Research article

Breeding and Rearing Giant Freshwater Prawn Larvae in Tanks Using Different Salinity

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Abstract While the population grows, and in order to keep food secured in rural areas, the possibility of "Breeding and Rearing Giant Freshwater Prawn Larvae in Tanks Using Different Salinity" was tested. The experiment aimed to (1) Analyze the potential for reproducing a gonad somatic index of freshwater prawn broodstock, (2) Analyze the protein levels of artificial foods for rearing freshwater prawn larvae in tanks, and (3) Compare the survival rates of freshwater prawn larvae until the post-larvae level using different salinity. There were three treatments using different levels of salinity: 9‰, 12‰, and 15‰. There were three more replicates to check for accuracy, and each replicate was put at 50 larvae/per litre. The amount of water per tank was 60 litres. There were two kinds of feeds, *Artemia Nauplii*, which was provided in the morning and at night time, and an artificial feed consisting of 10g of baby powder, the yolk of a chicken egg, 3% of oyster oil, and 1.5% of lecithin for each 1kg of the food. The artificial feed was given three times a day (10 am, 1 pm and 2 pm). The analysis showed that an average of 1g of gonad weight was equal to 610.63 eggs and therefore 100g of gonad weight was equal to 61,063 eggs. The amount of protein, furthermore, provided daily to the prawn larvae was 25.15%, lipid 49.46% and ash 3.98% respectively of the feed. We compared the survival rates and the first treatment, with 9‰ of salinity, was observed to enable a survival rate mean of 5.44±0.18%. The second, with 12‰ of salinity, enabled 13.68±0.50%, and the third enabled 7.23±0.24% with 15‰ of salinity. Therefore, freshwater larvae adapted best with 12‰ of salinity, which was the most suitable brackish water to nurse and rear the freshwater larvae to post-larvae level.

Keywords giant prawn breeding, *Artemia nauplii*, gonad somatic index, salinity

INTRODUCTION

Increasing human population is one of the main concerns to the world as a cause of food supply shortages. Recently, in part at least due to population pressures, water ecological systems have been changed by human activities to serve various ends. Cambodia is one of the Asian countries which have a huge fish population. However, the size of this fish population has sharply decreased in recent years. As a result, domestic food supply and nutrition may not be enough for the Cambodian people. Giant freshwater prawn (*Macrobrachium rosenbergii*) is one of the freshwater species which are not only edible but are also high in protein. Because of decreases in the freshwater prawn population, the price has risen to the extent that many poor people cannot afford them. Due to this decrease the Royal Government of Cambodia, as well as other governments, has been pushing to increase freshwater prawn population through reproduction and aquaculture.

Currently, the giant freshwater prawn is not widely consumed in Cambodia but many countries throughout the world are looking at ways to increase their numbers through both aquaculture and increasing natural stocks. *Macrobrachium rosenbergii* has a body size of between 25-30g after 4-5 months of aquaculture and when it is cultured for a year, its size increases to 80-100g. This kind of freshwater prawn enjoys both clear and dirty water. The males are mostly found in small streams, rivers, and some lakes but the female enjoys surviving in the slightly brackish waters in which the current flows to the salt water (Sovannry, 1992).

Information about the breeding and rearing of the giant freshwater prawn (*Macrobrachium rosenbergii*) has not to date been investigated and there is relatively little understanding of it. This experiment, namely: breeding and rearing giant freshwater prawn larvae in tanks using different salinity, was conducted to identify and compare survival rates in different conditions and also to analyze the possibility of reproducing a gonad somatic index of freshwater prawn broodstock.

METHODOLOGY

The experiment was conducted in the fish farm of the Faculty of Fisheries at the Royal University of Agriculture, Cambodia, and was composed of three treatments, each using different levels of salinity. The first used 9% of salinity, the second 12% of salinity and the third 15% of salinity. Each treatment had 3 replicates to check for accuracy, and each replicate was put by with 50 larvae/litre. The amount of water per tank was 60 litres, so each tank needed 3,000 freshwater prawn larvae to conduct the experiment. The prawn breeders to be reproduced were collected from natural waters located in Nakleung, Peam Ror district, Prey Veng province. To find out the number of eggs in the breeders, gonad somatic index was taken into account. It was referred to as the number of eggs in a giant freshwater prawn breeder. Therefore, each breeder gonad was balanced and cut various 1g samples for count; then was calculated for average of number of eggs in a breeders. The breeders were in good health and had good movements, and none were injured. There were two kinds of feeds to be provided for freshwater larvae in the tanks. The first, called *Artemia nauplii*, was provided two times per day, in the morning and at night time. The second was an artificial feed which was comprised of 10g of baby powder, a chicken egg yolk, 3% of oyster oil, and 1.5% of lecithin for 1kg of feed. This composed feed was given by exact amounts to each treatment three times daily (at 10 am, 1 pm and 2 pm).

RESULT AND DISCUSSION

Brooder weight and number of eggs in the somatic index of giant freshwater prawns

The extent to which it was possible to reproduce a gonad somatic index of freshwater prawn broodstock was assessed with various types of brooders for freshwater prawns. The calculation of 100g of brooder weight was made in order to analyze how many larvae could be provided for 100g of giant freshwater prawn. Although the experiment took into account the various kinds of brooder weights, the count was balanced to a gram of total amount of somatic weight. In table 1, the brooder weight and average number of eggs in the somatic index of giant freshwater prawns is shown and the various brooders which were taken to estimate the larvae which were expected to provide 100g of brooders. After the estimation of the average number of eggs in various somatic weights, there were about 61,093 eggs in a brooder, which held 100g of brooders.

Table 1 Brooder weight and average number of eggs in somatic index

Weight of breeders (g)	Weight of somatic index (g)	Number of egg/gram	Egg of a 100g breeder
50	5.85	4,962	58,056
52.20	6.02	5,245	60,489
67.20	7.80	4,727	54,863
69.30	8.05	4,645	53,957
70	7.85	5,866	65,783
50.65	6.00	4,867	57,655
70.145	7.98	6,269	71,320
65.15	7.24	4,706	52,296
53.145	6.15	5,546	64,179
72.025	8.13	6,408	72,332
Total Average			61,093

Protein level in the composed feed

There were, as already noted, two kinds of feeds provided for the freshwater larvae in the tanks. The first was called *Artemia nauplii* and was provided two times per day, in the morning and at night time. The second was composed of feed which consisted of 10g of baby powder, a chicken egg yolk, 3% of oyster oil, and 1.5% of lecithin for each 1kg of feed. This composed feed was given by exactly the same amount three times per day (at 10 am, 1 pm and 2 pm). As can be seen in table 2, the protein levels in the composed feed was around 25%, lipid was about 49.46% and ash 4%.

Table 2 Protein levels in the composed feed

Composed feed	Protein level	Lipid level	Ash
	25.15%	49.46%	3.98%

Survival rates of giant freshwater prawn larvae until post-larvae

There were several factors affecting the survival rate of the larvae. The experiment was conducted with three treatments, including three replicates for each. Larvae were put in the 80 litre tanks using different salinity in each treatment. In table 3, the number of larvae put in tanks is shown.

Table 3 Number of larvae in each treatment

Treatment	Replicates	Salinity	Density of larvae/tank
T1	T1R1, T1R2, T1R3	9%	3,000
T2	T2R1, T2R2, T2R3	12%	3,000
T3	T3R1, T3R2, T3R3	15%	3,000

The number of larvae lost in tanks was due to various factors. Siphoning was one of the problems as well as the change of water quality in tanks, which led to the larvae being stressed and dying if the feed was given improperly. Another problem was the difference in larvae growth in tanks due to uneven feed intake. In fig. 1, the survival rate of larvae in tanks was compared for each treatment using different salinity levels and it showed statistical significance at all levels ($P < 5\%$).

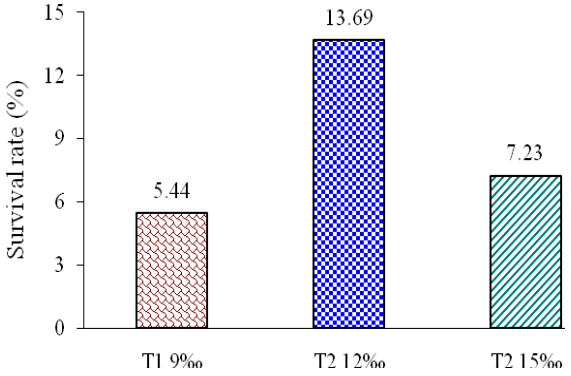

Fig. 1 Survival rate of giant freshwater prawns using different salinity levels

The survival rate of larvae to post-larvae depended on the various salinity levels. The study shows that the average survival rate in the three treatments was from 5.23% to 14.16%. The survival rate was about 5.44 ± 0.18%, 13.68 ± 0.50%, and 7.23 ± 0.24% for T1, T2, and T3 respectively. The survival rate of T2 using 12% was therefore the highest one compared to the other treatments. This was consistent with Dingchung. (1999) who reported that giant freshwater

prawns matured and survived best in brackish water from 8-14% and that the most suitable level was from 10-12%; therefore, T2 of the experiment had the highest survival rate of larvae.

Water quality in tanks for rearing giant freshwater prawn larvae until post-larvae

Looking at the water quality for rearing the larvae, there were three main factors to be observed. Temperature, pH, and dissolved oxygen were daily observed in order to analyze how they changed. In Table 4, the change of temperature for rearing larvae was observed twice daily, in the mornings and in the afternoons. It was shown that all treatments were statistically significant at $P < 5\%$. The temperature for each treatment was not different from the others for both mornings and afternoons.

Table 4 Temperature change

Observation	T1	T2	T3
	Mean ± SD	Mean ± SD	Mean ± SD
Morning	27.42±0.45	27.43±0.45	27.42±0.40
Afternoon	30.79±0.32	30.76±0.32	30.86±0.30

The temperature was observed since the first day of the experiment, and in the morning it was 27.42 ± 0.45^0C, 27.43 ± 0.45^0C, and 27.42 ± 0.40^0C for T1, T2, and T3 respectively while in the afternoon the temperature change was about 30.79 ± 0.32^0C, 30.76 ± 0.32^0C, and 30.86 ± 0.30^0C for T1, T2, and T3 respectively.

Apart from temperature, pH as a determinant for water quality was also analyzed. In table 5, the pH change is observed and analyzed for each treatment. There were two times daily for collecting the data, mornings and afternoons, and It was shown that it was always statistically significant at $P < 5\%$.

Table 5 pH change for rearing giant freshwater prawns

Observation	T1	T2	T3
	Mean ± SD	Mean ± SD	Mean ± SD
Morning	8.30 ± 0.91	8.33 ± 0.82	8.33 ± 0.98
Afternoon	8.27 ± 0.59	8.31 ± 0.71	8.31 ± 0.68

Apart from temperature and pH, dissolved oxygen was also observed in order to analyze the water quality. The observation was taken twice, in the mornings and afternoons. Each treatment shows little difference from each other at all significance levels ($P < 5\%$). In Table 6, the change of dissolved oxygen in the water was observed and the average calculated.

Table 6 Dissolved oxygen change

Observation	T1	T2	T3
	Mean ± SD	Mean ± SD	Mean ± SD
Morning	7.72 ± 0.27	7.7 1 ± 0.25	7.72 ± 0.26
Afternoon	7.80 ± 0.26	7.90 ± 0.31	7.83 ± 0.31

Dissolved oxygen was very important for rearing larvae in tanks. The average level of dissolved oxygen was about 7.72 ± 0.27 mg/l, 7.71 ± 0.25 mg/l, and 7.72 ± 0.26 mg/l in the morning for T1, T2, and T3 respectively. For the afternoon, it was around 7.80± 0.26 mg/l, 7.90± 0.31 mg/l, 7.83 ± 0.31 mg/l for T1, T2, and T3 respectively. The treatments had no statistically significant differences, and it was acceptable for rearing larvae in tanks. This was consistent with Sovannry. (1992) who showed that the dissolved oxygen level in the water for freshwater animals had to be above 3 mg/l.

CONCLUSION

Only healthy gonad freshwater prawn breeders were selected for the study to count the averages for the gonad somatic index. By counting 1g of total gonad weight, the analysis showed that this was equal to 610.63 eggs of freshwater prawn and therefore 100g of giant freshwater prawn weight was equal to 61,063 eggs, which the broodstock could hold in its somatic. Furthermore, the feed analyzed by the veterinarian laboratory for assessing the protein showed that the composed feed provided to the prawn larvae each day was 25.15% of protein level, 49.46% of lipid, and 3.98% of ash. This showed that the composed feed for larvae did not provide a high enough protein level to grow the larvae. After the end of experiment the first treatment, which put 3,000 larvae in 60 litres of water with 9‰ salinity, had a survival rate mean of 5.44±0.18%. The second treatment, which put 3,000 larvae in 60 litres of water with 12% salinity, had a survival rate mean of 13.68±0.50%, and the last treatment which had 3,000 larvae in 60 litres of water with 15% salinity had a survival rate mean of 7.23±0.24%,. We conclude therefore that freshwater larvae adopted with the 12% levels of salinity had the best survival rates. The survival rate in the second treatment with 12% of salinity was the highest. This experiment was designed to find the average amount of eggs in broodstock gonad somatic indices, analyze the protein levels in artificial feed, and compare the larvae's survival rates with different salinity. This was done in order to make recommendations to the next generation and rural farmers who may be willing to grow the giant freshwater prawns in Cambodia as to the best methods of so doing.

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