

Maturation and Spawning of Penaeid Shrimp *Penaeus monodon* Fabricius Collected from off Shore Water of the Bay of Bengal

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ABSTRACT

In total 65 gravid females of *Penaeus monodon* were collected from off shore waters of Bangladesh for the study of maturation, spawning and hatching performances. To promote ovarian maturation and spawning of *P. monodon* eye stalk ablation and control of physical factors of the environment were taken into consideration. The number of eggs depends on the weight of the gravid female that varied from 70,000 to 375,000 having the body weight of 65 to 120 g where the average number of eggs was 170,300. 77.26% of the eggs were fertilized and 83.28% of them produced nauplii.

Key Words: Maturation; Spawning; Hatching; Penaeid

INTRODUCTION

Shrimp culture plays an important role in the fisheries sector of Bangladesh. The tiger shrimp, *Penaeus monodon* is one of the largest shrimp among *penaeids* and is most suitable for mariculture in Bangladesh. Therefore, there is a great demand of *P. monodon* seed, which is about 3500 million in every year (Annual report of SHAB, 2003). At present shrimp hatcheries can produce about 2500 million seeds, while the number of wild seed is around 500 million of the total demand. The wild fry is highly seasonal and the supply is inconsistent. The successful controlled maturation in captivity of *penaeid* shrimp, *Penaeus monodon* has been accomplished in several countries of the world but very little work has done in Bangladesh. The propagation of *P. monodon* was successfully done for the first time in 1968 (Liao *et al.*, 1969) and the technique has been widely used specially in South East Asian countries. In Bangladesh the maturation in captivity of *P. monodon* was successfully completed in Pioneer Hatchery Limited, Cox's Bazar in 1995 (Das *et al.*, 1997). The availability of broodstock of *P. monodon* mainly depends on the capture of the wild gravid females from the Bay of Bengal. Unfortunately the number of gravid females has been decreased year by year but on the other hand the price of wild gravid females has increased every year. Therefore, to ensure a stable supply of seed of *P. monodon*, the induce maturation and spawning in captivity are very essential. During the last few years a little work has done on maturation, spawning & hatching of *P. monodon* and very little information is available on the various aspects of shrimp hatchery operation in Bangladesh. The result of the present study will be helpful to develop a reference database on the ovarian development by the eye-stalk ablation and hatching technique of *P. monodon* collected from the offshore water of Bangladesh.

MATERIALS AND METHODS

This study was carried out from January 2001 to June 2002 in Prime Shrimp Hatchery Limited, Cox's Bazar, where adequate research facilities for the study of hatchery operation and management were readily available. The broodstocks were collected from the south of south patches, near St. Martin's Island of the Bay of Bengal using deep sea fishing trawler (Fig. 1). The duration of each haul was about 2 h and the sorted matured male and female were packed at 4-5 inds./bag with proper aeration before carried to the hatchery.

For maturation, spawning and hatching the water quality was maintained at 28-33 ppt salinity, 28-32^o C temperature and 7.8-8.5 pH. The supplied seawater was filtered by using slow sand filter, cartridge filter and UV to remove the bacteria and other undesired particles. The water level in the maturation tanks was kept at 70 cm with a constant flow at about 10 L/minute that provides 200% exchange/day. The continuous aeration was provided in the maturation, spawning and hatching tanks treated with 4 ppm oxytetracycline. About 10% of the biomass was fed to the shrimp and the constituents of feed were crabs, squid, clam, beef liver etc.

Before ablation, both males and females were kept in two separate broodstock tanks containing 500 L of sea water. The males were transferred to the maturation tank after treating with antibiotic (20 ppm Oxytetracycline) for half an hour. Each female sorted from the holding tank of females was removed and hold it one hand with head facing away from the body and checked both the eyes for any damage. At first, the damaged eye was ablated. Ablation was carried out unilaterally with a heated surgical forceps (Chen, 1977). This seems to be the best procedure to keep the hemolymph from percolating from the wound. The body weights of the selected females varied from 65-120 g. After

ablation females were placed in indoor tanks containing antibiotic solution (20ppm) for half an hour and then released to the maturation tank. The number of shrimp per maturation tank (20 ton capacity) was around 25 with a sex ratio of male and female 1:2.

The ovarian development was examined by shining light against the side of the abdomen with a waterproof hand light, particularly in the area behind the cephalothorax. The gravid spawner was dipped for about 5 minutes in 500 ppm formalin. After formalin bath the female was rinsed with sea water and placed into the spawning tank. In each spawning tank (1 ton) a gravid female was placed and treated with 10 ppm EDTA and 4 ppm Ciprofloxacin.

After spawning the spent females were removed from the tanks by a scoop net. The tank water was drained and the eggs were passed through a 350 μ hand net which retains feces and they were collected on a 159 μ hand net in a bucket. Before transferring the eggs to the hatching tanks, they were washed thoroughly with running seawater at least for 10 minutes and then they were again treated with 10 ppm EDTA and 4 ppm Oxytetracycline. The number of eggs and the percentage of fertilized eggs were estimated by using the formula of Quinto *et al.* (1984). The hatching rate was determined by using the following formula: $H\% = Y/X \times 100\%$; H=hatching rate, Y=total number of nauplii and X=total number of eggs (Chen, 1979).

RESULTS AND DISCUSSION

A total of 50 individuals out of 65 females were responded to spawn completely. First the color of the ovary was whitish which turned gradually greenish to dark green on the spawning day. Spawning was always observed to take place between 10.00 p.m. to 4.00 a.m. Aquacop (1980) and Das *et al.* (1997) reported that spawning took place between 9.00 p.m. to mid night and midnight to 5.00 a.m. respectively. In this study, the whole spawning process was completed within 2–5 minutes where Das *et al.* (1997) reported 5–10 minutes. During maturation period shrimps were fed 10% of the total biomass twice daily at 8.00 a.m. and 5.00 p.m. but other researchers opined that the feed were given 1 to 4 times daily at the rate of 3 to 30% of the

Table I. Relationship between body weight (g) and no. of eggs. of *P. monodon* spawning(n=50)

Body weight (g)	No. of spawner	Total no. of eggs (10^3)	Average no. of egg (10^3)
65-69	7	515	73.5
70-74	5	440	88.0
75-79	2	210	105.0
80-84	7	1015	145.0
85-89	8	1490	186.2
90-94	13	3195	245.7
95-99	3	745	248.3
100-105	2	365	182.5
110-120	3	540	170.0

Fig. 1. The catching area of mother shrimp

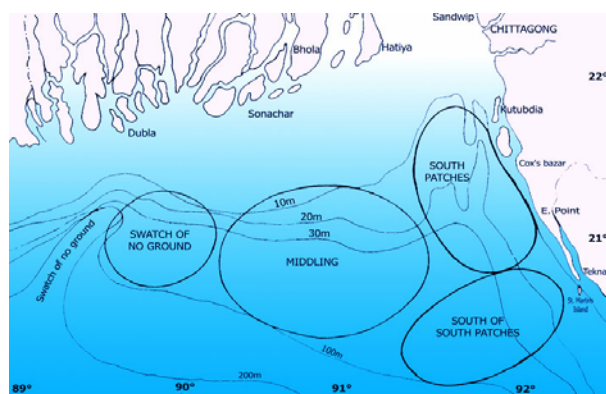


Fig. 2. Percentage of fertilized eggs (average 77.26%) in relation to the spawning number

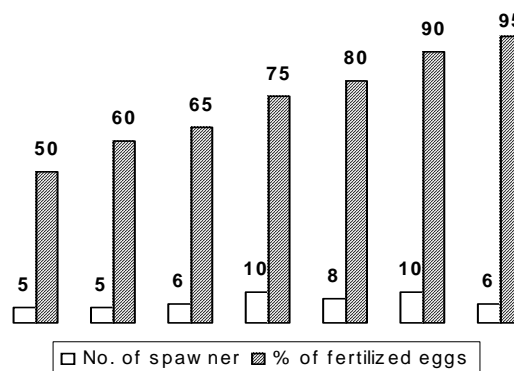
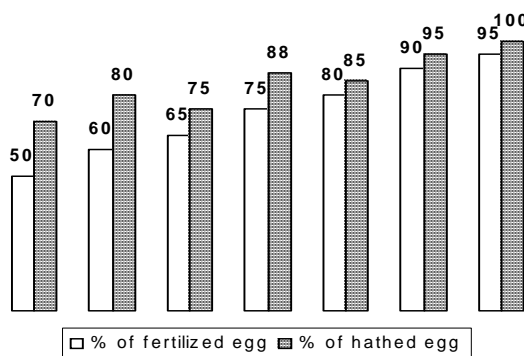


Fig. 3. Percentage of hatched nauplii (average 83.28%) in relation to the fertilized eggs



shrimp biomass per day (Santiago, 1977; Chen, 1979; Beard & Wickins, 1980). The time requirement of ovarian maturation in this study was recorded from 8 to 21 days after the eyestalk ablation. The first spawning of *P. monodon* was observed on 8th day where six females were found fully developed ovaries. Beard and Wickins (1980) while working on *P. monodon* breeding reported that

maturation could be obtained within 5 to 11 days after eye ablation. The number of laid eggs from 50 gravid females varied from 70,000 to 375,000 approximately (Table I).

Highest number (375,000) of spawned eggs was observed from the female of 90 g body weight and the lowest number of 70,000 was observed from the female of 65 g body weight. The percentage of fertilized eggs depends on the number of spawned eggs and the variation observed from 50% to 95% (Fig. 2). The average fertilized eggs were 77.26%. According to Aquacop (1980) the percentage of fertilized eggs varied from 40 to 100%. Three types of eggs were seen; unfertilized eggs and fertilized eggs with full and partial development.

After spawning, the nauplii were hatched out during the day time, between 2.00 p.m. to 4.00 p.m. under water parameters of temperature 29°C, salinity 31 ppt and pH 8.2. The nauplii reached 6th sub-stages within 36 hours and the percentage of hatched nauplii varied from 70 to 100% and the average was around 83.28% (Fig. 3). Das *et al.* (1997) reported that the percentage of hatching rate was 88.63% which shows a close relation to the present study.

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