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Production potentials of pabda (*Ompok pabda*, Hamilton) in semi-intensive management under different stocking densities

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Abstract. The present study was performed for evaluating the growth and production performance of pabda (*Ompok pabda*) for a period of six months from May to October 2016. Three stocking densities of pabda were tested where each stocking density was considered as treatment. Fingerlings of pabda were stocked at the rate of 2.0, 2.50 and 3.0 lac/ha in treatments-1, 2 and 3, respectively. The production of pabda was 7403±122, 7258±179 and 6624±204 kg in treatments-1, 2 and 3, respectively and they were significantly different ($p<0.05$) from one to another. The result implies that fish showed better growth and production in low stocking density. A higher net benefit of Tk. 12.68 lac was obtained from treatment-1 where the stocking density was 2.0 lac/ha.

Keywords : *Ompok pabda*, Stocking density, Water quality parameters

Introduction

Butter catfish, *Ompok pabda* is an important small indigenous fish species in Bangladesh but it has been characterized as threatened species by IUCN. IUCN (2015) declared 64 fish species in red list which are nearly threatened species in the world. Pabda is favorite to the consumers due to its delicious taste, fewer bones and nutrition value. So, the fish have a great demand and fetching high price in the market. Mass propagation coupled with judicious culture in controlled environments is often considered as the most appropriate approach to conserving the fish. With this in mind and increase its production through aquaculture, the Bangladesh Fisheries Research Institute under its Freshwater Station, Mymensingh has developed seed production technique through artificial propagation (Akhteruzzaman *et al.* 1993). Though this species have been reported quite favorable under standard conditions of carp farming (Hossain *et al.* 1998), their monoculture technique has not yet been developed and established. The present study was designed to evaluate the production performance of pabda in monoculture management.

Materials and Methods

Site of experiment

The trial was conducted for a period of six months from May to October 2016 in six farmer's ponds of 800-1000 m^2 area with a depth of 1.0-1.5 m at Dohakhola, Gouripur, Mymensingh. The ponds were rectangular in shape and size and bottom soil types were loamy and similar. The ponds were completely independent and fully exposed to prevailing sunlight. Pond embankments were covered with grass.

Pond preparation

Prior to the trial, the ponds were dried using submersible pump and all the predatory fishes and aquatic weeds were removed. The ponds were kept exposed to sunlight for a week for hardening of the pond bottom. After drying, bottom soil was treated with lime at the rate of 250 kg/ha for removing the gases and correction of pH.

Pond filling with water

After seven days of liming, underground water was supplied to the ponds and filled up to the depth of 1 meter. Before stocking of fingerlings, ponds were fertilized with urea and TSP at the rate of 12.50 and 250 kg/ha, respectively for production of plankton as natural food for the fish.

Stocking of fish

Three stocking densities of pabda were tested in this experiment. Each stocking density of pabda was considered as treatment and replicated twice. Fingerlings of pabda were stocked at the rate of 200,000; 250,000 and 300,000/ha in treatments-1, 2 and 3, respectively.

Feeding and pond management

After stocking, the fish was fed with pelleted floating feed (35% crude protein) at the rate of 15-6% of body weight. The fish was fed at the rate of 15, 12 and 10% of their body weight in the first month, second and third month, respectively and it was reduced to 6% on the sub-sequent months. For maintaining the suitable range of pH throughout the culture period, lime was applied in all the ponds at the rate of 25 kg/ha at fortnightly interval. Shallow tube well was used for adding underground water in the pond as and when necessary. This method mitigated pollution from execratory product of individuals and maintained suitable condition for the trial fish.

Fish sampling

For determining the growth rate as well as feed adjustment, random samples of 50 individuals from each pond were caught by seine net and weighed by portable sensitive balance (TANITA, Japan).

Measuring water quality parameters

Water quality parameters such as water temperature were measured weekly interval throughout the study period from 10.00 to 11.00 hrs. Water temperature (°C) from each pond was recorded from three spots by using a Celsius thermometer. Dissolved oxygen (mg/L) and pH were measured using a digital DO meter (HANNA, Model HI 98129) and a direct reading digital pH meter (HANNA, Model HI 9025), respectively. Total alkalinity (mg/L) was determined titrimetrically according to the standard procedure and methods (APHA, 1992). While, Ammonia-nitrogen (mg/l) was measured using a high precision HACH Kit (Spectrophotometer DR 1900, HACH, USA).

Fish harvesting

After grow out period of six months, fish were harvested by repeated seine netting. Total weight and number of fish from each pond were recorded. Survival and gross production of fish under each treatment was estimated.

Statistical analysis

For statistical analysis of data, a one-way ANOVA was carried out using the statistical package, Stat graphics Version 7.

Results and Discussion

Water quality parameters

A favourable physico-chemical condition of water body is the pre-requisite for healthy environment and better production. Growth, feed efficiency and feed consumption of fish are normally governed by some environmental factors (Brett 1979). A large number of water quality parameters including water temperature, pH, dissolved oxygen, alkalinity and ammonia nitrogen of pond water were measured throughout the experiment. Mean values of physico-chemical parameters over the six months rearing of pabda are presented in Table I. Physico-chemical and biological environment of a water body are mostly influenced by water temperature which is the most important physical factors. In present study, temperature varied from 25.80 to 34.70°C with the means of 27.20±2.42, 27.10±2.61 and 27.72±2.33°C in treatments-1, 2 and 3, respectively. Temperature difference among the treatments was not significant ($p > 0.05$) and was within the suitable range of growth of fish in tropical ponds (Jahan *et al.* 2013, Kohinoor *et al.* 2016). Boyd (1982) reported that the range of water temperature from 26.06 to 31.97°C is suitable for fish culture.

Table I. Water quality parameters (mean ±SE) of the ponds under different treatments

Parameter	Treatment-1	Treatment-2	Treatment-3
Temperature (°C)	27.20±2.42	27.10 ±2.61	27.72±2.33
pH	7.78±0.34 ^{a}	7.75±0.57 ^{a}	7.29±0.49 ^{a}
Dissolved Oxygen (mg/L)	4.80±0.83 ^{a}	4.56±0.82 ^{b}	4.18±0.65 ^{c}
Total Alkalinity (mg/L)	143±11.12 ^{a}	138±12.49 ^{a}	135±11.64 ^{a}
Ammonia-nitrogen (mg/L)	0.028±0.022 ^{a}	0.045±0.024 ^{b}	0.085±0.060 ^{c}

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

Throughout the study period, the pH values of the pond water under the different treatments were found to be alkaline. The mean values of pH of treatments-1, 2 and 3 were 7.78 ± 0.34, 7.75 ± 0.57 and 7.29 ± 0.49, respectively. Various authors have reported wide variations in pH from 7.18 to 7.24, 7.03 to 9.03, 6.8 to 8.20 and 7.50 to 8.20 in fertilized fish pond and found the ranges productive (Kohinoor *et al.* 2009, 2012, 2016, Singh *et al.* 2017). The values of pH recorded in the present experiment are well within above reported ranges, indicating the productive nature of the pond.

Dissolved oxygen (DO) is an important chemical factor and its suitable range is critical for success in any aquaculture operation. The level of dissolved oxygen was found to be lower in treatment-3 which might have caused due to of higher biomass of pabda. The mean values of dissolved oxygen concentration in treatments-1, 2 and 3 were 4.80 ± 0.83, 4.56 ± 0.82 and 4.18 ± 0.65 mg/L, respectively. The dissolved oxygen concentration was higher in treatment-1, which differed significantly from treatment-2 and treatment-3. Kohinoor *et al.* (2016) observed dissolved oxygen ranging from 5.91 to 6.03 mg/L from fish ponds located in Gouripur, Mymensingh, Bangladesh. In another study, Chakraborty and Nur (2012) recorded dissolved oxygen values ranging from 3.80 to 6.12 mg/L. Although fish might survive in 0.50 mg/L dissolved oxygen concentration but most suitable range of DO in a water body for fish culture is suggested from 5.0-8.0 mg/L. However, the fluctuations in DO concentrations in all treatments ponds were within the productive range throughout the experimental period (Boyd 1982).

Total alkalinity was found 122 to 168, 115 to 155 and 119 to 149 mg/L with mean values of 143 ± 11.12, 138 ± 12.49 and 135 ± 11.64 mg/l in treatments-1, 2 and 3, respectively. When the results of all the ponds collected over the entire experimental periods were compared, there was no significant difference. Higher total alkalinity level in the ponds of three treatments might be due to regular application of lime at fortnightly interval. The variations in total alkalinity in all the treatments were found in productive range for aquaculture ponds (Boyd 1982, Chakraborty and Nur, 2012 and Kohinoor *et al.* 2017).

Ammonia-nitrogen is toxic to fish and above a certain level it can cause fish mortality. The mean values of unionized ammonia-nitrogen were 0.028 ± 0.022, 0.045 ± 0.024 and 0.085 ± 0.060 mg/L in treatments-1, 2 and 3, respectively. The differences among treatments were significant ($p < 0.05$) when compared through ANOVA. The unionized ammonia was found in all the treatments because high density of fish was in all the treatments. The droppings of the fish might have produced more ammonia in the ponds. New (1987) reported that excessive use of feed or fertilizer caused sediments in the pond bottom which may produce ammonia and other gases. In this experiment it might have happened. Singh *et al.* (2017) reported ammonia-nitrogen values ranged from 0.01 to 0.13 mg/L in a study of pabda rearing pond. Suitable range of ammonia-nitrogen in fish culture was less than 0.1 mg/L (Boyd 1982).

Growth and production

Details of stocking, harvesting, growth and production of pabda in different treatments during the study are presented in Table II. On the basis of final growth attained under treatments-1, 2 and 3 were 46.86±8.00, 39.77±6.03 and 34.50±7.31 g, respectively. The highest growth was obtained in treattment-1 and lowest in treatment-3. The harvesting weight showed significant difference ($p<0.05$) with treatment-1 having the highest production followed by treatment-2 and 3 respectively. The monthly sampling weights of pabda under different stocking densities are shown in Fig. 1 which indicates that the growth rate was always higher in treatment-1 followed by treatment-2 and 3; i.e., higher growth rate was observed at lower stocking densities. The percentage increase in weight (g) was found to be 920.19, 807.28 and 635.71% in treatment-1, 2 and 3, respectively. The SGR (%) values showed significant difference among the treatments.

Table II. Growth, survival and production of pabda under different stocking densities

Treatment	Initial weight (g)	Harvesting weight (g)	Survival (%)	Production (kg/ha/6 months)	SGR (%)	FCR
Treatment-1	3.86±0.56	46.86±8.00 [a]	79[a]	7403±122[a]	1.38[a]	2.5[a]
Treatment-2	3.64±0.46	39.77±6.03 [b]	73[b]	7258±179[b]	1.32 [b]	2.8[b]
Treatment-3	3.56±0.45	34.50±7.31 [c]	64[c]	6624±204 [c]	1.26 [c]	2.9[c]

* Figures in the same column with different superscripts are significantly different ($p>0.05$)

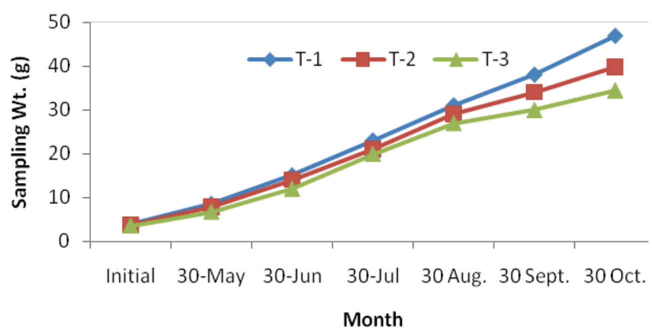

Fig. 1: Sampling` Wt. (g) of pabda (*O. pabda*) under different stocking density during rearing

The survival rate of pabda was found to vary with the stocking densities. The highest survival (79%) was obtained in treatment-1 where the stocking density was 200, 000/ha. while the lowest (64%) was obtained in treatment-3 where the density was 300,000/ha (Table II). The survival rate showed significant difference ($p<0.05$) among the treatments. The results revealed that higher survival rate was found at lower stocking density. The food conversion ratio (FCR) was found to be the lowest in treatment-1 which indicates that the applied feed was utilized more efficiently to gain the live weight of fish with lower stocking density. The results also noticed that the FCR value was significantly lower in treatment-1 than in treatments-2 and 3.

Production data of fish per hectare was extrapolated from the data of 800-1000m^2 water area over a 180-day culture period. The productions of pabda were 7403±122, 7258±179 and 6624±204 kg/ha, respectively in treatments-1, 2 and 3. These data showed significant differences ($p < 0.05$) among treatments. The production data of pabda showed that the lowest stocking density (200,000/ha) resulted significantly higher production (7403 Kg/ha). Whereas, the lowest production (6624 kg/ha) was observed in treatment-3 where the stocking density of pabda was 300,000/ha.

Correlation matrix among stocking density, harvesting weight, survival rate, FCR, SGR (%) and production of pabda is shown in Table III and exhibit a clear results of the relationship among the parameters. Stocking density showed a negative correlation with harvesting weight, survival and SGR. The result indicates that if stocking density increased, then mean values of harvesting weight, survival and SGR (%) decreased. While harvesting weight showed positive correlation with survival but negative correlation with FCR and production. Survival rate indicated the negative correlation with FCR and production.

Table III. Correlation matrix among stocking density, harvesting weight, survival rates, FCR, SGR (%) and production of pabda under grow-out system

Parameter	Stocking density	Harvesting wt. (g)	Survival (%)	FCR	SGR (%)	Production (Kg)
Stocking density	1.000	-	-	-	-	-
Harvesting wt. (g)	-0.996*	1.000	-	-	-	-
Survival (%)	-0.979	0.961	1.000	-	-	-
FCR	0.993*	-0.959	-0.991*	1.000	-	-
SGR (%)	-0.995*	0.998	0.969	-0.987	1.000	-
Production (Kg)	0.886	-0.865	-0.781	0.846	-0.873	1.000

*Significant difference at 5% level of probability

The production levels are comparable to those obtained in other mono and polyculture system in South Asian Countries. Kohinoor *et al.* (1997) recorded an average production from semi-intensive culture of pabda with Rajpunti (*Barbodes gonionotus*) and common carp (*Cyprinus carpio*) over six months culture period as 2932 kg/ha/six months where the contribution of pabda was only 15.27%. Kohinoor *et al.* (2009) also recorded a gross production of 2393 to 2986 kg/ha in six months from a composite culture of Indian major carps with pabda and gulsha, where the contribution of Pabda and Gulsha (*Mystus cavasius*) were 5.20 and 9.04%, respectively. However, Kohinoor *et al.* (2012) observed the effect of different stocking densities on the production of Stinging catfish Shing (*Heteropneustes fossilis*) in earthen ponds where production ranged from 7545 to 9031 kg/ha in six months. The production obtained in the present study was very encouraging. The reason might be due to application of protein-rich floating feed, higher stocking density and better management.

The aquaculture of endangered small fish like pabda would add social benefit. The fish farmer would get opportunity to sell pabda at a higher price in the market. It was found that monoculture of pabda is economically feasible. The study also revealed that the small and shallow water bodies may generously be used for small indigenous fish species (SIS) culture and indicates the feasibility of attaining a good production.

Cost and benefit

A simple cost-benefit analysis was performed to estimate the amount of profit that has been generated from such type of culture. The results of the analysis are shown in Table IV. The costs of production were Tk. 1623,000, 1803,560 and 1814,156 in treatments-1, 2 and 3, respectively. The cost of production was higher in treatment-3 while lower in treatment-1.

Table IV. Cost and return analyses of fish production in different densities in one ha pond

Inputs	Treatment-1		Treatment-2		Treatment-3	
	Quantity (Kg)	Cost (Tk.)	Quantity (Kg)	Cost (Tk.)	Quantity (Kg)	Cost (Tk.)
Lease value	-	75,000	-	75,000	-	75,000
Pond preparation		50,000		50,000		50,000
Fish fry	200,000	300,000	250,000	375,000	300,000	450,000
Feed	18,500	1073,000	20,320	1178,560	19,209	1114,156
Others cost		125,000		125,000		125,000
Total cost		1623,000		1803,560		1814,156
Benefits						
Sell price of pabda						
Tk. 380/kg (T-1)	7403	2813,140	7258	2540,300	6624	2185,920
Tk. 350/kg (T-2)						
Tk. 330/kg (T-3)						
Net benefit/ha	1190,140		736,740		371,764	

The higher net profit of Tk.1190,140 was obtained from treatment-1 where pabda was stocked in 200,000/ha. Kohinoor *et al.* (2009) analyzed the cost and benefit of Pabda and Gulsha (*M. cavasius*) with GIFT strain (*Oreochromis niloticus*) in polyculture condition and got the net benefit of Tk. 742,948/ha/6 months where fish were fed commercial pelleted feed. The net benefit of Climbing perch Koi (*Anabas testudineus)*, Kohinoor *et al*. (2016) found that Tk. 264,160 to Tk. 726,780/ha/4 months could be achieved by applying supplementary feed. Whereas, Kohinoor (2017) got the net profit of Tk. 521,250 to 708,000/ha/4 months in polyculture of Koi (*A. testudineus*) with Stinging catfish. In view of the above findings, it may be concluded that the production and economic return of pabda in monoculture system was very encouraging in one hand and culture of endangered species could ensure the availability as well as conservation of this species in inland waters on the other.

Literature Cited

Akhteruzzaman, M., A.H.M. Kohinoor, M.S. Shah and M.G. Hussain, 1993. Observations on the induced breeding of silurid catfish, *Ompok pabda* (Hamilton) in Bangladesh. *Bangladesh J. Life Sci.,* **5**(1): 71-75.

APHA, 1992. *Standard Methods for the Examination of Water and Waste Water*. American Public Health Association, Washington, DC.

Boyd., C.E., 1982. *Water quality management for pond fish culture*. Elsevier Sci. Publ. Co. Amsterdam-Oxford- New York. 318 p.

Brett J.R., 1979. *Environmental factors and growth*. *In*: W.S. Hoar, D.J. Randall and J.R. Brett (eds.), Environmental Relations and Behavior, Fish Physiology, Academic Press, New York, 6: 599-677.

Chakraborty, B.K. and N.N. Nur, 2012. Growth and yield performance of Shing, *Heteropneustes fossilis* and koi, *Anabas testudineus* in Bangladesh under semi-intensive culture systems. *Int. J. Agril. Res. Innov. Tech*., **2**(2):15-24.

Hossain, M.A., A.H.M. Kohinoor and M.G. Hussain, 1998. Polyculture of gulsha (*Mystus cavasius* Ham.) with rajpunti (*Puntius gonionotus* Bleeker) and silver carp (*Hypophthalmichthys molitrix* Val.) in earthen ponds. *Bangladesh J. Fish. Res*. 2(1): 9-14.

IUCN Bangladesh. 2015. *List of threatened animals of Bangladesh*. Paper presented in the Special Workshop on Bangladesh Red Book of threatened Animals, 13p.

Jahan, S., K.J. Chandra and D.R. Das, 2013. Growth performance of climbing perch Koi (*Anabas testudineus*) in monoculture and polyculture system. *IRJALS*, 2(3): 1-10.

Kohinoor, A.H.M., M. Begum and M.G. Hussain, 2009. Evaluation of different stocking densities of two small indigenous fish Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) with Indian major carps in polyculture system. *Iranian J. Fish. Sci.,* 8(1): 57-64.

Kohinoor, A.H.M., M. Moshiur Rahman and M. Shahidul Islam, 2017. Evaluation of production performances of koi (*A. testudineus*) with Shing (*H. fossilis*) and GIFT Tilapia (*O. niloticus*) in semi-intensive culture management. *J. Entomol. Zool. Studies.,* **5**(1): 446-451.

Kohinoor, A.H.M., M. Moshiur Rahman, M. Shahidul Islam and Yahia Mahmud, 2016. Growth and production performance of climbing perch, Thai koi and Vietnamese koi strain (*Anabas testudineus*) in Bangladesh. *Int. J. Fish. Aqua. Stud.,* 4(1): 354-357.

Kohinoor, A.H.M., M.A. Hossain and M.G. Hussain, 1997. Semi-intensive culture and production cost of pabda (*Ompok pabda)* with rajpunti (*Puntius gonionotus)* and mirror carp (*Cyprinus carpio* var. *specularis)* in mini ponds. *Bangladesh J. Zool.*, 25(2): 129-133.

Kohinoor, A.H.M., M.M. Rahman, H.M. Moniruzzaman and S.C. Chakraborty, 2012. Production performances of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) with GIFT strain (*Oreochromis niloticus*) in on-farm management system. *Bangladesh J. Fish. Res.*, 15-16: 27-36.

New, M.B., 1987. Food and feeding of fish and shrimp. Ext. Man. Aqua. Dev. Coor. Prog. ADCP/REP/87/26. FAO and UNEP. 275 p.

Singh, P., S.K. Nayak and Dhalongsalh Reang, 2017. A study on growth performance and survivability of *Ompok pabda* fingerling in earthen pond fed with different feed ingredients. *Int. J. Fish. Aquat. Stud.*, **5**(4): 289-294.

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