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Cover photo: New Ferry Wharf Jetty in Bombay.

INDEBTEDNESS AND UTILISATION OF FISHERIES CREDIT IN SAKTHIKULANGARA AND NEENDAKARA, KERALA — A CASE STUDY

R. Sathiadhas and G. Venkataraman

Majority of the fishermen of our coastal villages continue to be poor even though higher income has been generated among them by way of modernisation of fishing crafts and gears, mechanisation of indigenous boats and introduction of synthetic nets. The credit facilities that have been extended to them under the successive Five Year Plans steadily increased. However this has not resulted in any significant improvement in the standard of living of the majority of fishermen who continue to be in debt and in the grip of money lenders. In this context, it was felt desirable to carry out case studies regarding the state of indebtedness of fishermen and utilization of finance given to them in order to find out the maladies and suggest remedial measures in respect of credit facilities extended to them.

Sakthikulangara and Neendakara are two important fishing villages in Quilon district of Kerala state. Fishermen form majority of the population in these two villages where, in recent years, with the introduction of mechanised boats, there has been a great advance in the fisheries sector. This has led to the development of infrastructure facilities in this area like establishment of ice factories, cold storage plants and workshops for the repair of mechanised boats. The investment made here in this sector is far higher than in most of the other fishing centres and hence credit plays a vital role in their economy. Most of the fishermen in Sakthikulangara are engaged in mechanised fishing while in Neendakara it is otherwise, non-mechanised fishing being dominant. As the quantum of credit requirements and pattern of utilization differ between these two places, they were selected for the present studies. An account about the indebtedness of fishermen of this area during fifties and sixties was given by Asari T.R.T. and M.D. Menon in 1963. A detailed study of the socio-economic development that has taken place in this area is given in *Marine Fisheries Information Service No. 29, 1981* by Sathiadhas and Venkataraman. The present account dealing with the state of indebtedness is in continuation of the earlier studies carried out.

The objectives of this study are: (i) to find out the extent of indebtedness among the fishermen of Neendakara and Sakthikulangara (ii) to assess the role of Institutional and non-Institutional credit agencies in providing finance to the fishermen of this area and (iii)

to examine the utilization of credit by fishermen of different income groups and compare the percentage contribution of their annual income towards payment of interest.

All the fishermen households of Neendakara and Sakthikulangara have been included in this investigation. A questionnaire was formulated to collect relevant information keeping in view the main objectives of this study. Before the actual data collection, pretesting of the questionnaire was done and it was suitably modified. Data were collected during March-May 1980 by visiting the houses and interviewing the heads of the families. The annual income mentioned in this study is the net income of the households from their respective occupations and other assets.

Extent of Indebtedness

Out of 429 families in Neendakara 263 (61 per cent) are in debt and out of 1,209 families in Sakthikulangara, 770 (64 per cent) are in debt. The total debt incurred by the fishermen families of Neendakara and Sakthikulangara worked out to 17.5 and 229.2 lakhs respectively. The average outstanding debt per indebted household in Neendakara and Sakthikulangara worked out to be Rs. 6,671 and Rs. 29,766 respectively.

Supply of Fisheries Finance

The availability of credit is an essential requirement to the people of this area engaged in fishing and fishery related activities for the purchase of mechanised and non-mechanised crafts, engines for boats, transport vehicles (ordinary as well as refrigerated/insulated vans), setting up of processing units of various types such as cold storages and ice plants, construction of godowns, peeling sheds, boat building yards and establishment of service and repair centres. The sources of finance are commercial banks, Kerala Financial Corporation, money lenders and co-operative societies. Of these, Kerala Financial Corporation and commercial banks play a leading role for the supply of credit in this area. Money lenders also form an important source of credit for the fishermen. But the role of co-operative societies in extending credit to fishermen is quite limited. The details of extending credit by different agencies in the aggregate outstanding cash dues of fishermen at Neendakara and Sakthikulangara are given in Table 1.

Money lenders come foremost in respect of the quantum of credit supplied to the fishermen of Neendakara (46 per cent) while commercial banks stand first in this respect in Sakthikulangara (57 per cent). In Neendakara money lenders are followed by banks in respect of supply of credit with 31 per cent, Kerala Financial Corporation with 18 per cent, and the co-operative societies with 3 per cent. Regarding Sakthikulangara, next to banks, 28 per cent of credit is supplied by Kerala Financial Corporation and only 1 per cent by the co-operative societies. The contribution of others such as friends and relatives comes to 2 per cent in Neendakara and 1 per cent in Sakthikulangara.

Role of Credit Agencies

The supply of credit has two important though interdependent dimensions namely the cost or price of credit and the quantity or amount of supply at that price. To the weaker section of the society the credit market is also of dualistic structure composed of formal and informal markets. The fishermen, in many cases, find it difficult to obtain credit from the formal capital market as they are unable to fulfil the conditions imposed by it before extending credit facilities.

Table 2 indicated the extent of credit supplied by different agencies to fishermen households of various income groups at Neendakara and Sakthikulangara. Money lenders are the major source of finance to the lower income group (Rs. 2,500 and below per annum) in both the places, 61 to 72 per cent of the credit needs of this group being met by them. However it is seen that commercial banks have extended higher credit facilities to the fishermen of Sakthikulangara, 30 per cent and 26 per cent respectively when compared with that of the fishermen of Neendakara (4 per cent and 16 per cent respectively) of the lower income group (Fig. 1). In Neendakara the money lenders dominate even in the middle income groups (Rs. 2,500 - 10,000), whereas in Sakthikulangara substantial amount is advanced by the commercial banks to this category though the role played by money lenders is still significant. In Neendakara also the credit facilities extended by commercial banks to the fishermen belonging to middle income group is of a higher order (19 per cent and 37 per cent) compared to what has been observed in respect of lower income groups at this place. More than 87 per cent of the amount advanced by the commercial banks are for the purchase of mechanised boats, a loan of Rs. 90,000 being advanced for the purchase of a single boat. It may be seen that fishermen of Neendakara belonging to the higher income groups (Rs. 10,000 and above), whose number is very limited did not resort to money lenders for their

credit needs as the same was met by the commercial banks (30 per cent) and Kerala Financial Corporation (70 per cent). However in Sakthikulangara, a good percentage of the credit is supplied by money lenders in addition to what has been obtained from banks and Kerala Financial Corporation. A significant feature noted is that the Kerala Financial Corporation supplied credit only to those who earn more than Rs. 5,000 per annum. This can be attributed to two factors, one being the fishermen having an income of Rs. 5,000 and above go in more for higher investments mostly for purchase of crafts and gears for which preference is given and the other being these fishermen are in a better position to fulfil the terms and conditions laid by the Kerala Financial Corporation.

The interest rate charged by money lenders in Neendakara is in the range of 24 to 60 per cent and in Sakthikulangara 24 to 48 per cent. For more than 60 per cent of the loan advanced by money lenders, the interest charged is 36 per cent. The rate of interest charged by the commercial banks ranges from 11.5 per cent to 15 per cent. The rate of interest charged by the co-operative societies ranges from 12 per cent to 18 per cent and the Kerala Financial Corporation charges 11.5 per cent.

In addition to the professional money lenders, some boat owners also give loan to their crew apart from wages paid to them. Of the loan received by the lower income group from the money lenders as much as 80 per cent comes from boat owners and the rest from professional money lenders. The loan amount ranges from Rs. 1,000 to Rs. 3,000 depending upon the talent and experience of the workers and this is given on condition that he would work for him at least for an year. The boat owners used to charge interest of only 12 per cent for the loan and this lower rate of interest is compensated by paying comparatively lesser wages. The workers are bound to repay the whole loan with interest whenever they want to leave the concerned boat. In effect the majority of workers availing this facility are forced to continue their work under the same boat owner even if the working conditions are not satisfactory.

There are also some boat owners who took loans from the agents of processing plants on the condition that they would be giving prawns and other exportable items only to them. The agents recovered part of the loan when buying the catch at price fixed by them.

Demand for Credit

The utilization of credit for different purposes by the fishermen of Neendakara and Sakthikulangara is

given in Table 3. The loans taken for purchase and repairing of crafts and gears, purchase of land and gold ornaments, construction and maintenance of house buildings and working capital for business are considered for investment purposes. The amount taken for household expenditure during the lean season, expenditure on social and religious functions, medical treatment and for expenses on miscellaneous items are considered for consumption purposes.

It is observed that in Neendakara 62 per cent of the loan is utilised for investment as against 90 per cent in Sakthikulangara. In Sakthikulangara the bulk of the loan (79 per cent) is being utilised for the purchase of crafts and gears as against only 31 per cent in Neendakara. 18 per cent of the loans in Neendakara and 8 per cent in Sakthikulangara is used for the purchase of land and gold ornaments and construction and maintenance of house buildings. The amount taken for household expenditure during lean season is as high as 15 per cent in Neendakara as against only 1 per cent in Sakthikulangara. For social and religious functions 12 per cent and 7 per cent of the loan is utilised by the fishermen of former and latter respectively. While the people of Neendakara spent as much as 6 per cent of the loan towards medical expenditure, the people of Sakthikulangara only 1 per cent towards the same.

Consumption and Investment

Proportion of credit requirement for consumption and investment purposes by various income groups is given in Table 4. It is seen, in both the villages that lower the income, higher is the loan amount spent for consumption purposes and vice-versa. In Neendakara fishermen belonging to the lower income group (Rs. 2,500 and below) spent 9.5 per cent of the loans received towards investment purposes whereas in Sakthikulangara the same is 24 per cent. However in the middle income group (Rs. 2,500 - 10,000) the investment expenditure is more or less of the same order in both the places. In both the places in the higher income group (above Rs. 10,000) the diversion of credit towards consumption purposes is mainly towards social functions especially marriage.

Indebtedness, Income and Interest

The average debt, annual income and the amount to be paid as interest annually per household in different income groups are worked out and presented in Table 5 for Neendakara and Sakthikulangara.

It is seen that in both these places the average debt is more in the middle and higher income groups. This could be attributed to their going for higher

investments in mechanised boats and for infrastructure facilities. The average debt in general, was found to be higher than their average annual income with a few exceptions for all the income groups.

A significant feature noted was that out of 166 families not in debt in Neendakara 31 per cent of them come from lower and 69 per cent from middle income groups. In Sakthikulangara out of 439 families not in debt 29 per cent come in lower, 69 per cent in middle and only 2 per cent in higher income groups. The lower and middle income groups are also paying greater interest rates than the higher income groups. The overall interest rates paid by the fishermen belonging to lower income groups are 24 and 26 per cent, middle income groups 20 and 18 per cent and higher income groups 12 and 14 per cent in Neendakara and Sakthikulangara respectively. The lower and middle income groups paying higher rate of interest due to their greater dependence on money lenders as compared to higher income groups who mostly depend on Institutional credit.

It is observed that 48 per cent of the annual income of a fishermen household of Sakthikulangara is spent for payment of interest while in Neendakara it is 41 per cent. The burden of debt falls more on the middle and lower income groups than on higher income groups. The fishermen of Sakthikulangara despite their higher level of earnings paid a greater percentage of their income towards interest as compared with those of Neendakara as the average indebtedness of the former is higher than that of the latter.

Conclusion

The average annual income of fishermen households in Neendakara worked out to Rs. 3,529 and Rs. 6,420 in Sakthikulangara. 61 per cent of the fishermen households in the former and 64 per cent of the latter are in debt. Total debt incurred by their families amounted to Rs. 17.5 lakhs in Neendakara and 229.2 lakhs in Sakthikulangara. The average outstanding debt per indebted household worked out to Rs. 6,420 in Neendakara and Rs. 29,766 in Sakthikulangara. 41 per cent of the annual income of the fishermen of Neendakara and 48 per cent of Sakthikulangara go for payment of interest for their loans.

Till recent past the fishermen of this area were almost entirely dependent on the money lenders for their credit requirements. Of late Institutional agencies have come into the picture and been advancing loans to the fishermen of this area. However they are able to

Table 1. Loan advanced by different agencies

Source of credit	Amount advanced (Rs.)	
	Neendakara	Sakthikulangara
Money lenders	8,00,150	65,27,550
Banks	5,46,600	1,30,55,330
Co-operative society	52,100	1,69,200
Kerala Financial Corporation	3,25,000	29,31,300
Others	30,600	2,36,600
Total	17,54,450	2,29,19,980

provide only 52 per cent of the credit needs of the fishermen of Neendakara and 68 per cent of Sakthikulangara. The rest of the credit needs are still met by the money lenders at higher rate of interest. This is specially seen in the case of fishermen belonging to the lower income groups. Hence Institutional agencies should play a greater role in meeting the credit requirements of the fishermen of this area with particular reference to the lower income groups. They are unable to avail the credit facilities from Institutional agencies to a greater extent as they are not in a position to fulfil the terms and conditions laid by them for extending loans. Some relaxation in the conditions should be thought of so that they can also avail the facilities to a higher extent.

Differences in the utilisation of loan amounts has been noticed between these two places. While as much as 90 per cent of the credit in Sakthikulangara goes for investment purposes, the same in the case of Neendakara comes to only 63 per cent. This is due to the diversion of more funds by the people of the latter towards consumption purposes. So there is need to motivate the people of Neendakara to go in more for investment purposes. In this regard extension workers have a greater role to play.

The establishment of a Fisheries Bank at Sakthikulangara just in the pattern of Rural Banks of

Table 4. Proportion of utilization of credit for consumption and investment purposes by various income groups.

Income Group	Neendakara		Sakthikulangara	
	Consumption	Investment	Consumption	Investment
1200 & Below	100	—	98	2
1201 - 2500	81	19	54	46
2501 - 5000	40	60	50	50
5001 - 10000	27	73	17	83
10001 - 20000	7	93	3	97
20001 - 30000	—	100	4	96
30001 - 50000	—	—	3	97
Above 50000	—	—	—	100

Agricultural sector will go a long way to eliminate the money lenders and meet the credit requirements of the fishermen in this area. A Fishermen Co-operative Marketing Federation may be started here, which should not only help supplying materials for fishing activities but also help the fishermen in post harvest operations such as handling, processing, storage and marketing. The co-operative societies should be revitalised keeping in view the lower income groups who are the unfortunate prey of the money lenders, by supplying craft and gears to a group of 6 or 7 persons and the recovery be made through easy instalments.

Sakthikulangara is one of the biggest fish landing centres in India and the fishing activities will increase in this area with the coming up of Fisheries Harbour and the expansion of infrastructure facilities in the coming years. On account of these, the credit requirements of the fishermen of this area will increase. In this context, an integrated approach by the various Institutional agencies such as financial and welfare corporations of State, banks and co-operatives for supply of credit to fishermen of this area will go a long way in the growth of the fisheries sector.

The authors are thankful to Shri. T. Jacob, Scientist S-3 and Shri. K.K.P. Panikkar, Scientist S-1 for their valuable suggestions and comments.

Table 2. Supply of credit by different agencies to fishermen of various income groups

Supply of credit by different agencies (Rs.)													
Income groups (Net income per annum in Rs.)	Money Lenders		Banks		Co-operative Society		Kerala Financial Corporation		Others		Total		
	N	S	N	S	N	S	N	S	N	S	N	S	
1200 & below	4800 (61)	56250 (66)	300 (4)	26050 (30)	700 (9)	—	—	—	—	2050 (26)	3500 (4)	7850 (100)	85800 (100)
1201-2500	137050 (70)	230450 (72)	31250 (16)	84900 (26)	15050 (8)	1000 (—)	—	—	—	12400 (6)	6000 (2)	195750 (100)	322350 (100)
2501-5000	278600 (72)	958350 (54)	72400 (19)	792760 (44)	24650 (6)	11000 (1)	—	—	—	11750 (3)	9900 (1)	387400 (100)	1772010 (100)
5001-10000	379700 (45)	1951000 (35)	332650 (37)	2958600 (54)	11700 (2)	6200 (—)	125000 (15)	544300 (9)	—	4400 (1)	137200 (2)	853450 (100)	5597300 (100)
10001-20000	—	2222500 (26)	10000 (9)	5202120 (61)	—	151000 (2)	100000 (91)	849000 (10)	—	—	80000 (1)	110000 (100)	8504620 (100)
20001-30000	—	588000 (23)	100000 (50)	1576600 (60)	—	—	100000 (50)	442000 (17)	—	—	—	200000 (100)	2606600 (100)
30001-50000	—	421000 (14)	—	1614300 (53)	—	—	—	1011000 (33)	—	—	—	—	3046300 (100)
Above 50000	—	100000 (10)	—	800000 (81)	—	—	—	85000 (9)	—	—	—	—	985000 (100)

Note: 1. "N" denote Neendakara and "S" denote Sakthikulangara.

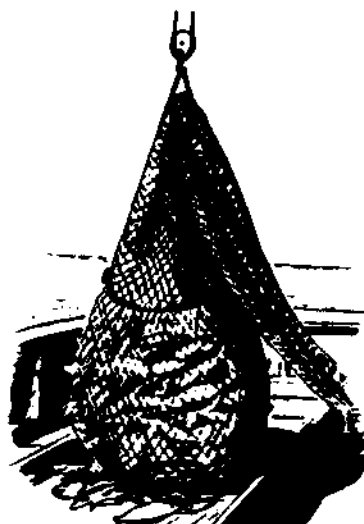
2. Figures in brackets indicate percentage of credit received by each income group in "N" and "S".

Table 3. Percentage utilization of credit for different purposes

Purpose	Percent utilization of loans	
	Neendakara	Sakthikulangara
I. INVESTMENT		
1) Purchase of crafts and gears	31	79
2) Repairing crafts and gears	6	1
3) Construction and maintenance of house buildings	11	6
4) Purchase of land and gold ornaments	7	2
5) Working capital for business	7	2
II. CONSUMPTION		
1) Household expenditure during lean season	15	1
2) Expenditure on social and religious functions	12	7
3) Medical expenditure	6	1
4) Miscellaneous	5	1

Table 5. Details of household income, indebtedness and interest in Neendakara (N) and Sakthikulangara (S).

Particulars		Income Group (Rs.)							
		1200 below	1201-2500	2501-5000	5001-10000	10001-20000	20001-30000	30001-50000	Above 50000
Total No. of households	N	12	128	205	80	2	2	—	—
	S	62	197	470	299	118	28	30	5
No. of households in debt	N	8	81	109	61	2	2	—	—
	S	34	97	264	202	112	27	29	5
Percentage households in debt	N	67	63	53	86	100	100	—	—
	S	55	49	56	67	95	96	97	100
Average debt of indebted households	N	981	2417	3554	24090	55000	100000	—	—
	S	2524	3323	6712	30755	75934	96541	101543	197000
Average annual income of the indebted household	N	1100	2000	3750	8000	15000	26000	—	—
	S	1150	22200	3800	8500	18570	28340	45300	135000
Annual interest to be paid	N	221	592	885	4700	6350	11750	—	—
	S	713	825	1458	5397	10632	14423	15044	27155
Percentage of interest to be paid from income	N	20	30	24	59	42	45	—	—
	S	62	38	38	63	57	51	33	20



BY-CATCH OF SHRIMP TRAWLERS IN GREATER BOMBAY*

Introduction

With the introduction of mechanized trawling operations, Maharashtra, with a coast line of 720 km, occupies an important place in the export oriented prawn fishing industry of India. The state stands second in penaeid prawn landings with an annual average (1971-80) of 27,000 tonnes, contributing to 25% of the all-India catch of penaeids.

Traditionally, the penaeid prawns have been caught by fixed bag nets "Dol". But during the last two decades, shrimp trawling has made rapid strides to contribute to bulk of its production. As in other areas, at Bombay also along with prawns large quantities of fishes both quality as well as cheaper fishes are landed as by-catch, a general report of which has appeared in these columns (Mar. Fish. Inf. Ser. T & E Ser. 28, 1981).

Sassoon Dock and New Ferry Wharf are two important bases in Greater Bombay for commercial trawling. The present account attempts to give a picture of the trawl fishery with special reference to prawns and by-catches during 1979-82.

The primary data were collected by the technical staff of the fishery resources assessment division. The manuscript was critically gone through by Dr. M.J. George. The authors record their thanks to them.

Craft and gear

Wooden boats of about 13.5 m in length with fish hold and fitted with 80 to 100 H.P. engines operate from these two bases. The number of boats operating from New Ferry Wharf is about 200-250, whereas from Sassoon Dock it is about 250 to 300. However, the duration of fishing operations differs. At Sassoon Dock, the absence from port is from 24 to 48 hours with actual fishing of 16 to 24 hours. At New Ferry Wharf, the absence lasts from 45 to 60 hours of which 32 to 36 hours are spent in actual fishing. Mostly boats belonging to Gujarat fishermen operate from the latter centre.

Fishing grounds extend from Ratnagiri in the South to Dahanu in North (17°-20°N and 72°-73°E). Some times the boats from New Ferry Wharf operate beyond Dahanu also. All the boats use 16 to 23 m otter trawl with head rope of varying length and cod end mesh of 25 mm.

Fishing season

At New Ferry Wharf the fishing season lasts from September to May. From June to August the fishing operations are suspended because of the rough sea conditions due to S.W. monsoon. At Sassoon Dock, the fishing season is identical but for the fact that during the monsoon period also some trawlers are operated in the nearshore waters.

Fishery

Total landings for both the centres varied from 38041.2 tonnes in 1979-80 to 42682.9 tonnes in 1981-82. The total landing for the entire period was 122921.7 tonnes (Table I) of which prawns constituted 31.3%. The by-catch contributed to the rest.

New Ferry Wharf

This centre accounted for 47.4% of the total landings. The catch varied from 17157.6 to 22751.7 tonnes during 1979-80 and 1980-81 respectively (Table I). The catch/fishing trip correspondingly ranged from 895.6 to 1128.5 kg during the same period. The prawn component was 33.1% (Table II).

Monthly variations in effort, catch and CPUE were observed during all the years (Fig. I). During 1979-80 the catches showed a fluctuating pattern with a pronounced peak in December. In the following year a steady increase in the catch was noticed upto December. The catch declined there after except for a secondary peak in April. During 1981-82 the fishery showed an upward trend upto January after which it gradually declined. The highest CPUE was seen coinciding with the maximum catch except during 1980-81 when the peak of CPUE occurred in November.

Sassoon Dock

This centre accounted for 52.6% of the total landing. The catch ranged from 19446.0 tonnes (CPUE 856.8 kg) during 1980-81 to 24326.5 tonnes (CPUE 1052.0 kg) during 1981-82 (Table I). Prawns constituted 29.6% on an average.

Month-wise, the catch revealed an upward trend till October. In the next year the catch showed wide fluctuations till March after which a gradual decline was observed. The best catch was in August. A secondary peak occurred in March and later in November. The following year also experienced wide variations in catch

* Prepared by Chakraborty S.K., Deshmukh V.D., Kuber Vidyasagar and Ramamurthy S. (in alphabetical order).

TABLE I

Catch in tonnes and cpue in kg.

Year	New Ferry Wharf			Sassoon Dock			Total		
	Effort (trips)	Catch	Catch/ Effort Kg.	Effort (trips)	Catch	Catch/ Effort Kg.	Effort (trips)	Catch	Catch/ Effort Kg.
1979-80	19159	17157.6	895.6	21572	20883.6	968.1	40731	38041.2	933.96
1980-81	20252	22751.7	1128.5	22697	19445.9	856.8	42949	42197.6	982.5
1981-82	19398	18356.4	946.3	23106	24326.5	1052.8	42504	42682.9	1004.21
Total	58809	58265.7	990.78	67375	64656.0	959.6	126184	122921.7	974.15
Average	19603	19421.9	990.7	22458	21552.0	959.6	42061	40973.9	974.15

TABLE II

Year-wise catch composition of different categories of fishes and their percentages in parenthesis at New Ferry Wharf

	1979-80	1980-81	1981-82	Average	Rank
Elasmobranch	1747.95 (10.19)	1014.22 (4.46)	971.32 (5.30)	1244.50 (6.41)	6
Eels	186.41 (1.09)	362.11 (1.60)	2086.93 (11.37)	878.48 (4.52)	7
Cat fishes	1198.08 (6.98)	499.81 (2.20)	851.65 (4.64)	849.85 (4.38)	8
Nemipterus	623.43 (3.63)	319.6 (1.40)	411.23 (2.24)	451.42 (2.32)	10
Sciaenids	2930.45 (17.08)	3167.74 (13.92)	2339.12 (12.74)	2812.44 (14.48)	2
Ribbon Fishes	1651.62 (9.63)	1984.85 (8.72)	1712.89 (9.33)	1783.12 (9.18)	4
Quality Fishes	1839.44 (10.72)	963.48 (4.24)	940.5 (10.57)	1581.14 (8.14)	5
Prawns	5327.21 (31.05)	8801.13 (38.68)	5175.88 (28.2)	6434.74 (33.13)	1
Other Crustaceans	251.95 (1.47)	291.59 (1.28)	229.32 (1.25)	257.62 (1.33)	11
Cephalopods	849.16 (4.95)	493.43 (2.17)	698.27 (3.80)	680.29 (3.50)	9
Miscellaneous	551.87 (3.21)	4853.77 (21.33)	1939.27 (10.56)	2448.30 (12.61)	3
TOTAL	17157.57 (100.00)	22751.73 (100.00)	18356.38 (100.00)	19421.90 (100.00)	

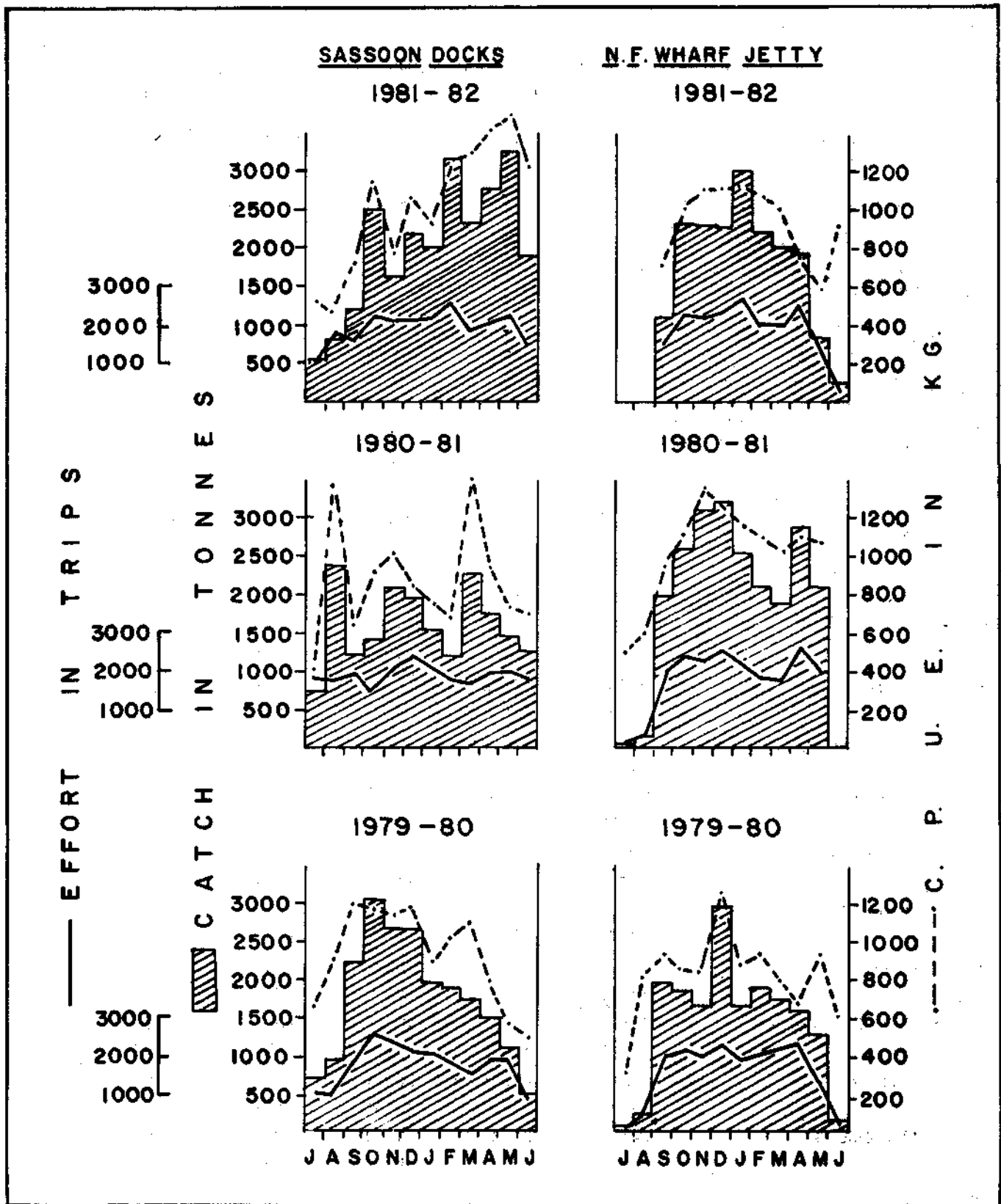


Fig. 1. Seasonal variations of catch, effort and C.P.U.E. at New Ferry Wharf and Sassoon Dock.

with three periods of abundance in October, February and May in the increasing order. The CPUE also showed more or less similar fluctuations with the peak occurring mostly during March and May (Fig. 1).

Catch composition

The catch has been grouped into prawns and the rest as by-catches consisting of fishes, cephalopods and other crustaceans (Plate I). The estimated catch of the various groups and their percentage composition at the two centres is given in Table II and III to show their annual variations.

By-catch

Fishes contributed to 62% and 64.5% respectively at New Ferry Wharf and Sassoon Dock. These are represented by a number of groups of species whose month-wise and species-wise fluctuations are given in Fig. 2 and 3.

Elasmobranchs: Although occurring throughout the year, they were most abundant during October to January. During March and April also they were common in the catches. Exceptionally high catch of 809 tonnes was netted in March 81 from Sassoon Dock

TABLE III

Year-wise catch composition of different categories of fishes and their percentages in parenthesis at Sassoon Dock

	1979-80	1980-81	1981-82	Average	Rank
Elasmobranch	1309.52 (6.32)	2113.30 (10.86)	1164.53 (4.78)	1529.11 (7.09)	7
Eels	140.17 (0.67)	72.49 (0.37)	107.59 (0.44)	106.75 (0.49)	11
Cat fishes	1865.42 (8.93)	1478.86 (7.60)	2633.71 (10.82)	1992.66 (9.24)	3
Nemipterus	1744.16 (8.35)	700.16 (3.6)	2501.52 (10.28)	1648.62 (7.64)	5
Sciaenids	3611.21 (17.29)	4894.35 (25.16)	3352.00 (13.77)	3952.52 (18.33)	2
Ribbon Fishes	1540.23 (7.37)	1430.05 (7.35)	1983.03 (8.20)	1651.10 (7.66)	4
Quality Fishes	2052.80 (9.82)	587.88 (3.02)	2178.37 (8.95)	1606.35 (7.45)	6
Prawns	6642.32 (31.8)	6127.47 (31.51)	6359.25 (26.14)	6376.34 (29.58)	1
Other Crustaceans	150.03 (0.71)	91.52 (0.47)	197.16 (0.81)	146.23 (0.67)	10
Cephalopods	983.07 (4.70)	483.61 (2.48)	1882.76 (7.73)	1116.48 (5.18)	9
Miscellaneous	844.84 (4.04)	1466.21 (7.53)	1966.55 (8.08)	1425.86 (6.61)	8
TOTAL	20883.17 (100.00)	19445.93 (100.00)	24326.47 (100.00)	21552 (100)	

comprising of 34.6% of the total catch. The elasmobranchs ranked sixth and seventh in abundance at New Ferry Wharf and Sassoon Dock respectively.

Eels: This group is represented by a single species *Muraenasox telabonoides* locally known as "Wam" and is caught only seasonally. At Sassoon Dock the fishery generally commences from November and continues upto June, whereas the seasonal abundance at New Ferry Wharf was very erratic. At Sassoon Dock, they were abundant in January, December and March-April respectively whereas at New Ferry Wharf the abundance was in May, March-April and January

respectively during 1979-80, '80-81 and '81-82. The eels were relatively more abundant at New Ferry Wharf with an annual average catch of 878.5 tonnes (4.5%). The fishery was exceptionally good at this centre during 1981-82.

Cat Fish: These ranked third in abundance contributing on an average of 9.2% of the catch at Sassoon Dock. At New Ferry Wharf they were far less abundant (4.4%). The fishery, mainly constituted by *Arius dussumieri*, *A. sona* and *Osteogeneosis militarias* was at the peak generally during September-January. However, during 1981-82 it was observed during February-May.

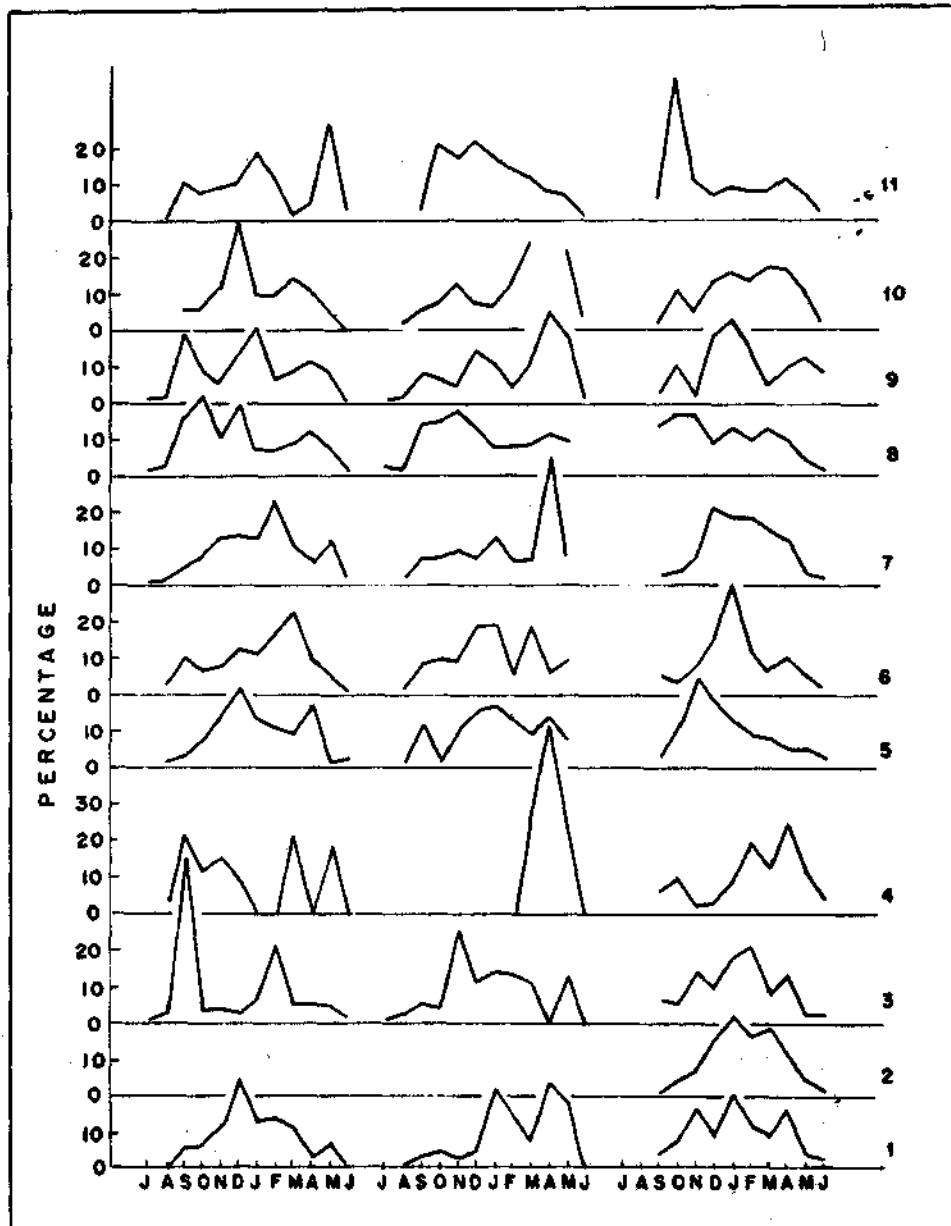


Fig. 2. Distribution pattern of major categories in the shrimp trawl at New Ferry Wharf.
 1. Elasmobranchi 2. Eels 3. Cat fish 4. Nemipterus 5. Sciaenids 6. Ribbon fish
 7. Quality fish 8. Prawns 9. Other crustaceans 10. Cephalopods 11. Miscellaneous

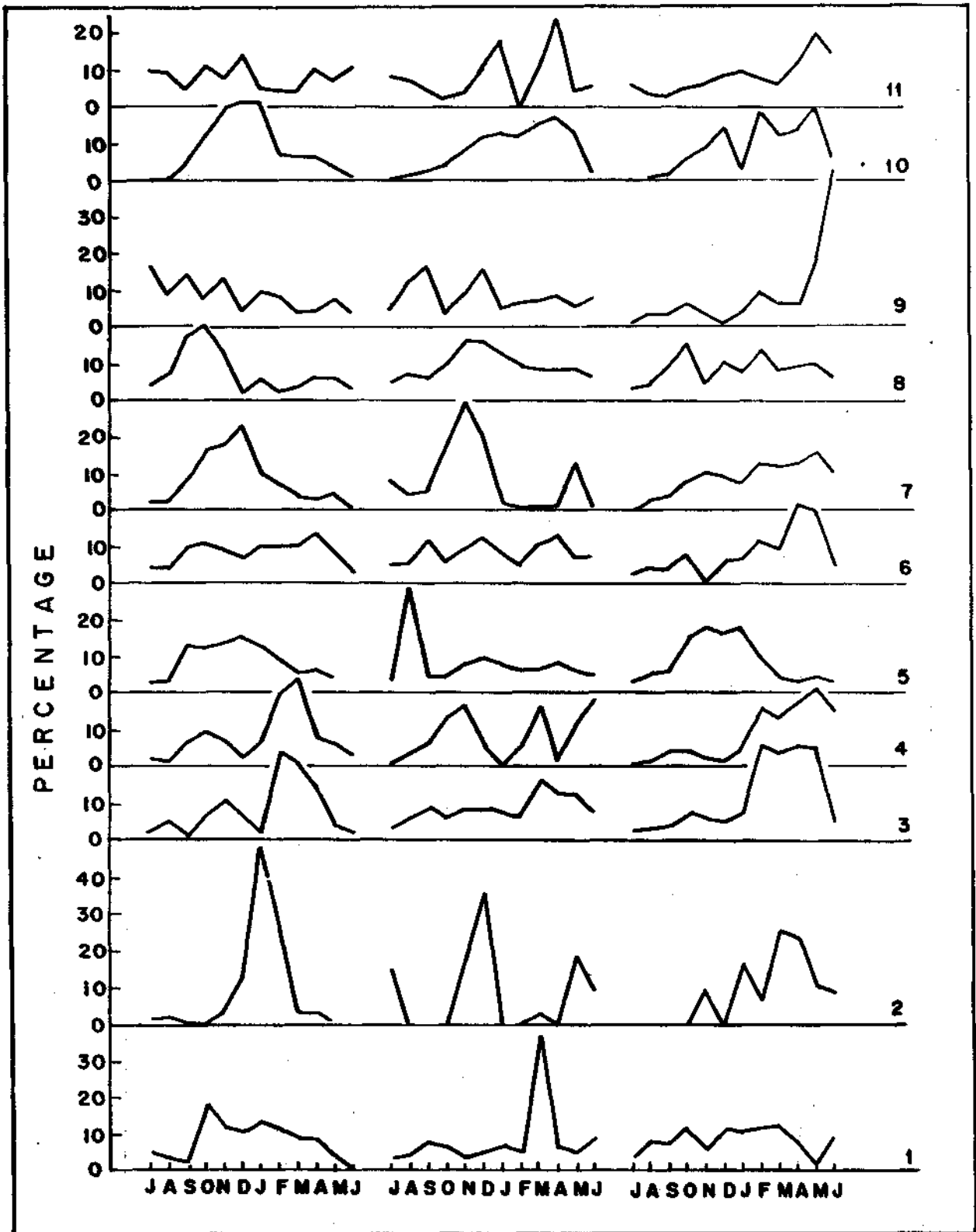


Fig. 3. Distribution pattern of major categories in the shrimp trawl at Sasson Dock.
 1. Elasmobranch 2. Eels 3. Cat fish 4. Nemipterus 5. Sciaenids 6. Ribbon fish
 7. Quality fish 8. Prawns 9. Other crustaceans 10. Cephalopods 11. Miscellaneous.



Catfish



Cephalopods



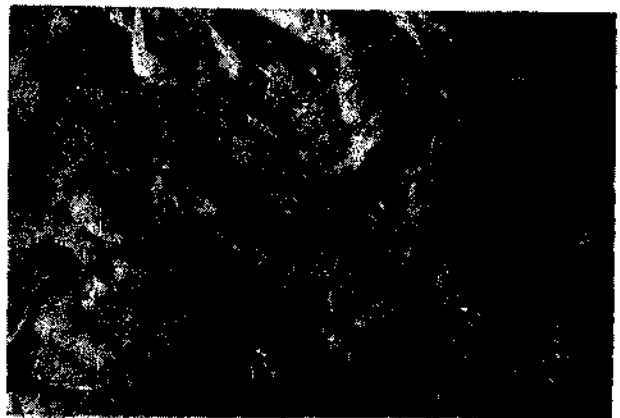
Nibea diacanthus



Lobster



Sciaenids



Prawns

Nemipterus: Locally known as 'Rani' three species viz. *Nemipterus japonicus*, *N. mesoprius* and *N. delo-gooe* occur in the catch, of which the first one is the most abundant. Ranked as fifth in abundance at Sassoon Dock, the average annual catch was estimated to be 1648.6 tonnes forming 7.6%. At New Ferry Wharf the fishery accounted only for 451.4 tonnes forming 2.3%. Generally there appeared to be two periods of abundance, February-May and September-November the former being the maximum.

Sciaenids: Of all the by-catch components, sciaenids are the most abundant group occurring at both the centres almost throughout the year. Locally, known as 'Dhoma', it includes smaller sciaenids. Species in order of abundance are *Johnius macrorhynchus*, *Johniops vogleri*, *Otolithus cuvieri*, *O. ruber* and *Johniops dussumieri*. Average annual catch of this group at New Ferry Wharf and Sassoon Dock was 2812.4 and 3952.0 tonnes forming 14.5% and 18.3% respectively of the total catch. Their abundance at New Ferry Wharf was noticed in December and April, September and January and November and at Sassoon Dock in September and December, August and October-January during 1979-80, 1980-81 and 1981-82 respectively at the two centres.

Ribbon Fish: Locally known as 'Wakti' they are represented by *Trichiurus lepturus* and *T. savala* in the trawl catches regularly. They ranked fourth in abundance at both the centres with mean annual catch of 1783.1 and 1651.1 tonnes at New Ferry Wharf and

Sassoon Dock respectively. Bulk of the catch was obtained during January-April.

Quality Fishes: These include pomfrets, carangids, perches, clupeids, polynemids and *Nibea diacanthus* etc. which, though individually contributed to a small fishery, but as a group occupied fifth place in abundance at New Ferry Wharf (1581.1 tonnes and 8.1%) and sixth place at Sassoon Dock (1606.4 tonnes and 7.5%). Clupeids contributed to 4.7% and 3% at Sassoon Dock and New Ferry Wharf respectively. The other major component among the quality fish was *Nibea diacanthus* (10.6%) at New Ferry Wharf.

Prawns: These form the largest component at both the centres. The mean annual catch was 6434.7 and 6376.3 tonnes with 33.2% and 29.6% of the catch at New Ferry Wharf and Sassoon Dock respectively. The fishery had a peak during October/November and a secondary peak during March/April (Fig. 2 and 3).

Penaeids contributed to the bulk of prawn landings. They were represented mainly by *Parapenaeopsis stylifera*, *Solenocera spp.*, *Metapenaeus affinis* and *M. monoceros*. Other species of minor importance were *M. brevicornis*, *Metapenaeopsis stridulans*, *P. sculptilis* and *Penaeus spp.* Non-penaeids were represented by *Nematopalaemon tenuipes* and *Acetes indicus*. The specise-wise fluctuations of the shrimp catch is given in Fig. 4.

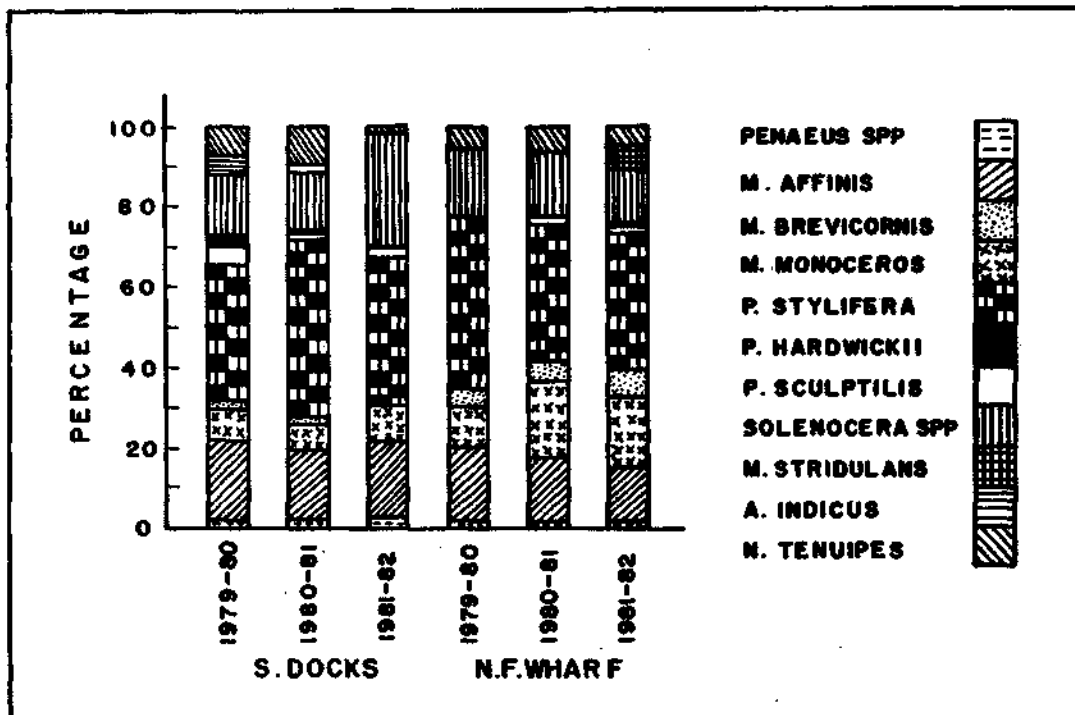


Fig. 4. Annual fluctuations of the species in the shrimp catch.

Other Crustaceans: An average of 257.6 and 146.2 tonnes were landed at New Ferry Wharf and Sassoon Dock respectively, represented by lobsters mainly *Panilurus polyphagus* and *Thenus orientalis* and crabs in negligible quantities. Lobsters were more common during September-December, January and April-May at New Ferry Wharf.

Cephalopods: Locally known as 'Makul', they occurred throughout the year in the trawl catches except during the monsoon months. Represented by squids, *Loligo duvauceli* and cuttle fish *Sepia aculeata* and *S. pharaonis*, they formed 3.5% and 5.2% of the catch at New Ferry Wharf and Sassoon Dock respectively. Good catches of cuttle fishes were observed from October to December and of squids from January to April.

Miscellaneous: Several other species of fishes such as Bombay duck, *Saurida* sp. seer fish, Tunnies, flat fishes *Upeneus* spp. etc. collectively accounted for 2448.3 tonnes contributing to 12.6% of the catch at New Ferry Wharf. At Sassoon Dock, miscellaneous fishes formed 1425.86 tonnes amounting to 6.6 per cent.

Marketing and disposal

Because of the availability of fish hold facilities on the trawlers and cleaner wharf at the landing site, the catch is landed in fairly good condition. The catches are auctioned daily at the landing centre itself. For this reason there is no consistency in the price structure. From the fishermen the catch goes to the middlemen who purchase the fish in auction. From there on, it is sorted out both size and quality wise and handed over to processors. This is done mainly in the case of items with export value like prawns, lobsters, cephalopods and quality fishes. Because of the middle men the fishermen get less profit out of the catch. Rest of the fish is transported to various markets for local consumption. Thus most of the by-catch is utilized for human consumption as observed by George et al (*Mar. Fish. Infr. Ser. T & E Ser. No. 28, 1981*), nothing from the trawler catches is wasted. The

estimated annual value of the catch at the auction site of both the centres was Rs. 404 million. Of this the prawns accounted for about 42%, lobsters 14%, quality fishes 19% and cephalopods 3%.

Remarks

The present study revealed that the fishing effort over the three years remained more or less steady at both the centres. This is a good sign as there is no increase of fishing pressure on the stocks. The fishery at Sassoon Dock registered an upward trend whereas at New Ferry Wharf, it showed fluctuating trends with 1980-81 recording the maximum catch. Most of the species constituents had the peak during October-April, following the south-west monsoon period. Compared to New Ferry Wharf, Sassoon dock was a better landing centre from the point of view of total catch. However, the catch per fishing trip was more at the former because the boats from this centre expended more hours of fishing coupled with wider operational range of fishing grounds. Eels, lobsters and miscellaneous fishes comprising of flat fish, tunnies etc. registered significantly higher catch at New Ferry Wharf showing that the grounds fished by these trawlers supported a comparatively rich fishery for these varieties.

Though this study did not indicate any adverse trend in the fishery, continued monitoring of the resources is necessary for scientific management of the fishery.

Further, it could be inferred that though the cheaper fishes formed the bulk of the by-catch, it contributed to only 22% of the annual value. These varieties are consumed either fresh or dried in domestic markets. Thus the fishermen's income is largely dependent on crustaceans, cephalopods and quality fish for export. It would therefore be advisable to go in for better product development out of the cheaper varieties to ensure better utilization in internal markets which would ultimately benefit the primary producers of the sea in getting better returns from the catches.



A POTENTIAL NEW RESOURCE OF PRAWN FROM THE KARNATAKA COAST*

Introduction

Along the Karnataka coast, Mangalore, Malpe and Karwar are centres from where prawns are caught in fairly good quantities throughout the year. The prawn production in Karnataka is mainly through mechanised sector, the contribution by non-mechanised sector being quite negligible. It is estimated that around 4 to 5 thousand tonnes of prawns are landed in this state annually and the important species contributing to the fishery are *Metapenaeus dobsoni*, *M. affinis*, *M. monoceros*, *Parapenaeopsis stylifera*, *Penaeus indicus*, *P. merguensis* and *P. monodon* belonging to the penaeid group.

Artisanal estuarine fishery for prawns at Mangalore

The non-mechanised gears like shore seine, miniotter trawl and cast net are operated throughout the year in the estuaries, and during monsoon period (June-August) in the inshore waters, for catching prawns. However, the prawn production from the estuarine waters is rather low in this area. It is estimated that at Mangalore only 5.3 and 14.4 t of prawns were landed from this sector during 1981 and 1982 respectively, contributed mostly by *M. dobsoni* and *P. indicus*. It is interesting to note that in addition to these, another species was landed in appreciable quantities, in these years and found to support a minor fishery in the Mangalore estuary for the first time. This species was subsequently identified as *Metapenaeus moyebi* (= *Metapenaeus burkenroadi*). Out of the total prawn catch from this estuary, this species alone accounted for 30.2% and 15.0% with the catch amounting to 1.59 t and 2.16 t respectively during 1981 and 1982 (Table 1). Although the species was available from May to December, the peak catches were obtained during May-July. Among the gears, miniotter trawl was the most effective, contributing 66.1% and 59.7% of the total catch of this prawn, followed by shore seine (29.5% and 21.1%) during 1981 and 1982 respectively. *M. moyebi* formed around 32.8% and 13.4% in miniotter trawl, 66.5% and 21.0% in shore seine and 5.1% and 16.3% in cast net, respectively during these periods (Table 1). Other than a few stray specimens collected from the trawl catches during May-June, this species was not caught in appreciable quantities from the inshore waters of Mangalore.

Fishery at Karwar

An entirely different picture is seen at Karwar, *M. moyebi* being caught exclusively from the inshore

waters during these periods. Shore seine is generally operated in the Karwar Bay during monsoon period (Fig. 1). In June 1980 in addition to *P. indicus* and *M. dobsoni*, *M. moyebi* (Fig. 2) occurred in sizeable quantities in these shore seine catches. The occurrence of this species has not been recorded from this area earlier and it is reported for the first time. Surprisingly, again this species was caught in large quantities (2.1 tonnes) by shrimp trawlers from the Karwar Bay during May 1981. (The shrimp trawlers, usually, do not operate in Karwar Bay. However, some boats operated in the Bay between 25.5.1981 and 29.5.1981 on their way back from the usual fishing grounds). The prawn catch mainly consisted of *M. dobsoni*, *M. affinis*, *M. moyebi* and *P. merguensis*. The data on *M. moyebi* landed by trawlers during the above period was collected, mainly through enquiry, as the catches from the Bay and the usual trawling grounds were put together and brought to the shore. Further observations revealed the occurrence of this species in January and February, May and July and November and December in the prawn catches from Karwar Bay.

Size composition of *M. moyebi*

In the case of this species the sizes ranging from 31 to 90 mm in males and from 31 to 95 mm in females supported the estuarine fishery at Mangalore. The stray specimens collected from the trawlers at Mangalore were of larger sizes (100-106 mm). The inshore fishery at Karwar Bay was supported by larger sizes ranging from 46 to 100 mm and 46 to 110 mm in males and females respectively.

Maturity and sex ratio

Majority of females were found to mature at 68 mm size. In the Mangalore estuary, practically all prawns were immature except in May 1981 when around 15.2% of females in a sample was found to be mature. A few specimens collected from the trawl catches at Mangalore during May-June were fully mature. At Karwar, mature females were recorded during January-February and May-July with maximum in June 83 (Table 2). It appears that the peak spawning in this prawn is during January-February and May-June. Month-wise distribution of sex ratio indicated that the proportion of females ranged from 56.0 to 88.0% at Mangalore and 30.6 to 83.0% at Karwar (Table 3). The overall ratio for males and females was 30.6 : 69.4 and 40.3 : 59.7 at these centres.

* Prepared by K.K. Sukumaran and G. Nandakumar with the guidance of Dr. M.J. George.

Table 1. The estimated catch and c.p.u.e. in kg and percentage composition of *M.moyebi* in different gears at Mangalore and Karwar

Month	MANGALORE						KARWAR					
	<i>Miniotter trawl</i>			<i>Cast net</i>			<i>Shore seine</i>			<i>Shore seine & trawl</i>		
	catch	% in prawns	catch/unit	catch	% in prawns	catch/unit	catch	% in prawns	catch/unit	catch	% in prawns	catch/unit
June 1980	—	—	—	—	—	—	—	—	—	156.0	20.5	0.7
May 1981	600.0	84.1	2.0	—	—	—	—	—	—	2,128.0	1.9	6.5
June	200.0	25.8	0.6	70.0	37.8	0.1	370.0	80.4	2.8	252.0	49.9	0.8
July	125.0	58.8	0.4	—	—	—	87.5	100.0	1.3	—	—	—
August	7.5	50.0	—	—	—	—	12.0	53.3	0.3	—	—	—
September	80.0	44.4	0.4	—	—	—	—	—	—	—	—	—
November	37.5	6.0	0.2	—	—	—	—	—	—	—	—	—
December	3.0	27.3	0.1	—	—	—	—	—	—	—	—	—
May 1982	15.0	16.7	—	15.0	8.3	—	—	—	—	—	—	—
June	1110.0	21.3	0.7	398.0	17.0	0.4	443.0	24.2	1.7	393.0	28.1	2.2
July	103.0	40.7	0.1	—	—	—	—	—	—	—	—	—
November	64.0	2.2	0.2	—	—	—	15.0	4.2	0.5	—	—	—
January 1983	80.0	23.2	0.2	—	—	—	—	—	—	—	—	—
February	—	—	—	—	—	—	—	—	—	12.0	26.7	—
June	312.0	33.7	0.3	—	—	—	—	—	—	112.0	28.4	0.6
July	—	—	—	—	—	—	—	—	—	7.0	1.2	—



Fig. 1. Shore seine operations in Karwar Bay

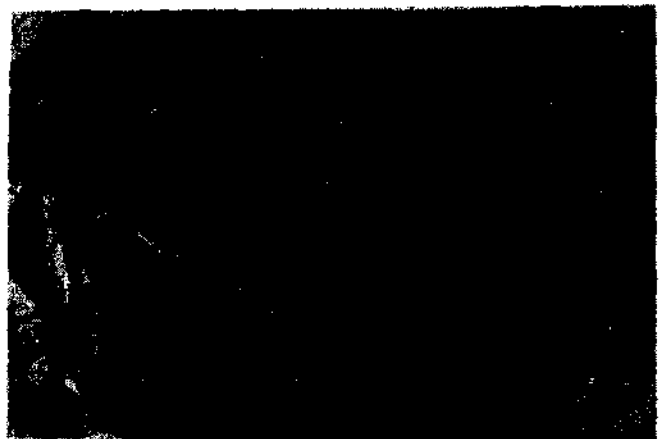


Fig. 2. *M. moyebi* caught from Karwar Bay

Table 2. Percentage distribution of mature and spent/spent recovering females of *M. moyebi* during different months at Mangalore and Karwar.

	June 1980	May 1981	June 1982	Jan. & Feb. 1983	June	July
MANGALORE						
M	—	15.2	—	—	—	—
Sp/SpR	—	—	—	—	—	—
KARWAR						
M	7.4	1.0	5.2	23.5	32.6	6.8
Sp/SpR	—	—	50.6	36.5	30.4	—

M - mature; *Sp/SpR* - Spent/spent recovering

Table 3. Sex ratio distribution of *M. moyebi* during different months at Mangalore and Karwar (% of females)

	June 1980	May 1981	June	July	August	Nov.	June 1982	July	Jan. & Feb. '83	March	June	July
MANGALORE												
—	—	64.8	56.1	60.0	63.5	73.2	88.0	70.0	—	75.5	73.8	—
KARWAR												
54.6	—	76.6	—	—	—	—	40.9	—	30.6	—	72.3	83.0

General remarks

M. moyebi is found to support a minor fishery in the Mangalore estuary as well as in the Karwar Bay. The estuarine fishery at Mangalore is largely supported by smaller sizes, whereas, at Karwar the inshore fishery is supported by larger sized prawns. The interesting point about the fishery of this species here is that although juveniles are abundant in the Mangalore estuary, apart from a few stray specimens caught in the trawl nets, adults are not caught in appreciable quantities either from the estuary or from the nearby inshore area. With the result the location of the adult population remains unknown and if it is possible to locate this population anywhere nearby it would definitely increase the catches of larger sized prawns.

At the same time in Karwar the adults are caught in fairly good quantities from the inshore waters of the Bay, while juveniles are not caught from any of the nearby estuaries. Thus in this case it is not clear where exactly the juvenile phase of this adult population is completed. From the occurrence of a few juveniles

(26–32 mm) from the same area in the Bay in June (in 'gorubale' catch) the possibility of their entire life cycle being completed in the Bay itself cannot be ruled out. Or it is also possible that this adult population of this particular species is originated from the stock found in the Mandovi-Zuari estuarine system of the Goa coast where the species in smaller sizes are found to occur during the monsoon period.

It is equally intriguing that the adult population of this species is caught from the Karwar Bay in fairly good quantities only during a very limited period of May–July. The search for this unconventional resource in the nearby areas during the rest of the year as well as other localities has not been successful so far. Thus it is not clear what happens to the stock of the population during the rest of the year. It is possible that the resource of the species is limited so as to be fished out during the period of 2 or 3 months. But in that case the smaller size groups of the prawns also should have been represented in the catches at some time or other. Experimental trawling at different depths along this coast particularly during March–May would probably throw more light on this problem.

PROVEN TECHNOLOGY

7. TECHNOLOGY OF CULTURED SEAWEED PRODUCTION

Major highlights

Production of seaweeds by culture practices is done generally by vegetative propagation of small fragments of some agarophytes, alginophytes and carrageenophytes. The fragments of the seaweed to be grown are inserted into the twists of the coir ropes or in the alternative tied to the mesh intersections of the HDP ropes (3 mm thick) which are fabricated in the form of 5 x 2 m size nets and floated at subsurface level in the inshore waters or in saline ponds with the help of sinkers and buoys. *Gracilaria edulis* and *Gelidiella acerosa* reach harvestable size after 2 and 2½ months respectively when the seaweed is harvested and processed for agar extraction.

Operational details

The seaweed culture farm either in the sea or in saline ponds will have several nets of 5 x 2 m size fabricated with coir (2.5 cm thickness) or HDP ropes (3 mm thickness). In the case of ponds, they should be preferably of sandy-loam bottom and of size 60 m x 30 m with free flow of seawater through sluice gate. The culture site must have a minimum depth of 1 m. The seed material is generally collected from natural beds and cleaned thoroughly to get rid of the debris, sand and other epiphytic algae. The length of the seed material is 4 to 5 cm for *Gracilaria edulis* and *Gelidiella acerosa*. The seed fragments are inserted into the twists of the coir rope but if it is a HDP rope net, the fragments of *G.edulis* and *G.acerosa* are tied to the mesh intersections of the nets with the help of nylon twine (No. 6). Fragments of *G.acerosa* are also tied to the nails fixed on the coral stones with the help of nylon twine (No. 6) and introduced in the inshore waters or in ponds. To minimise sedimentation on the plants, the stones are kept in cages. The minimum period for the seed material to reach harvestable size is 2 months for *G.edulis* and 2½ months for *G.acerosa*. Again the nets are reintroduced into the ponds or into the inshore waters with fresh seed material. Likewise six crops could be harvested in a year for *G.edulis* and 4 harvests for *G.acerosa* in a place like Mandapam where Gulf of Mannar or Palk Bay could be made use of for culture operations in a year alternating each other. The weight obtained after harvest is generally 3 times the initial weight. In the case of cultivation in inshore waters the crop is exposed to certain hazards such as grazing by fish and sedimentation. These problems can be minimised by carrying out culture

operations in 4 to 5 m deep areas using floats and sinkers. Periodical cleaning of the nets is very essential to remove sediments and attached organisms.

Production

One kg seed material of *G.edulis* yields an average of 3 kg per sq.m of net after 60 days growth. In one ha area of nets (i.e. 1000 nets) 30 tonnes of fresh *G.edulis* could be obtained in one harvest. Six harvests could be made in a year if the condition of the sea is favourable. The nets could be used for several crops. *G.acerosa* cultured on nets in the inshore waters yields three fold increase in weight after 2½ months growth. In the case of cultivation on coral stones, three fold increase in the yield would be obtained after 5 months.

Inventory of materials

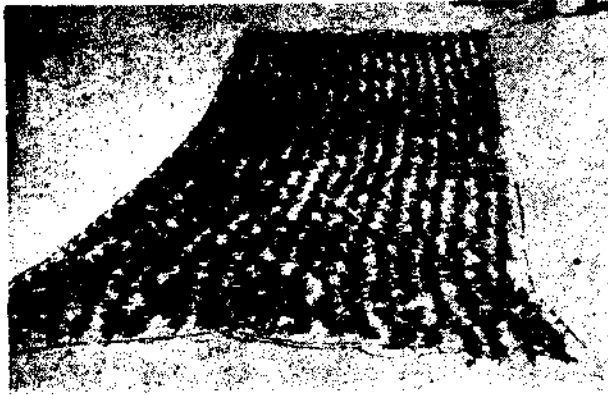
Cost of production of *G. edulis* only has been worked out so far and discussed here. For the cultivation of *G. edulis* in one ha, 1000 coir nets of 5 x 2 m size, 2000 casuarina poles of 1.5 m height and 10,000 kg of fresh seed material (for initial introduction) are required. The cost of 2000 casuarina poles is Rs. 6,000/- and cost of 1000 coir rope nets is Rs. 33,000/- including charges for fabrication. The seed material will be collected for the initial introduction from the natural beds and from the cultured crop for the subsequent seeding. Wages for seeding, harvesting and maintenance of the seaweed farm for 4 persons at the rate of Rs. 10/- per day for 360 days workout to Rs. 14,400/-. The total expenditure for one year would be Rs. 54,000/- including miscellaneous expenditure of Rs. 600/-.

Estimated cost of production

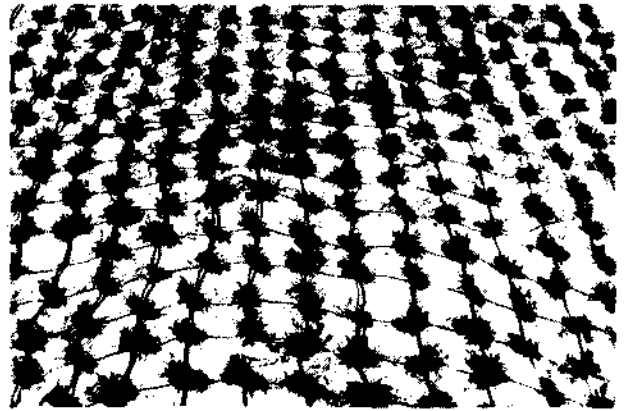
The estimated cost is arrived at on the assumption that a minimum of four harvests could be made in a year. A total of 120 tonnes (fresh weight) of crop could be obtained from the four harvests in a year when the yield is 3 kg/m². If the seaweed is dried (75% moisture) and marketed at a rate of Rs. 2,000/- per tonne, the net profit would be Rs. 6,000/- for one year.

Prospects

India has a good scope for starting a seaweed culture industry based on the know-how available at the Central Marine Fisheries Research Institute. Potential areas for seaweed culture would be the coastal areas of Palk Bay and Gulf of Mannar near



G. edulis
Culture net with seed material



G. edulis
Portion of the culture net showing the introduced seed material



G. edulis
Culture net showing 30 days growth



G. edulis
Culture net after 60 days growth

Mandapam and near the islands of Gulf of Mannar. Many industries producing agar and algin are being set up in India and the commercial harvest of seaweeds have gained importance in the coastal areas of Ramanathapuram, Tirunelveli and Kanyakumari districts of Tamil Nadu. Culture of seaweeds on large

scale would be of great help to augment the supply of seaweeds in addition to that harvested from the natural beds. The Central Marine Fisheries Research Institute can extend the technical know-how through training programmes at managerial and operative levels.

Prepared by the scientists of seaweed culture project

NEWS — INDIA AND OVERSEAS

New resources of fishes located in Indian coastal waters

In recent surveys made by the Fishery Survey of India (FSI) under the Indian Ministry of Agriculture large stocks of marine fishes and other resources have been reported to have been located in the coastal waters in different areas. Among the varieties identified are bulls eyes, pomfrets, mackerel, shrimps, squids, perches and sharks.

Bulls eyes have been reported in good quantities between 11° and 20° N latitudes at depths between 40 to 200 m along the east coast. Pomfrets were found in quantity at depths of 60 to 90 m off Machilipatnam and mackerel off Visakhapatnam on the east coast. Deep sea shrimps occurred at depths of more than 190 m along the lower east coast as well as 200 to 500 m depths off Goa, Karwar and Ratnagiri. Squids were located in plenty at around 300 m depth off Andhra Pradesh coast. Perches and sharks have been fished in large quantities in the Wadge Bank area.

Record quantities of shrimp expected by farming in Equador

Shrimp ponds in Equador are expected to produce 50,000 tonnes by 1986. The combined trawling and pond culture production of shrimp in the country stood at less than 18,000 tonnes two years ago. Heavy rains this year have assisted shrimp culture by ensuring plentiful supply of seeds for pond stocking.

The industry will have more than 12,500 acres of

shrimp ponds in use within the next three years according to officials of the country's fast growing aquaculture industry. In order to help in this expansion work, Taiwanese technicians have been brought to the country and shrimp pond operations are carried out under their advise.

FNI 22(7), July 1983

First International Conference on the Culture of penaeid prawns/shrimps

First announcement of the first International Conference on the Culture of penaeid prawns/shrimps scheduled to be conducted at Iloilo City, Philippines from December 4 to 8, 1984 under the auspices of Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC) has been issued. Papers for presentation at the Conference are invited on the following areas of penaeid prawn/shrimp biology and culture:

(1) Biology (2) Broodstock and gonadal maturation (3) Larval and postlarval rearing (Hatchery/nursery techniques) (4) Grow-out in ponds/tanks/cages/pens (5) Natural food (6) Nutrition and feed development (7) Physiology (8) Diseases (9) Socio-economics and marketing.

Abstracts of papers should reach the secretariat by July 15, 1984 and full papers by October 15, 1984. Registration fee is US \$150. For further details please contact the Secretariat, First International Conference on the culture of penaeid prawns/shrimps, SEAFDEC Aquaculture Department, P.O. Box 256, Iloilo City, Philippines.



GOOD SEASON FOR PRAWNS PREDICTED OFF MADRAS*

Forecasts of the magnitude of the prawn fishery based on the index of postlarval and juvenile abundance in estuaries and backwaters have been attempted by earlier authors. Garcia and Reste (1981 *FAO Fish. Tech. Rep.* 203:129) have summarised the forecasts based on earlier stages of life cycle. They have stated that "when an attempt is made to relate shrimp catches at the sea to the abundance of one of the preceding stages of the life cycle, it seems that only migrating sub-adults can give useful short-term prediction index (about three months in advance)" With the data available from the Ennore estuary near Madras on the postlarval and juvenile abundance an attempt was made to see whether any prediction of the forthcoming fishery of the ensuing season in 1983-84 was possible.

* Prepared by D. B. James and P. Thirumilu.

Regular weekly collections of juveniles were made with a small drag net made of velon screen of five m length at the Ennore estuary from three stations about 1 km apart from each other the first one being near the bar mouth. During the course of this study it was found that collections from Station III was good when compared to the other two stations as far as juvenile prawns are concerned and the data collected from this station for 19 months during March, 1982 to September '83 is analysed and interpreted in the present report. During day time three hauls were made roughly covering an area of 100 sq m. for each haul. The Ennore bar mouth is more or less kept open through out the year to draw coolant water for the thermal plant.

From Table 1 it is seen that during the period March, 1982 to September, 1983 maximum number of juveniles were collected during the months of July, 1983 (320 Nos) and August, '83 (342 nos.). During all other months on an average only 50 juveniles were collected. *Penaeus semisulcatus* started appearing

by November to January period. The increased occurrence of the juveniles tend to show that the fishery for these species particularly *P. semisulcatus*, *P. indicus* and *P. monodon* will be high during the coming season from November to January period.

Table 1. Numbers and sizes of juvenile prawns collected at Station III in Ennore estuary during 1982-1983

Months	<i>Metapenaeus dobsoni</i>		<i>Metapenaeus monoceros</i>		<i>Penaeus indicus</i>		<i>Penaeus semisulcatus</i>		<i>Penaeus monodon</i>		Total
	No.	Size range mm	No.	Size range mm	No.	Size range mm	No.	Size range mm	No.	Size range mm	
1982											
March	2	7-18	5	12-24	1	15	1	37	—	—	9
April	1	13-22	5	13-22	1	24	—	—	—	—	7
May	10	9-21	5	11-34	1	15	—	—	—	—	16
June	9	5-16	1	24	1	13	1	17	—	—	12
July	6	7-17	19	7-20	—	—	—	—	—	—	25
August	2	9-13	42	7-25	—	—	1	17	—	—	45
September	64	7-21	10	7-28	—	—	1	15	—	—	75
October	24	7-16	14	7-15	—	—	—	—	—	—	38
November	47	8-22	1	11	—	—	—	—	4	18-30	52
December	90	7-18	12	7-19	—	—	—	—	—	—	102
1983											
January	62	8-16	2	9-12	—	—	—	—	—	—	64
February	29	8-25	15	11-36	—	—	—	—	—	—	44
March	26	8-18	7	8-46	—	—	1	35	—	—	34
April	No collection										
May	23	7-24	6	7-28	—	—	19	11-62	—	—	48
June	7	10-21	9	13-39	—	—	12	11-44	—	—	28
July	274	8-20	7	11-24	27	13-26	12	13-62	—	—	320
August	119	9-13	15	16-54	90	14-52	97	16-56	21	14-64	342
September	154	7-34	12	9-52	10	15-22	5	11-52	1	16	182

during the month of May, 1983, *P. indicus* in July 1983 and *P. monodon* in August, 1983. When twigs were encountered in the drag net more juveniles of *P. monodon* were collected.

In Table 2 date-wise collections of juveniles from May 1983 when algal bed was formed is given. It is seen that the modal size increased in all species from May to September. Also it was found that the size range of the specimens collected was more in September than in May. This rapid growth in the estuary would result in the prawns reaching marketable size

The hydrological conditions of the estuary during 1982 and 1983 indicate that in 1983 the temperature has gone up to 37.2°C in May, 1983 whereas it was only 33.1°C in May, 1982. The four degree higher temperature may be the cause for the germination of the spores of the algae. The salinity was also found to be more in 1983 from May onwards.

It is interesting to note that the occurrence of the juveniles of some species especially *P. semisulcatus* show a relationship with formation of algal bed. In 1983 with the formation of algal bed composed of

Table 2. Details of juvenile prawns collected per haul from Ennore estuary at Station III during May-September 1983

Date	<i>Metapenaeus dobsoni</i>		<i>Penaeus semi-sulcatus</i>		<i>Metapenaeus monoceros</i>		<i>Penaeus indicus</i>		<i>Penaeus monodon</i>		Total
	No.	Size range mm	No.	Size range mm	No.	Size range mm	No.	Size range mm	No.	Size range mm	
4-5-83	2	11-24	10	11-62	2	14-28	—	—	—	—	14
18-5-83	18	7-20	3	11-17	2	7-15	—	—	—	—	23
26-5-83	8	9-17	13	11-32	4	13-28	—	—	—	—	25
29-5-83	2	13-17	37	14-57	22	13-56	2	32-76	1	27	64
1-6-83	5	10-17	2	13-44	7	11-27	—	—	—	—	14
8-6-83	3	16-21	3	17-44	5	13-21	—	—	—	—	11
15-6-83	—	—	6	11-42	2	15-32	—	—	—	—	8
22-6-83	3	8-20	5	18-42	1	39	—	—	—	—	9
6-7-83	3	9-16	1	13	1	15	—	—	—	—	5
20-7-83	180	8-20	8	15-62	4	11-24	28	13-26	—	—	221
24-7-83	48	6-22	128	15-84	4	13-32	20	17-37	—	—	199
31-7-83	73	7-22	58	15-52	19	17-41	28	10-42	4	11-24	189
3-8-83	74	20-27	20	16-56	6	16-54	20	14-41	6	14-30	126
7-8-83	38	8-24	32	15-69	38	11-80	16	15-56	5	16-41	129
10-8-83	15	9-30	16	15-60	—	—	32	16-52	9	14-63	72
21-8-83	8	12-29	32	15-81	13	16-90	14	16-90	2	9-24	69
24-8-83	29	12-32	44	15-94	6	16-60	45	15-52	6	17-40	130
28-8-83	4	16-22	32	19-68	9	14-46	4	16-38	1	25	50
31-8-83	40	12-31	49	14-93	8	13-57	24	13-72	7	14-62	128
4-9-83	11	16-41	5	32-100	9	16-67	2	27-72	—	—	27
7-9-83	10	11-34	2	11-43	3	15-51	3	15-22	—	—	18
14-9-83	8	7-23	2	19-52	4	9-52	4	15-22	2	16-39	20
25-9-83	14	7-14	4	24-71	4	22-62	19	15-44	—	—	41
28-9-83	135	7-29	—	—	5	11-32	4	17-44	—	—	144

species of *Hypnea*, *padina*, *Chaetomorpha* etc. there was sudden spurt of *P. semisulcatus* juveniles in the month of May. Again due to heavy rain in the month of August, 1983 most of the algae was found to be dead by 4-9-83. This immediately resulted in poor collection of juveniles particularly *P. semisulcatus* which always

live in association with algae. In fact the juveniles of this species is locally known as *Pachi Yera* referring to this habit. The fact of absence of algal bed formation in 1982 when there was lesser juveniles also strengthen the point of view that there is correlation between algal bed and occurrence of these prawn species.