Evaluation of hatching rate and survival rate of giant freshwater prawn (*Macrobrachium rosenbergii*) in Installation of Brackish Water Culture Mayangan, Probolinggo, East Java, Indonesia

T A A Wiguno¹ and N N Dewi²,³

¹Program Study of Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya 60115 Indonesia
²Department of Aquaculture, Faculty of Fisheries and Marine, Universitas Airlangga, Surabaya 60115 Indonesia
³Corresponding author: ninanurmaliadewi@fpk.unair.ac.id

Abstract. Giant freshwater prawn (*Macrobrachium rosenbergii*) is a fisheries commodity that has a high economical value. The purpose of this study is to determine hatching rate and survival rate of giant freshwater prawn in Installation of Brackish Water Culture Mayangan. This research was carried out at Installation of Brackish Water Culture Mayangan from December 2018 until January 2019. The work method used in this research is descriptive method. The giant freshwater prawn hatchery technique is carried out using a natural spawning system. Newly hatched larvae still have egg yolk as food reserves which will run out in 3 days. After that, the larvae will be fed with natural feed, namely *Artemia* sp. The results showed that the hatching rate and survival rate of giant freshwater prawn were 54.7% and 40.6%, respectively. Water quality parameters of giant freshwater prawn larvae for pH, temperature, dissolved oxygen were 7-8.7, 27-28°C, and 7-8 mg/l, respectively. Ammonia, nitrite, and nitrate for this study were 0.14-0.32 mg/l, 0.006-0.007 mg/l, and 0.2-0.4 mg/l.

1. Introduction

Giant freshwater prawn (*Macrobrachium rosenbergii*) is one of the best commodities in freshwater fisheries [1]. Giant freshwater prawns are a potential freshwater commodity with high economic value. The export potential of giant prawns has been developed since the 1970s. A request for giant prawns comes from local and international markets.

Farming the giant freshwater prawn is relatively easy. On the other side, there are many problems to develop production. The most influential factor that affected yields is fishpond concept, food quality, and infection of disease [2]. The key to advanced production is on the nursery stage. Due to heterogeneous individual growth (HIG), some individuals have maybe grown faster than others. The survival rate of giant freshwater prawns is low enough. An average survival rate is only 12%-37% [3]. The analysis for low survival rate is affected by fluctuating salinity, cannibalism, infection of the disease, water quality, broodstock, and human error. This fact signified contrast with the hatching rate of Giant Freshwater Prawn approximately 80% [4].

Hatchery of giant freshwater prawns requires special treatment. The treatment should prevent infection of disease because the immune of giant freshwater prawns is susceptible. The giant freshwater
prawn used at the Installation of Brackish Water Culture Probolinggo came from Sukamandi, Subang City, West Java. The hatching technique using natural spawning system.

2. Materials and Method
2.1 Time and Place
This research was conducted at the Brackish Water Cultivation Installation, Mayangan District, Probolinggo Regency, East Java Province on 17 December 2018 – 31 January 2019.

2.2 Work Procedures
The work method used in this study was a descriptive method with data collection including primary data and secondary data.

2.3. Data Analysis
   a. Hatching rate (HR)
      \[ HR = \frac{\text{Hatched eggs}}{\text{Fertilized eggs}} \times 100\% \]
   b. Survival rate (SR)
      \[ SR = \frac{\text{The number of fish that live at the end}}{\text{Number of fish that live at the beginning}} \times 100\% \]

3. Result and Discussion
3.1 Broodstock Treatment
The Installation of Brackish Water culture has five fishponds. Each fishpond is used around for 50 broodstock of giant freshwater prawns. The ratio between males and females is 1 : 3. Before spawning, broodstock is feeding with commercial pellets 5% of the total mass body per day. Moreover, the giant freshwater prawn feed with cassava 500 grams and earthworms 100 grams per pond.

   Roof tile and paddlewheel inserted into a pond of giant freshwater prawns. This shelter adopted from shrimp habits serves as a hiding place. The prawns need a hole or burrow, like a rock crevice to hide from predators and catch the prey [5].

   Aeration systems are needed to control dissolved oxygen. Moreover, aeration systems reduce toxic compounds inside nursery media. The water change regularly to waste every toxic compound like feces or leftover food [6]. Water discharge for circulation is 240 liters per hour with a diagonal layout between input and output.

3.2 Broodstock Selection
The broodstock used for spawning should have several criteria like complete body organs and normal, shells clean from algae or other parasites, and the prawn not molting [7]. The difference between males and females prawn in Figure 1.

![Figure 1. Differences between male prawn (a) dan female prawn (b)](image-url)
Male prawns were identifying for their claws more big and thick than female prawns. The color of the claws is blue or orange accorded to morphotype. Shrimp petaasma with a bulge is on the fifth pereiopod [8]. The second pleopod has appendix interna and appendix masculine [9].

Females prawn has a small claw and more slim than male prawn. Tellicum is on the third pereiopod [8]. All pleopods only have appendix [9].

The minimum age for giant freshwater prawn used for spawning is 4-7 months. Meanwhile, broodstock age on Installation of Brackish Water Culture Probolinggo is 8 - 20 months. The male prawn has a minimum weight of 50 grams and the female 45 grams. Technique carried out with natural spawning system. Female prawn which has brown egg are selected for hatching.

3.3 Preparing The Hatching Pond
The dimension of the pond for hatching an egg was 1 x 1 x 1 m. Before use, each pond is washed with soap and scrubbed with a wire brush to remove any dirt. All tools are decontaminating with chlorine solution 10 mg/l then aerated for 24 hours. Decontamination proves that all microorganisms are eliminated [8]. After being decontaminated, the pond filled up with saltwater and freshwater and aerated for 2 hours. The mixed water will become brackish water 6 ppt. The water is ready to be used for hatching a giant freshwater prawn egg.

3.4 Hatching Eggs
Selected female prawn acclimatized into freshwater with aeration system. Every pond filled with brackish water 6 ppt. The stocking density of each pond is 8 - 10 prawns. An aeration system is turn on to keep oxygen at a safe level. After that, the broodstock was monitored regularly until all eggs were hatching.

Usually, all eggs will hatch and being larvae for 36 hours. Larvae still have egg yolk as food reserves. However, it takes 96 hours for female prawns to hatch their eggs totally [7]. If all prawns didn't have eggs in their brood chamber, the broodstock was picked up and placed in the broodstock pond. Female prawns were re-acclimatized by freshwater. Then broodstock fed with high protein pellets 5% of the total mass body [10].

3.5 Larvae Feeding
A new hatched larvae still have an egg yolk as food reserves. Within 48 hours, the egg yolk will run out. On the third day, larvae are feeding with Artemia sp., Flake, and Cake four times a day. Feeding larvae regularly at 07.00, 11.00, 15.00, and 19.00 0'clock. An artemia newly hatched is called nauplii. Decapsulation is a process to stimulate the hatching process of the artemia cyst. Based on the estimated total larvae prawn on the third day. The total amount of larvae is 258.000.

The giant freshwater prawn larvae also feed with alternative feeds such as flake and cake. Flake is one of the products made from artemia shell. Flake has black color and granule form with high nutrition for larvae. Before being given to larvae, flakes should sift to collect flake powder. Based on the size of the larva's mouth, the flakes powder is easier to eat. The portion of feeding with flake is 2-3 grams per 100.000 larvae.

Another alternative food for larvae is called cake. Cake from wheat dough according to the prawn's nutritional needs. The larvae are feed with cake at 07.00 and 15.00. A portion of the cake is about 4 grams per 100.000 larvae. Before giving to the larvae, the cake is soaked in water and then crushed. Then a crushed cake is ready to be fed for giant freshwater prawn larvae.

3.6 Water Quality Management
Water quality has been testing regularly to anticipate fluctuating from eggs until becoming juvenile. Water quality like temperature, salinity, dissolved oxygen, and pH are analyzed every day. Meanwhile, water quality such as nitrite, nitrate, and ammonia are analyzed every week.

Water quality monitoring is necessary to know what optimum habits for giant freshwater prawns larvae. Temperature and dissolved oxygen show a constant rate at 27 – 28 ºC and 7 - 8 mg/l, pH 7 - 8.7,
Ammonia 0.14 - 0.32 mg/l, Nitrite 0.006 – 0.007 mg/l, and 0.2 - 0.4 mg/l, Salinity 6 ppt. Water temperature is not too conspicuous because the pond has used made from fiber. Oxygen is always on a safe level because the aeration system runs 24 hours a day. Ammonia, nitrite, nitrate, and pH levels remained in optimum conditions. The water changed regularly to waste all toxic waste such as leftover food or metabolism product.

Water quality for larvae nurseries always keeps on optimum conditions. Boyd and Zimmerman [11] recommended oxygen level 3 - 7 mg/l, temperature 25 - 32 °C, pH 7.0 – 8.5, ammonia <0.3 mg/l, salinity 0 - 15 ppt. Meanwhile, New [12] and Winata [13] recommended for giant freshwater prawns nursery is <0.1 mg/l and nitrate <10 mg/l.

3.7 Pest and Disease Control
Giant freshwater prawns can be infected by protozoa, fungus, viruses, bacteria, or worms. One of the prawns has died got a worm infection. The parasites named Benedenia sp. infect the gill of prawns. The parasites cause prawns hard to breathe. In the end, if the parasites didn't treat immediately can provoke secondary infection by bacteria. However, the injured gill disrupted the oxygen supply to the entire body. To eliminate all parasites, prawns dipped in saltwater for 30 minutes. For acute infection, the prawns dipped with formalin 70 - 100 mg/l for 1 - 2 minutes.

Microscope observation has found larvae got infected by protozoa. Protozoa that infect giant prawn larvae can disrupt growth. The observation has described Zoanthamnium sp. and Vorticella sp. These parasites infected the pereiopod of larvae. To eliminate all protozoa from larvae body, prawn dipped in fresh water mixed with formalin solution 20 mg/l for 10 minutes. Dipping treatment should be repeated twice a day until all parasites are gone.

![Image 1](image1.png)

Figure 2. Infection of Vorticella sp. on the larvae

![Image 2](image2.png)

Figure 3. Infection of Zoanthamnium sp. on the pereiopod of larvae

3.8 Hatching Rate and Survival Rate
Based on IBAP Probolinggo data, the prawn produced egg at least 750 per gram of broodstock weight. That data is slightly different from the opinion of Hadie [14] is approximately 1000 eggs per gram of broodstock weight. Decrease fecundity of broodstock was speculated if that prawn is too often use for
spawning. Broodstock was spawning too often can affect hatchability and affect the number of larvae. Result of the hatching rate (HR) when sampling shows 54.7%.

The survival rate (SR) of giant prawn larvae carried out in Installation of Brackish Water Probolinggo showed a survival rate of 40.6%. This result is low enough if compared to the standard from Nandlal and Pickering [7] that the minimum survival rate is 80%. This result is due to the decrease quality of the giant prawns. However, hatchery management does not notice operating standards for handling giant prawn larvae [15]. Using excellent broodstock is expected to increase the survival rate of giant prawns larvae [16].

3.9 Harvesting

The giant prawns become juvenile are ready to harvest. Juveniles were placed in separate tanks and given natural food like Artemia sp. to avoid cannibalism. The prawn was loaded in oxygenated plastic bags. The quantity of prawns inside plastic bags is approximately 1,000 juveniles [10]. Several spruce leaves are loaded too in a plastic bag which serves as a shelter for prawns.

The plastic bag was packed with a styrofoam box. Some ice cubes were also inserted to keep the temperature cool. Cold temperatures during the shipment process can reduce juvenile stress levels and decrease the mortality of prawns. Shipment can be set out morning or night to keep the temperature inside the bag always constant. However, if the delivery using an open container, it can only be done at night until morning. The point is to make distribution faster and avoid jammed traffic. In addition, delivery at night will suppress juvenile stress levels because the air temperature keeps cold [10].

4. Conclusion

The technique used in the hatchery of giant freshwater prawns is a natural spawning technique where the broodstock has fertilized brown eggs are picked to be hatched in separate ponds. Problems are related to the development of giant freshwater prawns are the low survival rate, which is only 40.6%, and the hatching rate of eggs 54.7%. The low survival rate and hatching rate are assumed because of the decreasing quality of broodstock. The broodstock has been spawning too often. In the end, new broodstock with the best quality is required to improve production.

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