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NATIONAL SYMPOSIUM ON RESEARCH AND DEVELOPMENT IN MARINE FISHERIES

MANDAPAM CAMP
16-18 September 1987

Papers Presented
Sessions III & IV

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

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PRELIMINARY OBSERVATIONS ON THE GROWTH AND SURVIVAL OF TIGER PRAWN (*PENAEUS MONODON FABRICIUS*) POSTLARVAE IN PEN-NURSERIES

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ABSTRACT

In an attempt to ensure all-time availability of stocking materials of *P. monodon* Fabricius, experiments have been undertaken on a large scale in the lower Sunderbans area of West Bengal for growing the wild-caught post-larvae (10-12 mm) of the species to an advanced juvenile (35-45 mm) stage under semi-controlled conditions. Six nursery pens (0.1 ha each) have been installed in a large (50 ha) brackishwater impoundment and stocked at the rate of 2.0-3.5 millions per hectare. Besides encouraging the growth of natural food, the postlarvae are fed with well balanced artificial diets having protein from both animal and plant origin. Encouraging results with high survival (upto 73%) and faster growth rates have been observed in some of the trial runs. Details of stocking density, growth rate, percentage survival and the feeding schedule etc. are presented and discussed. Various physico-chemical parameters recorded at regular intervals are also given.

INTRODUCTION

Shrimp farming has been given a top priority by many of the developing countries for earning foreign exchange and providing employment to the coastal poor. Cultured prawns form only 3-5% of the total 1.7 million metric tons of shrimps annually produced worldwide (Taki *et al.*, 1985). Among cultured prawn, *Penaeus indicus*, *P. merguensis*, *Metapenaeus monoceros*, *M. dobsoni*, *M. ensis* etc., *P. monodon* is the dominant species in the Indo-Pacific region (Aquacop, 1985). *P. monodon* not only grows much faster than others, but is capable of withstanding a wide range of environmental fluctuations. However, availability of stocking materials as and when required, is one of the major constraints confronting the development of tiger prawn farming on commercial lines.

Unlike many other south-east Asian countries, prawn farmers in India, in the absence of an operating tiger prawn hatchery, are totally dependant on the wild-caught postlarvae for stocking their ponds. Various estuarine systems with an intricate net work of canals and creeks in the Sunderbans areas of West Bengal (India) are one of the richest collection grounds for *P. monodon* postlarvae. A well-organised prawn seed trade with thousands of collectors, middle men and traders exists at Nazat (24 Parganas). However, the prawn seed industry is unstable since peak periods of seed availability in nature (May-June) do not synchronize with the peak periods of their demand (Jan.-Feb.). Further, the practice of directly releasing the wild-caught postlarvae into vast brackishwater impoundments (bheris) or in large nursery ponds (often more than a hectare) without proper control of predator,

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often results in miserably poor production. For intensified pond production of marketable size *P. monodon*, ready availability of healthy juveniles (30-45 mm) in large quantities is most essential. For this purpose, studies on large scale nursery rearing of tiger prawn postlarvae in pens have been taken up in the Sunderbans areas of West Bengal.

MATERIAL AND METHODS

Six rectangular nursery pens with an average area of 0.1 ha each have been erected in a large brackishwater impoundment at Shyamnagar (Deulbari) in the lower Sunderbans. Split bamboo screens (2 m high x 4 m long) woven tightly with coir rope were joined together to serve as the pen walls. Bamboo pattas were driven into the bottom mud (30-35 cm) and are supported and strengthened with the help of strong vertical and horizontal bamboo poles. All the pens are lined inside with a fine meshed strong nylon netting cloth for preventing the entry of predators and also to guard against escape of the stocked tiger prawn postlarvae. To deter displacement of the nylon netting cloth by strong winds especially during the monsoon months, lower ends of the nylon netting cloth have been given a mud lining whereas the upper and middle portions are pressed hard against the pen walls (bamboo pattas) using long narrow bamboo sticks and coir rope. Only one pen could be installed during December-January period and the rest were installed in the month of March when culture operations had already started and creek water drawn into the impoundment.

Four pens have been installed in the middle of a long (about 550 metres) and wide (about 100 metres) canal facing the main sluice gate whereas the other two were installed in the middle of a 2.5 ha pond connected to another 7 ha compartment through a cut in the dyke separating the two. Palm leaves, bundles of paddy straw and tree twigs were kept submerged in all the pens to serve as additional substrates for periphytic growth as well as to provide

shade and shelter to the tiger prawn postlarvae. Bamboo ladders have been provided in all the pens for an easy inspection and management.

Stocking of pens with *P. monodon* postlarvae procured from professional seed collectors started from the 2nd week of March, 1987 and continued till April end. All the pens could not be stocked at a time due to the non-availability of seed in large quantities. The baby prawns which were liberated early in the morning or late in the evening did not require any acclimation since they are captured from the nearby areas without any marked differences in water salinity and temperature. Pens were stocked one after the other and stocking of the next pen was undertaken only after completely stocking the first one. A mixture of finely powdered prawn meal, goat intestine, cow-pea leaf and wheat flour was broadcast 5-6 times a day in sections of the pens depending upon direction of the wind so as to ensure a minimum leaching out of the artificial feed. From 3rd week onwards, when the postlarvae started to become benthic, ground fresh flesh of palaemonid prawns and mussel meat, locally available in plenty, was given using feeding trays as well as by adhering the finely ground meat to pieces (3 metre x 0.5 metre) of nylon netting cloth kept vertically suspended in water with the help of bamboo sticks. Pen walls and the nylon netting cloth are regularly checked for any damage and cleaned using aquatic weeds or coir rope brush to facilitate free water circulation across the pen walls. Various physico-chemical parameters were recorded at regular intervals. Salinity ranged between 22.5-30.0 ppt; temperature, 28.0-31.5°C; pH, 7.5-8.3 and dissolved oxygen, 3.2-9.7 ppm. Table I gives data on stocking density, growth and percentage survival of the tiger prawn postlarvae in the initial trials.

RESULTS AND DISCUSSION

As seen in Table I, the highest survival (73%) was obtained in pen No. 1. Although stocked at the same rate, survival was only

Table 1: Details of stocking density, growth rate and percentage survival of *P. monodon* seed in various nursery pens

Pen No.	Area (ha)	Stocking period	Size at stocking (mm)	Number stocked	Stocking density/ha (in million)	Harvesting period	Size at harvest (mm)	Number harvested	Percentage survival	Remarks
1	0.1	March, 2nd week	10-12	200,000	2.0	April, 4th week	35-42	146,100	73.0	Only few predators found
2	0.1	March, 4th week	10-12	200,000	2.0	May, 2nd week	35-42	58,000	29.0	A large population of predatory fish and crabs also harvest-ed.
3	0.1	March, 4th week	10-12	250,000	2.5	May, 2nd week	35-40	51,150	20.5	
4	0.1	April, 2nd week	10-12	250,000	2.5	May, 4th week	35-40	45,000	18.0	
5	0.1	April, 2nd week	10-12	300,000	3.0	May, 4th week	32-37	78,000	26.0	
6	0.1	April, 2nd week	10-12	350,000	3.5	May, 4th week	32-37	40,250	11.5	

29% in pen No. 2. Similarly, recovery of tiger prawn juveniles was very poor in the rest of the pens. The low rate of survival in all the pens except pen No. 1, is attributed to the presence of a large population of predatory fish like *Eulethronema tetradactylum*, *Megalops cyprinoides*, *Lates calcarifer*, *Mystus gulio*, gobies and other burrowing animals like crabs and eels which might have been entrapped within the pens since these were installed at a later stage when tidal water had already been taken in to the impoundment. As these pens are installed by the side of a deeper perennial canal harbouring a large population of predators, the same could not be eliminated totally though netting with a narrow-meshed drag net was done before liberating the postlarvae in these pens. However, installation of pen No. 1 in a completely drained and dried area helped in total elimination of predators, thereby resulting in a higher survival of 73%.

These preliminary observations indicate that stocking density seems not to have affected

the survival rates except for little differences in the final average length of juveniles which were more (35-42 mm) at low stocking densities and less (32-37 mm) at the high stocking densities. A strong wave and wind action which facilitated free flow of water across the pen walls not only helped in maintaining high dissolved oxygen values (3.5-9.7 ppm), but also minimised the chances of any pollution due to the build up of metabolites and left-over foods in the nursery pens.

Crabs (*S. serrata*) posed a great problem in most of the pens which were installed after drawing of creek water in the bheri. Aside from taking a heavy toll of *P. monodon* juveniles, they were also instrumental in damaging the nylon netting cloth in 2 of the pens which had to be replaced partially. Later, a large number of crabs were removed. Seeds of *M. monoceros* entered almost in all the pens in large numbers and acted as the biggest competitors for food and space with the tiger prawn seed. A sudden and profuse growth of aquatic macrophytes viz., *Ruppia maritima* and *Nejas* sp. in four of the pens

was another problem noticed during the brief period. Barring few patches to provide shade and shelter to the prawn seed, especially at the time of ecdysis; rest of the weeds were removed promptly by manual means.

The system has much prospects for adoption by the brackishwater aquaculturists in the Sunderbans because of the relatively large size of bheris and reluctance of the farmers to shift to the semi-intensive and intensive systems as they require greater amounts of inputs, risk & technical know-how. Besides raising juveniles for multiple cropping of *P. monodon*, large quantities of seed can be maintained in a portion of the impoundment during November - December when the bheris are drained and dried. This can be achieved by partitioning the deeper perennial canal (a common feature in most of the large impoundments) with split bamboo pattas and removing predators before transferring the seed. This seed can be used during January-February when practically no seeds are available in the nature. Setting up of such 'Seed' banks will not only help in maintaining a stable supply of healthier juveniles and also provide employment to many in selling and buying of postlarvae/ juveniles and other activities like construction/ installation and management of pens etc.

The importance of nursery rearing before stocking the penaeid seed in grow-out ponds for increased growth and survival has been fully emphasized (Hirasawa, 1985; Pretto, 1983; Aquacop, 1985 and De la Pena *et al.*, 1985). Juveniles reared in nursery ponds or in net enclosures within the grow-out ponds are normally used in the extensive and semi-intensive culture system in the Philippines to get better production of table size *P. monodon* (Apud, 1985). Stocking juveniles (30-45 mm) instead of postlarvae (10-12 mm) not only resulted in better survival but also a shortened cropping time of *P. monodon* (Janseen *et al.*, 1986). Likewise, 1491.5 kg/ha/60 days of *P. monodon* were harvested when juveniles were stocked as against a production of only 971.5 kg/ha/ 90 days using

postlarvae of the species in brackishwater experimental pens of CIFRI at Kakdwip (Anon, 1985).

The nursery rearing of prawn postlarvae has been attempted in plastic pools, fibre glass and concrete tanks etc. which allows high stocking densities (4-20 nos/l) with higher survival rates of upto 80% and above (Anon, 1976). This system, however, seems impracticable in view of the enormous quantities of healthy juveniles required. Besides much higher initial capital investment, and the non-existence of electric supply in rural Sunderbans is another factor to be considered for routine aeration/replenishment of water in such a system. Very poor survivals (10.9-28.7%) have been reported even at low stocking densities of 75,000-200,000 nos/ha from the land based small earthen nurseries (0.02 ha) without any artificial aeration (Anon, 1982). However, high survivals (upto 80%) are obtained in Ecuador and Taiwan while nursing prawn postlarvae in earthen ponds at high stocking densities (50-200 nos/m²) with or without fertilization and by supplementary feeding. Using pumps, upto 400% of water is renewed daily and depending upon the species and site conditions, the postlarvae attain an average weight of 0.5-2.0 g in a period of 30-60 days (Aquacop, 1985). This system too, is capital intensive involving too much use of power, equipment and technical skill.

The latest approach in penaeid postlarval rearing is to nurse the baby prawns in floating net cages installed in protected inshore waters like bays and coves (Agbayani *et al.*, 1984; De la Pena *et al.*, 1984; De la Pena and Prospero, 1984; De la Pena *et al.*, 1985 and Walford and Lam, 1987). A survival of 78 and 67 per cent was achieved by Walford and Lam (1987) while rearing *P. indicus* postlarvae from PL₆ to PL₂₂ stocked @ 1700-2100 nos/m² and 3000 nos/m² respectively in floating net cages in the Straits of Johore (Singapore). De la Pena *et al.*, (1985) also obtained similar results in their floating cage nursery rearing experiments with *P. monodon* at the Batan Research Station of SEAFDEC

(Philippines). Though quite promising, allowing high stocking rates with better survival and an easy harvesting of juveniles, the highly turbulent and silt-laden waters of the estuaries and near-shore areas are not suitable for installation of floating nursery cages on the east coast in India.

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REFERENCES

- AGBAYANI, R., N. FRANCO, D. ISRAEL, D. DE LA PENA AND A. T. YOUNG. 1984. The Production Economics of an Integrated Prawn Hatchery-Floating Nursery Project. Poster presentation. *Proceedings of the First International Conference on the Culture of penaeid prawns/shrimps, Iloilo City, Philippines, 4-7 December 1984* 184 p.
- ANON, 1976. Collection and rearing of *Penaeus monodon* seed for stocking and supply. *Annual report, CIFRI, Barrackpore* 85-86 p.
- ANON., 1985. Breeding and culture penaeid prawns in ponds and bheris. *Annual Report, CIFRI* 84-85 p.
- APUD, F. D. 1985. Extensive and semi-intensive culture of prawns and shrimps in the Philippines. *Proc. of the First International Conference on the culture of Penaeid Prawn/Shrimps, Iloilo City, Philippines, 4-7 December, 1984* 105-114 p.
- AQUACOP, 1985. Overview of penaeid culture research impact on commercial culture activity. In Y. Taki, J. H. Primavera and J. A. Llobrera (Editors). *Proceedings of the First International Conference on the Culture of Penaeid prawns/Shrimps, 4-7 Dec., 1984, Iloilo City, Philippines*. Aquaculture Department, SEAFDEC, Tigbauan, Iloilo, Philippines 3-10 p.
- DE LA PENA, D., A. T. YOUNG AND O. Q. PROSPERO, 1984. Floating cage nursery culture system for *P. monodon*. *Ibid* 169 p.
- DE LA PENA, D. AND O. Q. PROSPERO, 1984. Floating nursery cage culture for higher supgo survival. *Asian Aquaculture, SEAFDEC Aquaculture Department, Vol. 41, No. 3*.
- DE LA PENA, D., O. Q. PROSPERO AND A. T. YOUNG, 1985. *Aquaculture Department, SEAFDEC, Aquaculture Technology Module 3*.
- HIRASAWA, Y., 1985. Economics of shrimp culture in Asia. *Proc. of the First International Conf. on the Culture of Penaeid Prawns/Shrimps, Iloilo City, Philippines, 4-7 Dec. 1984*. 131-150 p.
- JANSEEN, J. A. J., T. RADHAKRISHNA MURTHY, B. V. RAGHAVULU AND V. SHREE KRISHNA, 1986. Experimental shrimp farming in ponds in Polekurru, Andhra Pradesh, India. *Report of Bay of Bengal Programme (BOBP/WP/46)*: 1-32 p.
- PRETTO, R. M., 1983. *Penaeus* shrimp pond grow-out in Panama. In J.P. Mc. Vey (ed.), *CRC handbook of mariculture, Vol. 1, Crustacean aquaculture, CRC Press, Florida* 169-178 p.
- TAKI, YASUHIKO, J. H. PRIMAVERA AND J. A. LLOBRERA (Editors), 1985. *Proc. of the First International Conf. on the Culture of Penaeid Prawns/Shrimps, Iloilo City, Philippines, 4-7 December 1984* 1-87 p.
- WALFORD, J. AND T. J. LAM, 1987. Floating hatchery and net cage culture of *P. indicus* in the Straits, of Johore, Singapore. *Aquaculture, 62* : 11-32 p.