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Culture potentials of climbing perch, *Anabas testudineus* (Bloch) under different stocking densities at semi-intensive management

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Abstract
Anabas testudineus was cultured at different stocking density for the period of five months from May to September. Three stocking densities such as 50,000 (Treatment-1, T_1), 56,250 (Treatment-2, T_2) and 62,250/ha (Treatment-3, T_3) were tested with three replications. After five months rearing, the mean weights of koi were 46.74±2.59, 40.44±2.98 and 37.27±3.01 in T-1, 2 and 3, respectively. The calculated production of native koi in T_1, T_2 and T_3 were 1,916±314, 1,774.31±260 and 1,431±297 kg/ha, respectively which were significantly different ($p<0.05$) from each other.

Key words: *Anabas testudineus*, Stocking densities

Introduction

The climbing perch (*Anabas testudineus*), locally known as koi, is an important favourite small indigenous fish of Bangladesh. It can withstand harsh environmental conditions such as low oxygen, wide range of temperature and other poor water conditions (Habib and Hasan 1994). The species is considered as a valuable item of diet for sick and convalescents. The fish contains high amount of bionutritionally available iron and copper, which are essentially needed for hemoglobin synthesis. In addition, the fish also contains high amount of protein and easily digestible fat which is very low melting point and many essential amino acids (Saha 1971, Habib and Hasan 1994).

In late 1980s, the catches of the fish have drastically declined from open waters due to various ecological changes in inland water bodies. Keeping this aspect in mind, seed production technology through artificial propagation was developed in captive condition by the Bangladesh Fisheries Research Institute (Kohinoor *et al.* 1991). But proper culture technology has yet been optimized and evaluated with protein enriched feed. Therefore, research needs to evaluate its culture potentials in pond ecology. The present study attempted to evaluate the production potentials of native koi at on station management.

Materials and methods

Experimental design and pond management

Three ponds were selected having an area of 300 m^2 each. Each pond was equally partitioned in to three chambers by bamboo split (100 m^2 each with an average depth of 100 cm). Three stocking density of native koi (*A. testudineus*) such as 50,000, 56,250 and 62,250/ha were tested, which considered as T-1, T-2 and T-3, respectively. Prior to initiate the experiment, ponds were dried and pond bottoms were treated with lime (CaO) at the rate of 250 kg/ha and left for three days. After drying, ponds were filled with ground water and fertilized with cow manure at the rate of 2,000 kg/ha.

All the ponds clamberers were stocked according to the experimental design. After stocking, supplementary feed containing 35% crude protein (SABINCO Commercial feed) were applied at the rate of 20-4% of estimated fish biomass at twice daily at 10.00 h in the morning and at 15.00 h in the afternoon in all the treatments. The fingerlings were fed at the rate of 20% of their body weight for the first four weeks and it was reduced to 4% on the subsequent weeks. All the ponds were limed at the rate of 125 kg/ha at monthly interval during the culture period.

Fish sampling

Fish sampling were done at fortnightly intervals through seine netting and weighing 50 fish to measure the growth, assess their health status and also feed adjustment.

Water sampling and analysis

Water quality parameters such as water temperature (°C), DO (mg/L), pH, alkalinity (mg/L) were monitored at weekly intervals from 0930 to 1000 hrs. Water temperature was recorded using a Celsius thermometer and transparency was measured by using a Seechi disc of 20 cm diameter. Dissolve oxygen and pH were measured directly using a digital portable oxygen meter (OAKTON) and portable pH meter (HANNA 8424). Alkalinity was determined following the titrimetric method according to the standard procedure and methods (Clasceri *et al.* 1992).

Fish harvesting

After a grow-out period of five months, ponds were drained by pump and all fish were harvested. Total bulk weight and number of fish from each pond were recorded. Specific growth rate (bw/day) was estimated as:

$$SGR = [\ln(\text{final weight}) - \ln(\text{initial weight})]/\text{culture period (days)} \times 100.$$

Data analysis

One-way ANOVA was carried out using STATGRAPHICS version 7 statistical package following Zar (1984). Significance was assigned at the 5% level of probability.

Results and discussion

The physico-chemical factors of the pond water under three treatments are presented in Table 1. The water temperature in T_1, T_2 and T_3 ranged from: 24.90- 32.2, 24.30-32.7 and 24.40-32.3°C, with the mean values of 25.20±0.51, 25.72±0.55 and 26.73±0.70°C, respectively. The variations in temperature among the treatment means were found similar ($p<0.05$) and were within the suitable range of growth of fish in tropical ponds (Rahman *et al.* 1982, Roy *et al.* 2002, Begum *et al.* 2003).

Table 1. Mean values of water quality parameters in different treatments

Water quality parameter	T_1	T_2	T_3
Temperature (°C)	25.20±0.51	25.72±0.55	26.73 ±0.70°C.
Transparency (cm)	30.20±1.35	26.20±1.40	24.62±1.72
pH	7.52 to 8.80	7.24 to 8.34	7.65 to 8.59
Dissolved oxygen (mg L^{-1})	5.22±0.12	5.09±0.15	4.92±0.20
Total alkalinity (mg L^{-1})	142↑1±11.20	132±7.54	139±5.37

The water transparency did not show any significant ($p<0.05$) difference among the treatment means. The mean values were 30.20±1.35, 26.20±1.40 and 24.62±1.72cm in T_1, T_2 and T_3, respectively. The values of transparency some times varied with sampling dates which could be due to differences in abundances in abundance of plankton. Boyd (1982) recommended a transparency between 15-40cm as appropriate for fish culture. Normally, the transparency value was low in this experiment because usually koi did not consume plankton. (Nargis and Hossain 1987, Singh and Samual 1981).

The level of pH varied from 7.52 to 8.80, 7.24 to 8.34 and 7.65 to 8.59 in T_1, T_2 and T_3, respectively. The pH in all pond water was alkaline throughout the experimental period which might be due to regular application of lime in all the ponds at monthly interval. Different authors have reported a wide variations in pH from 7.18 to 7.24 (Kohinoor *et al.* 1998), 7.03 to 9.03 (Roy *et al.* 2002), 6.8 to 8.20 (Begum *et al.* 2003) and 7.50 to 8.20 (Chakraborty *et al.* 2005) in fertilized fish pond and found the ranges productive.

The dissolved oxygen contents in the experimental ponds ranged from 4.6 to 6.9, 4.2 to 6.1 and 4.09 to 5.94 mg/L in T_1, T_2 and T_3, respectively, with the mean values of 5.22±0.12, 5.09±0.15 and 4.92±0.20 mg/L. Comparatively lower level of dissolved oxygen as observed in the experimental ponds appeared to be related to sampling time where the dissolved oxygen was monitored at about 9.00-10.00 am. Rahman *et al.* (1982) reported that dissolved oxygen content of a productive pond should be 5.0 mg/L or more. The values found in present experiment were around 5.0.

Total alkalinity ranged from 135 to 160, 118 to 162 and 134 to 169 mg/L with mean values of 1421±11.20, 132±7.54 and 139±5.37 mg/L in T_1, T_2 and T_3, respectively. These values did not show any significant difference among the treatments. The

variations in total alkalinity in all the treatments were found in productive range for aquaculture ponds (Wahab *et al.* 1995, Kohinoor *et al.* 1998).

Growth and production

The growth rates of koi under different stocking densities are shown in Table 2. The weight increments of koi by different treatments over the culture period are graphically shown in Fig. 1. During culture period it was observed that the growth rate was not varied among the treatments first three months but it was increased significantly in rest of two months. It can be also seen that the final weight was higher in T_1, which followed by T_2 and T_3. After five months of rearing, the mean weights of koi were 46.74±2.59, 40.44±2.98 and 37.27±3.0g in T_1, T_2 and T_3, respectively. The mean weight of T_1 showed significant ($p<0.05$) differences from T_2 and T_3, whereas significant ($p<0.05$) differences was also observed between T_2 and T_3. The results indicated that higher growth rate attained at lower stocking density.

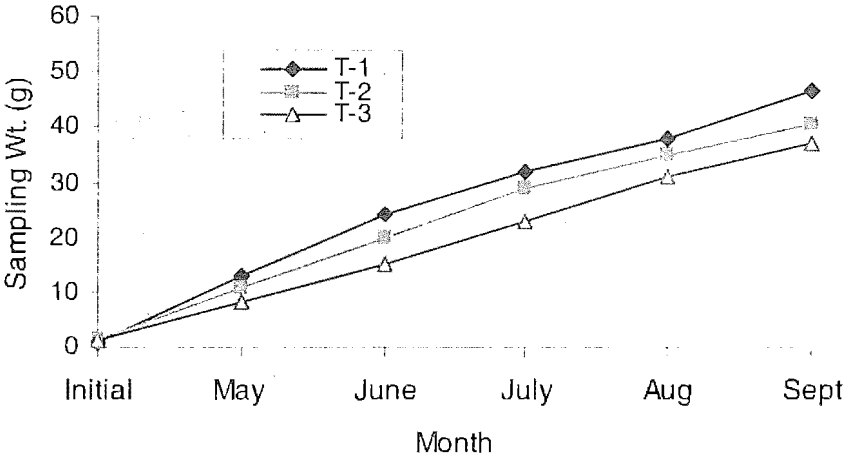

Fig.1: Monthly growth rate of Native Koi at different stocking densities

The specific growth rate (SGR) of koi at different stocking densities was observed to be 2.68, 2.59 and 2.55 for T_1, T_2 and T_3, respectively. The SGR of koi in T_1 was significantly ($p<0.05$) different from T_2 and T_3, whereas, T_1 and T_2 did not show any significant difference ($p>0.05$).

The mean survival rate of koi was found to vary with the stocking densities. The highest survival (82%) was observed in T_1, where stocking density was 50,000/ha and the lowest (76%) was obtained in T_3, where the density was 62,500/ha. The differences among the treatment means were found to be insignificant ($p>0.05$). The mean FCR value of T_1, T_2 and T_3 were 3.44, 3.76 and 3.81, respectively where T_1 resulted in the lowest FCR value, while the highest FCR value was found in T_3.

Table 2. Growth performance of native koi (*Anabas testudineus*) under mono culture management in different stocking densities

Treatment	Initial Wt. (g)	Harvesting weight (g)	Survival (%)	Production (kg/ha)	FCR	SGR (%)
T_1 (50,000/ha)	1.04± 0.22	46.74±2.59[a]	82	1,916±314[a]	3.44	2.54
T_2 (56,250/ha)	1.10± 0.22	40.44±2.98[b]	78	1,774±260[b]	3.76	2.44
T_3 (62,500/ha)	1.13± 0.20	37.27±3.01[c]	71	1,431±297[c]	3.94	2.39

* Dissimilar superscript indicates significant difference at 5% level of probability

The calculated production of koi T_1, T_2 and T_3 were 1,916±314, 1,774.31±260 and 1,431±297 kg/ha, respectively. The fish production was higher in T_1, where stocking was 50,000/ha and lowest production was observed in T_3, where the stocking density was 62,500/ha. Intermediate fish production results were obtained in T_2, where stocking density was 56,250/ha. The production level of T_1 was found to be significantly ($p<0.05$) higher than T_2 and T_3. But T_3, appeared to give the lowest production and differed significant ($p<0.05$) from T_2.

Correlation matrix among stocking density, harvesting weight, survival and production of koi is shown in Table 3. Stocking density showed a negative correlation with harvesting weight, survival and production. It means that if stocking density increased, then harvesting weight, survival and production decreased. While, harvesting weight showed positive correlation with survival, production and survival rate derived also significant positive correlation with production.

Table 3. Correlation matrix among stocking density, harvesting weight, survival and production of native koi under grow-out system

Parameter	Stocking density	Harvesting wt. (g)	Survival (%)	Production (Kg)
Stocking density	1.0000	-	-	-
Harvesting Wt. (g)	-0.9769	1.0000	-	-
Survival (%)	-0.9947	0.9937	1.0000	-
Production (Kg)	-0.9669	0.9991*	0.9881*	1.0000

* Significant difference at 5% level of probability

Thakur and Das (1986) reported that Koi (*Anabas testudineus*) production was 1,800 kg/ha in India by applying supplementary feed (rice bran, mustard oil cake and fish meal) with the stocking density of 60,000/ha in 170 days. They also stated that by applying the above feed, achieved 702 kg/ha over a period of 11 months, where the stocking density was 1,25,000/ha. Earlier study conducted by Akhteruzzaman (1988) evaluated the production potentials of koi in monoculture management at the density of 16,000/ha and obtained a production of 450 kg/ha in five months rearing with

supplementary feed consisted of rice bran (50%), mustard oil cake (30%) and fish meal (20%). The gross production of Koi in mono culture condition was 425 kg/ha at the stocking density of 20,000/ha, where rice bran (50%), mustard oil cake (30%) and fish meal (20%) was used as supplementary feed over a period of five months (BFRI Research Progress 1994-97). The production obtained in the present experiment was higher than the above mentioned results due to application of protein enriched (35%) supplementary feed which might gave the higher production and also regular water supply in the ponds might be another factor which enhanced the production.

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