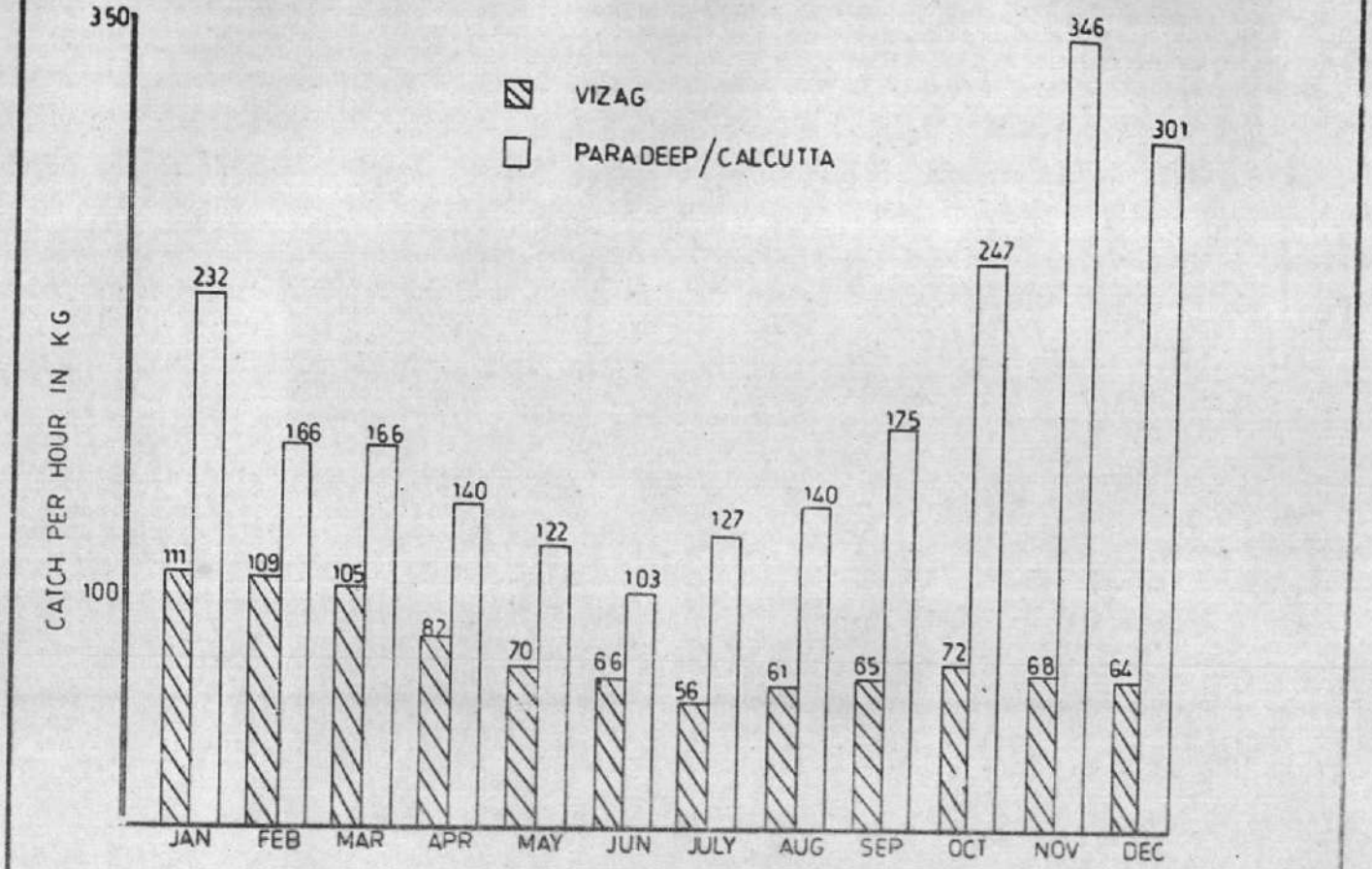


FIG 23- MONTH WISE CATCH PER HOUR (KG) OBTAINED BY THE 17.5M VESSELS FROM VIZAG & PARADEEP - CALCUTTA REGIONS.

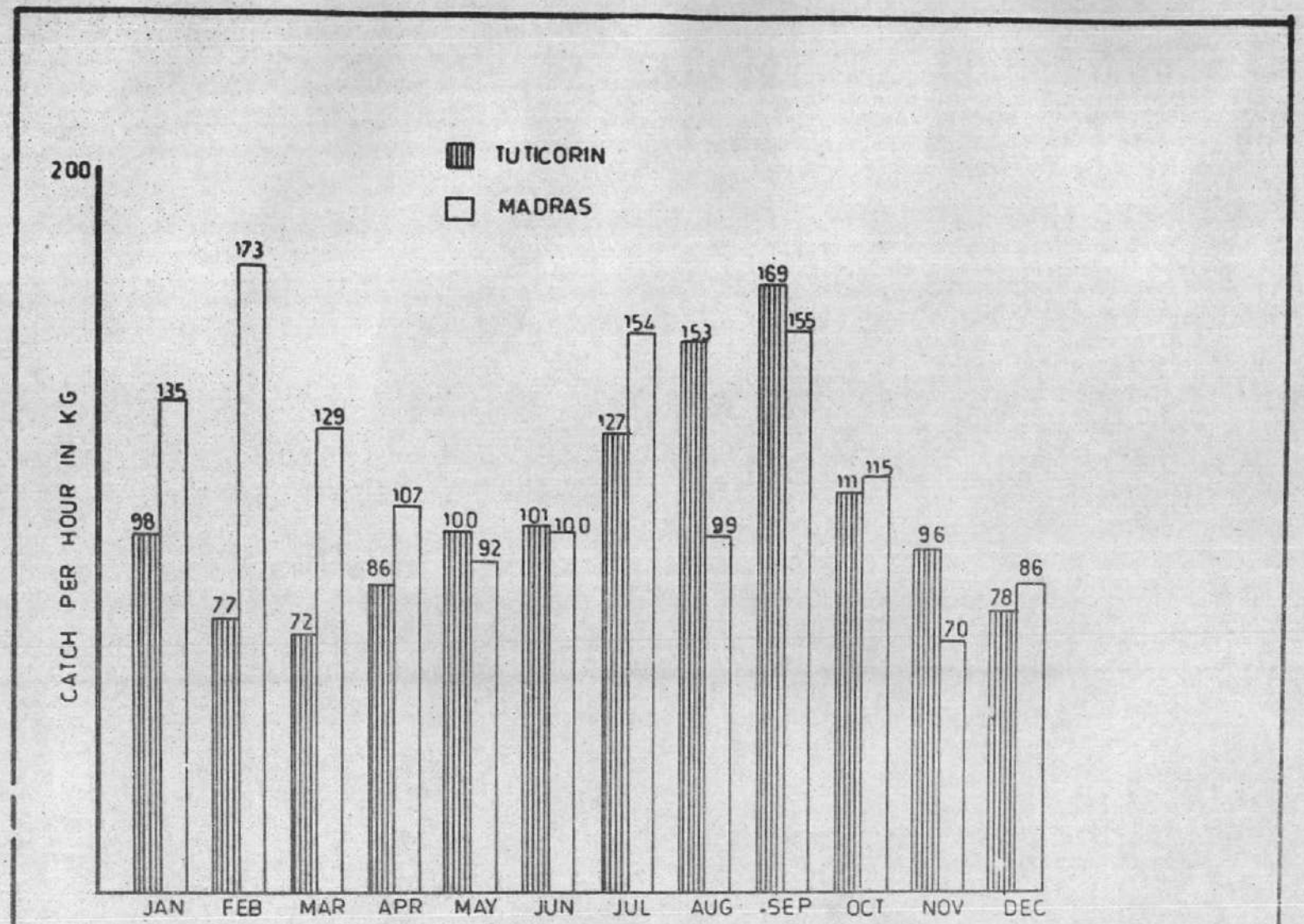


FIG : 24 - MONTH WISE CATCH PER HOUR (KG) OBTAINED BY THE 17·5 M VESSELS FROM TUTICORIN & MADRS REGIONS

While calculating the density of the demersal fish population by the swept area method it must also be borne in mind that it does not take into account of the fish population which is either buried in the sea bed beyond the effective range of the foot rope or distributed above the head rope of the trawl. The fact that all fish which is within the area swept by the trawl is not caught due to the evasive action of the fish also needs mention. It is also generally known that the trawl does not retain all fish which enter its mouth because of the selective action of the net. Necessary allowance has to be given for the mesh selectivity which depends on the species composition of the population, the size of the individual species of fish etc. Several authors have worked out the selective action of trawls. Panicker and Sivan (1965) have reported that the selective action of a 9 m shrimp trawl having cod end mesh of about 37 mm operated along the south west coast of India is between 45-60 percent depending on the species. For the purpose of this study the selective action of the mesh of the 24 m trawl is placed at 50 percent. Since the fish stock of most of the areas under study is exploited by commercial fishing vessels, suitable allowance has also been given for the quantity of fish already being exploited while calculating the potential yield.

Since the vessels have surveyed mostly areas within 75 m (40 fm) depth the present study of the potential yield is confined to fish resources within this depth. The area of the continental shelf within 75 m depth along the east and west coasts of the country is given in Table XI. From the table it may be seen that the area within 75 m depth is about 2,73,800 sq.km. The intensity of sampling by the vessels along different areas from 1972-73 to 1979-80 is given in Annex.IV, while the average catch per hour obtained from these areas during the same period is given in Annex. V. From the table it may be seen that the intensity of sampling was highest during the year 1975-76 and therefore the average catch per hour obtained during the same year has been used for the purpose of calculation of potential yield. The potential yield estimates of demersal fish stock for the four major zones viz., north west coast, south west coast, lower east coast and upper east coast, on the basis of the foregoing assumptions are given in Table XI.

Region	Area in sq.km	Potential yield (tons)
North west coast (Lat. 23°40'N & 15°N)	1,29,400	6,98,800
South west coast (Lat. 14°N & 7°N)	54,800	3,76,800
Sub-total (West coast)	1,84,200	10,75,600
Lower east coast (Lat. 8°N & 15°N)	38,100	2,31,300
Upper east coast (Lat. 16°N & 21°N)	51,500	3,72,100
Sub total (East coast)	89,600	6,03,400
Grand total (East and West coast)	2,73,800	16,79,000

TABLE XI. Potential yield estimates of demersal fish resources from within 75 m (40 fm) depth

From the foregoing it may be seen that the estimated potential yield of the demersal fish resources on the basis of the survey conducted by the 17.5 m trawlers is about 1.7 million tonnes of fish including crustaceans and cephalopods. Of this, about 0.64 million tonnes of fish and crustaceans are exploited at present (Annon. 1980 and Silas et al 1976). The average potential yield per sq.km works out to about 6.13 tonnes whereas the present yield from the area is about 2.5 tonnes per sq.km. This shows that there is good scope for further development of the demersal fisheries along both the coasts. On the basis of this study it also appears that the upper east coast portends with relatively better scope for development of the demersal fisheries than the other three zones.

CONCLUSION

1. The present study aims at giving a picture of the demersal fisheries resources of the east and west coasts of India as it emerges from the information gathered by eighteen 17.5 m trawlers of identical specifications operated from 11 bases along both the coasts during the period from 1971 to 1980. This is perhaps the first ever attempt by an organization to survey the demersal fishery resources of such a vast stretch of the sea using so many vessels of identical specifications and employing standardized fishing gear. The duration of the investigation also lends additional credibility to the findings of this investigation. Having regard to these factors, it may be said that the investigation under reference is, perhaps, unique in the history of demersal fishery resources survey in our country.

2. Due to limited endurance and capacity limitation of the vessels, the survey was mainly confined to areas within about 80 m depth. From the details of the intensity of sampling in various areas discussed elsewhere it will be seen that the vessels have surveyed most of these areas on a random basis except certain patches along the

south west coast and lower east coast where trawling was found difficult due to the uneven nature of the sea bed caused by rocky and coral outcrops. The intensity of the survey upto the depth range of 80 m is, therefore, considered to be adequate to make a preliminary assessment of the demersal fish resources of this area.

3. The relative abundance of the important species of fish by region and depth has been discussed in detail. Cat fish appears to be the most dominant group of fish along the west coast and in Visakhapatnam regions, its percentage contribution to the total being 15-37. Elasmobranchs were found to occur in all the regions and they contributed to sizeable percentage of the total catch, the contribution being 21-22 percent along the north west coast and 26 percent in the Tuticorin region. "Dhoma" is, perhaps the next group of fish, the distribution of which is rather wide spread along both the coasts. The highest percentage of "Dhoma" was (28-37%) recorded from the north west coast and from the upper east coast particularly from the Paradeep region. Perches were found to be most predominant group (36%) in the Tuticorin region while Leiognathus spp. accounted for 21 percent of the catches from Madras region. The percentage contribution of prawn was the highest (6%) from the Paradeep region while it was about two percent from all the areas except Porbandar/Kandla, Tuticorin and Madras regions. By and large the fishery consists of several species of low quality fish.

The quality fish consisting of Pomfret, perches, "Ghol", "Wam" and carangids groups account only for about 10 percent of the catch.

4. The distribution of the cat fish seems to be more dense in the deeper waters than in shallow waters. 20 to 79 m depth belt has given the highest catch rates. On the other hand the catch rates of elasmobranchs were better from shallow waters. The distribution of "Dhoma" too tends to be relatively denser in shallow waters in all except Porbandar region. "Nemipterus sp. is available in relatively larger quantities from the depth belt 40 to 79 m. Prawns were caught mainly from within 50 m depth.

5. The relative abundance of the demersal fish resources by geographical divisions and depth is also discussed. Along the west coast, it will be seen that the depth range 40 to 79 m was found to be the most productive in most of the geographical divisions. As far as the east coast is concerned the depth belt 0 to 39 m recorded the highest catch rate in all areas except Visakhapatnam region where the most productive zone appeared to have been 60 to 79 m belt.

6. From the details furnished on the seasonal fluctuations in the landings: it may be seen that the first and second quarters of the year appear to be more productive along the north west coast than the third and fourth quarters, whereas no such definite trend was observed in the case of the south west coast. Except for the period

of south west monsoon, the catch rates obtained from Cochin region does not show any significant fluctuations from month to month. The third quarter appears to have recorded better catches in Tuticorin region while the Visakhapatnam region yielded better catch rates during the first quarter. The first quarter was found to be more productive along the Paradeep-Calcutta region than the other quarters.

7. The potential yield of the demersal resources within the 75 m depth was discussed. The potential yield from the whole area under investigation is about 1.7 million tonnes. The present landing of demersal fish, the bulk of which is taken from within the 40 m depth is about 0.64 million tonnes. It therefore emerges from the present investigation that from the area within 75 m depth it is possible at least to double the demersal fish catch. It also appears that the upper east coast has relatively greater potential for further development of demersal fisheries than the lower east coast, the south west coast and the north west coast.

8. No attempt has been made to study the economics of operation of 17.5 m trawlers as it is beyond the scope of the present study. Joseph (1973) has, however, discussed the economic viability of the 17.5 m trawler on the basis of one 17.5 m trawler operated from Cochin base of the Project. This study shows that the 17.5 m trawler Meena Utpadak has landed about 196 tonnes of fish during 200 days the vessel was out at sea in one year.

9. In conclusion, it may be stated that the 17.5 m trawlers operated by the Project have furnished by far the most authentic and invaluable information on the demersal fishery resources of the country.

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REFERENCES

(1) Anon. 1980 — Trends in total marine fish production in India - 1979. Mar. Fish. Infor. Serv. T & E Ser., No. 22 : 1980. 1-19

(2) Antony Raja, B.T. 1980 — Current knowledge of fisheries resources in the shelf area of the Bay of Bengal. BOBP/WP/8, 3-6.

(3) Appukutta Panicker, P., and T.M.Sivan 1965 — On the selective action of the cod end meshes of a shrimp trawl. Fishery Technology, II(2):220-223

(4) Clark, W.G., 1978 — Estimation of stock size from trawl surveys. IOP/TF-REM/33(NOR)/78/3, 1-3

(5) Damle, V.G., and R.D. Paralkar 1970 — Design of 17.5 m Jheenga type stern trawler, Proc. of the symposium on Development of Deep Sea Fishing. Spl. pub. Ministry of Agriculture, Govt.of India, 188-194

(6) George, P.C., B.T. Antony Raja and K.C.George 1977 — Fishery Resources of the Indian Economic Zone. Sov. Integrated Fisheries Project, Cochin. Silver jubilee celebrations, 79-116.

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

(8) _____ 1974 — Demersal fisheries resources off the north west coast of India. Bull. Expl. Fish. Proj. No.1, 1-45

(9) Joseph, K.M., N.Radhakrishnan and K.P.Philip 1976 — Demersal fisheries resources off the south west coast of India. Ibid.3, 1-56

(10) Joseph, K.M., N.Radhakrishnan, Antony Joseph and K.P.Philip 1976 — Results of the demersal fisheries resources survey along the east coast of India - 1958-74. Ibid.5, 1-53

(11) Krishnamoorthy, B. 1974 — An assessment of the demersal fishery resources off the Andhra-Orissa coast based on exploratory trawling. Indian J. Fish. 21(2), 557-565

(12) Oknoski S.L. 1972 — Measurement of the horizontal opening of the trawl. Proceedings of the IPFC 13th session (3), 333-339

(13) Raghuram, T.S. 1970 — Performance of the 17.5 m fishing trawler. Proc. Symposium on Development of Deep Sea Fishing, Spl. pub. Ministry of Agriculture, 193-187.

(14) Samson, P.A. 1970 — Manner of functioning of the west coast consortium of ship builders, Ibid. 179-182

(15) Silas, E.G., S.K. Dharmaraja and K.Rangarajan 1976 — Exploited marine fishery resources of India. Bull. Cent. mar. Fish. Inst., No.27, 1-25

(16) Tom Wray 1980 — Flume Tank Report. Fishing News International. 19(10) 68-71

(17) _____ 1980 — Greenland fishermen test out their prawn trawls, Ibid. 19(12) 54-55

Annexure - I

Specification of a 17.5 m vessel

A. Dimensions

1. Length overall	(m)..	17.5
2. Length bet. pp	(m)..	16.25
3. Breadth	(m)..	5.5
4. Draft	(m)..	2.5

B. Propulsion

1. Type of main engine	..	Kirloskar/MAN; 6 cylinders
2. Engine rating	..	200 BHP at 1000 r.p.m.
3. Auxiliary engines	..	Kirloskar JV 2, 13 BHP at 1500 r.p.m.
4. Speed	..	8.75 knots

C. Navigational equipment

1. Radio direction finder	..	Model Robertson
2. SSB Transreceiver	..	Model NS - 6 Furuno

D. Fish finding equipment

1. Echo sounder	..	2 Nos. Model 861 - C 2. Mark II Furuno & 850 - C Furuno
2. Net recorder	..	Model: Furuno FNR - 2

E. Fish hold capacity (Non-refrigerated)	..	35.05 M^3

F. Main bunkers

1. Fuel tank	..	7.71 M^3
2. Fresh water	..	3.1 M^3
G. Gross Registered Tonnage	..	56.8 tonnes.
H. Net Registered Tonnage	..	26.51 tonnes.
I. Endurance	..	6 days
J. Accommodation	..	10 berths

Annexure II

Details of construction of 17.5 m vessels

Building yard	Vessel	Year Built
Garden Reach Workshop Calcutta	Meena Tarangini	1971
" "	Meena Saudagar	1971
" "	Meena Jawahar	1970
" "	Meena Shodak	1970
" "	Meena Gaveshak	1971
" "	Meena Sitara	1970
Mazagon Dock Ltd., Bombay	Meena Sangrahak	1969
" "	Meena Udyog	1970
" "	Meena Prayas	1969
" "	Meena Khojini	1969
" "	Meena Utpadak	1969
" "	Meena Niryantak	1970
Central Inland Water Transport Co. Calcutta	Meena Grahi	1973
" "	Meena Prasarak	1973
" "	Meena Sachetak	1971
Shalimar Works, Calcutta	Meena Prapi	1975
" "	Meena Pradata	1978
Hooghly Docks, Calcutta	Meena Anaveshak	1973
" "	Meena Ayojak	1973
Rajabhoja Docks, Calcutta	Meena Netra	1973

ANNEXURE III

LIST OF COMMERCIALLY IMPORTANT SPECIES OF FISH WITH COMMON ENGLISH NAME AND LOCAL NAME OCCURING IN THE TRAWL CATCHES ALONG THE EAST AND WEST COAST OF INDIA

Variety/Scientific name	Common English name	Local name(s)
1. Elasmobranchs		
Scolidon spp.	Sharp nosed shark	Pal sravu/sor Mushi
Zygenena malieus	Hammer headed shark	Madhayan/Kauar
Pristis spp.	Saw fish	Kompan sravu/Mali
Rhinobatus sp	Skate	Ranjis/Kalpoonth
Rhynchobatus sp.	Skate	Ranjis/Kalpoonth
Aetobatus narinari	Eagle ray	Kaka Thirandi/Bolod
Mobula sp.	Devil ray	Thirandi
Dasyatis sp.	Sting ray	Thirandi/Pakat
2. Sciaenids		
Pseudosciaena diacanthus	Jew fish	Ghol
Otolithoides brunneus	Jew fish	Koth
Sciaena spp.	Jew fish	Dhoma
3. Clupeids		
Sardinella longiceps	Indian oil sardine	Mathi/Tarli
Sardinella spp.	Lesser sardine	Karichala/Pedwa
Anchoviella indica	Indian anchovy	Netholi
4. Pomfret		
Pampus argenteus	Silver pomfret	Velutha Avoli/ Saranga paplet
Parastromateus niger	Black pomfret	Halwa/Machon
5. Perches		
Epinephelus spp.	Perch	Pulli kelava
Pristipomoides typus	Perch/Sharp toothed bass	Vellameen
6. Seer fish		
Scomberomorus commerson	Barred spanish mackerel	Iswan/Surmai
Scomberomorus guttatus	Spotted spanish mackerel	Iswan/Surmai
Scomberomorus lineolatus	Streaked spanish mackerel	Iswan/Surmai
7. Cat fish		
Tachysurus spp.	Cat fish	Shingada/koori

Variety/Scientific name	Common English name	Local name(s)
8. Eel		
Murenosox spp.	Eel	Vam/Vlanku
9. Karkara		
Pomadasys hasta	Silver grunter	Karkara
10. Ribbon fish		
Trichurus lepturus	Ribbon fish	Buga/Pampada
Lepturacanthus savala	Ribbon fish	Wagti/Pampada
Eupleurogrammus muticus	Ribbon fish	Wagti
11. Sea bream		
Argyrops spinifer	Sea bream	Palu
12. Carangids		
Caranx spp.	Carangids	Vatta
Decapterus russelli	Thread fin	Shitap
13. Dagol		
Chorinemus spp.	Queen fish	Dagol
14. Polynemids		
Eleutheronema tetradactylum	Indian salmon	Rawas
Polydactylus indicus	Monk fish	Dara
Polynemus spp.	Thread fin	Shende
15. Mackerel		
Rastrelliger kangurta	Mackerel	Bangada/Ayala
16. Nepiterids		
Nemipterus spp.	Thread fin bream	Kilimeen/Rani fish
17. Others		
Sphyraena spp.	Barracuda	Seclavu
Saurida spp.	Lizard fish	Chor bombil/Arana Meen
Mene maculata	Moon fish	Chand/Kannadi Karal
Chirocentrus dorab	Dorab/Silver bar	Karli/Mullu vala
Drepane punctata	Moon fish	Chand
Lactarius lactarius	Butter fish	Parava/Pervi
Stolephorus spp.	White bait	Netholi
Anchoviella spp.	Anchovy	Netholi
Pellona spp.	Shad	Kati
Leiognathus spp.	Silver belly	Karal/katiati Mullan
Lutjanus malabaricus	Red snapper	Chempalli/Tamp
18. Squids & cuttle fish		
Loligo spp.	Squid	Kanava
Sepia spp.	Cuttle fish	Kallu Kanava/Makul
19. Prawns		
Penaeus indicus	White prawn	Naran/kolambi
Penaeus monodon	Tiger prawn	Karachemmeen/Kolambi
Metapenaeus spp.	Prawn	Kazhanthan/poovalan/ Jheenga
Parapenaeopsis stylifera	Prawn	Karikkadi

Annexure - IV

Intensity of sampling (hrs) by the 17.5 m trawlers during 1972 - '80

Region/ Year	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
KANDLA/ PORBANDAR	75	204	517	475	757	582	779	997
BOMBAY	257	255	728	1105	1274	744	701	570
GOA	-	681	1227	1992	1778	1139	816	769
MANGALORE	-	1054	1108	1923	2014	1346	1206	1016
COCHIN	1809	1348	1390	1578	694	839	1466	1242
TUTICORIN	707	653	1035	1395	1637	1524	843	1322
MADRAS	453	1187	1540	1135	1271	830	537	94[illegible]
VISAKHAPATNAM	325	1344	1605	1649	1488	1199	1142	1239
PARADEEP/CALCUTTA	319	17	782	1355	995	666	758	1295
TOTAL	3945	6743	9932	12607	11908	8869	8248	9390

Annexure V

Catch per hour (Kg) obtained by the 17.5 m trawlers during 1972 - '80

Region/ year	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
KANDLA / PORBANDAR	161	157	114	121	135	98	72	105
BOMBAY	129	88	81	98	118	104	65	123
GOA	-	131	97	112	115	143	166	95
MANGALORE	-	141	82	136	88	53	69	94
COCHIN	217	115	82	142	131	143	133	126
TUTICORIN	159	79	87	71	93	111	87	107
MADRAS	127	150	128	159	125	109	65	82
VISAKHA-PATNAM	111	75	90	64	94	102	67	44
PARADEEP/CALCUTTA	120	276	288	260	236	142	124	96