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PRAWN FARMING IN THE TIDAL FLAT OF KALLAR ESTUARY

R. MARICHAMY*

Central Marine Fisheries Research Institute, Cochin 682 031

ABSTRACT

Prawn farming is gaining importance in Southeast coast of India in recent years. Derelict area along the edge of Kallar River at Veppalodai has been developed into productive culture ponds. Potential grounds for the collection of euryhaline species of prawn have been identified in the tidal inlets along Gulf of Mannar. Culture is done in 2 seasons in a year. Juvenile prawn *Penaeus indicus* of model size 25-35 mm obtained from wild and stocked in August 1985 grew to marketable size of 138 mm in five months and those stocked in February 1986 are harvested from July onwards. A difference in the growth rate has been noticed in two different sets of experiments and the causes attributed mostly to the environmental features of the culture ground. Better survival and production are obtained in the summer crop. Supplementary feed was given in the form of pelletized feed and trash fishes. Production rate was 530-1200 kg/ha/crop although salinity ranged from 31-48 ‰. The present results indicate the scope for further development of unutilized areas for culture practices by improving certain management practices.

INTRODUCTION

THE POTENTIALS of coastal aquaculture and the advantages of converting the vast derelict swamps and inter-tidal belts in the coastal zone into productive fish farms have been recognised only recently. Culture activities have expanded to the extent where large number of private farmers, mostly salt producers are accepting shrimp farming as a profitable one along the coast of Gulf of Mannar. Prawn culture under extensive method has been practiced in India in 'bheries' of West Bengal and 'Pokkali' fields of Kerala, involving natural stocking of prawns in tidal enclosures. Semi-intensive prawn culture under selective stocking system is practiced in few places of India (Muthu, 1978). Earlier attempt to study the effective utilization of resources raised in tidal flats for prawn culture at Veppalodai was carried out by Mohammed *et al* (1980). Srinivasan *et al* (1982) briefly dealt with the development of brackishwater prawn farming in Tamilnadu. The present paper presents the results of two different sets of semi-intensive prawn culture experiments done in a new site developed in the tital edge of the southernside of the Kallar Estuary at Veppalodai in Chidambaranar District of Tamilnadu.

The prawn farm belongs to Shri. John Motha, a leading salt producer of Tuticorin. Prawn culture programme was thoroughly monitoried by the author beginning from the designing and construction of ponds and was effectively carried out for good yield. The author expresses his grateful thanks to the owner of the farm for all co-operation and help extended for carrying out this project successfully. The author is indebted to Dr. P. S. B. R. James, Director, Central Marine Fisheries Research Institute, for his keen interest and encouragement and for giving permission to present this paper at the symposium.

* Present address : Tuticorin, Research Centre of CMFRI, 93, North Beach Road, Tuticorin-628 001, Tamil Nadu.

Topography and site development

The Kallar Estuary is located about 25 km north of Tuticorin. It is connected with the sea almost throughout the year, but gets land locked during July/August. However, the authorities of salt industry maintains steady flow of seawater by cutting open the narrow sand bar at the mouth of the estuary on such occasions, since it is a must for their work. Chances for getting flow of rain water in the river is poor with the low annual rainfall during north-east monsoon and also due to the construction of a reservoir across the river near Eppothumvenran, 30 km southwest of Veppalodai, for irrigation. There is flow of seawater into the estuary in most of the months upto a maximum distance of 3 km from bar mouth. It is not a typical type of estuary containing always brackishwater. The seawater enters inside when the tidal amplitude ranges from 0.5 to 1 m. It is on the southern side of the Kallar Estuary, the present productive prawn culture ponds are developed by converting the marshy tidal edges. The soil is loose clayey mixed with sand and rich in organic matter. The estuarine areas enjoy a tidal regime and supports a good fishery for juvenile prawns, fishes and crabs. It is a traditional fishing ground for local fishermen. In the beginning, 2 ponds each of 0.5 ha in area were constructed at an elevated place of the tidal edge by removing mangrove plants. 5 HP motor istalled on the bund of main feeder canal lifted water from the creek to a height of 2 metres to feed through the storage canal to the pond. An average water depth of 0.5 m was maintained in the ponds. Organic manure at the rate of 500 kg/ha was added to enrich the development of phytoplankton bloom before stocking the prawn seed.

Water characteristics

As Shigueno (1972) remarked, the hydrobiological regime is a highly complicated factor in prawn farming because of rather slow movement of water, shallow depth, intensive stocking of prawns, algal development and accumulation of organic matter. The variations in dissolved oxygen content, temperature, salinity and productivity rates are the key elements in the culture system which play important role in keeping the prawns in good condition. Phytoplankton was developed by manuring the water in both the experiments and the role of oxygen generated by the bloom was well realised. The hydrological conditions of rearing ponds are given in Table 1. Productivity of the pond was maintained generally in the range—500-850 $mgC/m^3/day$. Gopinathan *et al* (1982) based on the degree of primary production considered the similar productivity scale of 500-1500 $mg/Cm^3/day$ as moderately productive one. It was observed that temperature and salinity exhibit an upward trend during the warm seasons *i.e.* September-October 1985 and in the prominent summer, April-June 1986. Salinity was well above 45 pp. during most of the days in April-June 1986. Dissolved oxygen content was recorded in the range 2.98-4.72 ml/l and pH varied between 7.6 and 8.33.

Seed resources and stocking

The low saline reservoirs in the adjacent salt factory form the potential ground for the collection of prawn seed. Seed of *Penaeus indicus* were collected near the sluice gates of such reservoirs as well as form tidal pools of estuary at low tide using a close-meshed nylon surf net or tow net 2 m × 1 m in size. Collected seed were directly released into the pond without any acclamatisation as there was not much difference in the quality of water between the collection centre and rearing ponds. Two crops were raised in a year, one from February to July and another from August to January. The stock particiulars are presented in Table 2. The pond was prepared during the short interval by draining and ploughing twice while drying and manuring the ground. Prior to stocking a phytoplankton

TABLE 1. *Hydrological conditions and trend of growth*

Months	Mean size of prawn (mm)	(mm)	Rate of growth /m (gm)	Overall growth rate (mm/gm/m)	Water temp. (°C)	Salinity (‰)	Diss. oxygen (ml/l)	pH	Pro-ductivity (mgC/m³/day)
Experiment 1									
Aug. '85 ..	28	..	..	..	24.2	39.39	4.21	8.10	800
Sep. '85 ..	90	44.8	3.6	..	25.0	43.22	4.35	8.00	605
Oct. '85 ..	105	33.4	2.9	..	26.7	40.42	4.72	8.07	412
Nov. '85 ..	118	25.8	2.8	..	26.2	36.25	4.01	8.15	643
Dec. '85 ..	130	23.5	3.5	..	26.1	35.17	2.98	7.90	670
Jan. '86 ..	138	22.3	3.8	21.6/3.8	24.3	35.25	3.13	7.64	115
Experiment 2									
Feb. '86 ..	20	..	..	..	26.3	38.24	4.22	8.19	806
Mar. '86 ..	91	47.1	2.9	..	28.3	38.51	4.11	8.33	669
Apr. '86 ..	98	32.2	2.3	..	30.4	41.12	4.42	8.08	725
May '86 ..	100	25.5	2.2	..	29.5	47.92	3.80	8.00	824
June '86 ..	111	20.7	2.0	..	28.6	44.38	3.80	7.77	463
July '86 ..	123	19.2	2.6	18.1/2.7	27.7	40.55	3.24	7.75	849

TABLE 2. *The results of culture experiments of* P. indicus

		STOCK				HARVEST					
Period of culture	Size of pond (ha)	No. of prawns released	Rate of stocking per ha.	Size range min. & average (mm/gm)	Size range & average (mm)	Wt. range & average (gm)	Prawns harvested (Nos. & kg)	Survival (%)	Rate of production (kg/ha)	Food supplied (kg.)	Conversion ratio
Experiment 1											
Aug. '85-Jan. '86	0.5	22820	43842	25—35 28/0.3	131—144 138	17.5—22.0 19.8	15050 277	66	532	800	1 : 3.0
153 days											
Experiment 2											
Feb. '86-July '86	0.5	40000	80000	14—30 20/0.3	118—140 125	13.0—20.0 16	37500 600	93	1200	3179	1 : 5.3
174 days											

bloom was developed and hydrological conditions suitable for rearing prawns were maintained. The commencement of each season concides with the peak period of occurrence of young prawns in the estuary and surrounding saline water reservoirs. In the second experiment the rate of stocking was almost doulbe than in the first one and it was done with the aim of determining the variations in growth and production rates under existing conditions.

Maintenance of farm

Supplementary feeding was not practised during the first month since the algal growth was well noticed. Juveniles feed mostly on organic detritus and plant materials available at the bottom. Supplementary feed in the form of pellets, tresh fishes and clam meat was given in the first experiment whereas the second crop was raised purely with pelleted feed. The rate of feeding was 7-10% of body weight. Maintenance of water depth, adequate exchange of water in rearing pond, cleaning of screens in inlets and outlets, assessing the stock and progress of growth by random sampling methods are some of the routine programmes and were carried out at regular intervals.

Growth and production

The modal progression and growth pattern observed are depicted in Fig. 1. In the first experiment, prawn seed released at 28 mm/0.3 gm in August 1985, had grown to 138 mm/19.8 gm at the time of harvest in January 1986, in the course of a rearing period of 153 days. During the first month, the rate of growth was recorded to be 45 mm/month and in the second month, till they reached the average size at 105 mm, the growth rate was at 33.4 mm/month. Therefafter, it declined gradually. The overall growth rate (21.6 mm/3.8 gm/month) was better in this experiment when compared to the later one (18.1 mm/2.7 gm) raised during February-July 1986. Here, the seed released at 20 mm/0.3 gm have progressed to 125 mm/16 gm in the course of 174 days.

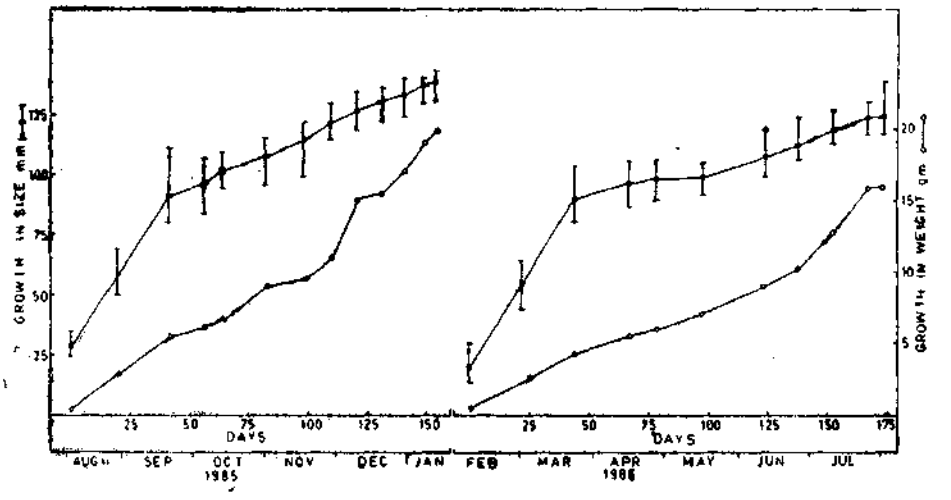

FIG. 1. Growth pattern of *P. indicus*.

The trend of growth observed in both the experiments are presented in Table-1 along with water characteristics for comparison. The estimated average rate of growth upto

100 mm size in monsoon crop was 33.4 mm/29. gm/month, while the same size group showed only 25.5 mm/2.2 gm/month in the summer crop. During April-June 1986, both the temperature and salinity increased to maximum values and hindered the growth. The hydrological factors particularly temperature and salinity play a vital role in the growth pattern of prawns. This is again evidently known from the better growth rate observed even in prawns of advanced size group of 130-138 mm as they exhibit a higher growth of 3.5-3.8 gm per month, because of the fall in temperature and salinity during December-January 1986.

The results of harvests are given in Table 2. During the first crop which was carried through the monsoon and winter, 66% of the prawns stocked was harvested. The yield amounted to 277 kg and the rate of production estimated to be 532 kg/ha/5 months. In the subsequent summer crop from the same pond, 600 kg of prawns with a high survival of 93% was attained. The rate of production was more than double i.e. 1200 kg/ha/6 months. This high production was due to high stocking intensity as well as to the crop being free from the problem of predators. The low percentage of survival in the earlier experiment was mostly due to the presence of predatory fishes like *Lates calcarifer* and *Elops*.

In the first crop, out of 800 kg of food supplied to the stock, the-product was 277 kg of prawns, establishing a conversion ratio as 1 : 3. In the summer crop, a higher ratio was observed and prawns weighing one kg had consumed 5.3 kg of pelletised feed.

Harvest

Harvesting was a simple task since the construction of pond was suitably planned. Maximum water was drained through outlets and a special drainage pipe provided at the lower level connecting the catching pit. Large meshed screen was tied to outlets in the previous night itself. As the water level recede, the whole stock slowly moved over to this pit in a corner of the pond due to the provision of a gradient slope.

A stake net or drag net was operated by a group of men in this limited area and the maximum catch was obtained by this method. Cast net was also employed to catch good quantity of prawns. Finally, after draining the pond completely, the remains were gathered by hand-picking. The harvested prawns were sold to exporters for the offer of highest price.

Discussion

As Rao (1980) reported on the season for occurrence of prawn seed in Tamilnadu, the distribution and abundance of seed of *P. indicus* in this region in natural habitat was during February-May and August-September. The available potential grounds with seed resources enable the farmers to raise the crop twice in a year. *P. indicus* grows relatively fast in its juvenile stages in estuarine conditions. In the present experiment, although the water was not of brackish nature, a good growth rate was noticed. Subrahmanyan and Rao (1968) observed a growth rate of 19.35 mm/month for juveniles of this species reared in brackish-water pond near the mouth of Pulicat Lake. Suseelan (1975) recorded 30.5 mm/month in younger stages upto about 125 mm length. Nandakumar (1982) observed the growth rate of 0.620 mm/day in prawns cultured in coastal ponds. In the present observation maximum growth rate recorded was high being 45-47 mm/month in the younger stages upto about 90 mm length and 33 mm upto 100 mm size. The overall growth rate per day was high i.e. 0.718 mm in the first experiment and quite comparable with many earlier works reported. The growth rate was slightly less in the second crop, being 0.603 mm/0.090 gm/day in a period of 174 days. This may be attributed to the high salinity, above 45 ppt which prevailed on

most of the days during April-June 1986. This is in confirmity with the observations made by Paulraj and Sanjeeva Raj (1982) as they observed the lowest gain in weight in *P. indicus* (4 mg/day) at 45 ppt salinity level and highest mean weight gain (37 mg/day) attained at 25 ppt level. Kurian (1982) reported the maximum growth rate to occur in salinity range of 25-30 ppt. Marichamy and Rajapackiam (1982) attributed the poor rate of growth to the quality of water.

A number of earlier workers have ascribed survival rate to the size of prawn seed released. Suseelan (1975) observed a high rate of survival (82%) with the seed size of 68 mm. Marichamy and Rajapackiam (1982) noticed better survival when larger seed at 70 mm were stocked at lower intensity. But in the present experiment a maximum survival rate of 93% was attained in the second crop even with the high stocking rate at 80,000/ha that too with seed of small mean size *i.e.* 20 mm. This was possible because the crop was free from predatory problems and mortality due to increased salinity or diseases.

Srinivasan *et al* (1982) reported the production in brackishwater prawn farm of Tamilnadu to vary from 200 to 400 kg/ha/crop. Relatively much better yield was attained in the present environment with a range of 532-1200 kg/ha/crop and thus the annual production is estimated to be a maximum of 2400 kg/ha by raising 2 crops. The conversion rate indicating the amount of food required for unit of growth appeared to be moderately low in monsoon crop but the culture in summer season required larger amount of food. Shigueno (1972) observed similar trends is a number of case studies. Intensive efforts of prawn farming are in progress due to the ample scope for large scale expansion in Kallar estuarine area as the site has abundant resources of land, water and seed of *P. indicus* and other infrastructural facilities.

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