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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the Fishery Data Centre and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

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Cover photo: Mechanised fishing boats on their return trip to the jetty through Neendakara bar mouth.

A CASE OF OVERFISHING: DEPLETION OF SHRIMP RESOURCES ALONG NEENDAKARA COAST, KERALA*

Introduction

Mechanisation of the fishery along the Kerala coast has progressed considerably, resulting in an increase of the exploitation of ground fishes and prawns inside the 80 m depth contour to a significant level. Based on the facilities available for landing and disposal of catches, the operation of these mechanised boats is concentrated in certain centres along the coast, like Vizhinjam, Neendakara, Azhikode, Cochin, Beypore, etc. Prawns being the most important commodity in demand from the catches of the mechanised sector, a study of the trend in mechanised fishery in general and prawn production in particular from these centres would show that Neendakara is by far the most important centre. In fact, in some years the entire prawn catch of the mechanised fishery of Kerala during the monsoon months are landed at this centre. Hence a detailed study of the prawn fishery by mechanised boats based at Neendakara–Sakthikulangara complex has been attempted, with a view to determine whether there are any indications of overfishing either biological or economic.

Fishing operations and seasons

Prawn fishing in this region is mostly carried out by small mechanised boats of size upto 14 m length, operating two or four seam shrimp trawls in the coastal waters upto about 40 metres depth. These vessels carry out daily fishing cruises, starting from the base early in the morning and returning in the evening. The catches are landed at Sakthikulangara landing centre situated on the southern end of Neendakara bridge. There has been a steady increase in the number of boats operating from this base for the past few years as a result of the establishment of suitable infrastructure facilities and attractive catch returns of prawns from the inshore areas. The maximum number of boats/day operating from here during the peak season of 1970 was about 185, which by 1979 increased to about 1,200. The centre is perhaps the biggest landing centre of the country, having the maximum number of boats engaged in shrimp trawling (Fig. 1).

The trawling operations are carried out almost throughout the year, but a characteristic feature noticed in this area is that the peak fishing activities are restricted to a brief period of two or three months during the southwest monsoon period June to August, when normally the trawling operations remain weak or totally suspended in other parts of the west coast. During this period, hundreds of boats from other parts of the state and also from outside the state assemble here and temporally camp until the season is over.

Prawns constitute an average of about 38.4% of the total trawl catches of this area and support the commercial fishery throughout the year in varying proportions. The seasonal trend in production follows more or less the same pattern every year as could be seen from Table 1. While the catches remain to be of a low or moderate magnitude in most of the months, an average of about 83% of the landings of the year are recorded during the period June-August or in some years July–September. The total catch as well as the CPUE of prawns during this period are remarkably high as compared to the catch returns of the rest of the year, thereby indicating heavy concentration of fresh stock in these areas during the peak monsoon period. The success of the prawn fishery of the state in a particular year largely depends on the catch landed at this centre especially during the monsoon season. A comparison of the monthly catch statistics of the different years from 1973 to 1979 (Table 1) would indicate that the maximum catch as well as CPUE were registered in the month of August consecutively for the first four years, with a record catch of 31,722.2 tonnes in 1975 and catch rate of 298.6 kg/hr of trawling in 1973. In the subsequent years, however, a slight deviation from this occurred, September having been the highest productive month in 1977 and July in 1978 and 1979.

* Prepared by M. J. George, C. Suseelan, M. M. Thomas and N. S. Kurup, C.M.F.R.I., Cochin.

Fig. 1. *Mechanised boats at landing jetty at Neendakara*

Species composition and biological aspects

The composition and biological characteristics of important species in the fishery were studied during the period May 1979 to April 1980 (Fig. 2). As in other regions of Kerala coast the prawn fishery of this area is supported by penaeid prawns only. *Parapenaeopsis stylifera, Metapenaeus dobsoni, Penaeus indicus, Metapenaeus affinis, Penaeus semisulcatus* and *Metapenaeus monoceros* contributed to the fishery in the order of their abundance. The dominant species in the month of January was *P. indicus,* amounting to about 41% of the total catch, followed by *M. dobsoni* and *P. stylifera* in almost equal quantities (25%). During the next month the trend changed suddenly, making *P. stylifera* the most important constituent species (41%) followed by *M. dobsoni* (31%) while *P. indicus* was reduced to about 6% of the month's catch. In March, *M. dobsoni* became the dominant species (40%), relegating *P. stylifera* (15%) and *P. indicus* (10%) to second and fourth places. *P. semisulcatus* appeared in large quantities (12%) occupying third place. In the next month *P. stylifera* showed considerable increase (70%) while *M. dobsoni* and *P. indicus* were second and third in importance, respectively. This increasing trend in the landings of *P. stylifera* continued in the succeeding months of May to October although the proportion between *P. stylifera* and *M. dobsoni* varied in different months. In July, the peak landing month in the monsoon period, the catch of *M. dobsoni* (6%) was negligible in comparison to that of *P. stylifera* (75%), while the quantity of *P. indicus* was 15%. The

Table 1. *Monthly catch trends of prawns at Sakthikulangara-Neendakara during* 1973–1979.

Months	Prawn landings in tonnes and CPUE in kg (in parenthesis)						
	1973	1974	1975	1976	1977	1978	1979
January	253.2 (7.9)	130.6 (5.7)	429.1 (7.6)	132.4 (4.9)	197.6 (6.1)	440.0 (2.3)	73.0 (3.7)
February	329.5 (11.2)	235.2 (9.2)	241.0 (5.3)	327.1 (10.3)	172.2 (4.2)	178.0 (0.9)	96.0 (4.0)
March	222.3 (7.5)	163.8 (5.5)	388.9 (5.3)	157.8 (8.6)	242.6 (1.7)	410.0 (2.6)	405.0 (15.5)
April	483.9 (16.3)	745.7 (12.8)	868.9 (10.1)	379.0 (14.2)	117.7 (2.9)	457.0 (1.9)	186.0 (4.8)
May	2,697.6 (34.9)	920.4 (12.0)	4,661.2 (22.5)	1,271.6 (12.2)	128.2 (2.7)	3,196.0 (8.8)	564.0 (6.5)
June	3,202.8 (73.0)	1,283.0 (16.1)	2,109.5 (13.1)	665.0 (18.9)	241.9 (6.8)	4,850.0 (8.0)	900.0 (22.3)
July	12,652.2 (197.1)	235.2 (7.2)	13,806.7 (50.0)	685.1 (50.3)	3,334.3 (25.7)	16,068.0 (80.2)	9,313.0 (71.8)
August	22,987.1 (298.6)	10,140.7 (111.4)	31,722.2 (148.8)	9,768.2 (104.1)	7,949.8 (42.6)	6,856.0 (37.1)	2,064.0 (15.7)
September	703.8 (15.7)	7,038.9 (52.2)	312.7 (7.8)	419.8 (8.1)	9,763.8 (45.5)	244.0 (1.9)	507.0 (5.9)
October	88.5 (3.2)	5,800.1 (49.5)	1,934.0 (28.1)	433.3 (9.6)	505.1 (3.1)	24.1 (0.5)	152.0 (2.5)
November	934.9 (26.4)	365.7 (4.7)	42.0 (0.7)	472.1 (8.1)	580.2 (5.4)	244.0 (4.8)	180.0 (3.6)
December	921.5 (15.4)	705.3 (9.0)	233.9 (5.1)	281.6 (8.9)	887.8 (4.4)	176.0 (3.3)	142.0 (4.6)
TOTAL (Average)	45,477.3 (82.6)	27,764.6 (33.7)	56,750.1 (42.6)	14,993.0 (27.9)	24,121.3 (18.0)	33,143.0 (13.7)	14,582.0 (20.1)

quantity of *M. dobsoni* landed in November was about 10% more (41%) than *P. stylifera* (30%) and *P. indicus* also showed increased catch in comparison to previous month. In December, the quantity of *P. indicus* further increased to 30%, although, the difference between the catches of *M. dobsoni* and *P. stylifera* remained more or less the same as in November. On an average *P. stylifera* formed 73%, *M. dobsoni* 19%, *P. indicus* 4% and other species 4% (Table 2).

A comparison of the species composition in the catches of the inshore prawn fishery of the neighbouring areas during the monsoon months when the fishery

Table 2. *Estimated catch and percentages of different species of prawns landed at Sakthikulangara-Neendakara during* 1979.

Species	Catch in tonnes	Percentage
P. stylifera	10,584	72.7
M. dobsoni	2,752	18.9
P. indicus	562	3.9
Others	684	4.5
TOTAL	14,582	100.0

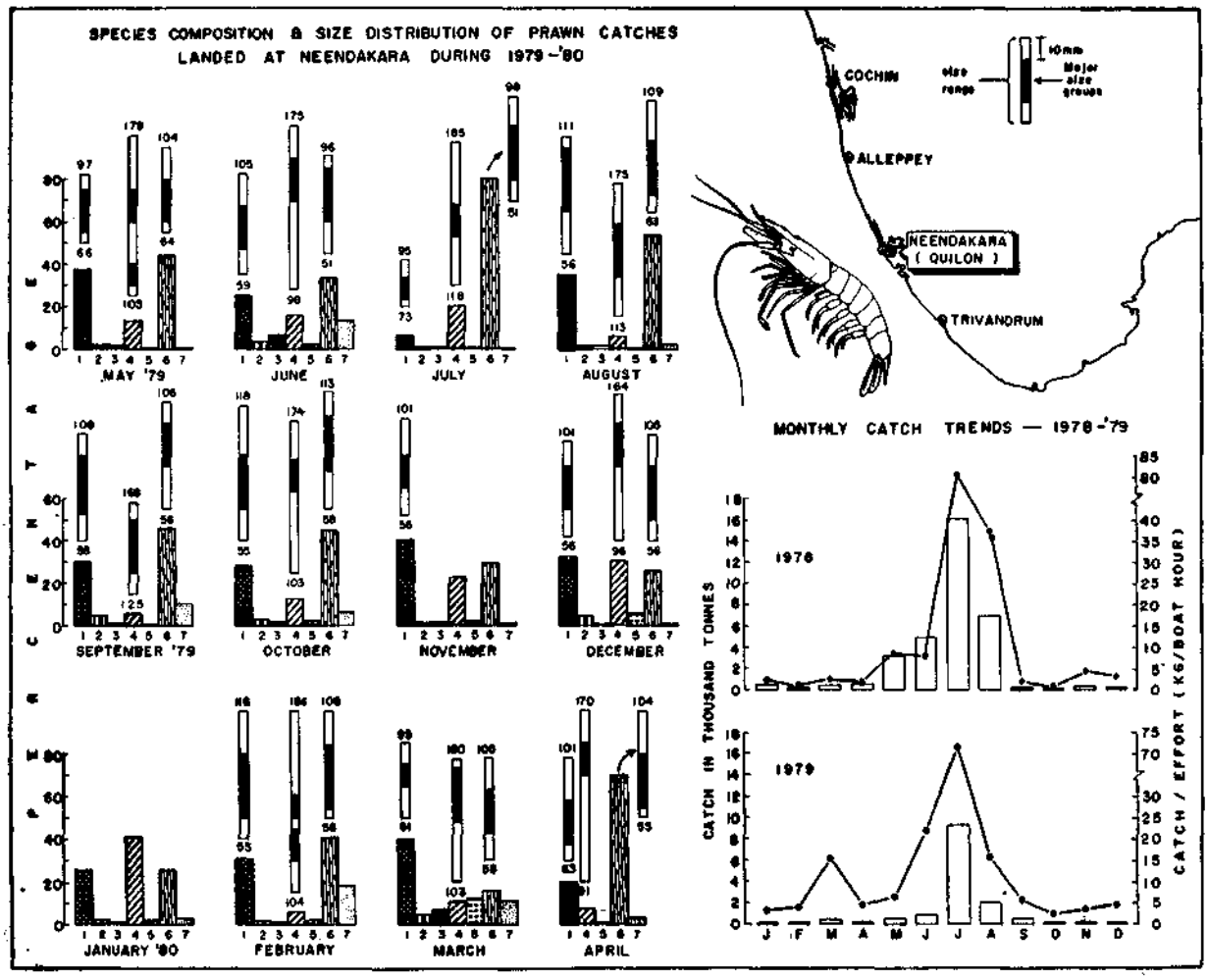


Fig. 2. *Monthly catch trends, species composition and size distribution of important species of prawns at Neendakara.* 1. *M. dobsoni,* 2. *M. monoceros,* 3. *M. affinis,* 4. *P. indicus,* 5. *P. semisulcatus,* 6. *P. stylifera,* 7. *Other species.*

is at its peak at Neendakara shows some differences between these nearby areas. The trawl fishery prawn catches at Cochin during the monsoon months is composed of 41.2% of *P. stylifera* and 40.6% of *M. dobsoni* while at Neendakara *P. stylifera* is quite dominant (76%) and only 18.6% *M. dobsoni* (Fig. 3). At the same time the indigenous fishery is dominated by *M. dobsoni* at both Cochin and Thottapilly area near Alleppey, the percentage contribution of the species being 65.2 and 84.3 respectively. If the area south of Neendakara is taken, the bottom-set gill-net catches at Colachel is quite different from all the other places in that it is almost exclusively supported by *P. indicus.* Thus it is quite evident that the peak fishery of Neendakara area is unique in that it is predominated by *P. stylifera* locally called 'Karikkadi chemmeen'. In fact, the fishermen and the industry has named the fishery as 'Karikkadi fishery'.

The size range in *P. stylifera* during the different months was from 51–109 mm in total length with large sized prawns in the range of 61–100 mm dominating in the catches. Although the general trend did not show much variation between the various months of the year, during the months of June and July the sizes showed a shorter range of 51–98 mm. In *M. dobsoni,* the sizes varied from 55 to 118 mm with the large sized prawns in the range of 66–105 mm more abundant. The months of March–May showed a decrease in the size range. *P. indicus* exhibited a range in total length between 91 mm and 186 mm. The larger sizes occurring in this species during the different months were within the size range of 131–160 mm.

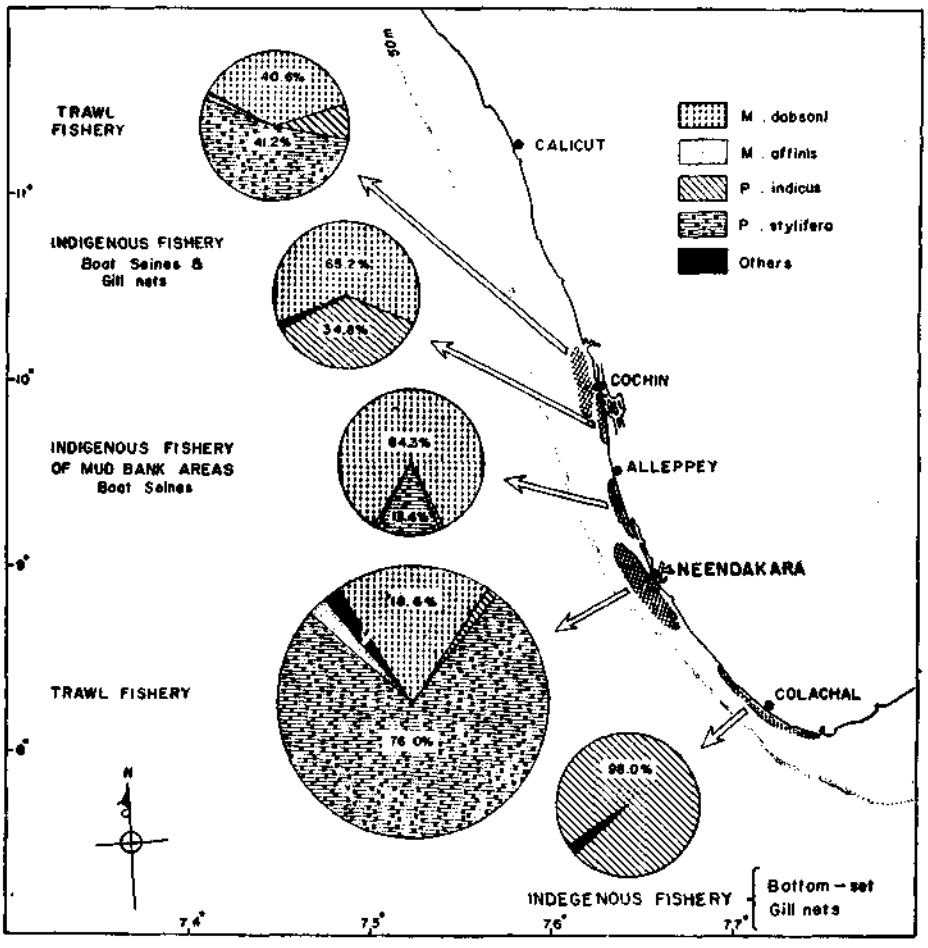


Fig. 3. Catch composition of the prawn fishery of Neendakara in comparison with that of the neighbouring centres during the monsoon period June — August. (Based on average for 3 years).

Studies on maturity distribution in females of the most important species have revealed that *P. stylifera* has a peak breeding season in March, May, October and December (Table 3). More females of *M. dobsoni* were observed with the ovaries in late stages of maturity during May–July, although higher percentages of mature females were also occurring during September, October and March. The percentage of mature females in *P. indicus* was more in comparison to the other two species, the probable peak breeding season being April, June–September and December, showing thereby that the breeding population of *P. indicus* may be moving into this area during this period.

Annual trend in production

The annual trend in prawn landings by shrimp trawlers at this centre in relation to the total fish catch

Table 3. *Monthly distribution of the spawning population of major species of prawns during May* 1979–*April* 1980.

Months		Percentage of mature females		
		M. dobsoni	*P. indicus*	*P. stylifera*
May	1979	36.4	19.2	33.3
June	,,	42.9	40.4	6.4
July	,,	39.0	43.1	13.9
August	,,	21.4	31.7	25.4
September	,,	30.3	48.1	18.5
October	,,	31.7	22.5	27.1
November	,,	—	—	—
December	,,	24.6	39.5	30.3
January	1980	—	—	—
February	,,	29.8	14.1	11.9
March	,,	32.7	21.6	29.1
April	,,	13.7	32.9	20.5

Table 4. *Annual trend in prawn landings by mechanised boats at Sakthikulangara-Neendakara in relation to total catch and fishing effort during* 1970–1979

Year	Total catch in tonnes	Total effort in hours	Prawn catch in tonnes	CPUE for prawns in kg/hr	Percentage of prawn in total catch
1970	26,704	1,46,185	1,845	12.6	6.9
1971	51,493	2,76,476	11,004	39.8	21.4
1972	23,622	3,83,227	11,267	29.4	47.7
1973	66,064	5,50,370	45,477	82.6	68.8
1974	77,748	8,23,719	27,764	33.7	35.7
1975	1,51,095	13,31,728	56,750	42.6	37.6
1976	29,836	5,36,897	14,993	27.9	50.2
1977	45,828	13,36,732	24,121	18.0	52.6
1978	89,892	24,13,475	33,143	13.7	36.8
1979	56,016	7,23,730	14,582	20.1	26.0

and effort expended during the ten-year period 1970–79 is shown in Table 4. It is seen that there is a steady increase in the fishing input from 1970 to 1975 and after a reduction in the subsequent year it picked up again to reach the maximum in 1978. The effort went down again in 1979. The prawn production also showed an increasing trend upto 1973, when an estimated catch of 45,477 tonnes (24 times more than in 1970) was landed at the highest catch rate of 82.6 kg/hr of trawling on an average. During this year the percentage contribution of prawns in the total catch (68.8) was also the highest ever recorded for this centre. In 1974, however, the fishery declined to the tune of about 40% over that of the previous year and the CPUE reduced to 33.7 kg/hr, inspite of the increased fishing effort put in for the exploitation. The year 1975 witnessed tremendous revival in the fishery and registered an all-time record catch of 56,750 tonnes along with the increase in fishing effort. The CPUE also showed improvement over that of the previous year. It is also of interest to note that in this year the prawn landings of this centre alone accounted for 72.8% of the total prawn catches of Kerala state and 40.0% of the penaeid prawn landings of the country. This situation did not last for long

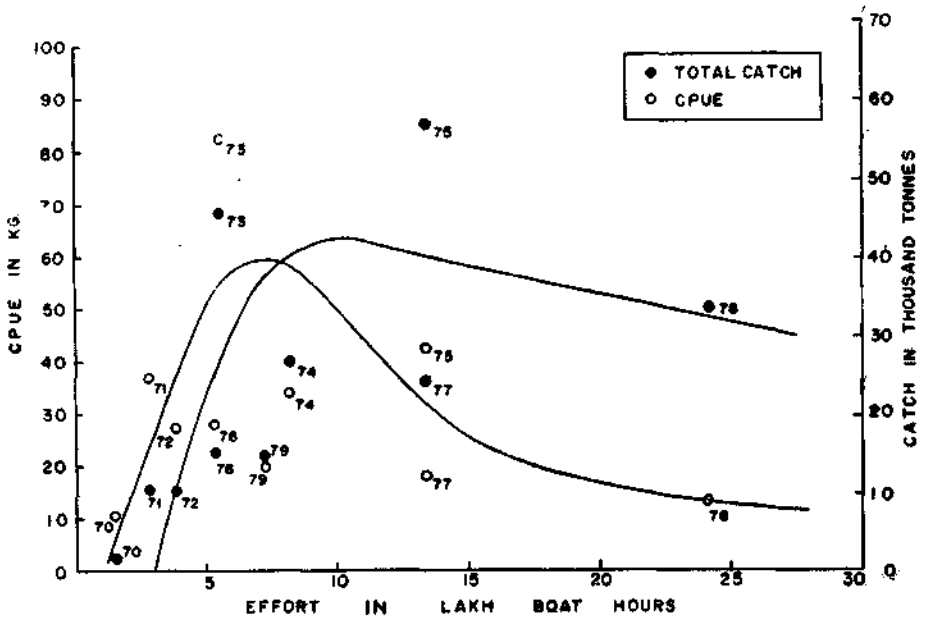
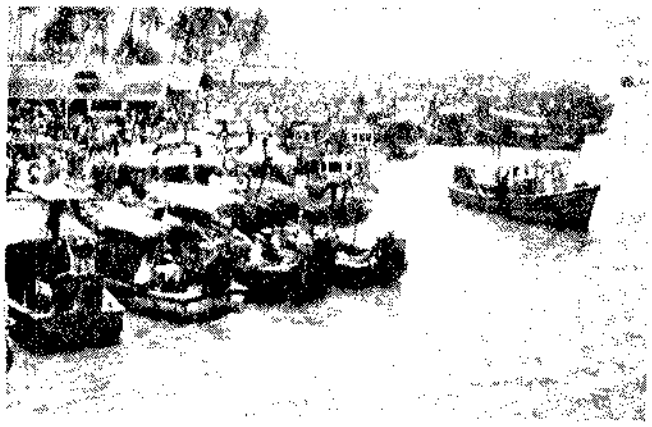
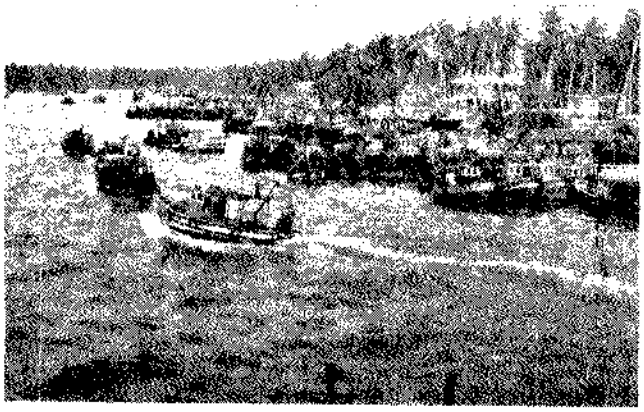


Fig. 4. Relation between effort and catch and catch per unit effort.

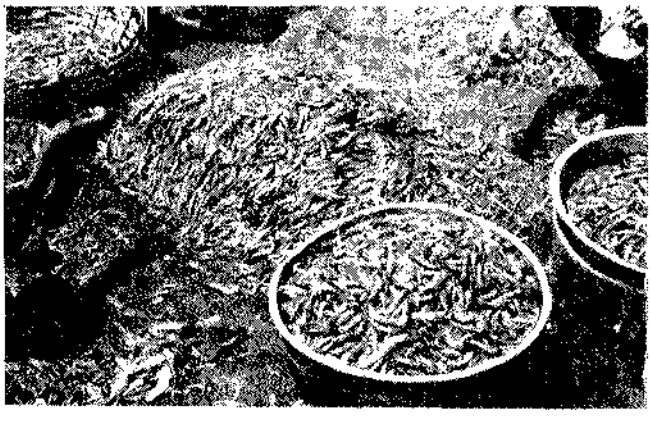




Mechanised boats landing at Neendakara jetty








Shrimp catches being sorted at the jetty

and followed a sudden decline in 1976 when the effort also reduced to almost the level of what was expended in 1973. But a remarkable difference noticed in the fisheries of these two years with more or less same input of effort is that when the highest CPUE was recorded in 1973 the catch rate was just one-third of it only in 1976. This declining trend in catch rate continued in the succeeding years. The total prawn production showed slight improvement, but not proportionate to the increase in trawling effort. In 1979 the prawn catch again declined to a very low level of 14,582 tonnes along with a decrease in trawling effort. However, the catch per unit effort showed improvement from that of 1978, brought about by the increased catch rate in the months outside the peak fishing season of July-August.

In general, from the peak fishing in 1973 and 1975, there has been considerable decrease in the total catch as well as catch per unit of effort in the subsequent years. This declining trend is quite evident in the yield curve (Fig. 4) drawn for the relationship of total effort and the catch per unit effort as well as total catch. Indications are that this is a case of economic overfishing. Prawns being an annual stock with high natural mortality, heavy fishing of prawn stock in one year may not very much affect the catch in the following year. However, when continuous declining trend in the catches with increasing input of effort over successive years is noticed it is possible that maximum sustainable yield in that restricted area has been reached and that further increase in effort input will result in only lesser economic return. Therefore conservation measures should be adopted for ensuring maximum economic return from the area. From the yield curve it would appear that the maximum sustainable yield would be about 35 to 40 thousand tonnes with an optimum input of effort of about 8 lakhs trawling hours. The catch per unit of effort could be controlled at the maximum economic level by restricting the effort at the desired level.

Discussion

In the light of this, having established that there is economic, if not biological, overfishing taking place in this area, it is high time that proper management of the fishery with implementation of conservation measures is thought of as pointed out by George (Fisherman 1 (2); 1980). Management of coastal prawn fishery is rendered difficult by the inherent problems associated with a multispecies fishery. There are several conservation measures which could be adopted for the management of a fishery, like control of the fishery in the estuarine phase, mesh regulation, closed season, licence limitation or restricting the effort and such others. Most of these methods are not only difficult to be implemented but also not very effective in a multispecies system.

Controlling the fishery in the adjoining estuarine water which is found to be helpful in enhancing the production of the inshore fishery in most areas may not be of use in this place. The major species contributing to the fishery here is *Parapenaeopsis stylifera* as seen earlier. It was also seen that in comparison to other neighbouring areas the fishery of this region is contributed to a large extent by this particular species. It is well known that this is one of the species which do not use the estuarine brackishwater areas to any great extent as its nursery ground for the juveniles as in the case of species like *Metapenaeus dobsoni* and *Penaeus indicus*. So the major portion of the catches come from the species which is distributed only in the inshore area of this region where the fishery is in operation. It is thus evident that the fishery is mostly contributed by a stock produced annually in these waters only and not moving in from any other areas apart from probably a slight offshore-inshore movement. Therefore any conservation measure for management of the fishery at the optimum level of exploitation will have to be necessarily concerned with the fishing operation of this particular region alone. In other words, control of the fishing in the estuarine region adjoining to this area may not help in improving the fishery here excepting in the case of species like *P. indicus* and *M. dobsoni* which also partly contribute to the fishery and may be using the adjoining estuarine area as their nursery grounds.

Mesh regulation will not be useful in a multispecies fishery constituted by species growing to different sizes. A catch of small or medium sized prawns would include smaller sized but adult specimens of the species growing to smaller sizes like *P. stylifera* and *M. dobsoni* as well as the smaller size groups of species growing to medium or larger sizes like *P. indicus*, *M. affinis* or *M. monoceros*. Hence, limitations of mesh size at a higher level with a view to catch only the larger sizes would lead to prevention of capturing the adults of the smaller growing varieties, which would thus be lost to the fishery.

So, restricting the input of effort in some way or other seems to be the only possible approach to management

of the fishery of this particular area. This is indirectly proved by the natural course of events also as evident from the effort and catch data for 1979 (Table 4). What has happened in this particular year is that due to lack of catches the number of boats operated from this centre was less, thus reducing the effort expended in this area. With the result, while there was considerable decrease in the total catch to less than half of that of 1978, the catch per trawling hour increased from 13.7 kg to 20.1 kg. So the natural reduction in effort has brought about an increase in catch rate. With the motivation of management the reduction in effort may be achieved either by enforcing a closed season for the fishery in the area or by limiting the number of boats in operation, the latter of which appearing more suitable due to the fact that during the peak season of the fishery several boats from even other states join the fishing fleet in these waters and enforcing a restriction to this entry to the fishing fleet may be easier. In both cases socio-economic considerations would render the implementation difficult. In view of the fast deteriorating situation in the catch rate obtained per boat at present the industry itself may be prepared at the moment for some restriction to be effected in the input of effort in order to get improved catch rate. It is up to the State Government and authorities concerned to take stock of the situation and evolve suitable method to restrict the effort expended for catching the prawns from this region.

COASTAL RURAL INDEBTEDNESS — A CASE STUDY*

The fisherman of our coastal villages borrows year after year and is heavily indebted. But he is not in a position to clear off the debts either because the loans are larger or his income is not enough to pay off his debts. Sometimes his income may not be sufficient to cover up even the interest he has to pay. Therefore the debt of the fisherman goes on increasing. This may be termed as coastal rural indebtedness. The specific objective of the present study is to find out the extent of indebtedness of fishermen in Vizhinjam (south of Trivandrum) and also to examine the credit system prevailing in this area.

Four hundred and four households have been surveyed from the fishermen families of the Vizhinjam sea shore surrounding the landing centre. Data have been collected in June, 1979 by visiting the houses and interviewing the heads of the families. Of these 404 families, 336 (83 percent) are in debt. Total debt incurred by these families amount to Rs. 7.26 lakhs. The average outstanding debt per indebted household worked out to Rs. 2,160.

* Prepared by K. K. P. Panikkar, C.M.F.R.I., Cochin

Sources of credit

The fishermen in this area are not in general benefited by institutional credit agencies. The commercial banks generally do not provide credit to fishermen on the plea that they don't have any valuable assets to show as security. The banks may have difficulties to advance loan on the security of catamaran or canoes which are the only valuable things some of these fishermen can hypothicate. Co-operative organisations are not functioning in this area. Naturally they are at the mercy of the local money lenders. Table 1 gives an indication of the extent to which different agencies contribute to the total borrowing of the selected 404 households. The contribution of money lenders is comparatively very high as they account for 87 percent of the total credit.

Money Lenders

There are two types of money lenders in coastal areas; the money lenders who combine fish trading with

money lending, their primary interest being fish trading but engaged in money lending as a side business and the professional money lenders whose only or main occupation is money lending.

Table 1. *Borrowing of fishermen from different agencies.*

Credit agency	Loan advanced (Rs)	Percentage to total
Money lenders	6,31,400	87.0
Boat owners	50,100	6.9
Banks	37,700	5.2
Relatives & others	6,500	0.9
Total	7,25,700	100.0

The importance of money lenders as suppliers of cash to the farmers in rural areas is rapidly declining, for instance, according to All India Rural Credit Survey undertaken in 1951 the money lenders accounted for nearly 70 percent of all rural credit. According to Reserve Bank's Survey for 1961–62 they accounted for 49 percent of the rural credit. By 1969–70 the co-operatives emerged as the main institutional agency for agricultural credit in India. In that year they accounted for 33 percent of the total credit. However, in the Vizhinjam coastal areas there is not much change. The money lenders are still the major source of credit in these areas. There are many reasons for the preponderance of the money lenders in our coastal areas. a) Availability of institutional credit is not easy or adequate. b) Money lender is ready to supply credit both for productive and non-productive purposes. c) He is not much bothered about the period of loan. d) He is easily accessible and his methods of business are simple and elastic. e) Being a local man he has the local knowledge and experience so that he can lend money without even any security and knows how to protect himself against default.

Since the institutional credit is not easily available the services of money lenders are indispensable and to a certain extent much useful to the fishermen in those areas. However, there are complaints that they charge high rates of interests, often 30 percent and more and they don't keep proper accounts of repayment. Generally no receipts are issued for repayments.

In the Vizhinjam village as per enquiry 33.4 percent of the loan advanced by money lenders is on contract basis and the rest on interest basis. Credit will be advanced on contract basis only to those fishermen who own some fishing equipments. The size of the loan depends on the value of these equipments. No time will be fixed for repayment of loan. For getting a loan the boat owner has to enter into a contract with the money lender. Generally, the terms of contract are that the borrower should give the money lender daily (or whenever there is fishing) a certain percentage of his catch (often ranges from 10 to 25 percent) till the repayment of the loan. This system is found to be more profitable to the money lender than system of charging particular interest rate. In case he is charging some interest for his loan he can get that interest either once in a month (often it is monthly) or once in 6 months or a year. But in the former case it is a daily payment.

The interest rate charged by money lenders in Vizhinjam area is in the range of Rs. 2 to 6 for Rs. 100 per month. For more than 50 percent of the total loan, interest charged is Rs. 3 to 4 for Rs. 100 per month.

Boat Owners as Money Lenders

Out of 404 families covered under the survey, 67 families come under the category of contract labourers and these households are indebted to the tune of Rs. 50,100 which is 6.9 percent of the total indebtedness. In this system, for getting a loan the fisherman as a wage earner has to enter into a contract with the boat owner that he should work only in the boat from the owner of which he has received the loan till the loan is repaid. This type of loan is advanced only by boat owners. There is no interest in cash or kind. The amount of loan will generally not exceed Rs. 1,500. Even if these labourers get an opportunity to have their own boat and net they cannot utilise it because of their contract with the present employer. Among the families surveyed only very few families are reported to have come out of this contract during the last two years. On the other hand their number is increasing year after year.

Most of the workers who don't have any fishing equipment, in their desperate need of money either to tide over a lean season or to meet some unforeseen domestic expenditure borrow by pledging their man-power to some boat owner and these boat owners, in turn hypothicate their fishing equipments to money lenders and get loan and thus a considerable portion of the disposable income created in fishery goes to the money lenders.

Institutional Credit

As mentioned earlier, because of the absence of Co-operative Societies in this area bank loan is the only institutional credit available to the fishermen. The bank loans advanced to the households covered under the survey amounted to Rs. 37,000/- which constitutes only 5.2% of the total debt.

Purpose of loan

Only 24.8 percent of the total debt is utilised for productive purposes (Table 2). Maximum amount is spent for construction or repairing of the house buildings followed by household expenditure during lean season (21.8 percent) and social functions such as marriage, birth, death etc. (19.3 percent).

Table 2. *The percentage of total debt incurred for different purposes.*

Purpose	Utilisation of loans (%)
Purchase of crafts and gears	14.2
Repairing crafts and gears	10.6
Construction and maintenance of house buildings	28.3
Household expenditure during lean season	21.8
Expenditure on religious and social functions	19.3
Other purposes	5.8
Total	100.0

Since about 75 percent of the debt is utilised for non-productive purposes and the rate of interest is very high, for most of the families it is practically impossible to clear off the debts in the near future. It has been observed that despite their poverty many families spend much beyond their capacity towards social ceremonies. Addiction to alcohol is a social evil that ruins the economic position of many of the fishermen families. Another source of unnecessary expenditure is litigation which is highly expensive in our country.

Some of the debts are inherited and the ancestral debt is honoured by the fishermen community.

The existence of middle men between fishermen and money lenders is a peculiar phenomenon observed during the survey. These middle men are a sort of brokers. They help the fishermen to get loan from the money lenders without any security. Money lenders advance loan to fishermen on personal security of these middle men who will see that the debtor is paying the interest regularly. In turn these middle men get a commission for their service from the fishermen.

Income and indebtedness

From a study of the relationship between income and indebtedness given in Table 3 and figure 1 it is found that, broadly speaking, the extent of indebtedness is higher among higher income groups and lower among the lower income groups. But the number of households in the former group is comparatively too small.

The burden of debt is more on the lower income groups than higher income groups. Even though the amount of debt is lower among lower income groups as

Table 3. *Distribution of households by income level and indebtedness.*

Income groups (Rs)	Number of households	Number of households in debt	Percentage households in debt	Average indebtedness per household (Rs)
500 & below	26	17	65.4	615
501–1000	204	177	86.7	1,277
1001–2000	150	123	82.0	3,049
2001–3000	18	14	77.8	4,806
3001–4000	2	2	100.0	5,000
4001–5000	1	1	100.0	10,000
5001–7000	2	1	50.0	7,500
7001–10000	1	1	100.0	12,000
Total	404	336	83.0	2,160

compared to higher income groups, the repayment capacity of the former is much lower than that of the latter. Families in higher income group take loan generally for investment and they may not find it difficult to repay the loan whereas lower income groups borrow mainly for unproductive purposes. Out of 68 households who are not indebted 63 families come under the income groups of less than Rs. 2,000 per year. Some of these families are not having any earning member and are supported by their close relatives and some are surviving on the old age pension received from the State Government. Such family can not get a loan from a money lender.

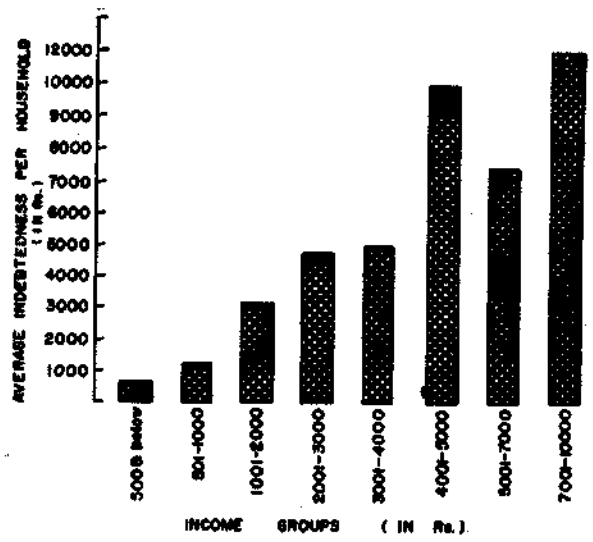


Fig. 1. Relationship of average household indebtedness to income.

The average annual income of the indebted household during 1978–79 worked out at Rs. 1,241 whereas the average outstanding debt per household during the same period worked out at Rs. 2,160. Calculating the annual interest for this amount at an average rate of 40 percent, a family with the aforesaid average annual income has to pay interest to the tune of Rs. 864. This would explain why a fisherman who once gets indebted can never escape from it. Artisanal fishery is not so productive as to enable the fishermen to meet the high interest rates. The fishermen are in a vicious circle of poverty. As they are poor they borrow and because they borrow they remain poor.

Summary and discussion

Out of 404 households surveyed for the study in Vizhinjam area, 336 families are in debt. Total debt incurred by these families amounted to Rs. 7.26 lakhs. The average outstanding debt per indebted household worked out to Rs. 2,160. Money lenders are the major source of borrowings. They are accounted for 87 percent of the total credit. Institutional credit is only 5.2 percent. Only 24.8 percent of the total debt is used for productive purposes. Households in higher income groups are more in debt than in lower income groups, as the money lenders are more interested to advance loans to people in higher income brackets. Average annual income of an indebted family of Rs. 1,241 is not sufficient to clear off its debts. Poverty is a cause and also an effect of indebtedness.

Measures should be devised for cancelling the old debts, fixing instalments for repayment of outstanding loans at a reduced interest rate and to control fresh borrowings. The following suggestions may be useful in solving the problem of indebtedness.

1. Legislation may be enacted for the compulsory reduction of ancestral debts and in specific circumstances for the liquidation of such debts.

2. Village Panchayats can be empowered for the settlement of outstanding debts by scaling down the debts and fixing the repayment in easy instalments.

3. Interest rate must be limited to a reasonable level.

4. Activities of money lenders have to be regulated. They must register themselves and get necessary licence. They should keep proper accounts and records.

5. Rural banks and co-operative societies have to be established in fishing villages. Banks may advance credit to fishermen through co-operative societies at concessional rates on mutual securities of the members of the co-operative societies. This is the only way by which the importance of the money lenders in the credit system of our fishing villages can be reduced. As pointed out in the report of the All India Rural Credit Survey Vol. II "in the village itself no form of credit organisation will be suitable except the co-operative society–co-operation has failed, but co-operation must succeed."

6. It is also necessary to see that the fishermen resort to borrowing only for most essential and productive purposes. Non-productive loans should be avoided. Education and propaganda can do something to prevent the fishermen from excessive expenditure in connection with religious and social functions.

7. It is highly essential to take some steps to induce the fishermen to save a certain portion of their income. Generally they are not in the habit of saving. It may be due to their acute poverty or even due to their ignorance. The rural banks and co-operative societies can formulate some schemes with this intention, for instance, a provident fund scheme can be formulated for all those active fishermen. This can be implemented through co-operative societies. At least all the members of the societies can be brought under the scheme.

The author is grateful to Shri T. Jacob, Senior Scientist, CMFRI for his guidance and valuable suggestions in the preparation of this paper.

NEWS — INDIA AND OVERSEAS

A System study of sea food industry in India

Matters like the import of foreign trawlers has become controversial in India and has been opposed on the ground that it would be against the interest of the traditional fishermen. Seafood industry circles complain that investments are not yielding the desired results and demand removal of uncertainties in the environment in order to improve investment climate.

M. Visveswarayya Industrial Research and Development Centre (MVIRDC) has undertaken a research project to define the potential constraints on the sea food industry. The project, to be completed in eighteen months, will suggest methodologies for resolving the conflicts among various interests.

Fish production from desert lake

Under a Sudanese project backed by China, production of fresh water fishes has been boosted up from Lake Nubia and the first fresh fish consignment from the lake went on sale recently in Khartoum. Lake Nubia was formed on the Nile in the desert area by the construction of Aswan dam in Egypt. A great deal of effort still lies ahead if the project in this desert lake is to achieve a production target of 1,500 tonnes a year, made up of Nile perch and two kinds of bagrus.

FNI 18 (10): October 1979

Method for cleaning seafood wastes

Dr. Stanley M. Barnett, a chemical engineering research worker at the University of Rhode Island has discovered a way to make seafood wastes clean themselves. It can also be used to float out contaminants from other discharges.

The method relies on properties of a foam created by pumping air into the shell fish processing wastes. As more of the waste discharge is pumped through a column of the foam, the bubbles collect small amounts of protein-rich-mixtures in the discharge, the major waste product in the processing operation. By forcing the foam through a special device, a foam of tiny, long-lasting bubbles is produced which is capable of drawing out the protein-rich surfactant from the waste stream.

The ability of foams to remove unwanted contaminants from a discharge stream has been known for many years and commercial surfactants are available. But the speciality of Dr. Barnett's foam is that the tiny size of the bubbles makes available large amount of surface area which can attract surfactants and contaminants. Another advantage is that the foam can be pumped without breaking down.

FNI 18 (10): October 1979

Problem of fish poisoning studied

A serious form of fish poisoning which afflicts many tropical islands has been studied by scientists of the South Pacific Commission. Although the extent of this poisoning, known as ciguetera, is not clearly understood, as many cases go unrecorded, several thousand cases in Pacific Islands are reported to the commission every year and there are indications of ciguetera increasing. Observations on 3,009 cases of ciguetera poisoning during 1964–1977 showed that one third of these patients were confined to bed. Nearly 90% of them showed neurological symptoms, such as numbness and tingling of the hands, cold objects feeling hot to the touch, dizziness and difficulty with balance. Patients with ciguetera poisoning usually

developed symptoms less than 24 hours after ingesting fish, nearly 77% of them within 12 hours. Those who have been poisoned multiple times by ciguetera appeared to suffer a clinically more severe illness than those experiencing it for the first time.

The fish poisoning has been proved to originate with a microscopic dinoflagellate which lives around corals. It is ingested with the food of a number of small and intermediate sized fish, some of them eaten by man. But it is more dangerous when these fishes in turn are eaten by others. By this the ciguatoxin becomes more concentrated.

FNI 19 (1): January 1980

Secret of the warm blooded albacore tuna

Scientists aboard the US National Oceanic and Atmospheric Administration's research vessel David Starr Jordan recently made discoveries that help explain how the extraordinary physiology of albacore tuna affects where and when the fish will be found. One of the key factors in the relationship between the fish and the environment may be its unusual adaptation of elevated body temperature and its ability to thermo-regulate. Since muscles are more efficient when heated, warm-bloodedness makes tuna one of the most powerful and fastest fish in the ocean.

It was possible to measure heart rates, outputs and blood pressures of captive albacore held for short periods in specially designed tanks aboard the research vessel. Blood pressure, two or three times higher than in other fish, was measured. This is believed to be an adaptation to the albacore's fast-swimming capability.

Isolation of chromosomes was carried out aboard the vessel. The characteristic chromosome bands found in all animals which can be used as "finger prints" for the species will be compared to those of albacore from other areas to determine the stocks.

Experiments carried out with the assistance of a second vessel to find out the preferred environment of the species showed that the fish spent much of their time 35–85 m below the surface, in water cooler than scientists had thought to be the preferred temperature of the fish.

FNI (19 (2): February 1980

BOOKS

Encyclopedia of Turtles. Peter C. H. Pritchard. T. F. H. Publication, Inc. Ltd. pp 895, 1979.

This book deals with the comprehensive survey of all living turtle species and subspecies. All the species are illustrated in colour or black and white. The author has given bibliography for each family to serve as a guide for further reading. Some sections cover such facets of turtles as their fossil record, anatomy and conservation. This is a good reference book on turtles.

Disease diagnosis and control in North American Marine Aquaculture. Edited by Carl J. Sindermann Elsevier Scientific Publishing Company. pp 329, 1977.

This is the sixth in the series "Developments in Aquaculture and Fisheries Science." It is the compilation and summarization of available information about diseases important to the expanding field of marine aquaculture in the United States. A basic list of general disease references and a list of research groups concerned with diseases of marine animals are given. This Volume is useful for those engaged in marine aquaculture development and pilot production and those who do not have time to go through the vast and highly dispersed literature to solve their immediate problems.

Marine Mycology: The higher fungi. Jan Kohlmeyer and Erika Kohlmeyer. Academic Press, New York. pp. 690, 1979.

This book deals with the higher marine fungi, ie. Ascomycotina, Basidiomycotina and Deuteromycotina. It includes sections on ecological groups of fungi and other topics such as phylogeny, ontogeny, physiology and vertical and geographical distribution. The taxonomy part contains illustrated keys for all species. This section is based mostly on the authors' examination of the filamentous marine fungi. It is an authoritative upto date source book on all aspects of the higher marine fungi through the authors' original investigations.

Compiled and prepared by M. J. George, G. Subbaraju and C. Suseelan. Published by Dr. M. J. George, Senior Scientist on behalf of the Director, Central Marine Fisheries Research Institute, Cochin-682 018

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