

Influence of stocking density on the culture potential of freshwater catfish *Pangasius pangasius* in pond

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Abstract

Influence of stocking density on the production of freshwater catfish *Pangasius pangasius* with formulated feed in ponds was studied. The fish fry were collected from the Meghna river near Chandpur which is a natural breeding ground of this fish. Three stocking densities chosen during this experiment were 5000, 8000 and 11000 fry/ha with an initial weight of 42.57 ± 2.51 g. The formulated feed was prepared in the laboratory which contained 45% fish meal, 30% mustard oil cake, 15% wheat bran and 10% rice bran to supply 40.48% protein in feed. The growth of *P. pangasius* in terms of net weight gain was 409.49, 266.49 and 236.37 g at the 5000/ha, 8000/ha and 11000/ha stocking densities respectively, which was statistically significant ($p < 0.05$). High food conversion ratio (FCR) was also observed during this research study which ranged between 7.06 to 7.72. A production of 2.6 tons/ha at the stocking density of 11000/ha; 2.13 tons/ha at the stocking density of 8000/ha and 2.04 tons/ha at the stocking density of 5000/ha was obtained, while the growth of individual fish at the end of experiment was in opposite order. The result of this experiment indicates that stocking density has significant influence on the culture potential of freshwater catfish *P. pangasius*.

Key words : *Pangasius pangasius*, Stocking density

Introduction

Among the farmed fish species cat fish is an important group of fish which is successfully being cultured in many countries of South Asia and South East Asia. Farming of freshwater scieilbeid cat fish *Pangasius pangasius* is particularly important because of its size and taste. In Bangladesh farming of this freshwater scieilbeid catfish in pond and lake has begun for the last few years. For profitable farming of this delicious fish an appropriate stocking density is essential to adopt in Bangladesh. Stocking density is an important parameter of fish farming which directly affect the growth of fish and hence its production (Backiel 1978). This fish is an open water fish migrates from the brackish estuarine delta to the middle or even rocky upper middle of the river Jamuna 1,000-2,000 km far from the estuaries (David 1963). *P. panganius* is known as a fluvial

anadromous fish attain a maximum length of 134 cm and a weight of 26 kg. Now a days this fish is under farming in pond and lake in many fish farm of Bangladesh.

In Bangladesh, commercial fish farming in pond and lake began with indigenous and exotic carp in last two decades but attempts for the culture of open water cat fish in such water bodies began only recently (in last few years). *P. pangasius* is such an open water catfish chosen by farmers for culture in pond and lake of Bangladesh considering the profit and market value, consumers acceptability, popularity as a delicious food. Hickling (1962) reported a good production of *Pangasius* spp. in Kampuchea and Thailand. *P. pangasius* is an omnivorous fish and takes crustaceans, insects, forage fish, mollusk, roots and other animal matters (Ali 1985). It generally grows in rivers, haor, baor, beels and flood plains with natural care. It is believed that culture of *P. pangasius* would be successful and profitable in Bangladesh due to its fast growth, wider tolerance in fluctuation of water condition, disease resistance and comparatively high market price as well as high demand. Another important fact is that this fish can easily be acclimatized to the artificial feed, as it is an omnivorous fish, in controlled conditions. In the past, this fish was abundant in natural water in Bangladesh. But due to ecological changes in the natural habitat, the production of this fish in natural water has declined seriously which necessitates the culture of this valuable fish on captivity. Culture of this fish was felt necessary for commercial profit as well as to save this valuable fish from the danger of extinction in this country. Some attempts have been taken to develop a culture technique or farming technique, feed formulation etc by the researchers (Ling 1967, Okamoto 1969, Bardach 1972, Hannan 1988, Rhman 1989). Results are being successfully adopted in fish farms for cat fish farming. But the influence of stocking density on the production of this important fish yet to be elucidated.

Thus the present study was designed to know the influence of stocking density on the production of *P. pangasius* in captivity. Although this fish is an open water fish the literature are available in favour of its successful culture in captivity. The specific objective of the present study was to find out the influence of stocking density on the average production and size of *P. pangasius* in natural pond.

Materials and methods

Study area and pond preparation

This experiment was conducted in six natural ponds of Riverine station of the Bangladesh Fisheries Research Institute at Chandpur. The area of each pond was 0.17 hectare and the depth of water was 1.30 ± 0.22 meter. Each pond was rectangular in shape, with an inlet for water supply. The banks (pond side) of each pond was high enough to prevent the inflow or overflow of water during heavy rain or flood. Undesirable vegetation was removed manually and unwanted fish were removed by repeated netting. The ponds were mainly rain fed but underground water was supplied by deep tube-well during the dry season in winter.

Collection and stocking of fish fry

The fish fry of the species *Pangasius pangasius* were collected in the month of August'88 from the Meghna river near Chandpur by the help of the fishermen, who caught these fish fry by box trap. The fish fry of almost same size and batch were transported to the experimental area keeping these fish fry in large circular tank made of corrugated iron filled with river water. Transportation was done as quickly as possible without undue delay to reduce mortality. On arrival to the experimental area only the healthy and naturally moving fish fry were released into the ponds which were previously been prepared for this experiment. Before releasing into the ponds the fish fry were graded for the desired ones by keeping them in an arena made of nylon cloth which was placed in the experimental ponds. Length and weight of each fry was recorded in centimeter and gram respectively before releasing into the experimental ponds. This is initial length and weight of fish fry of this experiment the average of which was 17.2 ± 2.01 cm and 42.57 ± 0.51 g respectively.

Design of experiment

In order to study the growth and production potential three treatments were given in the experiments each with two replications. Six experimental ponds were divided into three groups each group consisted of two ponds. A number of 850, 1360 and 1870 fish fry were released in duplicate into three sets of ponds maintaining a stocking density of 5000/ha, 8000/ha and 11000/ha respectively. The average length of the fish fry for this experiment was 17.20 ± 2.01 cm and the average weight was 42.57 ± 2.51 g. This is initial length and weight of the fish fry used in this experiment.

Fish feed preparation and feeding procedure

The fish feed was prepared by the locally available materials. Such materials were mustard oil cake (30%), rice bran (10%), fish meal (45%) and wheat bran (15%). The ingredients were weighed by a laboratory balance. The required quantity of mustard oil cake was soaked in water for 24 hours. This was done to remove toxic matters in the oil cake (if any). Required quantities of ingredients were mixed well manually with sufficient water in a plastic bowl. The feed was prepared just before feeding fish. The composition of feed ingredients and prepared feed is also stated in the Table 1 which was determined by laboratory analysis according to the official method of AOAC (1965).

After releasing into the experimental ponds the fish fry were allowed to acclimatize with the new captive environment for three days. During this time fish feed was not supplied to the ponds. Feeding began from the fourth day of releasing into ponds. The fish feed was supplied once a day in the morning between 9:00 to 10:00 a.m. at 5% (dry basis) of the body weight of fish in each pond. Feed requirement was re-adjusted once a month by measuring the growth of fish during this experiment.

Feed was prepared in moist form and supplied in the form of small ball in metal trays of 3' x 3' size. The trays were fixed at the two corners of each pond tied up with poles. The trays were placed at 0.6 m below the water surface. The required quantity of

feed for each pond was supplied in two trays so that the fish did not have to crowd around one tray.

Fertilization of ponds

Pond fertilization was done by urea and triple super phosphate (TSP) three times during this experiment. The urea and TSP fertilization was done at a dose of 90 kg/ha and 150 kg/ha respectively. The first fertilization was done 10 days before the release of fish fry into the ponds. Fertilizers were applied by spreading into the ponds.

Sampling procedure

Regular sampling was done to determine the growth of fish by catching fish from each pond by a seine net in every month. Sampling time was 9:00 a.m. in the morning. The growth in length and in weight was measured with the help of scale graduated in centimeters and a balance respectively. The data was recorded to calculate the growth of fish.

Limnological condition of pond water

Limnological condition particularly physico-chemical parameters of pond water was measured during this experiment. The following parameters were measured during this experiment:

Temperature : Recorded by a centigrade thermometer at 9:00 a.m.

pH : Recorded by a fisher Accument digital pH/ion meter (Model No. 420).

Dissolved Oxygen and Carbon dioxide: Determined according to the methods of APHA (1971).

Results and discussion

Result of the laboratory analysis on proximate composition of feed ingredients and that of fish feed are stated in Table 1. The protein level of the formulated feed used in the present study for the culture of *Pangasius pangasius* in ponds was 40.48%. Fish meal and mustard oil cake were the main source of protein for the fish of this experiment. The protein level was chosen on the basis of some previous studies where 40% protein in formulated feed resulted better growth of catfish (Deyoe and Tiemeier 1968, Cruz and Laudencia 1976, Rahman *et al.* 1982 & 1987, Sanaullah *et al.* 1986).

Table 1. Proximate composition of feed ingredients and fish feed

Feed ingredients	(% dry weight basis)					
	Dry matter	Crude protein	Fat	Ash	Crude fibre	N-Free extract
Fish meal	91.5	59.8	6.00	18.5	1.00	6.20
Mustard oil cake	84.96	32.98	17.5	8.75	12.97	12.76
Wheat bran	89.2	17.02	4.5	15.5	13.00	39.18
Rice bran	89.5	11.32	4.5	17.02	14.2	42.46
Fish feed	11.00	40.48	9.07	14.97	7.71	16.72

In all groups, *Pangasius pangasius* soon became accustomed to the experimental feed and were been observed to take formulated feed actively. Experimental fish did not suffer any mortality during this study. The growth of fish cultured in natural ponds with formulated feed is mentioned in Table 2. Data of Table 2 indicate that the growth of the experimental fish in the natural ponds is promising. High food conversion ratio (FCR) was also observed during this study which ranged between 7.06 to 7.72. The data stated in Table 2 indicate that the best growth was obtained with the stocking density of 5000/ha which was statistically significant ($p < 0.05$). High food conversion ratio (FCR) was also observed during this study which ranged between 7.06 to 7.72. The growth performance gradually declined with the increasing stocking density of 8000/ha and 11000/ha respectively. To elucidate the effect of initial weight of fish on growth performance, difference in weight gain of the experimental fish was calculated in percent weight gain. The growth of *P. pangasius* in terms of net weight gain was 409.49, 266.49 and 236.37 g at 5000/ha, 8000/ha and 11000/ha stocking densities respectively. The whole experiment was conducted for a period of 10 months. The production of fish was calculated in terms of ton per hectares of pond area. This resulted a production quantity of 2.6 tons/ha at the stocking density of 11000/ha; 2.13 tons/ha at the stocking density of 8000/ha; and 2.04 tons/ha at the stocking density of 5000/ha. But the growth of individual fish i.e. the average size of each fish at the end of experiment was in opposite order. Weight gain was highest (963%) at low stocking density of 5000/ha; followed by 626% at the stocking density of 8000/ha; and 555% at the stocking density of 11000/ha. That means the increase in stocking density retards growth performance of *P. pangasius* cultured in captivity. Some previous reports also support this fact (Mollah 1985, Okamoto 1969, Powell 1972).

Table 2. Growth of *Pangasius pangasius* in pond at various stocking densities

Mean values	Treatment 1	Treatment 2	Treatment 3
Initial weight (g)	42.57	42.57	42.58
Final weight (g)	452.53	309.06	278.95
Weight gain (g)	409.96	266.49	236.37
% Weight gain	963.02	626.00	555.12
Food Conversion Ratio (FCR)	7.06	7.58	7.72
Production (tons/ha)*	2.04	2.13	2.6

*Calculated value

Among the limnological factors particularly physico-chemical factors such as dissolved oxygen, free carbon dioxide, temperature, pH of water remained within the range suitable and productive for fish culture (Table 3). It is clear from the growth performance of the experimental fish that the above factors were within the tolerance limit of *P. pangasius*. The growth rate was higher in summer season and slower in winter. It is worthwhile to mention that water temperature of 32°C during summer fell down to 20°C in winter. Low water temperature might influenced the growth of *P. pangasius* in winter. It was true for all groups of fish in the experimental ponds at various stocking densities.

Table 3. Physico-chemical factors of pond water during *Pangasius pangasius* culture at various stocking densities

Stocking density	Water temperature (°C)	pH	Dissolved Oxygen (ppm)	Carbon dioxide (ppm)
5,000/ha	20.7 – 32.0	7.1- 8.0	3.5 - 5.4	5 - 8
8,000/ha	20.8 - 31.5	7.1- 7.7	5.3 - 6.0	5 - 7
11,000/ha	20.9 - 31.8	7.0 - 8.1	3.8 - 6.2	4.3 - 6.5

Proximate composition of fish muscle was almost similar in the fish cultured at various stocking densities (Table 4). The lipid percentage of *P. pangasius* caught from open water is usually higher than that of this fish in the present study. This is justified because of the average size of fish. In this experiment the final weight of each fish was between 310 and 450 g as against 4-5 kg on average in open water. Another fact may be the stocking density of fish, which resulted desired production in terms of weight of fish per unit area but the average size of individual fish remained much smaller than that of the open water species. Lipid is stored in fish muscle as well as in liver which is directly proportional to the size and age of fish.

Table 4. Proximate composition of *Pangasius pangasius* cultured in ponds at various stocking densities

Stocking density	Crude protein (%)	Lipid (%)	Ash (%)	Moisture (%)
5,000	18.35	2.98	2.48	76.16
8,000	18.27	2.89	2.75	76.29
11,000	18.25	2.75	2.82	76.16

We can summarize the findings of the present study as, growth of *P. pangasius* in natural pond is significantly different at various stocking densities. Growth of this fish is higher at lower stocking density if the weight of fish is considered as a measure of growth. Growth of fish gradually decline if the stocking density is higher. This is true if the weight of individual fish is taken into account. But if the total production in the

pond is considered the result is reverse. Highest production is obtained at highest stocking density. But such highest production per unit water area e.g. tons/ha is not always profitable. Because the average size of each fish farmed in pond is also important. The price and taste of this scheinbeid catfish depends on its size. Comparatively slight less production/ha with larger size of this fish usually get better price than that of slightly higher production with smaller size fish. People also prefer to buy larger size fish of this scheinbeid catfish to have a better taste and dietary satisfaction. There may be some exception if there is no market for such large fish. But usually there exists market for such large size fish in Bangladesh.

On the basis of the result obtained in this experiment we can conclude that the stocking density has significant influence on the farming of scheinbeid catfish *P. pangasius* in natural pond.

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