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Feasibility of indigenous yellowtail catfish *Pangasius pangasius* culture in earthen ponds

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Abstract: The feasibility of aquaculture of the critically endangered commercially important native Yellowtail catfish (*Pangasius pangasius*) was evaluated on the basis of comparative production performance between striped catfish (*Pangasianodon hypophthalmus*) and the experimental species following existing pangasiid culture system in Bangladesh. The study focused on the successful domestication and aquaculture of this high valued native species to overcome the financial losses in striped catfish enterprise due to repeated price fluctuation in recent years offering better profit. The results indicated that the growth performance of striped catfish was higher than Yellowtail; however, it revealed that Yellowtail culture is more profitable than striped catfish despite of lower growth rate considering the present market price. Average body weight increased from 17.82 to 151.11 and 18.09 to 396.67 g, specific growth rates were 1.19 and 1.71% per day and survival rate were 94.73 and 98.02% for Yellowtail and Striped catfish, respectively. The results of cost-benefit analyses showed that yields were 5598.67±41.17 and 14696.50±71.30 kg/ha; production costs were Tk.570247.10±4388.96 and Tk.949314.24±5242.69/ha and net profits were Tk.829244.87±7228.87 and Tk.5804.50±926.94/ha for Yellowtail and Striped catfish, respectively.
Key words: Yellowtail catfish, Striped catfish, earthen pond.

Introduction

Yellowtail catfish (*Pangasius pangasius*), a critically endangered species (IUCN Bangladesh, 2003), is one of the most commercially important riverine catfish. It is carnivorous and voracious in habit and occurs in freshwater tidal zone as juveniles, moves toward brackish water as sub-adults and finally as adults to river mouths and inshore areas (Rainboth, 1996). There are a number of catfish aqua farms all over Bangladesh producing mainly Striped catfish (*Pangasianodon hypophthalmus*), an exotic one, first introduced during early 90s from Thailand, very often face a huge loss due to very low margin profit compared to market price. Yellowtail catfish has been proved as a suitable species for culture in ponds or in cages by various scientists (Sarder and Mollah, 1991; Rahman, 1992). However, unavailability of seeds hindered the commercial culture of high priced Yellowtail catfish until now. Previously conducted experiments succeeded to produce spawn of Yellowtail catfish through artificial propagation (Khan and Mollah, 2004) although most of them died during development. During breeding season Yellowtail fry are notably found in the Meghna estuary (Chandpur), the Bakkhali estuary (Cox's Bazar) and some coastal waters of diluted salinity in Barishal and Patuakhali region, most of which are locally exploited for consumption. Restraining such destruction, introduction of these natural seeds in local ponds has ample potentials of production and conservation. Present study was undertaken to evaluate whether domesticated native Yellowtail has better production and profit potential in comparison to the exotic one.

Materials and Methods

The study was conducted during May to November 2011 at the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Six earthen ponds of 2 decimal with an average depth of 1.5 m each, prepared by conventional liming and fertilization, were used. Three ponds were stocked with fry of wild Yellowtail (*P. pangasius*) of average 17.82 g (±0.120) in weight and 13.29 cm (±0.137) in length while the other three with hatchery produced Striped catfish fry (*P. hypophthalmus*) of average weight 18.09 g (±0.075) and length 13.27 cm (±0.124). Fishes were fed daily with commercial pellet at the rate of 4-6% of the fish biomass in the pond. Random sampling was done in a monthly basis for the determination of length and weight. Based on the data, biomass of the fish was estimated and feeding was adjusted accordingly. Water quality parameters were recorded at a monthly interval. At the end of the six months grow-out period, the ponds were harvested by seine netting. The gross production per unit area, specific growth rates and survival rates were calculated. Feed conversion ratios and benefit-cost ratios were estimated by the following formulae.

$$\text{Food conversion ratio (FCR)} = \frac{\text{Feed fed (dry matter)}}{\text{Live weight gain}}$$

$$\text{Benefit-cost ratio (BCR)} = \frac{\text{Gross revenue}}{\text{production cost}}$$

The total yield of fish in experimental treatments were analysed for significant differences using the analysis of variance test.

Results and Discussion

From the very beginning of the study, Yellowtail (*P. pangasius*) showed lower growth performance as compared to Striped catfish (*P. hypophthalmus*) in terms of all the parameters. The features of different growth parameters are summarized in Table 1.

Growth performance:

During six months of rearing period, the average weight of Yellowtail increased from 17.82 g to 151.11 g and average length rose from 13.29 cm to 27.56 cm. However, the average weight of Striped catfish increased from 18.09 g to 396.67 g and average length increased from 13.27 cm to 32.93 cm (Fig. 1 and 2). Khan *et al.* (2004) found 70.05 to 116.67 g weight in Thai pangas (Striped catfish) during 50 days of experimental period with supplemental feeding. Khan *et al.* (2004) obtained SGR 0.02 to 0.68% for Striped catfish. Yellowtail showed to be higher FCR (2.85) efficiency than Striped catfish (1.82). Mukerjee and Majumder (1946) stated that the growth of fish was influenced by surrounding atmosphere which sequentially reflects on the reproductive activity of the fish. In the present study the observed variation in growth of the two experimental fish under similar ration was probably due to genetic variation.

In the present study the final growth of Striped catfish was much higher than Yellowtail despite of almost similar physico-chemical condition of water, for example, temperature, dissolved oxygen, pH, alkalinity, NO_3-N, NH_3-N, PO_4-P etc. were within suitable range in both treatments all through the study period. Moreover, water depth is an important parameter to ensure sufficient oxygen supply for successful growth of fish which is difficult to maintain in earthen ponds with lower depth. It might hamper the regular growth of fish. This case may have been happened to our experiment where the ponds were with low water retention capacity and sometime interruption of water supply due to mechanical problems with pumps.

Table 1. Comparative growth performance of Yellowtail catfish and Striped catfish during six months experimental period

Species	Mean weight (g) (Mean ± SE)		Mean length (cm) (Mean ± SE)		Percent gain (%) (Mean ± SE)		SGR (%/day) (Mean ± SE)	FCR (Mean ± SE)
	Initial	Final	Initial	Final	in weight	in length		
P. pangasius	17.82 ± 0.120	151.11 ± 1.110*	13.29 ± 0.137	27.5 ± 0.371*	747.97 ± 0.513*	107.38 ± 3.865*	1.19 ± 0.000*	2.85 ± 0.00*
P. hypophthalmus	18.09 ± 0.075	396.67 ± 1.925*	13.27 ± 0.124	32.93 ± 0.108*	2092.37 ± 10.678*	148.25 ± 3.096*	1.7 ± 0.003*	1.82 ± 0.00*

Values of the parameters in each row with * differs significantly (P<0.01) and others are non-significant

Specific growth rate (SGR):

The SGR (% per day) as recorded in the present study were 1.19 and 1.71 for Yellowtail and Striped catfish, respectively by feeding 35% protein feed which was close to 0.02 to 0.68% obtained by Khan *et al.* (2004) for Striped catfish. Availability of suitable feed in adequate amount is a crucial prerequisite for satisfactory growth of fish. In this experiment feed used was principally developed for Striped catfish. The poor performance of this diet for Yellowtail may be due to inefficient supply of nutrient required for the species. As a consequence the FCR was much higher in Yellowtail catfish (2.85) compared to Striped (1.82). Furthermore, lower growth rate of Yellowtail catfish compared to Striped catfish may be due to using natural seeds. Use of seeds produced in the captivity may give better results due to prior domestication.

Table 2. Survival rate (%) of fish during study

Species	No. of fish (Mean ± SE)		Survival rate (Mean ± SE)
	At stocking	At harvest	
P. pangasius	300 ± 0.00	284 ± 1.70*	94.73 ± 0.440*
P. hypophthalmus	300 ± 0.00	294 ± 0.82*	98.02 ± 0.154*

Values of the parameters in each row with * differs significantly (P<0.01) and others are non-significant

Survival rate:

Another important observation was that the survival rate of Yellowtail and Striped catfish was 94.73% and 98.02%, respectively (Table 2) which was nearly similar to 95.2%, 96.0% and 96.80% for Suchi catfish in a polycuture with Silver carp (*Hypophthalmichthys molitrix*) obtained by Azad (2006). The survival rate of native Yellowtail seeds collected from nature is very high which a good parameter for domestication and aquaculture.

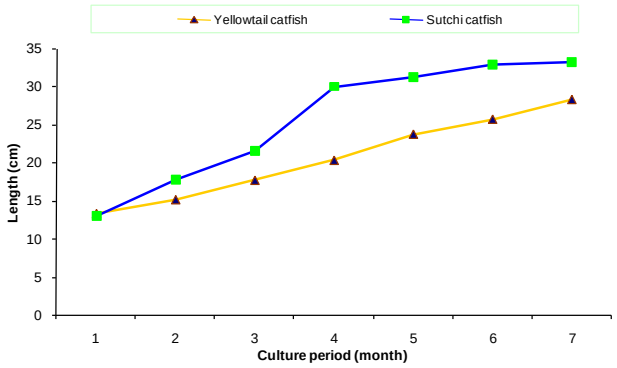

Fig. 1. Comparative growth performance of Yellowtail catfish and Striped catfish in length (cm) during 6 months of culture period

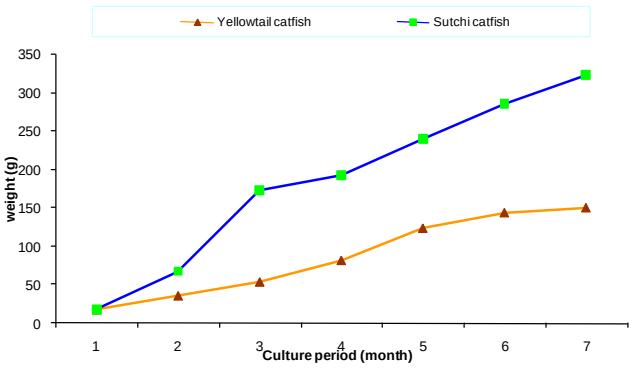

Fig. 2. Comparative growth performance of Yellowtail catfish and Striped catfish in weight (g) during 6 months of culture period

Water quality parameters:

In the present study average water temperature was 27.54 and 27.60ºC for Yellowtail and Striped catfish ponds, respectively. According to Islam (1997), temperature ranging from 18.5-33ºC was suitable for aquaculture. Dissolved oxygen content of the current study ranged from 7.29 to 8.40 mg/L. Alikunhi *et al.* (1971) suggested that good native water for fish cultivation should have a fair amount of DO level ranging from 5 to 7 mg/L. The pH of the present study ranged from 7.06 to 8.53 and the

alkalinity ranged from 65.07 to 82.26. Alikunhi *et al* (1971) stated that total alkalinity more than 100 mg/L should be present in highly productive waters. Nitrate and phosphate are the limiting factors for plant nutrient and are considered as the most important nutrients for fish culture. In the current study nitrate-nitrogen (NO_3-N) and phosphate-phosphorus (PO_4-P) were ranged from 0.13 to 0.17 mg/L and 0.04 to 0.18 mg/L, respectively. Lakshmanan *et al.* (1971) reported that nitrate and phosphate ranging from 0.04 to 0.18 mg/L and 0.03 to 0.14mg/L, respectively were considered suitable for fish culture. The mean values of different water quality parameters recorded from the experimental ponds are shown in Table 3.

Table 3. Variation (monthly interval) of water quality parameters in pond during six months experimental period

Water quality parameters (Mean ±SE)	Temp (ºC)	Dissolved oxygen (mgL^{-1})	pH	Alkalinity (mgL^{-1})	NO_3-N (mgL^{-1})	PO_4-P (mgL^{-1})	NH_3-N (mgL^{-1})
P. pangasius	27.54 ± 2.88	7.84 ± 0.38	7.87 ± 0.51	71.19 ± 6.43	0.16 ± 0.01	0.11 ± 0.06	0.54 ± 0.19
P. hypophthalmus	27.60 ± 2.96	7.96 ± 0.28	7.88 ± 0.32	70.90 ± 6.65	0.16 ± 0.01	0.11 ± 0.06	0.54 ± 0.18

Table 4. Economic analysis of Yellowtail and Striped catfish production at the end of the experiment

Parameters	*P. pangasius* (Mean ± SE)	*P. hypophthalmus* (Mean ± SE)
Pond re-excavation (Tk./dec)	150	150
Dyke preparation (Tk./dec)	100	100
Liming (Tk./dec)	15	15
Fertilization (Tk./dec)	35	35
Feed cost (Tk./kg)	30	30
Total feed cost (Tk.)	3,814.13 ± 35.54*	6,188.00 ± 30.02*
Price of fry (Tk.)	900	1200
Production cost (Tk./ha)	570,247.10±4388.96*	949,314.24±5242.69*
Farmgate price (Tk./kg)	250	65
Gross revenue (Tk./ha)	1399667.5	955272.5
Total production (kg/ha)	5,598.67 ± 41.17*	14,696.50 ± 71.30*
Net profit/ha (Tk.)	829,244.87 ± 7228.87*	5,804.50 ± 926.94*
Benefit cost ratio	2.45 ± 0.00*	0.00*

Values of the parameters in each row with * differs significantly (P<0.01) and others are non-significant

Cost-benefit analysis:

Gross production of Yellowtail catfish (*P. pangasius*) was 5,598.67 Kg/ha while it was 14,696.50 Kg/ha for striped catfish (*P. hypophthalmus*) which was significantly (P<0.01) higher the former (Table 4). Operational costs involved for this study are the cost of pond preparation, the purchase of fry, feed and fertilizers. Cost of labour has not been included. In the present study the per hactare gross cost were Tk.570,247.10 and Tk.949,314.24 and per hactare net profit were Tk. 829,244.87 and Tk.5,804.50 for Yellowtail catfish and Striped catfish, respectively. Akter (2001) calculated per hectare gross cost of *Pangasianodon hypophthlmus* production as Tk. 286,932.84 and total sale and net profit were Tk. 546,473.07 and Tk. 259,502.91, respectively. Kausari (2001) found that per hectare gross cost, gross return and net return were Tk. 7550,047, Tk. 1667,200 and Tk. 912,153 in Mymensingh. From this study it was observed that the gross cost was higher than the reports given by different authors. This might be due to use of only commercial pellet feed. Considering the present market price it was revealed that Yellowtail catfish culture resulted into much higher profit than striped catfish culture despite of lower growth. The features of cost-benefit for different treatments are presented in Table 4.

There are a number of risk factors responsible for huge finacial loss in Striped catfish buisness in Mymensingh region during recent years. High production cost, high price of quality feed, lower market price, high price of fingerlings, inbred fry produced in hatcheries, adulterated feed, poor technical knowledge etc. Islam (2009) also mentioned these factors as the major constraints of pangasiid catfish farming. The study carried out by Akter (2001) also depicted similar situation. Sometimes the farmgate price falls as low as Tk.50/kg in contrast to around Tk.60/kg production cost which derives no or very low margin profit. Farmers of this region often face a huge finacial loss because of this price fluctuation. In this situation successful domestication and introduction of high priced Yellowtail catfish aquaculture might be an effective mean to make the pangasiid enterprise of this region to be survived. As this fish is very popular for its delicate taste it is expected to pull off customers' attraction if cultured fish are marketed.

During breeding season a number of Yellowtail catfish fry are seen Meghna estuary near Chandpur and also in Bakkhali estuary near Cox's Bazar, Barishal, Patuakhali and even in Faridpur region. Therefore this species might be considered as a eurihaline one. Fry available in these

areas are mostly exploited by the fishermen for local consumption. Collecting those rather allowing destruction can be reared in local ponds of Chandpur and others. Moreover, in river *Dakatia*, Chandpur a huge water area is occupied by cage culture of tilapia. The experiment carried out in countries like Vietnam and Thailand revealed that cage culture of Striped catfish resulted higher production than pond culture. Since Yellowtail catfish is a fish of flowing water, the collected seeds may be reared and cultured in cages on the river ensuring the natural habitat of the fish which would generate employment opportunities for local people.

The BCR indicated that Considering the present market price it was revealed that Yellowtail catfish culture resulted into much higher profit than Striped catfish culture despite of lower growth. The present study indicates that Striped catfish performed well in terms of growth but its lower market price compared to production cost makes it less promising in overall production potential.

References

Akter, N. 2001. An economic analysis of pond pangas production in a selected area of Trishal *Upazila* in Mymensingh district. M.S. Thesis, Department of Agricultural Economics, BAU, Mymensingh, 89 pp.

Alikunhi, K.H., Sukumaran K.K. and Parameswaran S. 1971. Studies on composite fish culture: Production by compatible combinations of Indian and Chinese carps. *J. Inland Fish. Assoc.*, 1: 26-57.

Azad, M.A. 2006. Effects of feeding schedule on growth, production and economics of pangasiid catfish, *Pangasianodon hypophthalmus* and silver carp, *Hypophthalmichthys molitrix* polyculture in ponds. M.S. Thesis, Department of Fisheries Mangement, BAU, Mymensingh, 77 pp.

Islam, M.L. 1997. Impact of introduction of mola (*Amblypharyngodon mola* Ham.) in the polyculture with carps. M.S. Thesis, Department of Fisheries Management, BAU, Mymensingh, 41 pp.

Islam, M.S. 2009. Assessment of sustainability of panagasius (*Pangasianodon hypophthalmus*) farming in Mymensingh region. M.S. Thesis, Department of Fisheries Management, BAU, Mymensingh, 49 pp.

IUCN Bangladesh. 2003. Bangladesher Bipanno Bonno Prani , IUCN-The World Conservation Union. 294 pp.

Kausari, M.M.T. 2001. An economic study of pangas fish culture in selected area of Mymensingh and Jamalpur district. M.S. Thesis, Department of Agricultural Economics, BAU, Mymensingh, 89 pp.

Khan, M.H.K. and Mollah, M.F.A. 2004. Further trials on induced breeding of *Pangasius pangasius* (Hamilton) in Bangladesh. *Asian Fish. Sci.*, 17: 135-146.

Khan, M.M.R., Alam M.S., Barua S. and Bhuiyan M.H. 2004. Growth performances and morphological variations among Thai pangas, *Pangasianodon .hypopthalmus* collected from four different hatcheries in Mymensingh. *Bangladesh J. Prog. Agric.*, 15(1): 141-149.

Khan, M.M.R., Alam, M.S., Barua, S. and Bhuiyan, M.H. 2004. Growth performances and morphological variations among Thai pangas, *Pangasianodon .hypopthalmus* collected from four different hatcheries in Mymensingh. *Bangladesh J. Prog. Agric.*, 15(1): 141-149.

Lakshmanan, M. A. V., Sukumaran K. K., Murty D. S., Chakraborty D.P. and Philip M. T. 1971. Preliminay observations intensive fish farming in fresh water ponds by composite culture Indian and exotic species. *J. Indian Fish. Soc*., 2: 1-21.

Mukerjee, H.K. and Majumder, S.R. 1946. On the life history, breeding and rearing of *Anabas testudineus* (Bloch). *J. Dept. Sci.*, 2: 101-140.

Rahman, M.K. 1992. Aquaculture of *Pangasius pangasius*. Annual report (1989-1991). Fisheries Research Instiute, Riverine Station, Chandpur, Bangladesh. 20pp.

Rainboth, W.J. 1996. Fishes of the Cambodian Mekong. FAO species identification field guide for fishery purposes. FAO, Rome. 265 pp.

Sarder, M.R.I. and Mollah, M.F.A. 1991. Effects of supplemental feed on growth and production of pangas (*Pangasius pangasius*) in the ponds. *Prog. Agric.* 2: 83-87.