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EFFECT OF STOCKING DENSITY ON SURVIVAL RATE AND LARVAL DEVELOPMENT OF THE GIANT FRESHWATER PRAWN, *MACROBRACHIUM ROSENBERGII*

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ABSTRACT

A pilot study was carried out to observe the larval development and survival rates of the giant freshwater prawn, *Macrobrachium rosenbergii*, cultured under different culture volume. The study was conducted for 6 weeks in four concrete tanks of size 1.5 ton each at Biotechnological research Department, Yangon. They were fed 3 meals per day with A*rteria naupii* as live food and egg custard as prepared food. The giant freshwater prawn larvae were stocked with the stocking density of 50000 pieces in each of 500 L capacity tanks (100pcs /L stocking rate) as experiment 1 (T-I and T-II) and 1000 L tanks (50pcs/L stocking rate) as experiment 2(T-III and T-IV). The survival rates of the giant freshwater post larvae were obtained as 21% in T-I and 22% in T-II. The survival rates were obtained respectively as 26% in T-III and 25% in T-IV.

1. INTRODUCTION

Freshwater prawn farming is suitable for tropical or subtropical climates. They are reared in a variety of freshwater enclosures, including tanks, irrigation ditches, cages, pens, and reservoirs, although the most common enclosures are earthen ponds, which typically supply the best yields for commercial farming. Farming prawn shares many similarities with marine shrimp operations. The giant freshwater prawn is a valuable aquatic food source, high in protein and commands a good export markets (Brief notes on the giant freshwater prawns as an object of farming by (V.Soesanto 1980). It has become the main target commodity for freshwater aquaculture in Myanmar.

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There are 150 species of *Macrobrachium* in the world (Kumer and Pandy 2003), of which 49 are commercial (Laleh Abbaspour Davassi 2011). Twenty-seven of the commercial species are found in Asia and the Pacific by Holthuis (1980). They are commercially important in terms of capture fisheries and culture industries. It is considered as a suitable candidate for both tropical fresh and brackish water culture (Yutaka, U. and Soo, K.C. 1963). In Myanmar, there are 17 species of native freshwater prawn under the genus *Macrobrachium* (Yixiong Cai and Peter K.L.Ng 2002), they are commercially important in terms of capture fisheries and culture industries. Among them, the giant freshwater prawn (*Macrobrachium rosenbergii* de man) and the Monsoon River Prawn (*Macrobrachium malcomsonii*, H Mile Edward) are the most valuable species. Because of the larger in size and first fast growth they have the main target commody for

freshwater aquaculture industries and one of the major earner of foreign exchange.

Culture of giant freshwater prawn culture (*Macrobrachium rosenbergii)* was initiated during the period from 1974 to 1980 in Myanmar. As the pond culture of prawn developed, the demand of the fry increased. Myanmar has a long coastline of nearly 3, 000 km. Myanmar has many brackish water rivers and fresh water rivers, several large estuaries, delta system and numerous off shore islands

Aquatic resource area of the river systems within Myanmar encompasses 8.2 million ha (FAO, 1996) of permanent and seasonal water bodies and there were 29 000 ha of freshwater fishponds and a further 40 716 ha of shrimp ponds in 2001, and 115687 ha of reservoirs. The Department of Fisheries (DOF) in Yangon estimates a figure of six million ha of floodplains, which likely excludes river area and floodplain lakes. In coastal area, so-called unused lands can be used for aquaculture. Shrimp culture ponds can develop in this area. In the year 2004-2005 shrimps ponds area was about 63 000 hectares in the coastal region.

Myanmar tiger prawn culture situations was turns to fail. In the other hands Myanmar tried to substitute, white shrimp in place of tiger prawn in 2004. Nowadays, white shrimp was cultured in both marine and fresh water in the world. Myanmar has more changes than others because of her plenty of verging land and fresh and brackish water area.

In recent years when the higher income are derived from the harvested freshwater prawn, many farmers have converted into freshwater prawn ponds. For the prawn ponds, seed fry are collected from the hatcheries. Therefore ,the expansion of the freshwater prawn farming industries are still restricted due to in sufficient and inconsistent supply of the seed fry for the grow-out culture. For the development of a prawn farming industry, human resource development is essential in Myanmar. The scientists and highly qualified technicians as well as skilled and semi-skilled labors are a must and essential for sustainable production of an aquaculture industry. The result of the present research experiments on the larval rearing of giant freshwater prawn (*Macrobrachium rosenbergii)* in different water volume under laboratory conditions will hoped for the fulfilment in technology transferred to the rural farmers. Also, there may be hoped the development of seed fry production of giant freshwater prawn in rural areas. Finally, there may be hoped for the helpful in aquaculture development in Myanmar.

2. MATERIALS AND METHODS

Matured specimens were collected from estuary of Yangon River, Letkokkon Township. They were carried by placing in Styrofoam box with river water and provided aeration. After reaching the hatchery, the water temperature (27℃-29.8℃) was acclimatized for 30-45 minutes in original transportation Styrofoam box. After acclimation, the breeders were transferred into the aerated glass aquarium for spawning and hatching. After spawning and hatching, the larvae were harvested and rinsed with clean brackish water and transferred into the aerated plastic basin for counting. For tank preparation, the reservoirs and culture tanks were washed and dried for storage, sedimentation and mixing. For water preparation, brackish water (12ppt) was disinfected with 65% chlorine at 10ppm concentration. After chlorination, brackish water was pumped through a filter bag of 3-5 micro mesh into the larval rearing tanks and treated with Furazan Gold at 1-2 ppm concentration. And it was with provided with aeration for 24-48 hours and treated with EDTA at 1-2 ppm concentration.

During the experiments, two different types of feeds, Artemia nauplii and egg custard, were used in feeding of larvae. INVE brand of Artemia cysts were used for Artemia nauplii . The ingredients of egg custard were number of chicken egg, 10gm of milk power, 15 gm of wheat flour and one capsule of cod liver oil. Artemia nauplii was twice a day as initial feeding. The feeding amount of *Artemia nauplii* was 1-3 individuals per ml. After 10 days of stocking, *Artemia nauplii* were increased to 3-5 individuals per 1ml. In the post larval stage 1, the feeding amount of *Artemia nauplii* was decreased to 1-2 individuals per 1ml. Egg custard as supplemental food was fed according to the growth stages of larvae 3 times a day.

For the study of effect on different volume of brackish water in growth and survival rate of giant freshwater prawn larvae under Laboratory condition, the duplicated experiments had been conducted with the same stocking density.

For experiment 1, the stocking rate was 100pcs per 1 liter in tank I and tank II with 500liters water. For experiment 2, the stocking rate was 50pcs per 1 liter in tank III and tank IV with 1000 liters water.

Before the stocking of larvae, the tanks will filled with 50% of culture capacity and provided with continuous aeration. After stocking of larvae, the required amount of water was added daily until the desired capacity of 500 liters and 1000 liters respectively. After five to six days of culture experiment, daily were exchanged with 5-6 % of water. Depending on the condition of water, 7-8% of water was exchanged. During the study period, temperature, pH.DO, salinity and ammonia were recorded 27.0℃-29.8℃, 7.8-8.3, 8.1ppm-8.3ppm, 12-13ppt and 0.01-0.03ppm respectively.

The survival and chronological growth stages and health of the larvae were checked daily by microscopic examination and random samples examination at morning and evening.

After 42 days of culture experiment, the larvae of giant freshwater prawn at larval stages were harvested and counted by volume and estimation method. Then, calculated the survival rates of larvae from each culture tanks.

3. RESULTS

In experiment 1, the larvae stages 1-2 were stocked in the two tanks with 500liters .The stocking rate was 100pcs /L. After 42days, the post larvae were harvested and estimated number as 10500pcs and 11000pcs in the culture tank -I and tank -II respectively.

In experiment 2, the larvae stages 1-2 were stocked in the two tanks with 1000liters .The stocking rate was 50pcs /L. After 42 days, the post larvae were harvested and estimated number as 13000pcs and 12500pcs in the culture tank- III and tank -IV respectively.

The result show that the survival rates were 21% for tank-I, 22% for tank-II, 26% for tank-III and 25% for tank-IV. The lower survival was observed in higher stocking rate. During the operation, temperature, pH, DO, salinity and ammonia were recorded as the range between 27.0℃-29.8℃, 7.8-8.3, 8.1ppm-8.3ppm, 12-13ppt and 0.01-0.03ppm respectively. The water quality parameter resulted in culture tanks during the experiment are expressed in Table-1. No significant variations in the values of each parameter was found among treatments. Developmental stages are also described in Table-2.

4. DISCUSSION

Stocking density has the direct effect on growth and at the same time survival and production (Siddiqui and Al-Hinty, 1993). Stocking densities of *M. rosenbergii* and exogenous factors such as water temperature, seed availability, stress free environment, water quality and feed quality, quantity can affect the result of growth and survival (Baskerville-Bridges and Kling, 2000). Earlier works to optimize stocking density in polders (Kurup et al. 2002), river pens (Son et al. 2005), cages (Cuvin-Aralar et al. 2007) and in polyculture ponds (Hossain and Islam 2006; Marques et al. 2010) suggest that the most important factor for viable freshwater prawn culture is stocking density. The findings of Alikunhi, (1957); Kawamoto et al., (1957) and Haqueet al., (1984) who stated that, the growth rate is high in low density. Reduction in stocking rate resulted in increased weight of prawns and the proportion of marketable yield (Roberts and Bauer, 1978).

The present study, the result on the effect of different volume of brackish water showed that the survival rate of freshwater prawn (*Macrobrachium rosenberghii*) was 26% and 25% in 1000 liters culture capacities of respective experiments and 21% and 22% in 500 liters of respective experiments. Optimal water quality is crucial to all types of aquaculture production and needs to be maintained during the culture period. The variations in the parameters found to be negligible and thus assumed to have no direct impact on the survival and production. According to this result, the survival rates of post larvae in greater volume was higher than of post larvae in less volume in the same stocking density under laboratory conditions due to the availability of adequate space and adequate feeding to grow prawn.

From the result and information, there may be concluded that the research works were successfully achieved for technology to know how giant freshwater prawn post larval production.

5. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interests regarding the publication of this article.

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Table 1. Range and average value (Mean±S.D) of water parameters in tanks during rearing

Water parameter	Experiment(1)				Experiment(2)			
	Tank I		Tank II		Tank III		Tank IV	
	range	Mean ± SD	range	Mean ± SD	range	Mean ± SD	range	Mean ± SD
Temp: (℃)	27.2-29.8	28.24±0.646	27-29	28.23±0.557	27.3-28.9	28.07±0.326	27-28.5	28.08±0.287
PH	7.8-8.3	8.04±0.157	7.8-8.3	7.89±1.238	7.8-8.3	8.09±0.148	7.8-8.2	8.11±0.108
Salinity (ppt)	10-13	11.87±0.503	10-13	11.94±0.707	10-13	11.91±0.582	10-13	28.08±0.287
DO	8-8.2	8.07±0.078	8-8.3	8.14±0.121	8-8.3	8.1±0.112	8-8.3	8.15±0.11
ammonium	0.02-0.03	0.02±0.005	0.01-0.03	0.02±0.007	0.01-0.03	0.02±0.008	0.01-0.03	0.02±0.007

Table 2. Developmental stages during the larval development of river prawn *Macrobrachuim Rosenbergii* during the culture.

Experiment - 1				Experiment-2			
Tank-I		Tank-II		Tank-III		Tank-IV	
Cycle Days	Stages	Cycle Days	Stages	Cycle Days	Stages	Cycle Days	Stages
1	I	1	I	1	I	1	I
2	II	2	II	2-3	II	2-3	II
3	III	3-4	III	4-5	III	4	III
4-5	IV	5-6	IV	6-8	IV	5-8	IV
6-8	V	7-9	V	9-11	V	9-12	V
9-13	VI	10-15	VI	12-15	VI	13-17	VI
14-18	VII	16-21	VII	16-18	VII	18-20	VII
19-21	VIII	22-25	VIII	19-21	VIII	21-23	VIII
22-23	IX	26-27	IX	22-24	IX	24-25	IX
24-30	X	28-30	X	25-27	X	26-27	X
31	XI	31	XI	28	XI	28-29	XI
32	PL-1	32	PL-1	29	PL-1	30	PL-1

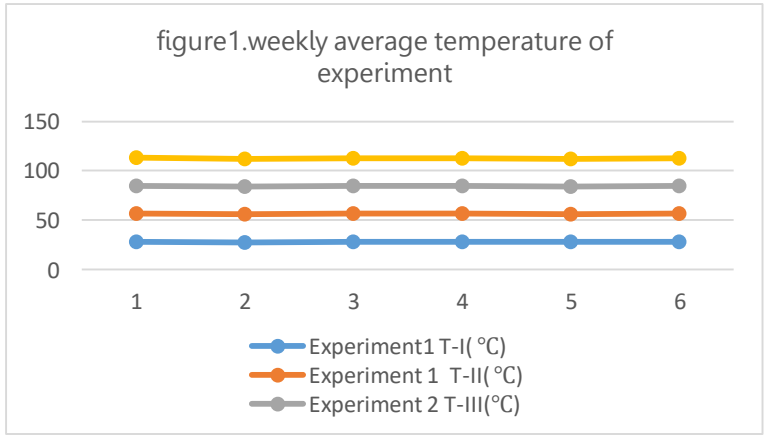
figure1.weekly average temperature of experiment
150
100
50
0
1
2
3
4
5
6
Experiment1 T-I(°C)
Experiment 1 T-II(°C)
Experiment 2 T-III(°C)

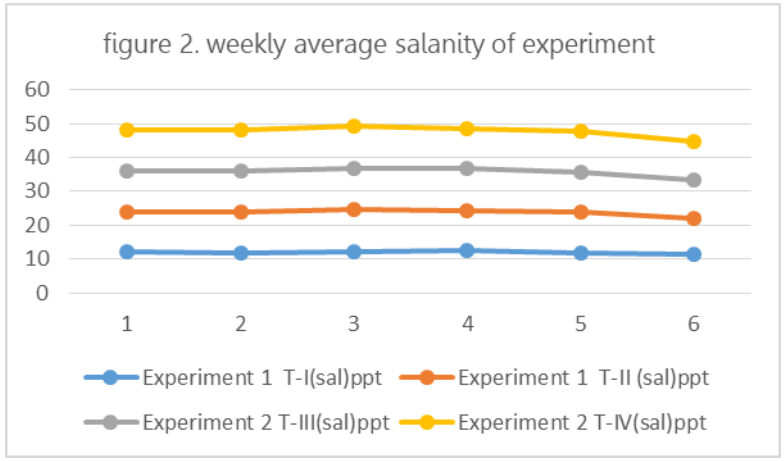
figure 2. weekly average salanity of experiment
60
50
40
30
20
10
0
1
2
3
4
5
6
Experiment 1 T-I(sal)ppt
Experiment 1 T-II (sal)ppt
Experiment 2 T-III(sal)ppt
Experiment 2 T-IV(sal)ppt

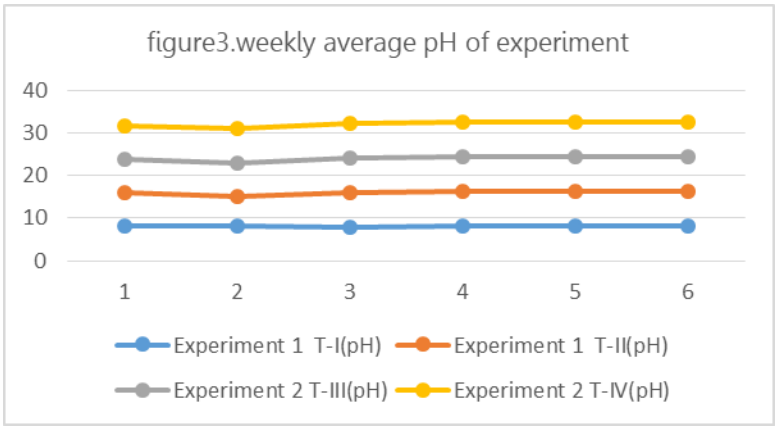
figure3.weekly average pH of experiment
40
30
20
10
0
1
2
3
4
5
6
Experiment 1 T-I(pH)
Experiment 1 T-II(pH)
Experiment 2 T-III(pH)
Experiment 2 T-IV(pH)

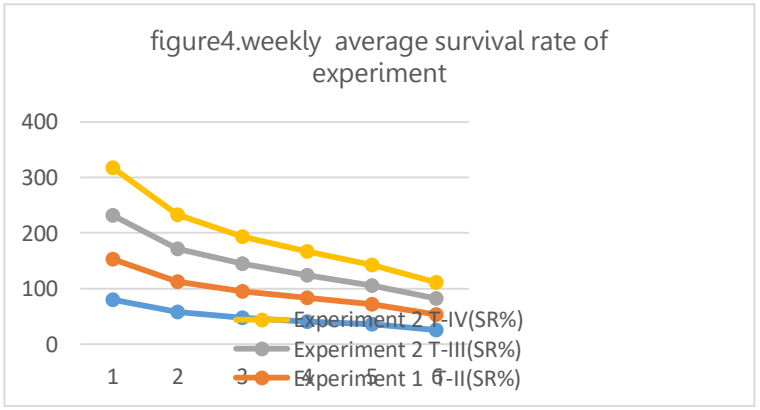
figure4.weekly average survival rate of experiment
400
300
200
100
0
1
2
3
4
5
6
Experiment 2 T-IV(SR%)
Experiment 2 T-III(SR%)
Experiment 1 T-II(SR%)