ON AN EXPERIMENTAL SEED COLLECTION AND FIELD CULTURE OF KING PRAWN, *PENAEUS LATISULCATUS*

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ABSTRACT

Early juveniles of the King prawn, *Penaeus latisulcatus* Kishinouye, were caught from the sandy barmouth area of Kovalam backwater, near Madras, during May-July 1986. These were successfully cultivated in an earthern pond at the Muttukadu Mariculture Centre of the Institute for a period of 80 days supplementing backwater clam (*Meretrix casta*) for feed. Over this time the females were found grown up and with developing ovary. The size-frequency analysis of the juveniles obtained from the wild and those reared showed a growth of 29-30 mm per month. The hatchery-raised postlarvae of the species were reared on a diet of zooplankton (copepods, rotifers and freshwater cladocerans) and molluscan meat (boiled flesh of clam and mussel). Those reared on copepod diet exhibited faster growth and those reared on a combination of zooplankton and molluscan meat exhibited higher survival.

INTRODUCTION

The King prawn, *Penaeus latisulcatus* Kishinouye, is considered to be a prospective species for culture, and attempts have been made to cultivate it in Japan (Shokita 1970), Thailand (Ling 1973) and Australia (Pownall 1973, 1974, Anon 1975, 1977). Except for the record of juveniles and adults in the backwaters and inshore seas (George 1969, Mohamed and Rao 1971, Thomas 1971, 1974, 1986, Silas and Muthu 1976, George and Suseelan 1982, Suseelan and Kathirvel 1982a, 1982b) and some ecophysiological studies of juveniles (Ramaswamy and Paul Pandian 1985), no biological information is available on the species from the Indian waters.

Recently, an appreciable quantity of juveniles of *P. latisulcatus* collected from the Kovalam backwaters near Madras were utilised as seed for field cultivation at the Mariculture farm of the Institute, Muttukadu. The result of this is presented in the paper.

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MATERIAL AND METHODS

Seed: As the species is more nocturnal in habit, early juveniles were collected during night (21.00-23.00 hrs) from the sandy barmouth area of Kovalam backwater (Lat. 12°46'N; Long. 80°18'E) by operating a 10 m long drag net (18 mm mesh) (Fig. 1). On each collection day, 4 hauls were made, covering an approximate area of 100 m^2 per haul. Though the expreimental drag netting was carried out between December 1985 and September 1986, juveniles of *P. latisulcatus* appeared only for a short while, i.e. from 15-5-86 to 5-7-86, during which time 10 collections were made.

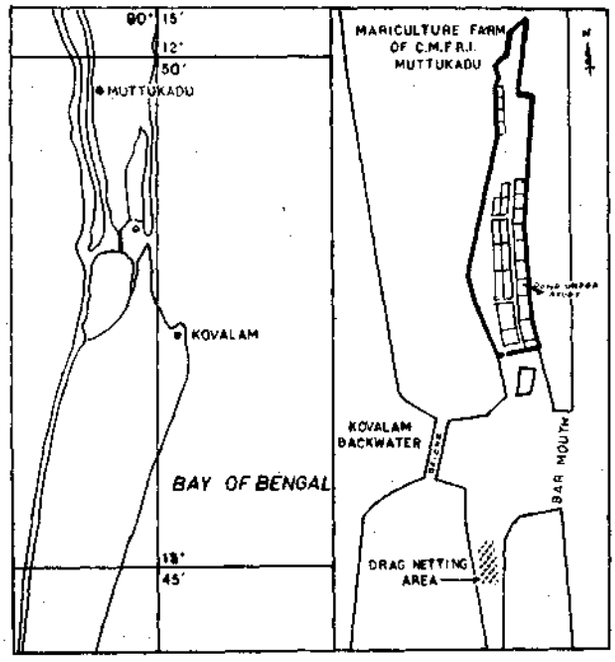

FIG. 1. Map showing the location of Mariculture Farm at Muttukadu and prawn seed collection area in Kovalam backwater.

Field culture: The culture operation was carried out in an enclosed 0.4ha-sandy-bottom pond at the mariculture farm, Muttukadu, where no exchange of water has been possible. Healthy and active juveniles in the size range of 35 mm to 82 mm, numbering 400, were stocked between 15-5-86 and 8-6-86 along with the already existing stock of *Penaeus japonicus* (2000 number) and *P. canaliculatus* (100 number) in the pond. They were fed on backwater clam (*Meretrix casta*) meat at a rate of 5% of their body weight. The prawns were sampled fortnightly by operating a drag net during 22.00-23.00 hrs for observations. The sampled prawns (19 to 46 numbers) were measured individually for total

length (TL), carapace length (CL), body length (BL) all in millimetre and total weight (TW) in grams, following the method of Motoh (1981). The prawns were reared for 80 days; after which the culture experiment was terminated because of interference of local fishermen. The surface temperature, salinity, dissolved oxygen and pH were recorded on each observation day.

Postlarval rearing: In postlarval rearing, the zooplankton such as laboratory-cultured rotifers (100/larva), the copepods and freshwater cladocerans (*Moina* sp.) collected from wild (70 numbers/larva/day), boiled clam and mussel meat (0.01 g/larva/day) and a mixture of zooplankton and molluscan meat were used as feed to study their effect on growth and survival at PL-5, PL-10, PL-15 and PL-20 stages. A batch of 500 post-larvae 1 (PL-1) were stocked in 200-l tanks for each feed.

OBSERVATION

Abundance of juveniles: In the weekly experimental drag netting carried out since December 1985 in the barmouth area of Kovalam backwater, early juveniles of *P. latisulcatus* were caught on ten occasions between 15-5-86 to 5-7-86. The average number of juveniles per haul, their percentage in the total number of prawns caught per haul and the hydrographical features such as temperature, salinity, dissolved oxygen and pH recorded at the time of collection are given in Fig. 2. On the first day (15-5-86), *P. latisulcatus* formed 11% by number, which increased to 51% on the fourth day (24-5-86) and afterwards it gradually declined to 1.0% on 5-7-86; and they were absent in the collections made after 5-7-86. The juveniles of other penaeid prawns recorded were *Metapenaeus monoceros, Penaeus indicus, P. semisulcatus, P. canaliculatus, P. japonicus* and *M. dobsoni*, in the order of abundance.

The occurrence of juveniles of King prawns for a short while in the study area coincided with moderately higher values of temperature (27.0-29.8°C) and salinity (34.01-36.07 ppt). The dissolved-oxygen values ranged between 2.62 ml|l and 2.81 ml|l up to 5th observation (1-6-86) and increased to a range of 2.91-4.21 ml|l in the subsequent collections, whereas pH ranged between 7.6 and 7.9.

The percentage frequency of different size groups is plotted in Fig. 3. As the samples drawn on the last three observations had specimens less than 10, they were not considered for size-frequency analysis. The first day sampling (15-5-86) has indicated that the dominant size was 51-35 mm. However, the sample collected after one day interval, on 17-5-86, comprised two dominant size groups, 31-35 mm and 61-65 mm, which could be traced in the subsequent collections. The smaller size group was traced up to 15th June, over which time (30 days) there was a growth of 30 mm. An increase of 15 mm was

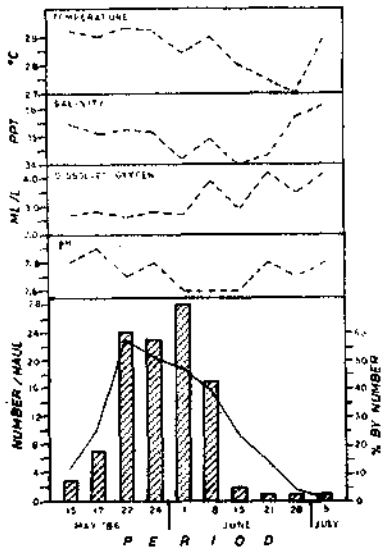

FIG. 2. Occurrence of early juveniles *P. latisulcatus* and hydrographical features of barmouth area in Kovalam backwater during May-July 1986.

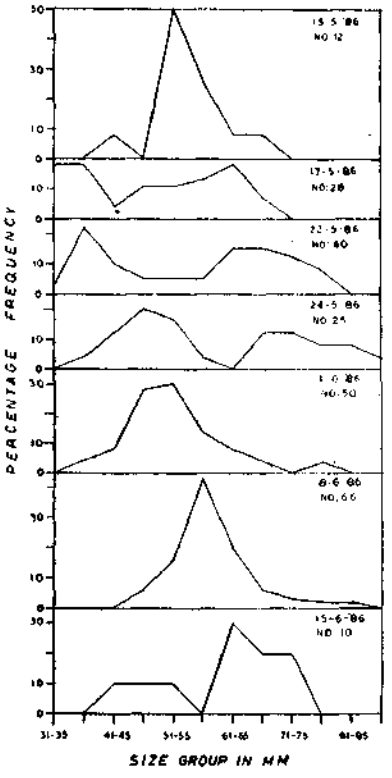

FIG. 3. Size distribution of early juveniles of *P. latisulcatus* in the dragnet collections.

observed in the case of the larger mode which shifted to 76-80 mm on 1-6-86, thus exhibiting a growth of 1 mm/day in both the size groups. The record of few specimens in the size range 41-92 mm during the last three observations, followed by the absence of the species in the study area, could be due to its complete emigration from the backwater system.

Field culture: For the whole culture period the surface temperatures in the pond recorded between 09.00 hrs and 11.00 hrs did not show much variation (Fig. 4). However, the salinity values had an upward trend (27.92 to 31.78 ppt), apparently due to evaporation of the pond water. The dissolved-oxygen values were greatly influenced by the presence of dense colonisation of the weed *Chaetomorpha* sp., the values shooting up after the 15th day of culture. On many occasions the blooming of weed had hampered the sampling programmes. The weed grew so fast that it had to be removed periodically. The pH values varied from 7.1 to 8.1.

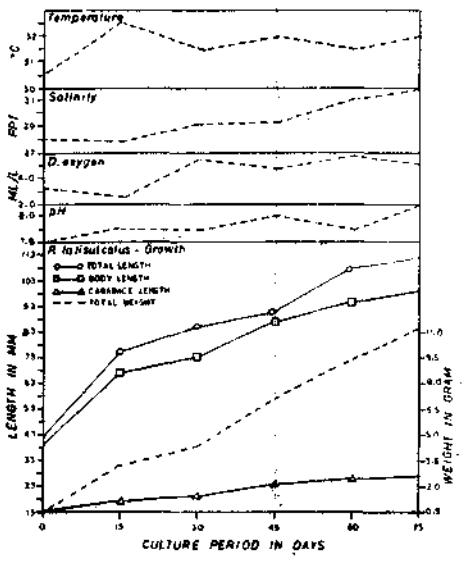

FIG. 4. Growth in pond-reared *P. latisulcatus* and hydrography of the culture pond at Muttukadu.

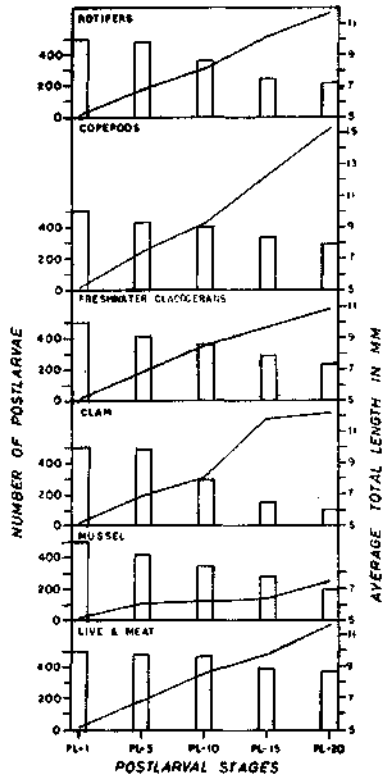

FIG. 5. Effect of different zooplankton (rotifers, copepods and freshwater cladocerans), and molluscan meat (clam and mussel) feeds on survival and growth of postlarvae of *P. latisulcatus*.

The average values of lengths (TL, CL and BL) and weight (TW) obtained from the fortnight samplings are given in Fig. 4. The stocked King prawns with an initial average size of 42 mm in TL and 0.5 g in TW attained an average size of TL|TW 74.5 mm|3.2 g, 84.8 mm|4.3 g, 90.9 mm|7.1 g, 108.2 mm|9.3 g and 112.4 mm|11.2 g on 15th, 30th. 45th, 60th and 73rd day of culture, respectively, thus recording a growth of 70.4 mm in TL and 10.7 g in TW in 73 days rearing. The corresponding increment in CL and BL was 13.3 mm (5.4 mm|month) and 50.0 mm (20.5 mm|month), respectively. The rate of growth in terms of TL was 29.0 mm|month and that of TW 4.2 g|month.

An interesting observation is that among the eight females caught on the 73rd day of culture, 4 specimens in the size range 114-125 mm TL (29-30 mm CL) were found impreganted and with developing ovaries in stages I to III.

The dissected-out ova in stage III measured 0.32 mm to 0.42 mm in diameter. Spurred by this attainment of maturity at a smaller size in confined waters, further experiments have been initiated to induce the species to mature under controlled conditions. The preliminary results of these breeding experiments are being reported elsewhere (Kathirvel et al 1987, in press).

Postlarval rearing: The postlarvae produced in these experiments were used to conduct experiments with different types of feed. The survival and growth of the postlarvae fed on zooplankton and meat of molluscs at PL-1 (initial), PL-5, PL-10, PL-15 and PL-20 (final) are depicted in Fig. 5. It is seen that the postlarvae fed on copepods had faster growth (0.51 mm|day) and higher survival rate (58.2%) than the postlarvae reared on rotifers and cladocerans. With regard to molluscan meat, the clam meat induced significant growth (0.35 mm|day) but poor survival (19.4%), whereas the mussel meat led to moderate survival (41.6%) but poor growth (0.12 mm|day). However, the postlarvae fed on a combination of zooplankton and molluscan meat registered good growth (0.33 mm|day) as well as good survival (77.6%).

Discussion

The study has brought to light that *P. latisulcatus* juveniles that can form seed for culture occur in the sandy area of Kovalam backwater near Madras, though only during May-July, and that the species can grow fast and attain maturity in earthern ponds.

The salinity recorded at the time of seed collection in the present study varied from 34.01 to 36.07 ppt. Suseelan and Kathirvel (1982a) recorded appreciable number of juveniles of King prawn in the Ashtamudi backwater on the southwest coast of India during November when the salinity of the backwater ranged between 9.42 and 14.10 ppt. However, Ramaswamy and Paul Pandian (1985), who studied the salinity tolerance of juveniles of *P. latisulcatus* under laboratory condition, have stated that a salinity range of 0 to 10 ppt would be lethal. Hence, a detailed study is desired to ascertain whether this species is less euryhaline or not.

The juveniles cultivated in the earthern pond and those collected from wild had growths respectively of 29 mm and 30 mm (TL) per month, which is comparable with the growth of the closely related species, *P. japonicus*. In the wild juveniles of *P. japonicus*, the monthly growth rate varied from 24 mm (Kubo 1956) to 33 mm (Lumare 1984), while the pond-reared juveniles of the same species recorded a monthly growth of 14.0 to 20.8 mm (Shigueno 1975), 10.5 to 20.4 mm (Kathirvel and Selvaraj, MS), 23 mm (Seno 1910), 27 mm (Silas and Kathirvel, MS) and 30 to 34 mm (Hudinaga 1969).

The studies made in Japan (Shokita 1970) and Australia (Anon. 1977) have shown that the postlarvae of *P. latisulcatus* reared both in aquarium tank and in earthern pond attained maturity. But here the rate of growth is not mentioned. In the present study, the probable age based on the length of the prawn collected from wild could be 3-4 months. The attainment of maturity in 73 days of rearing has suggested that the species could reach maturity during the first 6-7 months of its life-span, which appears to be faster than the recorded time of 8-11 months for *P. japonicus* (Kathirvel 1985, Kathirvel and Selvaraj MS), 14 months for *P. stylirostris* (Conte et al 1977) and 21 months for *P. kerathurus* (Rodrigues 1981) in the field culture trials.

The size (29-30 mm in CL) of impregnated and maturing female King prawns obatined during the present field-culture study agrees with the observations made by Penn (1980), who has reported the minimum size at first maturity for *P. latisulcatus* in Autsralian waters as 29 mm in CL.

Shigueno (1975) recorded a survival of 29% to 31% from PL-1 to PL-19 of *P. japonicus* when the postlarvae were fed on *Artemia* nauplii and copepods and a higher survival rate of 36 to 51% for the larvae fed on *Artemia* nauplii and clam meat. In the present case also the post larvae (PL-1 to PL-20) of *P. latisulcatus* fed on zooplankton showed a survival range of 44.0% to 58.2% and an increased survival rate (77.6%) for a combination of zooplankton and molluscan meat

The earlier observations on *P. latisulcatus* in Japan (Shokita 1970) and Australia (Pownall 1973, 1974, Anon 1975, 1977) as well as the present one suggest that the cultivation of King prawns could be advantageously taken up in the hitherto unutilised sandy lagoons along our mainland coast and those of Lakshadweep, Andaman and Nicobar Islands.

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