Production of mola fish (*Amblyparyngodon Mola*) at different stocking densities of freshwater prawn (*Macrobrachium Rosenbergii*) in rice fields

M. Aminur Rahman * and Md. Shamim Parvez

Abstract—The research was conducted at Shahpur, Dumuria, Khulna to assess the effects of stocking densities on growth and yield of prawn (*Macrobrachium rosenbergii*) in rice fields with mola (*Amblyparyngodon mola*) from 2 August to 30 November, 2014 in 12 experimental rice plots. Each of four treatments with three replicates was tested in this experiment. In all treatments *M. rosenbergii* was stocked with *A. mola*. The stocking densities of *M. rosenbergii* were 10,000, 15,000, 20,000 and 25,000 individuals/ha in treatments T₁, T₂, T₃ and T₄, respectively. The stocking density of *A. mola* was the same (20,000/ha) in all the treatments. In regards of the cultural suitability, the production of prawn and mola showed a higher growth with subsistence in T₂, in which the stocking density of prawn was 15,000/ha and the mola was 20,000/ha. The highest production of prawn was recorded as 386.20±4.96 kg/ha, whereas the mola was 70.68±1.23 kg/ha in treatment T₂ than those of other treatments. The survival was the highest in T₁ (49.65%) followed by T₄ (44.25%) and T₂ (43.55%) and the lowest in T₃ (39.58%). Overall, the highest production and survival were obtained in T₂ and hence, it found to be more productive than the other treatments. The study therefore, established the fact that polyculture of freshwater prawn and mola is a better composition for rice-fish integration in Bangladesh.

Index Terms— Freshwater, Prawn, Mola, Stocking density, Rice fields, Production.

I. INTRODUCTION

Bangladesh is among the most densely populated countries in the world, having more than 985 inhabitants per km². According to United Nations projections the population will grow further to 1687 inhabitants per km² by the year 2050. Providing sufficient food for the counties vast population will put increasing pressure on Bangladesh’s scarce natural resources. Especially water and land need to be utilized more efficiently due to the development of the population and the rise of other sectors of the economy competing with agriculture for resources. In fact cropland has already declined in Bangladesh by 3.1 percent from the mid-1980s to the mid-1990s [1]. Efficient utilization of resources in agricultural production is therefore, of utmost importance to ensure food security in Bangladesh.

Rice-fish culture has long been recognized as an option to improve the productivity of the country’s rice-based agriculture. Dewan [2] estimated that Bangladesh had approximately 2.83 million hectares of rice fields, which would be suitable for integrated rice-fish production. However, he noted that much research remains to be done to optimize the management of such systems in order to make them more profitable for the farmers. A survey was conducted on 256 farms in Bangladesh to assess the feasibility and economic viability of rice-fish culture [3]. They found an average fish production of 233 kg/ha in the dry season and 212 kg/ha in the rainy season, and an average increase in the net benefit by 64.4% and 98.2% compared to rice monoculture, respectively. A number of field experiments were carried out in Bangladesh under defined conditions. The suitability of the small indigenous species, for example, *Amblyparyngodon mola* was tested for production in rice yields [4]) and obtained a maximum fish yield of 262 kg/ha. In another study, silver barb (*Barbonymus gonionotus*) and Nile tilapia (*Oreochromis niloticus*) were cultured and obtained a fish production of up to 271 kg/ha and a rice yield of 1.5–3.7 t/ha [5]. In all studies known from Bangladesh so far, the fish yields were moderate as compared to the generally accepted production potential of 200 to 700 kg/ha [6].

Rice-fish culture may become more attractive for farmers if fish production can be increased through efficient management strategies. Therefore the objective of the current experiments was to test the performance of prawn and mola and to maximize the production of rice and prawn in the same land through proper integrated culture management.

II. MATERIALS AND METHODS

A. Experimental protocol

The experiment was carried out from July to November 2006 in a village of Shahpur at Dumuria under Khulna district. Twelve rectangular plots having an average area of 152 m² each were used for this experiment. The only sources of water were rain for the experimental plots. The embankments (1.0 m height and 0.5 m width) were constructed surrounding the experimental plots and were made free from flood, safe and escaping of fish or prawn. Fencing by plastic nets (0.5 m height) was provided around the experimental areas to prevent the stocked prawn from escaping.

The experiment was designed into completely randomized design (CRD) with four treatments having three replicates for each. The stocking density of *M. rosenbergii* were 10,000, 15,000, 20,000 and 25,000/ha in T₁, T₂, T₃ and T₄, respectively. However, stocking density of *A. mola* was the same (20,000/ha) in all the treatments.

A small ditch was constructed in the middle point of each plot, covering an area of 2.0 m² with 0.5–0.6 m depth in order to make a shelter for mola and prawn during low water column and also rising the temperature. To increase the pond productivity, some fertilizers (i.e. urea, triple super phosphate-TSP and murate of...
potash-MP were applied with the doses of 200, 150 and 75 kg/ha, respectively in all experimental plots [7].

B. Rice variety and transplantation

Rice seedlings were transplanted during July-August, following normal agronomy practices. Among the rice varieties BR-22 (HYV) was transplanted due to its short culture period (105-125 days), medium height, high resistance to insect and disease infestation, and highest yield performances.

C. Stocking of fish

The juvenile of *M. rosenbergii* were purchased from a local private nursery, while *A. mola* were collected from the outside ponds. The juveniles were released after 18 days of transplanting rice by which time the rice plants must have well established. After stocking of fishes, the depth of water in the rice fields were maintained at a level of 15 to 25 cm throughout the experimental period.

D. Overall Management after stocking of Fish and Prawn

For proper management of rice field, all the activities including fertilization were done according to the normal agronomy practices, recommendation by the Farming System and Environmental Studies (FSES) of Bangladesh Agricultural University, Mymensingh. Feeding was started five days after stocking at the rate of 10-3% of estimated body weight once daily. The composition of diet was 50% fish meal, 44% wheat flour, 4% soybean oil, and 2% mineral and vitamin premix. Feed was provided manually once daily between 9.00 and 10.00 h and the rate of feeding was adjusted at fortnightly sampling of fishes. After stocking in the rice fields, sampling was done at monthly interval to observe the growth and health condition of fish as well as to adjust the feed requirements for the subsequent months. Not only observed the growth but also monitored the water quality of each rice plot [8].

E. Harvesting of rice and fish

After 132 days of transplantation, rice was harvested by cutting the plants at ground level with sickle. The representative samples of rice were taken randomly from each plot comprising of an area of 1 m². The weights of dried grain and straw were recorded separately from each plot. Immediately after harvesting most fishes were collected from the refuge ditch and the remaining was hand-picked from the drained plot surface. The collected prawns and mola from the plots were counted and the number was recorded separately. The final length (cm) and weight (g) of each species were taken randomly from each plot to determine the growth rate and yield of prawns and mola.

Total count of each species was recorded to determine the survival rate of each species.

F. Data Analysis

The data obtained from the experiment were analyzed using one-way analysis of variance (ANOVA) followed by Duncan’s Multiple Range Test [9, 10]. A simple cost-benefit analysis was conducted to estimate the net benefits from each treatment.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
<th>T&lt;sub&gt;1&lt;/sub&gt;</th>
<th>T&lt;sub&gt;2&lt;/sub&gt;</th>
<th>T&lt;sub&gt;3&lt;/sub&gt;</th>
<th>T&lt;sub&gt;4&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight (g)</td>
<td>Prawn</td>
<td>1.15 ± 0.008&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.25 ± 0.005&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.20 ± 0.008&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.17 ± 0.007&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Mola</td>
<td>1.16 ± 0.008&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.21 ± 0.013&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.32 ± 0.015&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.31 ± 0.017&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Final weight (g)</td>
<td>Prawn</td>
<td>53.18 ± 1.90&lt;sup&gt;a&lt;/sup&gt;</td>
<td>55.34 ± 2.57&lt;sup&gt;a&lt;/sup&gt;</td>
<td>44.12 ± 1.87&lt;sup&gt;b&lt;/sup&gt;</td>
<td>33.95 ± 2.40&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Mola</td>
<td>3.15 ± 0.012&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.16 ± 0.003&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.49 ± 0.030&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.36 ± 0.06&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Survival (%)</td>
<td>Prawn</td>
<td>44.25 ± 0.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>49.65 ± 1.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>39.58 ± 0.43&lt;sup&gt;b&lt;/sup&gt;</td>
<td>43.55 ± 2.7&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Mola</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Specific growth rate (SGR%/day)</td>
<td>Prawn</td>
<td>3.16 ± 0.023&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.10 ± 0.011&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.93 ± 0.440&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>2.77 ± 0.060&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Mola</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Production (Kg/ha)</td>
<td>Prawn</td>
<td>238.16 ± 5.41&lt;sup&gt;b&lt;/sup&gt;</td>
<td>386.20 ± 4.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>322.65 ± 2.95&lt;sup&gt;b&lt;/sup&gt;</td>
<td>334.23 ± 1.72&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Mola</td>
<td>58.29 ± 1.65&lt;sup&gt;c&lt;/sup&gt;</td>
<td>70.8 ± 1.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>61.97 ± 1.79&lt;sup&gt;b&lt;/sup&gt;</td>
<td>51.02 ± 11.36&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total production of fish (Kg/ha)</td>
<td>Prawn</td>
<td>296.45&lt;sup&gt;a&lt;/sup&gt;</td>
<td>457.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>384.62&lt;sup&gt;b&lt;/sup&gt;</td>
<td>385.25&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

ND = Not determined (Mola had bred after stocking, therefore harvesting number was too much high than stocking). Mean values with the same superscripts are not significantly different (p < 0.05).
Among the treatments, the highest production of prawn (386.20±4.96 kg/ha) and mola (70.68±1.23 kg/ha) were obtained in the plots of T₁ where stocking densities of prawn and mola were 15000/ha and 20000/ha, respectively. In an integrated prawn and fish culture practice in rice fields, a total of 70-500 kg/ha prawn was produced [11]. The present production level of prawn was more or less similar with the above reported prawn production. On the other hand, the production of mola (25.9-29.2 kg/ha) recorded in combination with other fish species was lower than that obtained in the present study [12]. This was possibly due to the better environmental conditions prevailed in the experimental plots.

The mean survival of prawn was ranged from 39.58 to 49.65% in different treatments. Significantly higher (p < 0.05) survival rate was found in T₁ than those in T₃, T₄ and T₅ respectively. The survival rates of prawn were found to be 70.74 to 80.41% [13], which were higher than that obtained in the present study; similarly, the survival rate ranged from 53.90 to 70.24%, was also higher than those recorded in the present study [14]. The lower survival of prawn in the present study might be due to the smaller size of fingerlings at stocking. However, the survival rate of A. mola was not recorded because it had spawned after stocking; therefore harvesting number was too much high than stocking.

The highest yield of rice (3.78±0.04 mt/ha) and straw (4.30±0.03 mt/ha) were obtained in T₁ and the lowest production of grain (2.86±0.05 mt/ha) and straw (3.39±0.03 mt/ha) were recorded in T₂. There was no significant differences (p > 0.05) recognized in the yield of rice among the treatments. The yields of straw were also followed the more or less similar trends as rice production (Table 2). The yields of rice grain and straw obtained in the present study were more or less similar to the yield of the published records [12]. But the yield of rice grain and straw recorded by Chowdhury [15], Mondal [16] and Uddin [17] were less than the yields of the same obtained in the present study. However, the yield of grain found in other fish-experiments [14, 18, 19] were more or less close to that obtained in the present study.

### Table II: Mean (±SD) Yields of Rice Grain and Straw in Different Treatments.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean yield (mt/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rice</td>
</tr>
<tr>
<td>T₁</td>
<td>3.78±0.04a</td>
</tr>
<tr>
<td>T₂</td>
<td>2.86±0.05a</td>
</tr>
<tr>
<td>T₃</td>
<td>3.31±0.04a</td>
</tr>
<tr>
<td>T₄</td>
<td>3.02±0.04a</td>
</tr>
</tbody>
</table>

Mean values with the same superscripts are not significantly different (p > 0.05)

### IV. Conclusion

Based on the result of the study, it can be concluded that the growth, production and survival of prawn and mola at stocking densities of 15000/ha and 20000/ha, respectively showed highest performances than those obtained in other stocking densities. Therefore, these stocking densities of prawn and mola may be advisable for integrated rice–fish farming in Bangladesh.

### REFERENCES


http://doi.org/10.15242/IAE.IAE1116479