

*Short Communication*

## Growth of hatchery raised banana shrimp *Penaeus merguensis* (de Man) (Crustacea:Decapoda) juveniles under different salinity

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In order to optimise the conditions for improved production of the banana shrimp *Penaeus merguensis* in the farms, effect of salinity on growth and survival was studied for 4 weeks using hatchery reared juveniles. Survival was very poor in salinity <15 ppt. Weight progressively increased with increase in salinity to record a significantly high growth ( $P < 0.05$ ) in 40 ppt salinity (8.5 times the initial weight in 4 weeks). The results indicate that this species is suitable for cultivation in high saline waters.

Biology of any aquatic organism is profoundly influenced by several abiotic factors and its distribution in any ecosystem is determined by the degree of influence exerted by any one of the factors either independently or in combination<sup>1</sup>. Salinity is one of the important abiotic factors that affects survival, growth and distribution of organisms in marine environment. The semi-catadromous life of penaeid shrimps involves both high and low saline ecosystems as spawning and early larval development occur in the sea and late larvae and juveniles grow in the estuarine environment. Thus, salinity plays a vital role in growth and survival during larval and juvenile phases as they get exposed to wide variations in salinity in the estuarine environment<sup>2-3</sup>. Therefore, a greater knowledge of the influence of salinity is imperative for understanding the physiology, biology and productivity potential of the organism.

Juvenile specimens of *Penaeus merguensis* (de Man) (Crustacea: Decapoda) used for the study were reared from a single spawn in the shrimp hatchery at the National Institute of Oceanography (Goa). The average weight of the juveniles was <0.2 g. The experiments were conducted in aquarium tanks of 20 liter capacity.

Seawater of appropriate concentrations (5, 10, 15, 20, 30 and 40 ppt) were prepared by diluting 30 ppt filtered seawater (Triton II Fibreglass Sand Filter, USA) with dechlorinated freshwater or by adding common salt. Experiments in >40 ppt salinity were not conducted as such high saline conditions do not

normally prevail in the ponds. To maintain the water pH at 7.8 in all prepared salinity concentrations, either 1N HCl or 1N NaOH was added. Salinity (Refractometer, Atago, Japan), pH (Philips PP 9046), and temperature ( $30 \pm 1$  °C) were measured every morning and required adjustments were made.

Juveniles, maintained at 30 ppt and 7.8 pH seawater were acclimatised for 24 hr in the respective test salinity before commencing the experiment by gradually increasing or decreasing the salinity by 5 ppt at a time to prevent salinity shock. Specimens were starved while acclimatising. During the experiment, they were fed a commercial diet (Higashi, Grower), equivalent to 10% of body weight, split equally in the morning and evening.

Five acclimatised juveniles were placed in the aquarium tank for each salinity after recording the initial total biomass and three replicates were maintained for each treatment. Every morning, uneaten food and moult (when present) were siphoned out. Test solution was exchanged once in three days. At the end of every week, juveniles in each tank were carefully removed, blot-dried and weighed to determine the total weekly absolute weight gain. The experiment was carried out for a period of 4 weeks. Average weekly absolute weight gain per juvenile was calculated for each tank and the mean  $\pm$  SD of the replicates were calculated for each treatment. The data were subjected to ANOVA.

At 5 ppt salinity, all juveniles died within the first 2 days and at 10 ppt, within the first week. Therefore, these data were not used for computation or comparison. At other salinities, no mortality occurred throughout the period of the experiment. The weekly

\*Deceased. The paper is dedicated to the fond memory of Dr. Christina M. Saldanha

Table 1 — Weekly mean weight gain (g) of *P. merguensis* juveniles in different salinities. SD values are in parentheses

Experimental duration (week)	Salinity (ppt)			
	15	20	30	40
0	0.154 (0.007)	0.195 (0.004)	0.168 (0.012)	0.176 (0.018)
1	0.189 (0.006)	0.332 (0.020)	0.271 (0.011)	0.419 (0.017)
2	0.192 (0.004)	0.415 (0.005)	0.465 (0.013)	0.559 (0.014)
3	0.196 (0.008)	0.600 (0.014)	0.834 (0.011)	0.991 (0.022)
4	1.99 (0.007)	0.714 (0.025)	0.950 (0.009)	1.494 (0.180)

mean absolute weight gain obtained in different salinities are given in Table 1. At 15 ppt salinity, growth was very slow and the total weight gain at the end of the 4th week was only 1.3 times the initial weight. At 20, 30 and 40 ppt salinity, the weight progressively increased and attained 3.7, 5.7 and 8.5 times the initial weight, respectively at the end of the 4th week. Pronounced growth difference between salinities was observed from 2nd week onwards. Analysis of variance indicated that the differences obtained at a given salinity ( $F=9.76$ ,  $P<0.05$ ) and between the salinities ( $F=4.79$ ;  $P<0.05$ ) were significant. The results suggest that growth of juvenile *P. merguensis* can be considerably improved by increasing the salinity in the pond.

The results of the experiments provide a convincing evidence for the important role of salinity in improving the growth performance of juvenile *P. merguensis*. As the growth is favoured in high salinity (40 ppt), it would perhaps explain the abundance of wild brood stock of this species in the coastal waters of Goa during the high saline summer months (February- May)<sup>4</sup> and this is also supported by the high density of larval occurrence<sup>5</sup>.

According to Staples<sup>6</sup> and Staples & Vance<sup>7</sup>, postlarvae and juveniles of *P. merguensis* inhabiting the Australian estuaries tolerate wide ranges of salinity. The hatchery reared juveniles of this species also was observed to tolerate wide ranges of salinity (10-30 ppt), but growth reduced<sup>8</sup> considerably at temperature below 28°C, suggesting that temperature is the main controlling factor for growth. Staples & Heales<sup>9</sup> observed that although the optimal salinity for growth of juveniles of *P. merguensis* was 30 ppt at 31°C, the greatest increase in biomass and production were obtained at 28°C in 25 ppt. However, In the tropics (as in India), temperature may not have a

decisive role in growth and the temperature (30± 1°C) maintained in the experiments was high and comparable with the above.

Present results clearly indicate that it is beneficial to cultivate *P. merguensis* in high saline waters (40 ppt). It appears that the wild population also prefers a high saline regime as they abundantly occur along the west coast of India during the summer season. It is suggested that this species may be considered for the summer crop along the west coast of India when the salinity in the ponds goes generally higher and the broodstock is also available in good numbers. A crop rotation of *P. monodon* with *A. merguensis* is also recommended as this would reduce pressure on the wild broodstock of the former and may also reduce the chances of recurrence of whitespot baculo virus infection prevalent in the farm produced *P. monodon*.

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