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Effect of mola (*Amblypharyngodon mola* Ham.) on the growth and production of carps in polyculture

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Abstract

The effect of introduction of mola (*Amblypharyngodon mola*) in polyculture with rohu (*Labeo rohita*), catla (*Catla catla*) and mirror carp (*Cyprinus carpio* var. specularis) was studied in semi-intensive culture system in the pond complex of the Fisheries Faculty, Bangladesh Agricultural University, Mymensingh. Mola, a small indigenous fish was found to exert a negative impact on growth and production of carps. After four months' rearing, significant difference ($P<0.05$) was observed in the net production between the treatments.

Key words : *A. mola*, Poluculture, Indian major carp, Common carp

Introduction

While fish production in the country from the natural sources is gradually declining, intensive efforts are being directed towards polyculture of Indian major carps and some exotic carps (Kohinoor *et al.* 1996). However, despite the active support of the Government of Bangladesh to boost fish culture, the nutritional intake of the rural people remains poor. Fish farmers normally grow fish as a cash crop and sell all their produce in the market saving little fish for their own consumption. This tendency could be changed by producing small indigenous fish along with carps in the polyculture system.

The small indigenous fishes are a chief source of animal protein and micro-nutrients for the rural poor in Bangladesh. Sixteen species of small indigenous fishes are considered suitable for aquaculture (IFADEP 1996). Among those, mola (*Amblypharyngodon mola*) is of special interest to the fish farmers because of its good taste. Its high nutritional value has created an equally great interest among the scientists. Thilsted *et al.* (1997) recorded that 100g mola contain approximately 1960ug, 1071mg and 7.0mg of vitamin A, calcium and iron respectively. Though the small fishes have always been regarded as competitors of carps in the polyculture system and therefore invariably eliminated but no studies have so far been made on the effect of small indigenous fish such as mola, chela, punti etc. on the growth and production of carps in the system. The present study was, therefore, undertaken to assess the effects of mola (*A. mola*) in the carp polyculture system.

Materials and methods

Study area

The experiment was conducted in six earthen ponds of 75m^2 each with a depth of 1.5m in the pond complex of Faculty of Fisheries at the Bangladesh Agricultural University, Mymensingh , during August '96 to January '97.

Preparation of ponds

All the ponds were treated with lime at the rate of 250 kg/ha. After three days of liming,the ponds were fertilized with cow manure at the rate of 1000kg/ha.

Stocking of fish

The ponds were stocked after three days of fertilization. The experiment consisted of two treatments with three replicates. In both the treatments, rohu (*L. rohita*), catla (*C. catla*) and mirror carp (*C. carpio var. specularis*) were stocked at a stocking density of 10,000/ha in the ratio of 1:1:1. A small indigenous species, mola (*A.mola*) was stocked as an additional component in treatment II at a stocking density of 25,000/ha.

Post stocking management

Both the treatments were subjected to the same regime of feed and fertilizer application. Commonly available agricultural by-products such as rice bran (60%) and mustard oil cake (40%) were used as supplementary feed at the rate of 3-4 % of standing crop of fish. Fish were sampled at fortnightly intervals to assess their growth and health. Feeding was adjusted on the basis of estimated fish biomass. All the ponds were also regularly fertilized with cattle manure at the rate of 1000 kg/ha at 15 days interval.

Water sampling and analysis

Water quality parameters transparency, p^H, dissolved oxygen(DO) and chlorophyll-a were estimated at weekly intervals between 0800 to 0900 hrs, while total hardness, PO_4-P and NH_3-N analysed at fortnightly intervals. Standard procedures and methods were followed (American Public Health Association 1989) for analyses of water samples.

Plankton enumeration

Plankton samples were collected at fortnightly intervals following Dewan *et al.* (1991). Using a Sedgwick-Rafter cell, identification and enumeration of plankton were done following Bellinger (1992).

Harvesting of fish

At the end of the experiment, the fishes were recovered by repeated netting and de-watering the ponds. About 40% fish were measured to

determine the final growth and all the fishes were weighed for the estimation of total production.

Statistical analysis

For statistical analysis of the data, ANOVA was applied following Sokal and Rohlf (1991).

Results

Water quality

The values of water quality parameters such as temperature, transparency, p^H. DO, total hardness, total ammonia, phosphate and chlorophyll-a are presented in Table 1. These values were not found to be significantly different (P>0.05) when compared between the treatments.

Table 1. Mean values of water quality parameters under two treatments

Treatment	Treatment-I	Treatment-II	F ratio	Significance Lable
Water Temperature (°c)	27.55±0.25	27.72±0.01	1.49	NS*
Transparency(cm)	32.10±3.50	32.50±2.40	0.03	NS*
pH	7.20±0.13	7.18±0.06	1.01	NS*
DO (mg/l)	4.45±0.10	4.20±0.12	7.51	NS*
Total Hardness(mg/l)	114.54±16.84	104.81±8.12	0.84	NS*
PO_4-P (mg/l)	0.24±0.04	0.292±0.03	1.72	NS*
NH_3+NH_4 (mg/l)	0.15±0.10	0.14±0.02	0.03	NS*
Chlorophyll-a (µg/l)	69.75±29.83	44.57±3.53	2.10	NS*

**NS= Not significant (P > 0.05)*

Plankton

Phytoplankton population mainly comprised four major groups: Bacillariophyceae, Chlorophyceae, Cyanophyaceae and Euglenophyceae (Table 2). Chlorophyceae was the most dominant group and was represented by a large number of genera in both the treatments. Cyanophyceae was the second largest group of plankton while the third largest group was the Euglenophyceae. The phytoplankton population did not show any significant difference (P>0.05) in the two treatments.

Table 2. Mean abundance of plankton ($x10^4$) in two treatments

Treatment	Treatment-I	Treatment-II	F ratio	Significance
Phytoplankton				
Bacillariophyceae	3.50±0.66	3.250.25	0.390	NS*
Chlorophyceae	11.08±1.61	8.83±0.38	1.730	NS*
Cyanophyceae	7.25±4.56	5.42±0.381	1.150	NS*
Euglenophyceae	6.0±1.04	5.0±0.66	0.875	NS*
Zooplankton	6.34±1.04	5.20±1.28	1.700	NS*
Total plankton	33.17±7.34	27.70±2.52	1.590	NS*

**NS-Not significant (P > 0.05)*

The abundance of zooplankton comprising Crustacea and Rotifera was low in both the treatments. The mean abundance of zooplankton was 6.34 ± 1.04 x 10^4 cells /l and 6.33 ± 1.28 x 10^4 cells/l in treatment I and treatment II respectively. Though ozooplankton population was appeared high in treatment I but there was no significant difference (P>0.05) between the two treatments.

Growth and production of fish

The details of fish growth and production are presented in Table 3. The average survival of rohu in four months was 88% and 80% in treatment I and treatment II respectively. The mean final weights of fish were found to be 122.06 g and 109.73 g in treatment I and treatment II respectively. The net yield of fish in treatment I was 344 kg/ha, which was significantly higher(P<0.05) than that of treatment II (244 kg/ha).

Catla showed insignificant difference in growth (P>0.05) between the two treatments with survival rates of 92% and 88 %, average final weights of 147.60g and 135.30g and the net yields of 425.36 kg/ha and 352 kg/ha in treatment I and treatment II respectively, which showed significant differences (P<0.05) between the treatments.

Table 3. Growth, survival and production of fish under two treatments

Treatment	Fish species	At stocking			At harvest				Survival (%)		Net production (Kg/ha/4 months)
		Average initial wt. (g)	No. of fish	Total wt. (Kg)	Average final wt. (g)	No. of fish recovered	Total wt. (Kg)	Species wise	Average	Species wise	Total
	Rohu	4.85	25	0.12	122.06	22	2.70	88		344.00	
T-I	Catla	4.79	25	0.11	147.60	23	3.30	92	86.22	425.36	1,448
	Mirror carp	5.25	25	0.13	266.70	20	5.22	80		678.64	
	Rohu	4.85	25	0.12	109.73	20	1.95	80		224.00	
	Catla	4.79	25	0.11	135.30	22	2.75	88	85.70	352.00	1,127
T-II	Mirror carp	5.28	25	0.13	224.37	19	3.67	76		472.00	
	Mola	1.59	159	0.30	0.74	991	0.74			58.67	

** Mola reproduced during the experiment*

For mirror carp, the survival rates were 80% and 76%, average final weights of 266.7g and 224.37 g and net yields of 678 kg/ha and 472 kg/ha in treatment I and treatment II respectively. These values when tested statistically, showed significant differences ($P<0.05$).

In all the ponds under treatment II, the number of mola was higher than the initial number, as most of the mola had bred in the ponds. The average net production of mola was 58.67 kg/ha/4 months.

The monthly growth rate and specific growth rate (SGR) of fish in treatment I and treatment II are presented in Table 4. The specific growth rate (SGR) of mirror carp was the highest among all the species in both treatments whereas that of rohu was the lowest. All the species in treatment I showed higher growth than that of treatment II. The average net production of carps in polyculture without mola in treatment-I was 1448 kg/ha, while it was 1126 kg/ha in treatment-II with mola, where the contribution of mola was 58.67 kg/ha only. The total production was 29.41% higher in treatment-I where only carps were stocked. When the total net productions between the treatments were compared using ANOVA, there was a significant difference ($P<0.05$) between the treatments.

Table 4. Monthly average growth of fishes (wt.) in the two treatments

Treatment	Species	Initial	Growth (g)				SGR
		Weight (g)	Sept.	Oct.	Nov.	Dec.	(%)
I	Rohu	4.85	47.73	68.43	102.67	122.06	2.7
	Catla	4.79	56.63	88.63	121.27	147.60	2.8
	Mirror carp	5.28	40.30	91.20	124.70	266.70	3.3
II	Rohu	4.85	39.50	62.70	96.53	109.73	2.6
	Catla	4.79	58.06	81.13	102.67	135.30	2.8
	Mirror carp	5.28	51.10	90.23	119.73	224.37	3.1

Discussion

The water quality parameters were found within acceptable ranges in all the ponds and the fish were not found in a distressed condition at any time during the experimental period. However, dissolved oxygen and P^H were relatively low in all the ponds throughout the experimental period. Application of cattle manure and supplementary feed might have reduced dissolved oxygen to some extent and affected the p^H levels too. Ahmed (1993) also reported low dissolved oxygen and P^H levels from the fertilized and fed carp fingerlings ponds in Bangladesh. Total hardness, phosphate and total ammonia were within the ranges for semi-intensive fish culture and similar with the findings of Wahab *et al.* (1994), Dewan *et al.* (1991) and Azim *et al.* (1993).

With the four families of phytoplankton were represented by a number of genera found in tropical ponds as reported by Mollah and Aminul Hoque (1975), Dewan *et al.* (1991), Wahab and Ahmed (1991), Wahab *et al.* (1994) and Azim *et al.* (1995). Representatives of both chlorophyceae and cyanophyceae were present in higher numbers indicating a positive bearing on the greater survival of fish in general (Wahab *et al.*,1995). Both phyoplankton and zooplankton were decreased in numbers/liter in treatment-II where mola (*A .mola*) was introduced, as its main food consists of blue green and green algae, crustaceans and rotifers (Mustafa 1990).

Both fertilization and application of supplementary feed, resulted in better survival of all species in both the treatments. With the introduction of mola, the growth of rohu, catla and mirror carp was reduced to some extent. This might be due to the fact that mola competed for food and space with all of them. Miah and Dewan (1977) observed that rohu is an omnivore with preference for debris and decaying vegetation. Dewan *et al.* (1977) have reported that fry and fingerlings of catla were absolutely zooplankton feeders and showed a greater preference for animal food with increase in size. They also found that catla was strictly a surface feeder when small in size but fed in the middle and bottom layers as the size increased. Common carp prefers to feed on different food items at different sizes. Smaller fish prefer to feed on debris, animal and plant foods. Intermediate size fish are omnivore with a marked feeding preference for animal foods (Uddin 1981). It is clear from the present experiment that with stocking of mola, the growth of rohu and mirror carp is affected severely. It is suggested that mola may not be cultured with carps.

References

Ahmed, Z.F., 1993. Electivity index and dietary overlap of *Catla catla* (Hamilton) in fertilized and fed and fertilized ponds of Bangladesh. M.Sc. Thesis, Faculty of Fisheries, BAU, Mymensingh.

Azim, M.E, G.S. Talukder, M.A. Wahab, M.M. Haque and M.S. Haq, 1995. Effect of liming and maintenance of total hardness levels on fish production in fertilized ponds. *Progress. Agric.* , **6**(2): 7-14

AMERICAN PUBLIC HEALTH ASSOCIATION, 1989. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington, DC.

Bellinger, E.G., 1992. A Key to Common Algae. The Institution of Water and Environmental Management, London. 138pp.

Dewan, S., M. M. Ali and M. A. Islam, 1977. Studies on the size and patterns of feeding of fry and fingerlings of three major carps *viz. Labeo rohita* (Ham.), *Catla catla* (Ham) and *Cirrhina mrigala* (Ham.). *Bangladesh J. Agric. Sci.*, **2**(2) : 223-228.

Dewan, S., M.A. Wahab, M.C.M. Beveridge, M.H. Rahman and B.K. Sarker, 1991. Food selection, electivity and dietary overlap among planktivorus Chinese and Indian major carps fry and fingerlings grown in extensively managed , rain-fed ponds in Bangladesh. *Aquaculture and Fisheries Management*, **22** : 277-294.

IFADEP, 1996. Small Indigenous Species Culture in Bangladesh. Integrated Food Assisted Development Project (IFADEP). Technical Report No.1. Department of Fisheries, Government of Bangladesh, 3p.

Kohinoor, A.H.M., B.M.M. Kamal, S.M. Rahamatullah and M.A. Wahab, 1996. Research and achievement: Preliminary observation on the culture potential of three SIS, Mola, Chela and Punti. Paper presented at the seminar on "Small Indigenous Fish Species (SIS) culture in Bangladesh" organized by Department of Zoology, Rajshahi University, 12 December,1996.

Miah, J.U. and S. Dewan, 1977. Diel pattern of feeding of a major carp *Labeo rohita* (Ham.) in a Bangladesh pond. *Bangladesh J. Agric. Sci.*, **4** : 81-88.

Mollah, M.F.A. and A.K.M. Aminul Haque, 1978. Studies on monthly variations of plankton in relation to the physicochemical conditions of water and bottom soil of two ponds. *Bangladesh J. Fish.*, **1**(1) : 7-17

Mustafa, G., 1990. Composite Culture and Biology of Some Indigenous Fishes of Bangladesh. Ph.D. Thesis. Department of Zoology, Dhaka University. 145pp.

Sokal, R.T. and F.J. Rohlf, 1991. Biometry 2nd ed. W.H. Freeman and Co., New York.

Thilsted, S.H., N. Roos and N. Hassan, 1997. The role of small indigenous fish species in food and nutrition security in Bangladesh. *NAGA News Letter,* 13p.

Uddin, M.N., 1991. Food and feeding habit of common carp (*C. carpio*). M.Sc. Thesis, Department of Aquaculture and Management, Bangladesh Agricultural University, Mymensingh. 91pp.

Wahab, M.A. and Z.F. Ahmed, 1992. The effect of planktivorous carp species combination on food organism and electivity indices in the fish ponds. *Progress. Agric.*, **2**(2) : 21-30.

Wahab, M.A., Z.F. Ahmed, M.S. Haq and M. Begum, 1994. Compatibility of silver carps in the polyculture of cyprinid fishes. *Progress. Agric.*, **5**(2): 221-227.

Wahab, M.A, Z.F. Ahmed, M. Aminul Islam, M.S. Haq and S.M. Rahmatullah, 1995. Effects of introduction of common carp, *Cyprinus carpio* (L.) on the pond ecology and growth of fish in polyculture. *Aquaculture Research*, **26** : 619-628.

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