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OBSERVATIONS ON THE GROWTH OF *PENAEUS SEMISULCATUS* IN THE NURSERY PONDS

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ABSTRACT

Hatchery produced postlarvae (PL 40) of green tiger prawn *Penaeus semisulcatus* were stocked in three earthen ponds at a rate of 40,000/ha in one (400 sq.m) and 50,000/ha in two ponds (800 sq. m) in November 1993 and reared for 110 days. During February-March water level and salinity in the ponds were raised by pumping water (25‰ salinity) from adjacent lagoon. Pond water was fertilised with urea and Ammonium phosphate at a rate of 50 kg/ha and 100 kg/ha respectively, 15 days before stocking. Shrimps were fed with commercial pellet feed. The survival was 51.9%, 15.0% and 65.8% in pond I, II and III respectively. The length and weight increment was 68.42 mm and 7.95 g in pond I; 65.78 mm and 8.25 g in pond II; and 53.14 mm and 4.85 g in pond III. Difference in growth between sexes was statistically significant in all three ponds on day 110. Growth in pond III was poor as compared to other two ponds due to prevalence of low salinity (<12‰) for a period of 48 days.

INTRODUCTION

PENAEUS SEMISULCATUS, is the principal species contributing to more than half of the shrimp landings of Gulf of Mannar and Palk Bay regions along the south-east coast of India. However, in recent years on observing a declining production trend (Sampson Manickam *et al.* 1989), sea ranching of this shrimp was initiated and as a part of this mark-recovery study was done. Hatchery-produced post-larvae of *P.semisulcatus* were reared in three earthen ponds in the Fish Farm Complex of the CMFRI Regional Centre, Mandapam to a targeted approximate size of 100 mm during a period of 110 days. The growth pattern of *P.semisulcatus* observed during the nursery rearing; data on oxygen, salinity and feed has also been incorporated and correlated with growth.

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MATERIAL AND METHODS

P.semisulcatus seed for the present study was hatchery raised through community culture as described by Maheswarudu *et al.* (1990) by utilising ripe spawners collected from Gulf of Mannar. For rearing, three ponds (pond I, II & III, Fig. 1) were used. Pond I is square and has 400 sq.m. water spread area (20 m × 20 m); pond II and III are rectangular and each has 800 sq.m. water spread area (40 × 20 m). All three ponds are old; were excavated to a depth of one metre below the ground level and have no draining facility. Pond bottom is admixture of sand, clay with shell fragments of marine molluscs and coral fragments.

Fifteen days before stocking, all the ponds were predator-eradicated and fertilised with Urea

and Ammonium phosphate at the rate of 50 kg/ha and 100 kg/ha respectively to increase the phyto and zooplankton production. They were stocked with PL40 (29.8 mm TL) in November 1993 at two different densities: Pond

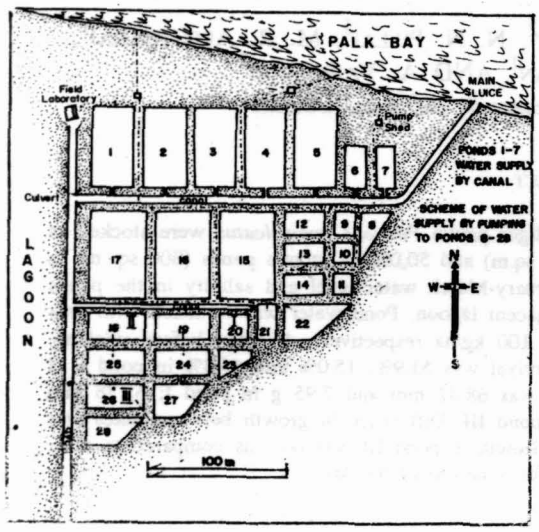

FIG. 1. Map of Fish Farm at Mandapam Showing three experimental Ponds

I at 40,000/ha and pond II and III at 50,000/ha. While stocking the water level in ponds was uniformly at 70 cm and it gradually increased to 130 cm by end of December due to rains and then decreased to 60 cm by the end of January. From February onwards pond water level was maintained at 80-90 cm by pumping brackishwater from nearby lagoon.

An imported commercial shrimp feed 'Biofeed' (protein 40%) was given for shrimps in pond I at 5-10% of total biomass/day. Another commercial shrimp feed 'Shrimpro feed' (protein 40%) was given for the shrimps in pond II and pond III at the rate of 5-10% of total biomass/day throughout culture period. Feeding was done in the evening and shrimps were observed to pick the pellets during dark.

Growth was monitored by fortnightly sampling. Hydrological parameters such as temperature, salinity and dissolved oxygen were recorded at 15 days interval throughout rearing period. On 110th day of rearing all the shrimps were netted alive and used for tagging programme during March, 1994.

RESULTS

Salinity, dissolved oxygen and temperature of water in all three ponds before stocking and during rearing period are presented in table 1. In pond I the salinity was 30‰ on day I during stocking and it decreased to 12.8‰ on day 47 and then slowly increased to 35.2‰ on day 98. In pond II it decreased from 35.4‰ on day-1 to 17.6‰ on day-47 and then raised to 32‰ on day-98. The initial salinity of pond III was low on day-1 (20.5‰) as compared to that of other two ponds and it decreased to 8.0‰ on day-47 and continued to be same upto day-67 and then increased to 27.2‰ on day-98. A low salinity range (8.0‰ - 27.2‰)

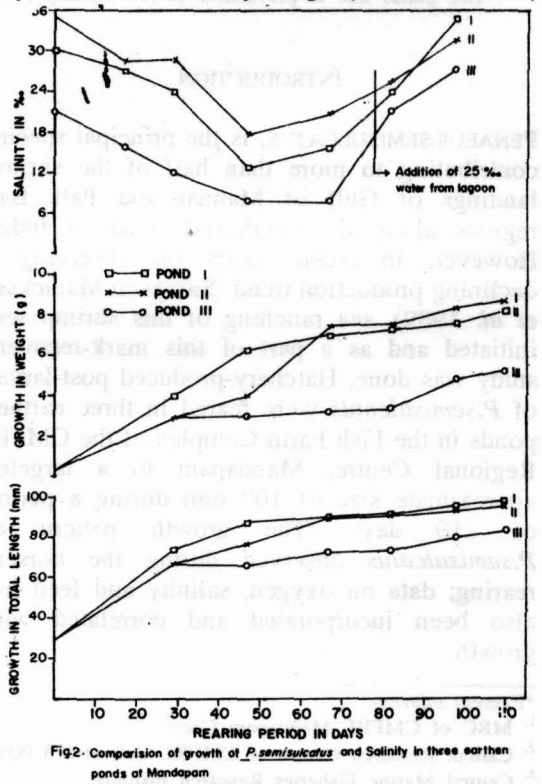

Fig.2. Comparision of growth of *P. semisulcatus* and Salinity in three earthen ponds at Mandapam

FIG. 2. Comparision of growth of *P. semisulcatus* and Salinity in these earthen ponds at Mandapam

TABLE 1. *Salinity, Dissolved Oxygen and Temperatuer of pond water during rearing period*

Hydrological Parameter	Pond No.	11 days before stocking	Stocking day	After Stocking					
				17 days	29 days	47 days	67 days	82 days	98 days
Salinity ppt.	I	32.0	30.0	27.2	24.0	12.8	16.0	24.0	35.2
	II	40.0	35.4	28.8	28.8	17.6	20.8	25.6	32.0
	III	25.6	20.5	16.0	11.9	8.0	8.0	20.8	27.2
Dissolved oxygen ml/l	I	4.5	4.4	5.9	6.1	5.3	5.3	4.0	4.0
	II	4.3	4.5	5.6	5.8	6.2	5.1	5.0	4.9
	III	4.6	4.9	5.8	5.9	5.9	5.2	4.9	4.4
Temperature °C	I	26.5	26.5	26.5	28.5	28.2	29.3	31.0	33.1
	II	26.5	26.3	26.5	29.0	28.3	29.5	31.0	33.0
	III	26.5	26.6	26.5	28.5	28.3	29.4	31.4	34.0

prevailed in pond III as compared to that of other two ponds. Comparison of salinity in three ponds during rearing period is presented in Fig. 2.

Dissolved oxygen in all three ponds had increased from 4.3 ml/1 to 6.2 ml/1 on day-1 to day-47 and then decreased to 4.0 ml/1 on day-98. This trend in dissolved oxygen negatively correlated with the salinity trend of the ponds.

Water temperature did not significantly vary from pond to pond and had gradually increased from 26.5°C in November to 34.0°C by end of February.

Out of 1,600 seed stocked in pond I, 830 (51.9%) were recovered on harvest. The average total length increment during the experiment period of 110 days was 68.42 mm (29.83 mm to 98.25 mm) and the weight increment was 7.95 g (0.3 g to 8.25 g). The growth rate per day was 1.50 mm and 0.127 g during first 29 days; during subsequent 38 days the growth rate per day was 0.43 mm and 0.077 g. For the last 43 days shrimps showed 0.193 mm total length increment and 0.030 g weight increment per day. The growth rate was faster during the first 47 days. On 50th day due to rains, the adjacent pond water had overflown into pond I bringing along-with unknown number of *P.indicus* which resulted in slow growth due to competition for food and space (Fig. 2).

In pond II, 600 nos (15%) were recovered out of 4,000 seed stocked resulting in low survival because of mortality on day-75 due to low water level. The initial size 29.83 mm increased to 95.61 mm and weight from 0.3 g to 8.55 g after 110 days. During the period of first 29 days, the growth per day was 1.273 mm and 0.089 g. During the next 38 days period the growth per day was 0.564 mm and 0.117 g. In the following 43 days the growth was 0.172 mm and 0.027 g per day.

In pond III out of 4,000 seed stocked, 2,630 were recovered resulting in 65.8%

survival after 110 days. Net growth was poor as compared to that of pond I and II and the size at harvest was 82.97 mm and weight was 5.15 g. The growth rate was 1.232 mm/day and 0.093 g/day during first 29 days period. During succeeding 38 days period the growth rate has come down to 0.176 mm/day and 0.005 g/day. During subsequent 43 days the growth rate improved to 0.248 mm and 0.045 g per day. Growth was affected between 30 and 82 days and again progressed from 83 day onwards (Fig. 1). The decline in salinity to < 12‰ between 30 and 82 days and then increase from day 83 onwards coincided with the decrease and increase in rate of growth.

Sex wise growth of *P.semisulcatus* in all three ponds is presented in Table 2. Since secondary sexual organs petasma and thelycum are prominant only at 80-90 mm size, growth was recorded separately from then onwards. Though the growth varied between sexes from 67th day onwards in pond I and II, it was significant statistically at 5% level only on day 110 in all three ponds and female had faster growth than male.

Discussion

The average length and weight increment was 68.42 mm and 7.95 g in pond I; 65.78 mm and 8.25 g in pond II after 110 days' rearing indicated 0.622 mm and 0.072 g; 0.598 mm and 0.075 g growth per day in pond I and II respectively. After 82 days, the recorded growth rate per day was 0.744 mm and 0.084 g; and 0.738 mm and 0.087 g in pond I and II respectively. This growth was fairly good as compared to that reported by Nandakumar (1982), 0.62 mm and 0.050 g/day after 78 days of experiment. Though the location and soil conditions are same for both series of the experiments, Nandakumar (1982) conducted during summer (April-September) in the salinity range 31.00‰ -33.93‰ and the present study during rainy-winter (November-March) in 12.9‰ — 35.0‰ salinity range. Paulraj and Sanjeevaraj (1982) observed growth 0.96 mm

TABLE 2. *Sex wise growth of* P.semisulcatus *in rearing ponds. Total length expressed as mean ± standard deviation. Number of measurements recorded given in parenthesis*

Pond No.	Sex	Stocking size	After Stocking				
			29 days	47 days	67 days	82 days	98 days	110 days
I	Male	29.83 ± 5.93 (20)	73.52 ± 5.76 (17)	87.85 ± 3.99 (20)	90.11 ± 4.19 (10)	91.4 ± 4.08 (10)	94.5 ± 3.80 (10)	97.03 ± 4.33* (29)
	Female				89.80 ± 4.15 (10)	90.4 ± 6.18 (10)	96.33 ± 3.26 (6)	99.68 ± 4.26 (25)
II	Male	29.83 ± 5.93 (20)	66.75 ± 7.09 (20)	77.2 ± 4.99 (20)	89.62 ± 3.99 (10)	90.8 ± 2.74 (10)	92.6 ± 3.59 (10)	94.05 ± 2.73* (19)
	Female				87.5 ± 3.14 (16)	90.0 ± 5.33 (10)	94.7 ± 3.12 (10)	96.60 ± 4.70 (30)
III	Male	29.83 ± 5.93 (20)	65.57 ± 6.7 (21)	65.58 ± 4.57 (20)	72.28 ± 3.75 (25)	72.28 ± 3.25 (25)	80.3 ± 3.94 (20)	81.85 ± 2.90* (21)
	Female							83.88 ± 3.50 (26)

and 0.03 g/day for the same species at 25‰ salinity in laboratory conditions for only 60 days. The culture experiment conducted on *P. semisulcatus* at Taiwan by Liao and Chao (1987) in the salinity range of 21-34‰ also reveales that at day 90 shrimp gained 9.0 g weight, slightly higher than that of the present study.

In the present study the significant growth variation between sexes was observed at 98.25 mm, 95.61 mm and 82.97 mm in pond I, II and III respectively. Mohamed (1981) also reported significant growth variation between sexes of wild *P. semisulcatus* at 18 mm carapace length, equavalent to 82 mm total length.

From day 1 to day 29 the salinity values declined steadily from 35‰ in all the ponds but did not go below 12‰. During the same period uniformly good growth was also observed in all the ponds. Subsequently from day 30 to day 82 a poor growth was observed in pond III due to prevalence of < 12‰ salinity and from day 83 to day 110 an improved rate of growth was observed which corresponds with the increase in salinity (Fig. 2). Similar observations were also reported about the less euryhaline character of *P.semisulcatus* by Vedavyasa Rao and Kathirvel (1971) and Suseelan and Kathirvel (1979). They reported the appearance of juveniles of *P.semisulcatus* in Cochin backwaters during post-monsoon period due to increase in salinity.

In pond I and II where salinity range was almost similar, a better growth in pond I was observed during the first 67 days, as compared to that of pond II. This may be due to difference in stocking densities (40,000/ha in former and 50,000/ha in latter) and different brand feeds given. After 67 days, growth in pond I slightly reduced to that of pond II because of increased unintentional stocking of *P.indicus* juveniles resulted by overflow of pond water from neighbouring pond during heavy rains and sharing the quota food.

In the present study though the stocking rate and yield are low, it may be worth mentioning that the water source is by seepage; it is an impounded water except for topping for the evaporation loss and no other replenishment. The input by way of pumping and canal systems are minimal. In semi-arid remote coastal areas along Tamilnadu coast this method of culture can be adopted for a low but sustained income.

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SPATIAL AND SEASONAL VARIATION IN HEAVY METALS IRON, ZINC, MANGANESE AND COPPER IN THE INDUSTRIAL REGION OF THE ENNORE ESTUARY, MADRAS

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ABSTRACT

An estuarine surveillance programme, with a view to assess the current status of the water quality of estuarine zone of Ennore, Madras was carried out during the period from November 1987 to October, 1988. Water and sediment samples were collected from three different stations in the estuarine zone of Ennore. The levels of iron, zinc, manganese and copper were estimated in water and sediment samples. There were only slight seasonal fluctuations in the levels of metals in the water as well as sediment with higher concentrations occurring during the monsoon seasons. The concentration of iron, zinc, manganese and copper in water and sediment exceeded the admissible limit. The pattern of changes in trace metal levels is discussed with reference to variations at the three stations and during different seasons.

INTRODUCTION

WITH THE RAPID PHASE of industrialization, the problems created by the discharge of heavy metallic toxicants are of great concern in the management of marine and estuarine ecosystem (Qasim and Siddiqui, 1960 ; Azariah, 1985 ; Subramanian and Varadaraj, 1989). Among the various types of pollutants, heavy metal is considered to be of serious concern (Holden, 1973 ; Vernberg and Vernberg, 1974). There are numerous reports from developed countries on the contamination and sedimentary load of heavy metals in marine and estuarine environment and their consequences on the environmental quality. However, few studies have been carried out pertaining to the seasonal variations in the levels of heavy metals in the water and sediments of the estuarine environment of the east coast of India. Hence, it was felt necessary to assess the levels of different trace metal in the water and sediment of the Ennore estuary located at the northern border of highly populated Madras city.

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MATERIAL AND METHODS

Description of the study area

The present work was carried out at the Ennore estuary (13°14'N and 80°20'E) located 20 Km north of Madras (Fig. 1). The Kortaliyar river forms the estuary at Ennore, which is connected to the Buckingham canal and discharges their contents into the Bay of Bengal.

Sampling Design

To monitor the water quality of Ennore estuary, three stations S I, S II and S III were