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Experimental Culture of Juvenile Spotted Babylon, *Babylonia areolata* Link 1807 (Neogastropoda: Buccinidae) in Thailand

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Abstract

To assess the aquaculture potential for spotted babylon, *Babylonia areolata L.*, hatch-ery-reared juveniles were produced and grown-out until they reached marketable size. Juveniles with mean shell length of 15.0 mm were held in a flow through seawater sys-tem containing a 10-cm layer of fine sand as substratum. Growth in length and weight were measured individually once a month for a period of 12 months. The monthly average growth increments of the juveniles were 2.9 mm per month in shell length and and 1.6 g per month in whole weight. Survival rate typically exceeded 90%.

Introduction

Spotted babylon, *Babylonia areolata* Link 1807, commonly known as Hoy Wan in Thailand is a carnivorous marine benthic gastropod of the order Neogastropoda, family Buccinidae (Habe 1965). Its shell is thick with a high, pointed apex, while the body whorl is patterned, with round brownish patches on the white shell background. This species is abundant all year round and inhabits the muddy sand bottom, usually less than 15-20 m in depth. Literature on *B. areolata* is limited (Munprasit and Wudthisin 1988, Singhagraiwan 1996). Other studies on the biology of *B. spirata, B. zeylonica,* and *B. lutos* have been recently done in Hong Kong and India (Thirumalavalavan 1987, Morton 1990, Ayyakkannu 1994, Patterson et al. 1994, Raghunathan et al. 1994).

Spotted babylon is an important marine resource harvested from the natural local beds. The fishery has recently developed by trapping and as a by product of sand crab (*Portunus pelagicus*) harvests. Babylonia harvest on the other hand, has recently declined in traditional areas, particularly in the larger size classes. The decrease in production resulted to an increase in both

demand and price. The price of babylonia of 5.0-6.5 cm shell length is about 7.0 and 10.0 US$ per kilogram in seafood markets and resturants. In recent years, babylonia mariculture has been proposed as a means to increase its supply. Continuous yearly exploitation of babylonia may result in the depletion of local stocks. The declining stocks and interest in aquaculture prompted this study on spawning, larvae and juvenile rearing of *B. areolata*.

Materials and Methods

One hundred adult spotted babylon, *B. areolata*, with mean shell length of 5.7 cm (Fig. 1) were obtained by local fishermen from the fishing ground of Rayong province, inner part of the Eastern Gulf of Thailand. They were then transported to Sichang Marine Science Research and Training Station, about 40 km from the collection site. The animals were held in 2.0 x 1.0 x 0.8 m spawning tanks supplied with flow-through seawater (10 L/min). Salinity and temperature ranged from 26 to 29 ppt and 28 to 29°C, respectively. A 10-cm layer of fine sand was provided as substratum. The animals were fed twice daily with fresh meat of carangid fish, *Selaroides leptolepis*. The adult snails were acclimatized for 5-10 days to spawn naturally in the laboratory. After spawning, egg capsules were collected and rinsed with 1-μm filtered seawater. The capsules were then placed in plastic baskets of 1-cm mesh size and submerged in 1.5 x 0.5 x 0.3 hatching tanks containing 1-μm filtered and gently aerated seawater. Water was replenished daily until hatching. After hatching, the newly hatched planktonic veligers were collected with a 20-um nylon mesh sieve and rinsed with 1-mm filtered, ambient seawater three times. These veligers were transferred to 1.5 x 0.5 x 0.3 m larval rearing tanks containing 1-μm filtered, ambient, continuously aerated seawater. The initial stocking density was 10,000 larvae per litre. Larvae were primarily fed twice daily with 20 $x10^6$ cells ml^{-1} of unicellular microalgae (*Tetraselmis sp.*). Water was changed every two days, and the rearing tank was cleaned with 3 ppt chlorine concentration for 10 min and rinsed with wellwater three times.

Larvae set on the bottom of the larval rearing tanks. The settled juveniles were transferred into 1.5 x 0.5 x 0.5 m rearing tanks. The tanks were supplied with flow-through (10 L/min) and gently aerated water. At an average shell length of 16.5 x 2.5 mm, the juveniles were transferred to duplicate 1.0 x 1.0 x 0.5 m rearing tanks containing a 10-cm layer of fine sand. The initial stocking density was 100 individuals per m^2. After transfer, the food was changed from unicellular microalgae to chopped carangid fish (*S. leptolepis*). Snails were fed twice daily at 9:00 PM and 17:00 AM. Food was offered until the animals stopped eating. The length and weight were measured at monthly intervals over a 12-month period. The absolute growth rates and their standard deviation were calculated from average increments in shell size and weight per month. The number of dead individuals was recorded in each tank at monthly intervals, and an average monthly survival rate was calculated. For morphometric relationships, regression analyses of shell length and weight were calculated.

Fig. 1. Broodstock of spotted babylon, *Babylonia areolata*, used in the experiment.

Results and Discussion

Growth

Average monthly shell growth of juveniles *B. areolata*, differed significantly ($P<0.05$) through out the period of study. The shell growth increased linearly, although the average monthly shell length rapidly increased over the first 4 months and, thereafter, gradually decreased. Average growth increment in terms of shell length was 2.9±2.5 mm per month (n=20) and 1.9±1.5 mm per month (n=20) of shell width. At the end of the experiment, the juveniles had reached an average shell length and width of 48.3±9.2 and 29.7±6.1 mm (SD; n=20), respectively (Fig. 2).

Increase in weight, the average monthly increase in whole body weight and wet meat weight of juveniles *B. areolata*, also differed significantly ($P<0.05$) through out the period of study. The average whole body weight increment was 1.6±0.9 g per month (n=20) and 0.8±0.2 g per month (n=20) for those of wet meat weight. At the end of the experiment, the juveniles had reached an average whole body weight and wet meat weight of 17.5±5.7 and 9.4±6.8 g (SD; n=20), respectively (Fig. 2).

For morphometry, the equation describing the relationships between shell length and weight was (Fig. 3)

$$\text{Log}_{10}(L) = 23.2923 + 1.4695\ \text{Log}_{10}(W) \qquad (r^2 = 0.8090)$$

The average monthly growth rate of juvenile *B. areolata* was 2.9 mm/month in length and 1.6 g/month in weight. The growth rate of juveniles *B.*

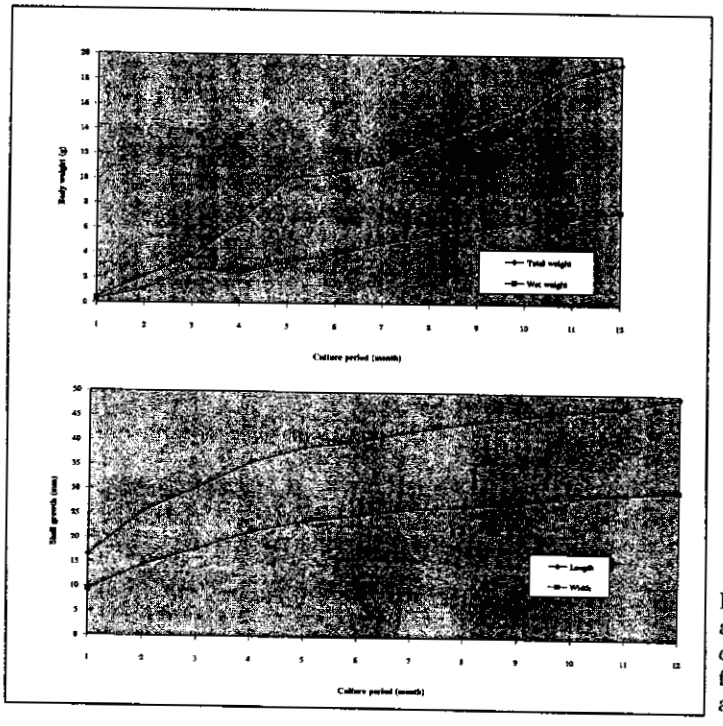

Fig. 2. Growths in length and weight of juveniles *B. areolata* reared under flow through system over a period of 12 months.

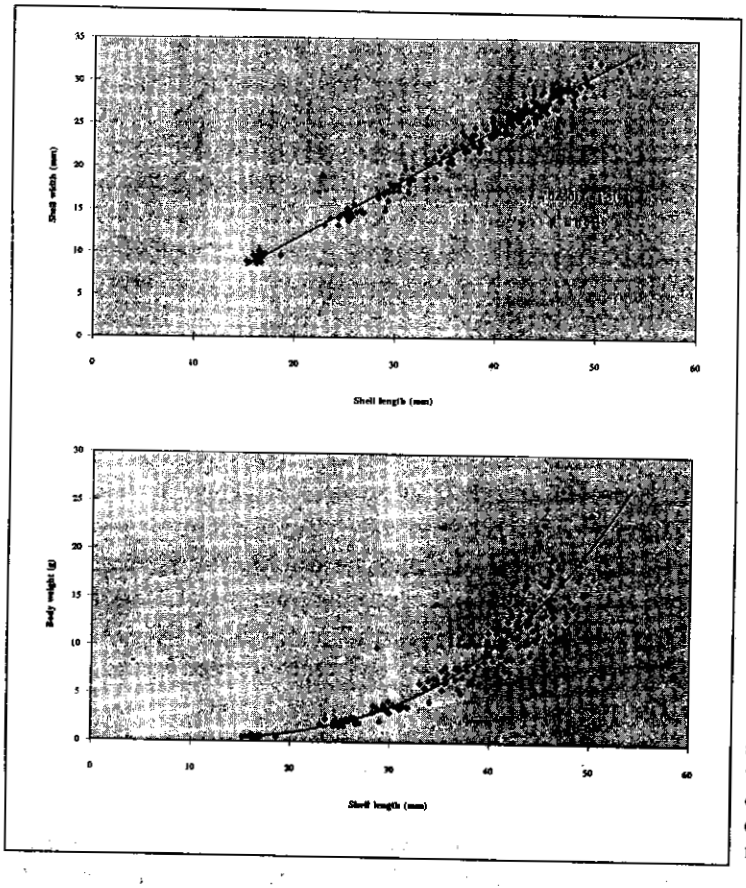

Fig. 3. Scatter diagram depicting relationships between shell length, shell width and body weight of juveniles *B. areolata*, including the equations and fitted regression lines.

areolata was higher than that of the spiral babylon, *Babylonia spirata*, and the giant muricid gastropod, *Chicoreus ramosus*. Raghunathan et al. (1994) reported that the average growth of *B. spirata* showed a gradual increase from 2.9 to 3.0 cm to 3.5-3.8 cm in shell length and 6.5 to 6.8 g to 11.1 to 14.1 g in total weight over a 10 month period. Patterson et al. (1995) reported average growth rates of 1.22 and 0.05 g per day for *B. spirata* fed with oyster and crab. In contrast, juveniles of *C. ramosus*, showed average growth increments of 2.60, 10.91, 9.26, 4.27 and 1.01 mm per month in shell length at ages of 2, 4, 5, 8 and 12 months, respectively (Nugranad et al. 1994). Kraeuter et al. (1989) reported that the average growth rate of knobbed whelk, *Busycon carica*, was 14.40 mm per year for the first 10 years of life in laboratory condition.

Survival

The average monthly decrease in the survival rate of juveniles *B. areolata*, did not differ significantly ($P<0.05$) through out the period of study. The monthly survival rate gradually decreased over the first 3 months and no further mortality was observed. The average monthly survival rate was 94.08% during the 6 months of juvenile culture (Fig. 4).

Sizes at harvest

The spotted babylon showed the best results in uniform shell growth. After the 12-month period, harvested animals were graded into 3 size classes of 5.0 mm interval in shell length. Animals within the size classes of 40 to 45, 46 to 50 and 51 to 55 mm had a growth rate of 15.0, 75.0 and 10.0%, respectively.

This study shows that *B. areolata* has characteristics that can make it a potentially valuable aquaculture species. It exhibited a fast growth rate, market size was reached in 10 months, using relatively simple hatchery techniques. Additional studies to manipulate seedling production and culture technology of this species are necessary. These should include methods to improve growth and survival rates of larvae and juveniles in both nursery and growout systems and to evaluate the costs of scaling up the culture conditions to commercial levels (Table 1).

Table 1. Growth rates of spotted babylon, *Babylonia areolata*, under hatchery condition.

Month	Total length	Increament	Total width	Increment	Total weight	Increment	Wet weight	Increment
Jan	16.48		9.35		0.48		0.2955	
Feb	25.47		14.44		2.09		1.0796	
Mar	30.30		17.81		3.70		2.6853	
Apr	35.56		21.35		6.47		2.3365	
May	38.67		23.56		10.00		3.2476	
Jun	40.00		24.81		10.44		3.8749	
Jul	42.08		26.24		11.22		4.7969	
Aug	43.72		26.74		12.97		5.4749	
Sep	45.08		27.62		14.35		5.9987	
Oct	46.22		27.98		15.08		6.5879	
Nov	47.48		28.76		15.97		6.9258	
Dec	48.35		29.23		16.85		7.4250	

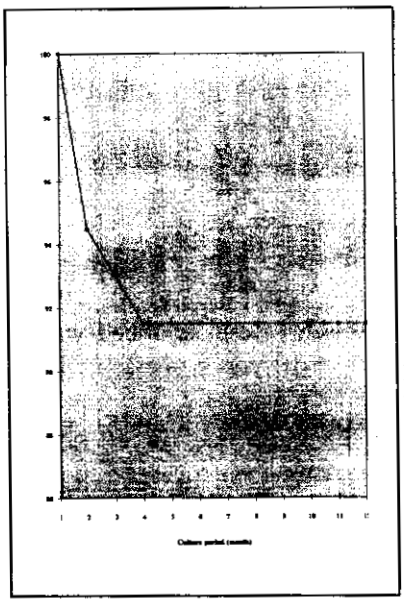

Fig. 4. Survival rate (%) of juveniles *B. areolata* reared under hatchery condition over a period of 12 months.

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References

Ayyakkannu, K., 1994. Fishery status of *Babylonia spirata* at Porto Novo, southeast coast of India. Phuket. Mar. Biol. Cent. Spec. Publ. No. 13 : 53-56.

Habe, T., 1965. Notes on the ivory shell genus Babylonia Schluter (Mollusca). Bull. Nat. Sci. Mus. Tokyo, 8(2) :115-125.

Munprasit, R and Wudthisin, P., 1988. Preliminary study on breeding and rearing of areolata babylon (*Babylonia areolata*, L). Technical paper No. 8, Eastern Marine Fisheries Development Center, Department of Fisheries. 14 pp.

Morton, B., 1990. The physiology and feeding behaviour of two marine scavenging gastropods in Hon Kong : the subtidal *Babylonia lutosa* and the intertidal *Nassarius festivus* (p). J. Moll. Stud. 56 : 275-288.

Nugranad, J., Poomtong, T. and Promchinda, K., 1994. Massculture of *Chicoreus ramosus* (Gastropoda : Muricidae). Phuket. Mar. Biol. Cent. Spec. Publ. No. 13 : 65-71.

Patterson, J., Shanmugaraj, T. and Ayyakkannu, K., 1994. Salinity tolerance of *Babylonia spirata* (Neogastropoda : Buccinidae). Phuket. Mar. Biol. Cent. Spec. Publ. No. 13:95-97.

Patterson, J. K., Raghunathan, C. and Ayyakkannu, K., 1995. Food preference, consumption and feeding behaviour of the scarvenging gastropod *Babylonia spirata* (neogastropoda: Buccinidae). Indian Journal of Marine Science 24:104-106.

Kraeuter, J. N., Castagna, M. and Bisker, R., 1989. Growth rate estimates for *Busycon carica* in Verginia. Journal of Shellfish Research 8(1) : 219-225.

Raghunathan, C., Patterson Edward, J. K. and Ayyakkannu, K., 1994.Long term study on food consumption and growth rate of *Babylonia spirata* (neogastropoda : Buccinidae). Phuket. Mar. Biol. Cent. Spec. Publ. No. 13 : 207-210.

Singhagraiwan, T., 1996. Some biological study of babylon shell, *Babylonia areolata* Link) in captivity for seedling and releasing. Technical paper No. 57, Eastern Marine Fisheries Development Center, Depaetment of Fisheries. 16 pp.

Thirumalavalavan, R., 1987. Studies on *Babylonia spirata* (Linn.) Mollusca (Gastropoda: Buccinidae) from Porto Novo waters. M. Phil. thesis, Annamalai University, India.

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