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ON THE PADDY FIELD PRAWN FISHERY OF TRAVANCORE-COCHIN AND AN EXPERIMENT IN PRAWN CULTURE¹

by

M. K. Menon²

The extensive paddy fields on both sides of the backwaters and many of the connected canals in the northern parts of the Travancore-Cochin State, which are single crop lands, have been used for the past several decades for prawn fishing. Enquiries have revealed that about 11,000 acres of such fields are being utilised for this purpose at present, the annual yields from which, judging from the figures collected, seem to vary very widely, from about 700 lbs. to 1,900 lbs. per acre. Expressed in terms of dry meat, which is the form in which these prawn catches are marketed, the yields vary from 106 lbs. to 295 lbs. per acre. Practically the entire production is exported from Cochin to Rangoon, Singapore and Hong Kong. In 1952, 3,825 tons of dried prawns valued at approximately 85 lakhs of rupees were exported from this port.

The owners of the fields, in most cases, do not fish the prawns themselves, but lease out the fields after the harvest is gathered to those engaged in the industry, deriving thereby, an additional income which, in recent years, has been quite considerable (about Rs. 100 to Rs. 300 per acre). The lessee's right to fish is usually limited to a period of 5 months or less, from about the 15th of November to the 15th of April. He is also required to take out a licence from the State Government.

In view of the importance of this fishery in the economy of these coastal villages it was considered desirable to collect accurate data on various aspects like the annual yield per acre, the monthly catches and their fluctuations, if any, the different species represented, their proportions and size range from month to month etc. A field of about $1\frac{1}{2}$ acres in extent on the border of one of the main canals of this place was, therefore, taken on lease in October, 1951. It has been divided into two portions, one of which is exactly an acre in area. A sluice 7' long, 5' high and $1\frac{3}{4}$ ' wide has been put up in each portion.

The one acre portion had been used for carrying on fishing operations while the smaller portion has

been devoted to experiments in prawn culture. A similar experiment has also been carried out in a portion of the fish farm belonging to the State Fisheries Department through the courtesy of the Superintendent. The farm was originally a part of a long stretch of low-lying swampy land situated close to the sea shore and not quite suited for paddy cultivation.

FISHING OPERATIONS

The fishery has been described in some detail by Panikkar³ (1937), but the operations involved may be briefly stated here. Soon after the paddy crop is harvested in October, the bunds of the fields are strengthened and sluices are installed. The method is, in reality, simply a device for large-scale prawn fishing which does not allow any time for the prawns to grow within the fields. Enquiries, however, show that in some localities e.g. in and around Narakkal, the current practice is a later development and that some 25-30 years ago it was actually a process of culture that was in vogue. After allowing prawns to enter the fields in the manner indicated above for some days, the sluices were finally closed and the prawns were left in the completely enclosed fields for 2-3 months after which they were fished.

When letting in water at high tide, the sluice is opened only after the water has risen almost to the highest level in the canal. This is to ensure that the water flows in with the maximum force possible, since the number of prawns entering depends largely on the force and duration of the current. The time taken to bring the water in the field to the same level was 25-30 minutes. A good portion of the water is let out at low tide (this also is done when the level of water has dropped almost to the lowest) so as to allow more water to flow in at the next high tide. A lamp is hung at the mouth of the sluice at night when taking in water in order to attract prawns towards it.

¹ Published with the permission of the Chief Research Officer, Central Marine Fisheries Research Station, Mandapam Camp, S. India.

² Prawn Research Unit of the Central Marine Fisheries Research Station, Narakkal, India.

³ Panikkar, N. K. The Prawn industry of the Malabar Coast. *Jour. Bombay Nat. Hist. Soc.* Vol. 34, 1937.

The fishing usually starts with the neap tides, 4-5 days before every new and full moon and is continued for 7-8 days. The net, about 20' long has a rectangular wooden frame tied to its mouth. Its cod end is tied up with a piece of rope to which a float is attached. When the level of water in the canal is nearly at the lowest limit, the wooden frame of the net is fixed vertically inside the sluice and the shutters are removed. Water rushes out through the net with considerable force, carrying with it some of the prawns, which collect at the narrow end, which is lifted from time to time and emptied into a boat moored nearby. The time taken for completing the operation (till the level of water inside and outside the field is equal) is about the same as that taken for filling the field. If the fishing is done after dusk a light is also used.

MONTHLY CATCHES AND TOTAL YIELD

Operations were started in the first week of December in the 1951-52 season, a fortnight after they had begun in many of the neighbouring fields. In 1952-53 fishing was started somewhat early in the first week of November. The last fishing was done on 18-4-53 and 21-4-53. The weight of prawns (fresh) caught and the number of days on which fishing was carried out in each month are given in Table 1. On the last day cast nets were used since the ordinary method usually leaves a considerable number of prawns and some water behind in the fields. The catches of March and April, when the salinity of the canal water ranged from 26‰ to 33‰, were on the whole better than those of other months and this was true in regard to several other fields also.

The approximate yield per acre for the two seasons of a number of other fields situated at different

places was obtained for purposes of comparison and these are included in Table 2. The yield from every one of these fields is considerably more than that of our experimental field for the corresponding season, probably because, owing to their much larger size, the length of time taken to fill them will be greater, thus allowing a larger number of prawn to pass into them. The table also tends to show that besides acreage some other factors like location, nature of the bottom etc. may also affect the yield.

SPECIES OBTAINED

Eight species of prawns and shrimps have been, obtained in the catches, namely *Peneus indicus*, *P. carinatus*, *Metapenaeus monoceros*, *M. dobsoni*, *Palaemon rudis*, *Leander styliferus*, *Caridina gracilirostris* and *Acetes* sp. Among them *P. carinatus* and the last two species have been obtained in extremely small numbers on a few days only and are, therefore, of no importance to the fishery. The percentage values of the other species for each month will be found in Table 3, which also includes the range of salinity of the canal water during each. It is very likely that the fall in the percentage value of *M. monoceros* may be correlated with the rising salinity of the canal water. It is also noteworthy that the maximum numbers of *P. indicus* have been captured in the months of March and April, i.e. at the end of the season, in the other months its percentage value not exceeding 12. Such a low proportion of the only species of penaeid prawn that grows to a fair size in the backwaters is one of the factors that may render prawn farming in such fields hardly more profitable than by the present method. The data collected in regard to growth of penaeids in these environments, particularly

Table 1

Monthly weight of prawn catches in 1951-52 and 1952-53 seasons from a 1-acre field

| Month | 1951-52 | | 1952-53 | |
|----------------|-------------|------------------|-------------|------------------|
| | No. of days | Wt. caught (wet) | No. of days | Wt. caught (wet) |
| November | .. | .. | 14 | 105½ lbs. |
| December | 13 | 78 lbs. | 15 | 113 " |
| January | 13 | 91 " | 16 | 74¾ " |
| February | 13 | 62 " | 13 | 107½ " |
| March | 14 | 125 " | 16 | 139¾ " |
| April | 8 | 130 " | 10 | 171 " |
| Total | 61 | 486 lbs. | 84 | 711½ lbs. |

Table 2

Approximate yields per acre of some other fields

| Acreage | Situation | Distance | Yield per acre 1951-52 | | Yield per acre 1952-53 | |
|---------|------------|---------------------------------|---------------------------|-----------------|---------------------------|-----------------|
| | | | Dry meat | Fresh prawns | Dry meat | Fresh prawns |
| 11½ | Canal | Adjoining experimental Field | 106 lbs. | 690 lbs. | 131 lbs. | 851 lbs. |
| 16 | -do- | 2 Furlongs north | 139 " | 904 " | 138 " | 897 " |
| 15 | Backwaters | 8 miles north | 106 " | 690 " | .. | .. |
| 60 | -do- | ½ mile east | 155 " | 1,008 " | 153 " | 995 " |
| 26½ | -do- | -do- | 294 " | 1,911 " | 181 " | 1,177 " |
| 32 | -do- | 5 miles south | 97 " | 630 " | 131 " | 852 " |

Table 3

Approximate composition of prawn catches and range of salinity

| Species | November | | December | | January | | February | | March | | April | |
|-----------------------|----------|-------|----------|-------|---------|-------|----------|-------|-------|-------|-------|-------|
| | 1951 | 1952 | 1951 | 1952 | 1952 | 1953 | 1952 | 1953 | 1952 | 1953 | 1952 | 1953 |
| | | % | % | % | % | % | % | % | % | % | % | % |
| <i>M. dobsoni</i> | .. | 87.9 | 74.6 | 82.3 | 81.6 | 89.8 | 86.8 | 89.5 | 79.2 | 67.1 | 84.5 | 45.7 |
| <i>M. monoceros</i> | .. | 8.6 | 14.3 | 7.0 | 5.6 | 0.6 | 7.5 | 2.6 | 2.8 | 1.1 | 0.8 | 2.6 |
| <i>P. indicus</i> | .. | 1.6 | 7.5 | 8.7 | 11.7 | 9.0 | 8.4 | 7.0 | 12.5 | 29.8 | 2.0 | 48.0 |
| <i>Pal. rudis</i> | .. | 1.8 | 2.5 | 1.1 | 0.5 | 0.5 | 0.8 | 0.4 | 1.5 | 1.0 | .. | 1.3 |
| <i>L. styliferous</i> | .. | .. | 0.8 | 0.1 | 0.5 | .. | 2.4 | .. | 3.9 | .. | 12.6 | 2.4 |
| Range of sal. | .. | 4.9 | 4.9 | 15.73 | 19.89 | 22.41 | 25.12 | 24.76 | 26.74 | 28.91 | 31.62 | 33.24 |
| per 1,000 | .. | 14.29 | 18.17 | 21.33 | 23.86 | 24.76 | 26.74 | 28.73 | 29.63 | 31.26 | 31.98 | 22.05 |

of the two species *P. indicus* and *M. dobsoni* also tend to support this inference.

Unless prawn farming can be shown to lead to an improvement in production, at least in respect of those fields of which the present yields are comparatively low, it has little chance of being adopted by those engaged in the industry. Improvement could be effected if the proportion of *P. indicus* can be appreciably raised, or if they could be made to grow larger than at present within the fields. Observations so far made have indicated the presence

of considerable numbers of the fry of this species in the canals and back-waters in October and November.

GROWTH OF *P. INDICUS* AND *M. DOBSONI*

Random samples from the catches of each fortnight have been regularly analysed and the proportion, sex ratio, length frequencies etc. in regard to the three species of penaeids determined. The frequencies for each month in respect of *P. indicus*

and *M. dobsoni* have been plotted in order to estimate whether and to what extent growth takes place in the brackish-water environments of the backwaters and canals. *M. monoceros* was omitted from this study because of the insignificant numbers occurring in some months.

The frequency curves in respect of *P. indicus* illustrate a steady diminution in the percentage of prawns exceeding about 90 mm, due to intensive fishing. Further, as the days become hotter many of them would go down into the mud at the bottom of the fields and may not therefore be carried in the out-flowing current.

There is clear evidence of growth, however, in regard to the small sized individuals. The curve for December, 1951, shows that 57.2% of the catch was formed of juveniles measuring not more than 50 mm while those between 50 mm and 90 mm accounted for 14%. In the succeeding months there is a steady fall in the percentage of the former group and a corresponding rise in that of the latter. In March the first group constituted only 20.6% of the catch, while the remainder was almost entirely composed of prawns of the second group. It cannot, of course, be claimed that the whole of this increase in the proportion of the latter is due to growth; a part of it, no doubt, is only apparent, being the effect of the disappearance of individuals of over 90 mm in length. The majority size group of December, 1951, was 31-35 mm in length while that of March, 1952, measured 71-75 mm.

The curves for November, 1952, to March, 1953, are substantially similar, though the percentage of juveniles does not show any fall in December and January.

It would, therefore, seem that in the conditions prevailing in the canals and backwaters, the extent of growth of these juveniles of *P. indicus* has been about 40-50 mm in the course of approximately 4-5 months.

In the case of *M. dobsoni*, the frequency curves do not help in estimating the growth of the young ones. It seems fairly clear, however, that the vast majority of prawns belonging to this species do not grow beyond 61-65 mm in the backwaters during these months.

EXPERIMENT IN PRAWN FARMING

While the observations detailed above were in progress, an experiment in farming for a short

period of about two months was conducted in the smaller field (about $\frac{1}{4}$ acre in extent) mainly for the purpose of ascertaining roughly how growth is influenced by the different conditions obtaining in paddy fields. The preliminary operations of taking in water and letting it out were done exactly as described above for a period of 10 days (from 1-2-52 to 10-2-52) and the sluice was kept closed thereafter. On 11-2-52 a few sheafs of paddy straw were introduced in order to approximate the conditions prevailing soon after harvest. A week later the water turned green owing to the abundant growth of microscopic algae¹ and a scum appeared on the surface, which persisted in patches till about 9-3-52. During this period the temperature of the water rose to a maximum of 35°C during the day and the salinity was 28.73‰ on 5-3-52. Many of the prawns were seen swimming at the surface at daybreak and remained there for about a couple of hours, exposing themselves to the attacks of crows and kites. A little water was therefore let in on some days and this proved effective in preventing the prawns from remaining at the surface long. They seemed to be otherwise unaffected by the conditions induced in the field by the fertiliser and temperature. They were fished in the first week of April, thus allowing about two months for growth. The length frequencies indicated that substantial growth had taken place, although the method adopted to stock the field with prawns makes it difficult to determine their initial length frequencies.

The differences in the frequencies of most of the groups of *P. indicus* were reduced appreciably, probably because of their unequal growth rates, the smaller groups growing more rapidly than the larger. The increase in the proportion of groups between 75 and 95 mm would also seem to show that growth has been more rapid than in the backwaters and canals.

The second experiment similar to the one described above was conducted in a part of the Government fish farm, about two acres in extent. Its location and the nature of the land have been referred to in the introduction. Water was let in, as in the former experiment, for about 11 days (from 10-3-52 to 21-3-52) and was stopped only after making sure that a good number of prawns had entered. Two days later some sheafs of paddy straw were put in, mainly to stimulate algal growth, which gave rise to the same changes as were noticed in the first experiment. The salinity of the water in the farm rose

¹ According to Dr. F. Thivy, Algologist, there are two dominant species, one a blue-green alga belonging to the genus *Anabaenopsis* and the other a species of diatom of the genus *Chaetoceros*.

to 33.06% in the first week of April. As in the previous experiment most of the prawns used to swim at the surface in the morning during the period, but kept to the bottom after allowing some water to pass in occasionally. They were apparently quite healthy as long as the experiment lasted and hardly any mortality occurred. Fishing was done on 8-5-52 and the following day, but some prawns, mostly small, were still left behind. The total quantity fished was 767 lbs. In addition, a few pearl spots, catfish and mullets were also caught. On one day one of the bunds was slightly breached and a few prawns may have escaped before the breach was closed. Making an allowance for this, it would not be wrong to assume that about 800 lbs could have been fished, i.e about 400 lbs per acre.

During the period November to May, at least two and probably three crops of prawns could be raised. The annual average yield per acre could, therefore, be estimated at approximately 800 to 1,200 lbs. As such land is not usually used for rice cultivation and as prawns in the surrounding canals had become very scarce after the monsoon started, the farm was stocked with some young

mulletts and chanos in the last week of May. Nothing was done to influence their growth and they were fished on the 17th and 19th, October, 1952. The catch consisted of:—

| | | |
|------------|-----|------|
| Mulletts | 79 | lbs. |
| Chanos | 527 | „ |
| Pearlspots | 26 | „ |
| Other fish | 73 | „ |

The total weight of the catch is thus 705 lbs and the net yield was about 350 lbs. per acre. Though the number of mulletts originally stocked was more than the number of chanos, the number actually caught was remarkably few. The experiment would thus seem to show that farms developed in such coastal tracts with facilities for taking in water by tidal action from backwaters and canals could be expected to yield between 1,000 and 1,500 lbs of valuable food per acre annually.

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