THE PRAWN CULTURE PRACTICES IN SALT-PAN RESERVOIRS AT MANAKKUDY NEAR CAPE COMORIN

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ABSTRACT

The methods employed for culturing *Penaeus indicus* in the brackish-water reservoirs of the salt works adjoining Manakkudy Estuary near Cape Comorin are described together with notes on biology of the species. Observations were carried out in three reservoirs (3 hactares) from January 1973 to December 1973. Culturing is done in two seasons in a year, one from February to May and another from June to December. Juvenile prawns of modal size 61 - 70 mm obtained from nearby estuary and stocked in February grow to marketable size of 135 mm and are harvested in May and those stocked in June are harvested from September onwards till December. During the period of culture no artificial food is given and the production rate is estimated at 1144 Kg/ha/year. The maximum growth rate of 30.55 mm/month was recorded in early stages till the species attains 125 mm and thereafter the growth rate slows down. Analysis of stomach contents revealed that the diet consists of polychaetes, crustaceans, bivalve molluscs, foraminiferans, filamentous algae, detritus and diatoms with preponderance of vegetable constituents in the smaller prawns and of crustaceans in the larger ones.

INTRODUCTION

Commercial culture of prawns is practised in India mainly in the paddy fields of Kerala (George, *et al.*, 1968) and in the salt water 'bheris' of Sundarbans in West Bengal (Hora and Nair, 1944). In the present communication, the observations made by the auther from January 1973 to December 1973 on the culture of *Penaeus indicus* in three reservoirs of the salt-pans adjoining Manakkudy Estuary are reported.

LOCATION, EXTENT AND HYDROBIOLOGICAL CONDITIONS OF THE RESERVOIRS

The Manakkudy Estuary (Fig. 1, a) which has an area of about 150 ha, is situated in the southern extremity of the west coast about 8 kilometres north of Cape Comorin. It is connected with the sea almost throughout the rainy season viz. June to August and October to December, but

remains land locked for the rest of the year. In the summer months also, however, it gets connected with the sea occasionally when the local people cut open the narrow sand bar to avoid damage to the neighbouring areas by heavy flood caused by the accumulation of water from Pazhayar River. The estuary supports a good fishery for juvenile penaeid prawns throughout the year. According to an estimate made by the author, nearly 4 tonnes of prawns are caught annually from this environment with peak catches in February and March. *Penaeus indicus* forms over 90% of the catches and it has been observed that the recruitment of smaller size groups of this species into this fishery takes place in February – March, May - June, September – October and in December, with peak in the first half of the year.

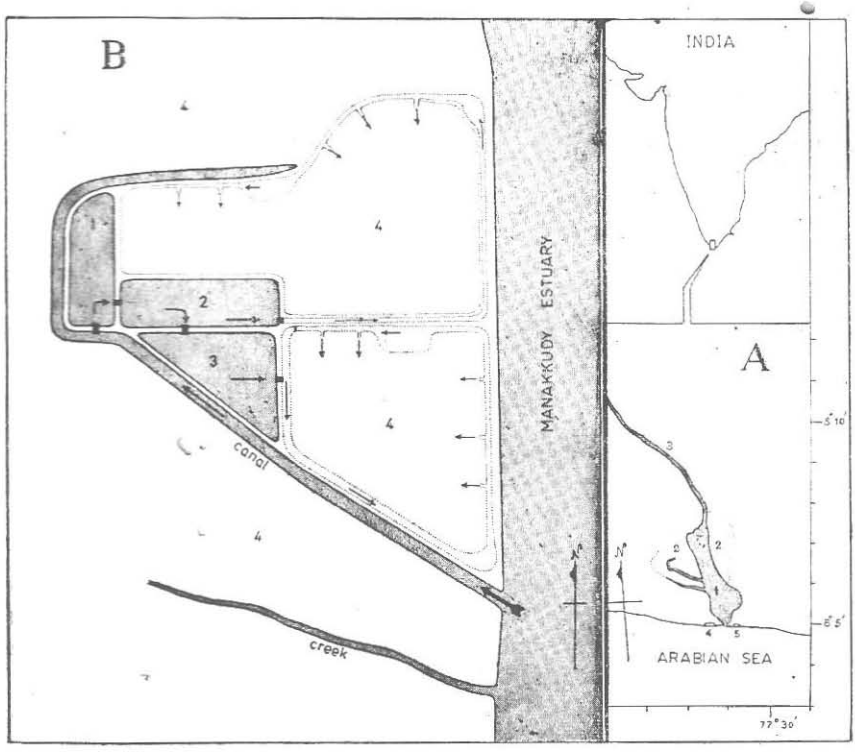

Fig. 1. a — Manakkudy Estuary and adjoining salt-pans; 1. topography of estuary; 2. salt pans; 3. Pazhayar River; 4 & 5 Manakkudy fishing villages.
b — Topography of reservoirs and salt pans (not to scale): 1 to 3 reservoirs; 4. salt-pans. (Arrows and black squares indicate directions of water movement and positions of sluices respectively).

Large areas of land adjoining the two sides of this estuary are used as salt-pans. Brine for salt making is mostly taken from the estuary and stored

in reservoirs. The three reservoirs of the western side, from where observations were made, had 0.9, 1.2 and 0.9 ha areas respectively (Fig. 1, b). The estuarine water is first stored in Reservoir 1 and subsequently in Reservoirs 2 and 3 when the level of water in the feeder canal remains higher than in the reservoirs and its flow is regulated with the help of wooden sluice gates provided at different places as indicated in the figure. During dry season when salt making is in full swing, the reservoirs are refilled once in fifteen or twenty days. The refilling is less frequent during the rest of the year and is totally suspended throughout the monsoon months.

The normal depth range of the reservoirs is 1 to 1½ metres and the bottom is covered with sandy clay of 15 to 30 cm thickness with dense admixture of dead lime shells.

Surface temperature and salinity of the reservoirs, estuary and the inshore sea were examined on four different occasions during the culture period of 1973 (Table I). The temperature of the reservoirs was always higher than that of the estuary and within the reservoirs its variation was only less than 0.4°C. Similarly the salinity was also higher in the reservoirs than in the estuary, but remained considerably lower than in the inshore sea. Its mean values were 10.08‰, 19.21‰ and 23.22‰ for the three reservoirs respectively. During July, the salinity of all the reservoirs remained low due to the mixing of rain water.

Table I — Surface temperature* and salinity readings of the reservoirs, estuary and inshore sea

Date of observation	Tem. & Salinity	Reservoirs 1	2	3	Estuary	Sea	Remarks
21-4-1973	T.°C.	31.2	31.5	31.5	30.8	29.7	Bar
	S.‰	10.55	22.95	28.10	6.24	34.26	closed
13-7-1973	T.°C	28.8	28.5	28.9	28.6	24.2	Bar
	S.‰	4.95	13.43	17.65	1.40	32.50	open
14-12-1973	T.°C	—	27.0	—	25.8	27.7	Bar very
	S.‰	—	20.37	—	25.31	31.93	narrow
21-12-1973	T.°C	25.4	25.7	25.7	24.8	27.8	Bar
	S‰	14.74	20.08	23.93	4.28	31.14	wide open

* Recorded between 8.30 hrs. and 9.30 hrs.

A number of species of fishes and decapod crustaceans that are drawn in while refilling the reservoirs were found to inhabit this environment in the natural conditions. Among fishes, the most abundant were species of *Tilapia*, *Mugil*, *Etroplus*, *Gerres*, *Mystus*, *Chanos* and *Anguilla*. The crustacean fauna was predominantly represented by four species of penaeid prawns viz. *Penaeus indicus*, *P. monodon*, *Metapenaeus dobsoni* and *M. monoceros*, a few species of caridean prawns chiefly belonging to the genus *Macrobrachium* and a single species of crab. *Scylla serrata*. Moderate growth of algae (*Prasiola*, *Enteromorpha* and *Chaetomorpha*) were occasionally observed, of which *Enteromorpha intestinalis* was dominant during the culture period.

Prawn Culture

In the beginning of every year the reservoirs are taken on lease from the owner of the salt works by a party consisting of 3 or 4 persons of the locality for prawn culture purpose. The period allowed at a time is January to December on a lease amount of Rs. 1500 to Rs. 2000 per year. The method employed is a simple way of raising small sized juveniles of *Penaeus indicus* in the reservoirs to marketable size in three to four months time.

Culturing is done in two seasons in a year, one from February to May and another from June to December. The commencement of each season coincides with the peak period of the occurrence of small juvenile praws in the estuary.

Stocking of seeds in the reservoirs:

Seeds are obtained from the cast net catches of the estuarine fishery. As soon as small sized prawns begin to occur in the estuary in large numbers the culturists make arrangements with the fishermen, offering high prices, for the supply of their catches in live condition. If necessary, advance payments are also made for this purpose. The fishermen, numbering about forty, conduct intensive fishing day and night for about a week to catch the required seeds for stocking in the reservoirs. Prawns are collected in small bamboo baskets with narrow mouth and bamboo lids and are kept alive by hanging the baskets down in the water with pieces of ropes tied to the catamaran. Every two to three hours of fishing the catches are taken to the culture site through the canal by catamaran and keeping the baskets under water. Then the culturists, after estimating the number of prawns contained in each of the baskets and fixing the price, gently transfer the collections to a pit of about 50 cm diameter and 15 cm deep made in the reservoir near the shore. All the active prawns swim away into the reservoir leaving the dead or dying ones in the pit, which are removed immediately. Normally, most of the prawns thus released would survive, the mortality rate observed in this process being less

than 10% only. The average stocking density has been estimated to be between 38,000 and 50,000/ha. Majority of the seeds thus stocked are in the size range 56–80 mm (total length) and the price paid is Rs. 2 to Rs. 2.50 per hundred.

Maintenance of the stock and harvesting:

While storing water in the reservoirs and letting out the same to salt-pans the prawns are prevented from escaping or getting mixed up from one reservoir to another by placing small bamboo screens at the sluice gates. The prawns are not fed artificially. One of the major jobs associated with the maintenance is the removal of other animals especially those above juvenile stages. As far as possible they are fished out every ten or fifteen days with gill nets and hooks and lines operated from small catamarans. Gill nets are used mainly for catching fishes like species of *Tilapia*, *Mugil*, *Etroplus* and *Chanos* and are operated without attaching sinkers to avoid the prawns. Hooks and lines, baited with pieces of *Tilapia*, are effectively used for catching carnivorous fishes like cat fishes and eels. The crabs, which are reported by the culturists to be highly predacious on freshly moulted prawns, are fished out by a method more or less similar to the one commonly employed in Pulicat Lake (Thomas, 1971).

Harvesting begins 3 to 3½ months after stocking, by which time majority of the prawns attain marketable size of abut 135 mm length. Cast nets are the common gear employed for this purpose. Generally, intensive fishing is made just before fresh estuarine water is admitted into the reservoirs, so that the depth of water will be at its minimum which would facilitate better yield. At the end of the first crop the entire stock is harvested in about 5 or 6 days. In the second crop, however, only about 50% of the stock is caught at this stage and the remaining are allowed to grow further and are fished out little by little till the end of the lease period in December. Towards the close of both the seasons, in addition to cast nets, other gears such as drag nets and small shore seines are also operated in the reservoirs in order to ensure complete harvest.

Rate of production:

For assessing the rate of production involved in this fishery, details of the number of prawns stocked and harvested during the two culture seasons of the year 1973 were examined. Information regarding the estimated total number of seeds stocked were collected from the culturists, while the total number of prawns harvested was estimated based on the collections made by merchants. The production figures are given in Table II. During the first crop, which extended from 27th February to 30th May, nearly 82% of the

prawns stocked was harvested before the end of that season. In the second crop, which commenced on 7th June and lasted till the end of December, the overall recovery was only 71%. The annual production of prawns from this environment by culture is estimated at 1134 Kg/ha with relatively better yield in the first season.

Table II — Production figures of *P. indicus* by culture in the reservoirs during the year 1973

	Culture periods	
	February-May	June-December
Estimated total number of prawns stocked	1,50,740	1,15,870
(Weight in Kg.)	(354)	(188)
Estimated total number of prawns harvested	1,22,560	82,250
(Weight in Kg.)	(2,231)	(1,714)
Rate of production per hectare in Kg.	625	509

The prawns thus grown in the reservoirs, which are locally called 'Kula naaran', are sold entirely to prawn merchants by auctioning. Normally, the cost of individual prawns after bidding will be about 30 to 35 Paise for medium sized ones and about 50 to 60 Paise for the large sized prawns fished towards the end of the second crop.

Biological Observations

Growth rate of the species in this environment has been studied by following the progression of modes in the size-frequency distribution of catches examined at different stages of culture during the year 1973. The size distribution of the freshly stocked juveniles was unimodal, with mode at 66–70 mm in the first crop season and at 61-65 mm in the second crop season for both the sexes. The modal progression and growth pattern observed are summarised in Table III. The estimated average rate of growth upto 135 mm size in the first season was 24.68 mm/month for both sexes. In the second season, the growth increment observed upto about the same size was comparatively low, the estimated monthly growth rate being 19.81 mm for males and a slighity faster growth of 21.23 mm for females. The growth beyond 135 mm size was very much retarded and the monthly growth rate was only 5.29 mm in both sexes.

Table III — Progression of size modes and growth pattern of *P. indicus* during culture in salt-pan reservoirs

Sex	Initial position of size modes		Final position of size modes		Interval between initial and final position	Growth observed during the period	Estimated growth per month
	Sampling dates	Modal size (mm)	Sampling dates	Modal size (mm)			
MALES	27-2-73	68	21-4-73	123	54 days	55 mm	30.55 mm
	21-4-73	123	15-5-73	133	25 days	10 mm	12.00 mm
	15-5-73	133	25-5-73	133	11 days	nil	—
	8-6-73	63	21-9-73	133	106 days	70 mm	19.81 mm
	21-9-73	133	14-12-73	148	85 days	15 mm	5.29 mm
	14-12-73	148	21-12-73	148	8 days	nil	—
FEMALES	27-2-73	68	21-4-73	123	54 days	55 mm	30.55 mm
	21-4-73	123	15-5-73	133	25 days	10 mm	12.00 mm
	15-5-73	133	25-5-73	133	11 days	nil	—
	8-6-73	63	21-9-73	138	106 days	75 mm	21.23 mm
	21-9-73	138	14-12-73	153	85 days	15 mm	5.29 mm
	14-12-73	153	21-12-73	153	8 days	nil	—

The ratio between males and females in the population was more or less equal throughout the period of culture. Towards the end of the second crop, however, the males were more numerous in the catches than the females. The largest male and female prawns measured respectively 164 mm and 167 mm in total length, the former weighing 32.5 gms and the latter 34.5 gms. Though the females grew to very large size in this habitat, all of them remained only in the immature condition.

The stomach contents of 25 prawns in the size range 63-128 mm and 30 in 142-160 mm were examined. In the smaller size group, 19 had full or partly full stomachs and the remaining empty stomachs. Among the larger prawns, however, only 7 had food in their stomach in varying degrees of fullness. The food consisted of animal and vegetable matter mixed with fair amounts of detritus and sand. Remains of polychaetes, crustaceans (copepods, benthic ostracods, megalopa larvae and smaller decapods), bivalve molluscs and foraminiferans formed the animal matter and filamentous algae and

diatoms the vegetable matter. The average percentage composition of the food items (as estimated visually) in the two size groups is shown in Table IV. The proportion of vegetable constituents was relatively high in the younger prawns and so was crustaceans in the older ones.

Mohanty (1974) observed organic detritus, microcrustaceans, algae, weed cuttings, molluscan shells and sand particles in the stomach of the prawns he reared in brackishwater ponds at Keshpur and noted preponderance of algae in juveniles and detritus in adults.

Table IV — Percentage composition of food items of *Penaeus indicus* cultured in the reservoirs

Food items	Percentage composition	
	63–128 mm size	142–160 mm size
Foraminiferan shells	...	2.0
Polychaete remains	20.0	22.0
Copepods	...	1.0
Ostracods	...	5.0
Megalopa larvae	...	3.0
Other crustacean remains	8.5	25.0
Molluscan remains	20.0	1.0
Filamentous algae	17.5	1.0
Diatoms	10.0	...
Detritus	22.5	30.0
Sand particles	1.5	10.0

General Remarks

The growth of *Penaeus indicus* in the natural environments has been studied by many workers and there is general agreement in that this species, as other penaeid prawns, grows relatively fast in its juvenile stages under estuarine conditions. This, coupled with the fact that the prawn continues to grow in prolonged confinement and attains very large size in the brackish-water enclosures as observed by Subrahmanyam and Rao (1968), Mohanty (1974) and George (1974), is significant from the standpoint of commercial culture. Subrahmanyam and Rao (1968) noticed a growth rate of 19.35 mm/month for the juveniles when reared in a brackishwater pond near the mouth

of Pulicat Lake. Recent laboratory experiments of Sultan *et al.* (1973) have indicated an average grotwh rate of 25.81 mm/month for this species up to 105 mm size, with relatively faster growth of 35.4 mm/month in the early stages between 30 and 65 mm size in brackishwater media. In the present observation also the growth noticed was high, the maximum growth rate recorded being 30.55 mm/month in the younger stages up to about 125 mm length (Table III). The rate of growth beyond this size was very low. It has also been observed that the growth rate was relatively high during the first crop, which may be probably due to better ecological conditions resulting from frequent changes of water in the reservoirs and also to the higher temperature of water during summer months.

Among the many biological factors involved in brackishwater farming of penaeid prawns, growth of the species is the most important one and the success of any culture operation on commercial basis largely depends on the rapidity of growth as well as the size to which the animal attains in captivity. The species extensively cultured at present in most of the countries belong to the genus *Penaeus* (Mohamed, 1973) obviously because of their large size and the ability to grow fast under artificial conditions. In India, *P. indicus* and *P. monodon* are considered to be the most suitable species for the culture purpose (Mohamed, 1969; Gopalakrishnan, 1973) and therefore efforts should be intesified to augment their production by culture as well as by improving the existing traditional farming practices by adopting scientific methods. From the foregoing observations it would appear that large scale culturing of *P. indicus* in the reservoirs of salt-pans will be a promising enterprise if carried out on scientific lines. Besides, there is also considerable scope for further extension of culture practices on both the sides of Manakkudy Estuary, which has abundant resources of the seeds of this prawn.

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