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# Effect of Stocking Density on Growth and Survival of Indigenous Catfish, *Heteropneustes fossilis* (Bloch) Reared in Cemented Cistern Fed on Formulated Feed

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**Abstract.-** A three month long experiment was conducted to evaluate the effect of stocking density on the growth and survival of indigenous catfish *Heteropneustes fossilis* in cemented cisterns (each of 1.25 $m^2$ size) situated by the side of Faculty of Fisheries, Bangladesh Agriculture University, Mymenisingh. Water quality parameters (temperature, pH and dissolved oxygen) were recorded throughout the study period and found within the suitable range. Three stocking densities used were 8, 16 and 24 fishes/$m^2$ and designated as Treatment-I, Treatment-II and Treatment-III, respectively. Each treatment had two replicates. All the fish were of same age group having mean length and weight of 5.2±0.28 cm and 9.4±0.58 g, respectively. Experimental fish were fed with formulated pelleted feed (30% protein), containing wheat bran, rice bran, mustard oil cake and fish meal. The result of study showed that the fish in treatment-I stocked at the rate of 8 fish/$m^3$ significantly ($P<0.05$) showed increase in individual length and weight followed by treatment-II and III. There was significant ($P<0.05$) variation among the survival rates of fish which ranged between 100 and 80%. The net production in different treatment were 0.206, 0.38 and 0.406 kg/$m^3$/90 days for treatment-I, II and III, respectively. The result of the present study indicated that the best individual growth of *H. fossilis* was obtained at a density of 8 fish/$m^3$ but the total production was obtained at a stocking density of 24 fish/$m^3$ in cemented cistern fed with formulated feed.

**Key word:** Stocking density, catfish, *Heteropneustes fossilis*, formulated feed.

## INTRODUCTION

Successful aquaculture requires not only careful selection of species, appropriate feeding and water quality management but also a great extent, the density to which the fish are stocked as compared to the food ration and extent of management (Barua, 1990). Backiel and LeCren (1978) described stocking density as an important parameter in fish culture as the health, growth and survival of fish depend upon this factor. Higher stocking density reduces the growth and survival rates during fish culture (Shagunan, 1997).

The stinging catfish, *Heteropneustes fossilis* (Bloch) is commercially as well as aquaculturally an important species in many Asian countries (Akand *et al*., 1991) and it is an indigenous species to Indo-Pak-Bangladesh subcontinent. It is locally known as "shingi". It occurs in all types of inland water bodies and can survive for a long time when kept in captivity even in a small quantity of water as it has a massive pair of sac-like pharyngeal lungs as accessory respiratory organ (Das, 1972). Earlier very few studies were conducted on the biology of *H. fossilis* like Mia (1984) reported length-weight relationship, Das *et al*. (19890 calculated fecundity and Singh and Goswami (1989) studied age and growth. No published information is available on the effect of stocking density on growth and survival rate of *H. fossilis*. For the development and culture technique of indigenous catfish (*H. fossilis*) stocking density might play a very important role. Considering the lack of information on these lines, the present investigations were carried out to ascertain to optimum stocking density of *H. fossilis* fed with formulated pelleted feed.

## MATERIALS AND METHODS

The present investigation was carried out during August to October 2002 in cemented cisterns situated by the side of the Faculty of Fisheries Building, Bangladesh Agricultural University, Mymensingh. Six rectangular cemented cisterns (1.25 $m^2$ each) were chosen in lieu of mud ponds to avoid burrowing of the fish. Each cistern was

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provided with 10 pieces of PVC pipes (4.0 to 5.5 cm diameter) as shelter. The depth of the water was maintained 30 cm throughout the study period. Water was exchanged on every alternate day to prevent the accumulation of the growth inhibitory ammonia.

*Collection of experimental fish*

Experimental fish of the same size (5.2±0.28 cm and 9.4±0.58 g in length and weight) was collected from local fisherman of Mymensingh region and acclimatized for 20 days in cemented cistern. Three different densities 8, 16 and 24 fish/$m^2$ were applied and designated as treatments with two replications.

*Preparation of pelleted feed*

To prepare the feed for feeding the experimental fish, fish meal, mustard oil cake, wheat flour, vitamin premix were ground thoroughly and sieved to pass through 0.5 mm mesh size. An experimental diet was formulated to contain 30% protein. All the ingredient well mixed together according to the formula composition (comparison) of pelleted feed is shown in (Table I) and then put into the manually operated pellet machine for the preparation of pelleted feed of size 1 mm.

**Table I.- Composition of the experimental diet for the feeding of catfish, *H. fossilis* reared in the cemented cisterns of BAU, Mymensingh.**

| Ingredients | Protein content (%) | Amount (g/kg) |
|---|---|---|
| Fish meal | 55 | 336 |
| Mustard oil cake | 15 | 150 |
| Wheat bran | 14 | 150 |
| Rice bran | 11 | 294 |
| Wheat flour | 4.7 | 50 |
| Vitamin premix | 0.1 | 10 |
| Salt | 0.2 | 10 |
| Total | 100 | 1000 |

*Feeding and sampling*

The feeds were supplied twice daily, in the morning (at 9:00 AM) and in the evening at (5:00 PM) at the rate of 10% of the body weight during the first month and then the feeding rate was reduced 8 and 6% for the 2nd and 3rd month respectively. Sampling was accomplished at an interval of one month. Fish were weighed on an electronic balance (Model No. 100A) with the help of a small plastic bucket, while length measurement was recorded by an ordinary wooden scale in mm. The growth was determined in terms of increase in length and weight. The water quality parameters (temperature, dissolved oxygen and pH) were recorded fortnightly and presented in Table II. Temperature and dissolved oxygen of water was determined by DO meter (YSI Model-58, USA) and pH was recorded by a portable pH meter (Jenway Model 3020).

**Table II.- Monthly water quality parameters as recorded from the cemented cisterns used to study the effect of stocking density on growth and survival of catfish (*H. fossilis*).**

| Parameters | Treatment-I | Treatment-II | Treatment-III |
|---|---|---|---|
| Temperature (°C) | 29.0 | 29.1 | 92.2 |
| PH | 8.1 | 8.2 | 8.2 |
| Dissolved oxygen (mg/L) | 5.3 | 5.0 | 4.9 |

*Statistical analysis*

The data was analyzed statistically by using analysis of variance (ANOVA). The mean values were compared according to Duncan's New Multiple Range Test (DMRT).

## RESULT AND DISCUSSION

The growth parameters of fish in the different treatments in terms mean weight gain, mean length gain, % length gain, % weigh gain, SGR %/day, FCR, survival (%) and production (kg/m/90 days) were calculated and are shown in Table III. Growth of *H. fossilis* in cemented cisterns were investigated and the results obtained from the experiment indicated that the growth rate varied in different stocking densities. Treatment-I showed significantly ($P<0.05$) the highest growth among the treatments. The net weight gain of individual fish in Treatment-I was higher (16.4 g) than those of Treatment-II (11.7 g) and Treatment-III (8.8 g). The present result coincides with the findings of Alikunhi (1957),

**Table III.- Growth parameters of the catfish, *Heteropneustes fossilis* with different stocking densities reared in cemented cisterns of BAU, Mymensingh.**

| Parameters | Treatment-I | Treatment-II | Treatment-III |
|---|---|---|---|
| Mean initial length (cm) | 5.21[a1]±0.28[2] | 5.2[a1]±0.56[2] | 5.2[a1]±0.14[2] |
| Mean final length (cm) | 18.0[a]±0.70 | 16.0[b]±0.28 | 14.0[c]±0.70 |
| Mean length gain (cm) | 12.8[a]±0.56 | 10.8[b]±0.34 | 8.8[c]±0.23 |
| % length gain | 246.15[a]±2.61 | 207.96[b]±2.39 | 169.23[c]±1.75 |
| Mean initial weight (g) | 9.4[a1]±0.58 | 9.4[a1]±0.33 | 9.4[a1]±0.14 |
| Mean final weight (g) | 25.8[a]±0.84 | 20.1[b]±0.28 | 18.20[c]±0.42 |
| Mean weight gain (g) | 16.4[a]±0.53 | 11.7[b]±0.35 | 8.8[c]±0.28 |
| % weight gain | 174.46[a]±2.06 | 113.82[b]±2.57 | 82.97[c]±1.75 |
| SGR % day | 0.48[a]±0.014 | 0.36[b]±0.014 | 0.31[c]±0.013 |
| FCR | 2.57[c]±0.23 | 3.61[b]±0.19 | 4.08[d]±0.13 |
| Survival rate (%) | 100[a]±0.0 | 90.0[b]±2.0 | 80.c[c]±3.5 |
| Production (kg/m$^3$/90 days) | 0.206[c]±0.001 | 0.308[b]±0.0012 | 0.406[a]±0.001 |

1. Figures in the same row having same superscripts are not significantly different (P>0.05).
2. Standard deviation.

Kawamoto *et al*. (1957) and Haque *et al*. (1984) who achieved best growth at lower stocking densities. The lowest stocking densities provide more space, food and less competition, which were reported by various authors like Ahmed (1982); Hasan (1982) and Haque *et al*. (1984). This phenomenon indicated that there might be a lower community feelings among the fishes which influenced them to consume feed properly and it might be absent in the treatments with higher stocking densities. The percentage of survival as recorded in the present study was 100, 90 and 80 for Treatment-I, Treatment-II and Treatment-III, respectively. Survival was found to be negatively influenced by stocking densities. In might be due to high competition and space among the fishes. Mollah (1985) reported that the lower density gave larger size and higher survival rate in *Clarias macrocephalus*. Barua (1990) reported that the survival rates were higher in the larvae raised at the stocking densities of 2, 4 and 8 fish per litre compared to those obtained 16 fish per litre. Ita *et al*. (1989) reported that lower stocking density showed higher survival (60%). Bardach *et al*. (1972) observed *Pangasius larnandi* attained an average weight of 0.45 kg on the termination of one year and 1.0 kg in two years when stocked at 25 fish/m$^3$, while *P. sutchi* attained 4.0 kg in two years. Ling (1967) reported an average production of 100t/year/1000 cages of (4x2x30 m$^3$ size with a semi-traditional polyculture of *P. sutchi*, *Channa* sp., *Clarias macrocephalus* and *Puntius* sp. Significantly (P<0.05) higher net production was obtained in Treatment-III in the rpesent study (0.406 kg/m$^3$/90 days), it might be due to higher number of fish stocked. The present result agrees with the findings of Dimitrov (1976) who obtained the best production from higher stocking densities (80 fish/m$^3$) when compared to that achieved with the lower ones (15, 50 fish/m$^3$). The results of the present study indicated that a stocking density of 8 fish/m$^3$ might be suitable for *H. fossilis* culture. Water temperature was recorded 29.0 to 29.2°C, hydrogen ion concentration (pH) was in the range of 8.1 to 8.2 and dissolved oxygen content was 4.9 to 5.3 mg/l (Table II). The water quality parameters during the present study were found within the suitable range as reported by Rahman *et al*. (1982), Mumtazzuddin *et al*. (1982), Rahman (1992), Islam *et al*. (1996) and Kohinoor *et al*. (1998).

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