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Culture of *Scylla serrata* Megalops in Brackishwater Ponds

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Abstract

Three- to five-day old hatchery-reared megalops (4.0 to 6.4 mg body weight) of the mud crab, *Scylla serrata*, were cultured to the juvenile stage in 20 m^2 net cages installed in brackishwater nursery ponds. To establish a suitable stocking density, megalops were stocked at 10, 20, and 30 ind·m^{-2} in net cages. Treatments were replicated three times over time. After 30 days of culture, mean survival of juveniles ranged from 48.3 to 53.3% and did not vary significantly ($P > 0.05$) among the three stocking densities. Similarly, the mean final body weights of juveniles ranging from 2.91 to 3.40 g and mass weights 458.9 to 1066 g did not significantly differ among stocking densities. These results show that stocking of crab megalops directly in net cages in a brackishwater pond is feasible at any of the stocking densities tested.

Introduction

In the Indo-Pacific region there is a strong preference for the culture of mud crab juveniles (*Scylla* spp.). In the Philippines, interest in growing mud crabs among commercial fishpond operators has increased and is currently viewed as an alternative to the declining prawn industry. However, the inadequate seed supply for grow-out culture limits the promotion of mud crab farming. Thus, the establishment of appropriate hatchery and nursery techniques is necessary to meet the increasing demand for crab seeds.

Seed production of the mud crab *S. serrata* (Keenan et al. 1998) from zoea to megalopa in the hatchery and up to the juvenile stage in nursery tanks have been established at the Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC/AQD). Megalopa is a critical phase in the life cycle of the mud crab that is marked by high cannibalism and abrupt declines in survival. Cannibalism-related mortalities are often due to asynchronous molting and inadequate food. Since megalops are highly active, free swimming and predatory (Heasman and Fielder 1983), abundance of natural food in the culture water and stocking at low density may circumvent problems of high cannibalism and poor nutrition. Culture of megalops at high density in tanks may aggravate this problem. Hence, stocking them in nursery ponds with a greater surface area to reduce encounter rates between animals could be a viable alternative. When properly fertilized, there is abundant natural food for the megalops in ponds.

To improve the survival of mud crab megalopa to the juvenile stage, the feasibility of growing them in net cages installed in brackishwater ponds was tested. The effect of different stocking densities on growth and survival was also determined.

Materials and Methods

The study was conducted at the Western Visayas Demonstration Fish Farm (WVDFF) in Molo, Iloilo City. Prior to stocking of megalops, the pond was prepared according to the protocol of Triño and Sarroza (1995). The pond bottom was sun-dried for 5 to 7 days or until the soil cracked. After applying agricultural lime at 1 ton·ha^{-1} and chicken manure at 1 ton·ha^{-1}, the pond was filled with water to about 30 cm. When good growth of plankton was obtained, water volume was gradually increased to 80 cm deep over a period of 3 days. To sustain plankton growth for the 30-day culture period, pond water was fertilized with the same dose of fertilizers every 10 days.

Three to five-day old hatchery-reared mud crab megalops (4.0 to 6.4 mg initial body weight) previously reared for 23 to 24 days at the SEAFDEC/AQD hatchery were transported in plastic bags at a density of 200 to 300 ind·l^{-1} following Quinitio and Parado-Estepa (2000). After transport, megalops were gradually acclimated to the pond water salinity and temperature. They were then stocked in 9 units of 20 m^2 (4 m wide x 5 m long), net cages installed in a 1000 m^2 brackishwater nursery pond. The net cages were of 1-mm mesh size and the inner side of the upper end of each net was fitted with 30 cm wide plastic sheet (gauge 14) to prevent juveniles from escaping. Bamboo poles served as support to these cages. Six dried coconut fronds were positioned in the water column in each cage to serve as shelters or refuge for crabs.

Crab megalops were stocked at densities of 10, 20, and 30 ind·m^{-2} and cultured for 30 days. They were fed macerated brown mussel meat (*Modiolus metcalfei*) or fish at 30% of biomass per day for the first week. Feeding was reduced to 20% of the biomass in the succeeding weeks. Feed ration was divided equally and given at 0800 h, 1300 h, and 1700 h daily. Throughout the culture period, pond water depth was maintained at 60 to 80 cm. About 30% of the pond water was drained and replenished gradually for 3 to 4 days during spring tides. Pond water salinity, temperature, pH, and dissolved oxygen were monitored thrice weekly at 0900 h. Zooplankton species were sampled inside and outside the net cages and preserved in 5% buffered formaldehyde for microscopic examination. Predominant species of zooplankton were noted.

Crab juveniles were sampled for weight gain by lifting the net cages after 20 days of culture. After 30 days, juveniles were harvested by draining 70% of the pond water and lifting each net cage. Survival and mean individual body weight of juveniles were determined in each cage. Mass weight was also determined from the total weights of juveniles in each cage. Three runs were conducted to replicate the treatments over time. Analysis of variance and Duncan's new multiple range test were used to compare treatment means.

Results

Figure 1 shows the mean survival of megalops to crab juveniles after 30 days. Survival rates were similar ($P > 0.05$) at 10 ind·m^{-2} (53.3 ± 7.3%), 20 ind·m^{-2} (48.3 ± 9.1%), and 30 ind·m^{-2} (50.0 ± 9.0 %). The final body weights of juveniles at 10 (2.91 ± 0.42 g), 20 (3.4 ± 1.1g), and 30 ind·m^{-2} (2.96 ± 0.42 g) did not differ significantly (Fig. 2). Mass weights (Fig. 2) were lowest at 10 ind·m^{-2} (458.9 ± 55 g), followed by 20 ind·m^{-2} (857.5 ± 222 g), then 30 ind·m^{-2} (1066 ± 212 g). Although mass weight at 10 ind·m^{-2} seemed much lower than that in 30 ind·m^{-2}, no significant difference was detected due to the large variation encountered in the two higher stocking densities.

The levels of water parameters namely; salinity, 16 to 26 ppt; water temperature, 22 to 34°C; pH, 8.1 to 8.5; and dissolved oxygen 3.5 to 10.3 ppm were within tolerable limits for culture of crabs. The dominant zooplankton species in water samples obtained from the pond were the rotifer *Brachionus* sp., copepodids, nauplii of *Oithona* sp., *Acartia tsuensis*, and mysids. Quantification of zooplankton was not done in this study.

Discussion

There were no significant differences in survival and body or mass weight among the various treatments, indicating that megalops can be stocked using any of these stocking densities. However, stocking at 30 ind·m^{-2} would maximize the use of the pond area.

The megalopa reared until juvenile stage for 30 days under hatchery conditions in tanks attained similar survival rates as those in ponds. However, growth was slower compared to that attained in the present study. Body weight of tank-reared juveniles ranged from 0.70 to 1.2 g (shooters not included) while those in ponds attained 2.9 to 3.4 g within the same culture period. Juveniles that attained more than 2 g can already be stocked directly in grow-out ponds provided that the ponds are predator-free, and have substantial natural and unprocessed food as supplement.

Direct release of *Portunus trituberculatus* megalops in a bay was first tested in Japan but did not seem successful (Cowan 1984). *P. trituberculatus* crab instar 1 (C_1) released in a small bay in Japan had a

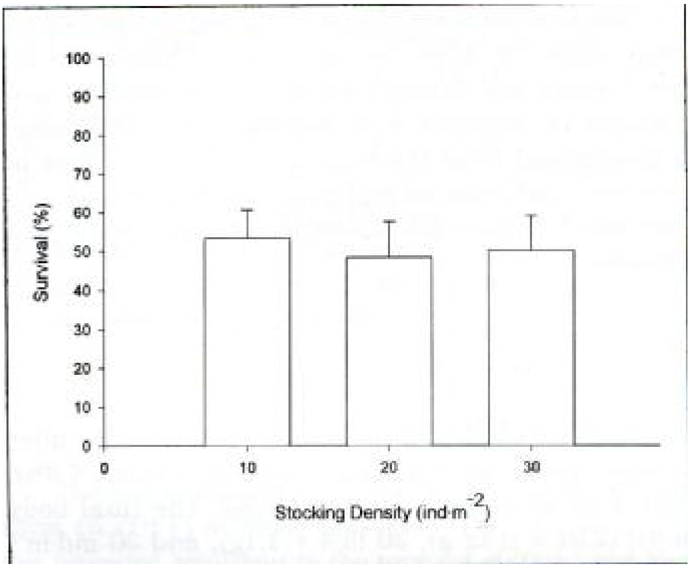

Fig. 1. Survival of *S. serrata* megalops stocked at different stocking densities after 30 days of culture in hapa nets installed in ponds. Bars represent means ± SE.

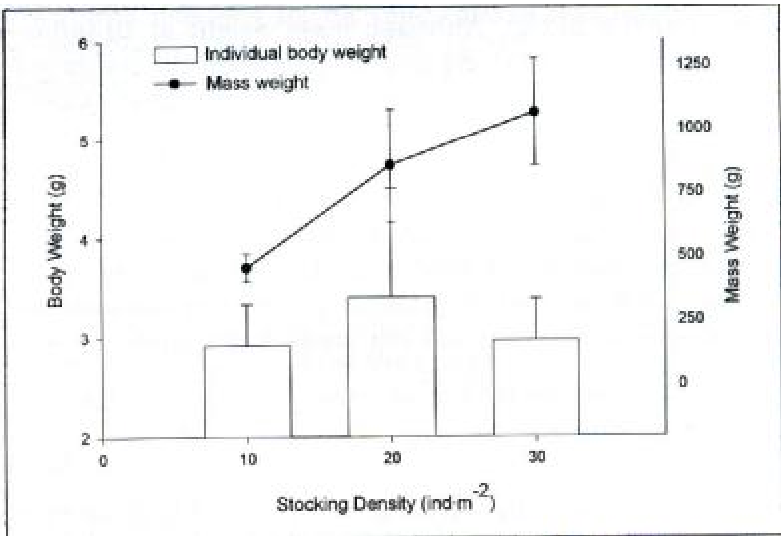

Fig. 2. Final mean body weight and mass weights of *S. serrata* megalops at different stocking densities after 30 days of culture in net cages installed in ponds. Bars represent means ± SE

survival rate of 5% after 10 days and 3.5% after 30 days (Inoko et al. 1979a; 1979b) which are much lower than that obtained in the present study considering that the megalopa is more sensitive than the crab instar. Further, the use of net pens for intermediate rearing of C_1 at 100 to 500 ind·m^{-2} with shelters and food has also been reported (Cowan 1984). With this system, a survival rate of 29 to 39% to C2 to C4 was obtained.

Megalopa is the first stage when pincers appear (Ong 1964) hence, cannibalism is high resulting to low survival. Putting up several tanks in the hatchery to thin out megalops would be expensive. On the other hand, a nursery pond presents a larger surface area, hence more extensive space for the dispersion of megalops apart from increased availability of natural food. However, megalops should be stocked in net cages for better retrieval and for protection from predation by bigger organisms that may be present in the ponds.

This study shows the feasibility of growing mud crab megalops in net cages installed in brackishwater ponds, thus reducing the use of nursery tanks in the hatchery. This study also provides valuable information that would lead to the development of a viable mud crab seed production for grow-out culture.

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