JFLS | 2018 | Vol 3(1) | Pp 9-15

Journal of Fisheries and Life Sciences
International Peer-Reviewed Biannual Journal
www.fishlifesciencejournal.com

Research Article

Production of Stinging Catfish (*Heteropneustes fossilis*) in different stocking densities with GIFT (*Oreochromis niloticus*) and Thai Sharpunti (*Barbonymus gonionotus*) in ponds

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ISSN: 2456-6268

ARTICLE INFO
Received: 17 January 2018
Accepted: 19 Aril 2018
Available online: 12 June 2018

KEYWORDS
Densities
GIFT Tilapia
Catfish
Stocking
Thai Sharpunti

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ABSTRACT

Stinging Catfish (*Heteropneustes fossilis*) was cultured with Genetically Improved Farmed Tilapia-GIFT (*Oreochromis niloticus*) and Thai Shrpunti (*Barbonymus gonionotus*) in ponds over a period of 6 months from 15 March to 15 September 2017 to estimate the production of stinging catfish at different stocking densities. Six earthen ponds (0.06 ha) were divided into three treatments. Three treatments differing in stocking densities of *H. fossilis* such as 148, 200 (T1), 172,900 (T2) and 197,600 (T3) per hectare were tested with two replicates each. However, *O. niloticus* (4940 individuals/ha) and *B. gonionotus* (2470 individuals/ha) were stocked @ of 4940 and 2470 individuals/ha with *H. fossilis*. Mega commercial floating fish feed was used in ponds which containing 32 to 36% (prestarter 36%, starter and grower 32%) crude protein. The water quality parameters were recorded within the acceptable range for fish culture. The final weight of *H. fossilis* was found 59.70±1.4g in T1 which showed the better performance followed by T2 and T3. Significantly ($p < 0.05$) better FCR and survivals was found in T1 followed by T2 and T3. Considering the survivals, the highest gross production (kg/ha) of *H. fossilis* was recorded in T2 (7415.12±214.22) followed by T1 (7133.74±120.39) and T3 (6529.45±62.12). But highest benefit was found in T1 (BDT 151, 7771) followed by T2 (BDT 125, 5470) and T3 (BDT 636,779) which indicate T1 is more efficient and profitable culture technology to produce *H. fossilis* in ponds. So, it could be concluded that, *H. fossilis* might be suggested to culture in ponds with *O. niloticus* and *B. gonionotus* at the stocking density of 148,200 individuals per hectare.

INTRODUCTION

Fisheries sector plays a very important role in the national economy having a share of 3.69% in national GDP, almost one-fourth (22.60%) in agricultural GDP. About 60% of total required animal protein comes from fish (FRSS, 2015). Bangladesh is ranked fourth position in Inland fishery production just after China, India and Myanmar and fifth position in closed waters (FAO, 2014). About 1.5 million people are directly employed by this sector (DOF, 2012). Many ponds in our country have lost their water retention capacity day by day and retained water only 5 to 6 months in a year. These water bodies are being used mainly for household activities but some are still abandoned due to their derelict and marshy nature (Saokat *et al.*, 2017). But it should be used in fish culture technologies emphasis on short life cycle, faster growth, high market demand and require low inputs, such as shing *(Heteropneustes fossilis)*, GIFT(*Oreochromis niloticus*), Thai sharpunti (*Barbonymus gonionotus*) etc. (Gupta 1991; Borthakur *et al.*, 2007; Shah *et al.*, 2008 and Anani *et al.*, 2017).

H. fossilis is an indigenous stinging cat fish of South-East-Asia which have the above mentioned characteristics (Khan *et al.*, 2003 and Kohinoor *et al.*, 2012). The species is not only recognized for its delicious taste and market value but is also highly esteemed from nutritional and medicinal properties of view (Chakraborty and Nur, 2012). It remains high amount of iron (226 mg/100 g) and fairly high content of calcium compared to many other freshwater fishes (Saha and Guha, 1939). It is characterized by an accessory respiratory organ (air breathing organ) which enables it to exist for hours when out of water or in indefinitely oxygen-poor water and even in moist mud (Ali *et al.,* 2014). *H. fossilis* is known to be carnivorous, but under culture condition it responds to supplementary feeding with slaughter house waste, trash fishes, silk worm pupae, oil cake, rice bran, compost, bio-gas slurry in various proportions and combinations (Dehadrai, 1978). So, this species is very potential in seasonal water bodies of Bangladesh. But in recent years, the fish has become gradually been endangered as the natural habitats and breeding grounds of this fish has been severely degraded due to over exploitation, ecological changes, reduction of water bodies, application of pesticides in rice cultivation, release of chemical effluents from industrial plants and hydrological changes due to construction of flood control infrastructure (Khan *et al.,* 2003 and Kohinoor *et al.,* 2012). International Union for Conservation of Nature (IUCN) recorded this species as one of the threatened species in Bangladesh due to recent climate changes and destructive fishing practices in open water system (Khan *et al.,* 2000). To protect this fish from extinction and to conserve the natural stocks, development of culture technology for Shing (*H. fossilis*) is essential.

Since GIFT and Thai sharpunti reaches to market size as well as 4 to 5 months, so farmers can get quick return culturing these fishes. But lack of proper knowledge of appropriate culture techniques and unavailability of quality seeds of these species in time are found to be some of the major constrains at present time to disseminate the Bangladesh Fisheries Research Institute (Saokat *et al.,* 2017). So it is also very essential to estimate the cost benefit cost ratio of the culture technologies to the farmer so that they can easily understand how much of benefit they can get and more encouraged to culture *H. fossilis* with other faster grower and market demand species. Hence, the present study has been undertaken to estiamte the production of Stinging Catfish (*H. fossilis*) in different stocking densities with farmed tilapia (GIFT) and Thai sharpunti along with assessing the water quality parameters

MATERIALS AND METHODS

The experiment was conducted in six uniform farmer owned earthen ponds situated at near to Bangladesh Agricultural University Campus, Mymensingh, Bangladesh. The experiment was continued for a period of 6 months from 15 March to 15 September 2017. The ponds were rectangular in shape and the surface area of each pond was 15 decimal (0.06 ha) with an average depth of 5 feet. Water of the experimental ponds was drained out and all fish species and aquatic vegetations were removed. After drying, pond bottoms were treated with quicklime (CaO) at the rate of 1 kg/dec to kill harmful animals and pathogens. All the ponds were then filled with ground water at a depth of about 5 feet. Five days subsequent to liming, the ponds were fertilized with organic manure (cattle dung) at the rate of 1000 kg/ha, urea at the rate of 25kg/ha and TSP 25 kg/ha. Soon after the appearance of light-plankton bloom, all the ponds were stocked with short cycle and faster grower fishes such as Shing (*H. fossilis*), genetically improved farmed tilapia (*O. niloticus*) and Thai sharpunti (*Babonymus gonionotus*). At the stocking, fingerlings of *H. fossilis* and other fishes were stocked as per experimental design (Table-1). Fish are being fed commercially available Mega fish feeds at the rate of 9 to 5% body weight per day.

Table 1: Layout of the design with species composition and stocking density under three treatments

T	Species composition	Stocking densities ((No of fish/ha)	Average weight (g)
T1	Shing (*H. Fossilis*)	148200	3.15±0.06[a]
	GIFT (*O. Niloticus*)	4940	5.18±0.06[a]
	Silver barb (*B. gonionotus*)	2470	6.11±0.13[a]
T2	Shing (*H. Fossilis*)	172900	3.13±0.05[a]
	GIFT (*O. Niloticus*)	4940	5.21±0.16[a]
	Silver barb (*B. gonionotus*)	2470	5.95±0.07[a]
T3	Shing (*H. Fossilis*)	197600	3.10±0.12[a]
	GIFT (*O. Niloticus*)	4940	5.10±0.08[a]
	Silver barb (*B. gonionotus*)	2470	5.86±0.62[a]

Values in the same column for same species having the same superscript are not significantly different ($p > 0.05$); T= Treatments

From the second day of stocking, the fingerlings were fed two times at 9:30am and 5:00pm daily with Mega prestarter fish feed which containing 36% protein for the first two months. For the second two months used Mega starter fish feed containing 32% protein and the rest of two months used MEGA grower fish feed which containing 32% protein. Fingerlings were sampled fortnightly by using a ber jal and weight of fishes were measured by using a portable balance (Model HI 400EX) for the assessment of growth, health condition and feed adjustment.

Water quality parameters viz. temperature, dissolved oxygen (DO), water pH, transparency and total ammonia (NH3) were observed and recorded every fifteen days interval between 09.00 and 10.00 hr. Temperature (°C) and dissolved oxygen (ppm) were determined directly by a digital water quality analyzer Hanna DO meter (Model-HI 9146, Romania), pH by a digital pH-meter (Milwaukee pH meter, Model-PH55/PH56, USA), and transparency (cm) by a secchi disc and ammonia by using test kit. Total alkalinity was estimated following the standard method of Stirling (1985) and APHA (1992). Quantitative and qualitative estimates of plankton in the experimental ponds were also taken fortnightly. Ten liters of water, collected from different locations and depths of each pond were filtered through fine-meshed plankton net (25 µm) to obtain a 50 ml sample. The samples were preserved immediately with 5% buffered formalin in plastic bottles. Plankton density was estimated by using a sub-sampling technique. A Sedgwick-Rafter (S-R) cell was used under a calibrated compound microscope for plankton counting. Plankton cells in 10 randomly chosen squares were counted for quantitative estimation using the formula proposed by Rahman (1992).

At the end of experiments all the fishes were harvested by netting repeatedly with a ber jal from each and finally drying the ponds. All the harvested fishes were counted species wise and necessary data were recorded for analysis.

One-way analysis of variance (ANOVA) followed by Duncan's Multiple Range Test (Duncan, 1955) was conducted by SPSS 20 (Chicago, USA) to identify the significance level among the treatments. The level for statistical significance was set at 0.05%

RESULTS AND DISCUSSION

Water quality parameters

The mean values of physic-chemical parameters recorded during the experimental ponds were recorded and presented in Table 2. The water quality parameters were found to be more or less similar and all of the parameters were within the suitable ranges for fish culture. Fish culturists are more conscious about the maintenance of optimum condition of water quality parameters. The water quality parameters of water temperature, dissolved oxygen and pH were not significantly differ ($P > 0.05$) among the treatments but significantly difference ($P < 0.05$) were found in transparency, alkalinity and ammonia. The results of water quality parameters in Table 2 showed that the mean values of water temperature were 30.33±0.67, 30.58±0.58 and 31.42±0.35 °C in T1, T2 and T3, respectively. The lowest temperature was found in the month of March (28°C) whereas the highest in September (32.5°C). Dewan e*t al.,* (1991) reported a temperature range of 30.2 to 34.0°C (June to August), while Wahab *et al.,* (1996) recorded the same from 28.5 to 31.3°C (August to November) in their experiments with carps. Saokat *et al.,* (2017) recorded a temperature range of 24.58 to 33.00°C (March-August) in their experimental ponds of shing polyculture system. These findings are also more or less similar to that of the present study. The mean DO levels were 6.03±0.14 (T1), 5.87±0.18 (T2) and 5.61±0.19 (T3) mg/l with a range between 4.83 to 6.40 mg/l. The highest (6.03±0.14) and lowest (5.61±0.19) dissolved oxygen content were found in T1 and T3, respectively but there was no significantly differences ($P > 0.05$) among the treatments. The dissolved oxygen (DO) was lower in T3 where stocked with a high density of fish compared to low stocking density ponds. This might be due to the higher consumption rate of oxygen by the higher density of fish and other aquatic organisms that agreed with Boyd (1982). Saokat *et al.,* (2017) recorded dissolved oxygen ranging from 4.50 to 7.34 mg/l in polyculture of shing in seasonal ponds of greater northern region of Bangladesh. Similar results were also reported by Rahman *et al.,* (2017), Azhar *et al.,* (2017), Kohinoor *et al.,* (2012), Uddin (2002) and Monirozzaman and Mollah (2010) in various fish culture ponds. The oxygen content in the experimental ponds was within the good productive range. The mean values of pH were satisfactory level for fish culture. The mean values of pH were 7.38 ± 0.21, 8.03 ± 0.25 and 8.18 ± 0.13 in T1, T2 and T3 respectively. The mean pH values significantly no differences ($p< 0.05$) among the treatments. Kohinoor *et al.,* (2012) recorded pH value of 7.08 to 8.70 in shing culture ponds whereas Saokat *et al.,* (2017) reported the ranges of pH value from 7.31 to 7.49 in seasonal ponds of shing polyculture system. These results are agreed well with the present study. The water transparency values ranged from 23.0 to 56.0 cm with a mean value of 28.67±1.48, 38.17±2.39 and 46.33±3.13 in T1, T2 and T3, respectively. The mean transparency level was significantly higher ($p< 0.05$) in T3 than T1 and T2, which might be due to the reduction of the plankton population by higher density of fish (Rahman and Monir 2013 and Saokat *et al.,* 2017). The transparency of productive water bodies should be 40 cm or less according to Rahman (1992). The mean values of total alkalinity were 129.17±1.89, 140.50±3.92 and 151.83±4.7 in T1, T2 and T3, respectively. The highest total alkalinity was recorded in T3 and lowest in T1. The mean values of total alkalinity were significantly different ($p < 0.05$) among the treatments. Similar results were also found in the studies of Monir and Rahman (2013). The mean values of ammonia were 0.11±0.007, 0.15±0.009 and 0.20±0.017 in T1, T2 and T3, respectively. The highest ammonia were recorded in T3 (0.24) due to high stocking density and more amount of faecal materials were released in the ponds and lowest in T1 (0.09) due to lower stocking density than T2 and T3. Similar results were recorded by Saokat *et al.,* (2017) in Shing polyculture system at northern region of Bangladesh. It might be concluded that all of water quality parameters were within suitable range for fish culture.

Table 2: Physico-chemical parameters of water in the experimental ponds during the experimental period

Parameter	Treatments		
	T1	**T2**	**T3**
Water temp. (°C)	30.33±0.67[a]	30.58±0.58[a]	31.42±0.35[a]
DO (mg^{-}l)	6.03±0.14[a]	5.87±0.18[a]	5.61±0.19[a]
pH	7.83±0.21[a]	8.03±0.25[a]	8.18±0.13[a]
Transparency (cm)	28.67±1.48[c]	38.17±2.39[b]	46.33±3.13[a]
Total alkalinity (mg/l)	129.17±1.89[c]	140.50±3.92[b]	151.83±4.79[a]
Ammonia (NH_3) (mg/l)	0.11±0.007[c]	0.15±0.009[b]	0.20±0.017[a]

Values in the same row having the same superscript are not significantly different ($p > 0.05$).

Plankton population

During the experimental period, the total phytoplankton and zooplankton have been estimated from the experimental ponds and given in Table 3. Phytoplankton population mainly composed on Bacillariophyceae, Chlorphyceae, Cyanophyceae and Euglenophyceae. Among the four groups of phytoplankton, Chlorophyceae was found to be the most dominant group throughout the study period followed by Bacillariophyceae and Cyanophyceae in respect of total count. Euglenophyceae was the least abundant group. The total phytoplankton population was 10359±936 (T1), 10289±1024 (T2) and 10114±858 (T3) units/l, respectively. There was no significantly difference ($p > 0.05$) observed among the treatments in case of phytoplankton. The zooplankton abundance included Crustaceans and Rotifers. Among the zooplankton population, Crustaceans was the abundant group recorded during the experimental period. The total zooplankton populations were 5514±984, 4411±1103 and 3686±971 units/l in T1, T2 and T3, respectively. However, significantly lower ($p >0.05$) zooplankton was recorded in T1 might be due to the lower density of fish than those in T2 and T3. It seems likely that in the ponds where stocking density was high, consumption of plankton by the fishes was also high. However, the plankton population of the present study showed to be closely related with the findings of Rahman *et al.,* (2008) and Monir and Rahman (2015).

Table 3. Mean values (±SE) and ranges of plankton abundance (units/l) of pond water under different treatments during the study period

Plankton group	T1	T2	T3
	Phytoplankton		
Bacillariophyceae	3062±442[a]	3098±343[a]	2987±391[a]
Chlorophyceae	3645±322[a]	3592±501[a]	3641±362[a]
Cyanophyceae	1881±521[a]	1845±485[a]	1798±321[a]
Euglenophyceae	1771±231a	1754±312[b]	1688±398[b]
Total	10359±936[a]	10289±1024[a]	10114±858[a]
	Zooplankton		
Crustacea	3355±387[a]	2784±423[b]	2231±581[c]
Rotifera	2159±208[a]	1627±406[b]	1455±388[c]
Total	5514±984[a]	4411±1103[b]	3686±971[c]

Values in the same row having the same superscript are not significantly different ($p > 0.05$).

Growth performances and production

The mean initial weight, final weight, weight gain, specific growth rate (SGR%/day), survival rate and production of fishes were recorded during the study period and summarized in Table 4. There was no significant variation in initial weight of various species among the treatments but in case of final weight, weight gain, SGR and production of *H. fossilis*, *O. niloticus* and *B. gonionotus* in ponds varied on different stocking densities. The mean final weight of *H. fossilis* in T3 (45.38±0.64g) was significantly lower (p>0.05) than T1 (59.70±1.47g) and T2 (54.65±1.18g) but no significant variation between T1 and T2. The mean final weight gain of *H. fossilis* in different treatment was 56.55±1.53g, 51.52±1.13g and 42.28±0.52g in T1, T2 andT3, respectively. The value of weight gain in T3 was significantly lower (p>0.05) than T1 and T2 due to higher stocking density in T3. The highest weight gain was recorded in T1 but there was no significant difference in T1 and T2. Specific growth rate (SGR %/day) in T1 (3.46±0.04) was significantly higher (p<0.05) than T3 (3.19±0.01) but not T2 (3.37±0.02). In case of *O. niloticus* and *B. gonionotus*, T1 showed highest growth performance than T2 and T3. This is because a relatively less number of *H. fossilis* of similar size in a pond could get more space, food, less competition and dissolved oxygen etc. Although same feed was supplied in all the treatments at an equal ratio. The results also indicated that higher growth rate was always observed at lower stocking densities in the experiment of shing polyculture suystem (Saokat *et al.*, 2017). More or less similar growth performance was observed by Kohinoor *et al.*, (2012) who recorded the growth 49.50 to 69.42 g from six months cultured of *H. fossilis*. The lower growth performances of *H. fossilis* were observed in T3 might be due to competition for food and habitat for higher number of fingerlings. Stocking density is known to be one of the important parameters in fish culture. The present results coincided with the related previous findings (Narejo *et al.*, 2005, Saokat *et al.*, 2017). Survival rate of *H. fossilis* observed 80.65±0.63, 78.47±0.58, 72.84±1.72 in T1, T2 and T3, respectively. Significantly higher (p< 0.05) survival was recorded in T1 than T2 and T3 where the stocking density was lower than T2 and T3. Same trends of survival rate were recorded for *O. niloticus* and *B. gonionotus*. Survival was found to be negatively influenced by stocking densities. The reason for reducing survival rate in treatment T2 might be due to higher stocking density of individuals as well as competition for natural food and space in the water area of pond which is supported by Haque *et al.*, (1994) and Chakraborty *et al.*, (2005). Feed Conversion Ratio (FCR) was recorded 2.84±0.07, 3.04±0.03 and 3.46±0.12 in T1, T2 and T3, respectively. The lowest FCR was recorded in T1 where the lowest number of fingerlings was reared which indicated the best feed utilization. FCR in T1 is significantly differ (p<0.05) from T2 and T3. Table-3 clearly showed that the FCR was decreased in the population of T1 than that of the T2 and T3 which is supported by Pechsiri and Yakupitiyage (2005) and Saokat *et al.*, (2017). The FCR values of different t reatments were acceptable and indicated better food utilization, which is agreed by Islam (2002). The mean gross productions of *H. fossilis* were 7133.74±120.39, 7415.12±214.22 and 6529.45±62.12 kg/ha/6 months in T1, T2 and T3, respectively. The production of *H. fossilis* in T2 varied significantly higher (p<0.05) than T1 and T3. However, the production of *O. niloticus* and *B. gonionotus* were 1463.57±1.60 and 483.59±4.82, 1311.01±2.04 and 426.05±3.29 and 1187.28±2.47 and 375.14±5.19 kg/ha/6 months in T1, T2 and T3, respectively. The total production of *H. fossilis* including *O. niloticus* and *B. gonionotus* was 9080.90, 9152.18 and 8091.87 kg/ha/6 months in T1, T2 and T3, respectively. Fish production of *H. fossilis* were found higher in T2 (9152.18 kg/ha/6 months) followed by T1 (9080.90 kg/ha/6 months) and T3 (8091.87 kg/ha/6 months) where the stocking density of *H. fossilis* was 172,900 piece/ha. The growth and survival decreased with increased stocking density, but the total production did not maintain the same trends. In the present study the stocking density of *H. fossilis* 172,900 piece/ha showed the better result in term of total production. The present result agreed with the findings of Narejo *et al.*, (2005), Siddik (2007) and Saokat *et al.*, (2017).

Economic analysis

A simple benefit-cost analysis (BCA) was done to know the profit level of the studied three types of culture systems. The total cost of production (Tk./ha) was consistently lower in T1 (156,9585) than those in T2 (174,44503) and T3 (179,6649) (Table 5). Highest net benefit (Tk./ha) was obtained in T1 (151,7771) followed by T2 (125,5470) and the lowest in T3 (63,6779). Saokat et al. (2017) estimated the benefit cost ration and profitability of shing culture in seasonal water bodies in greater northern region of Bangladesh and got the net benefit of BDT 959,116.04/ha/150 days. Rahman *et al.*, (2013) recorded the cost and benefit of Thai koi, *Anabas testudineus* (Bloch) in monoculture system and got the net benefit of BDT 69,277.32/ha/6 months. More or less similar benefit was found by Khan *et al.*, (2003) when culture of stinging catfish (*Heteropneustes fossilis*, Bloch) at different stocking densities in earthen ponds. In the present experiment, the net benefit was found higher than the above findings.

CONCLUSION

The feeding frequency and species combination of *O. niloticus* and *B. gonionotus* were same under different treatments but survival, growth and productions were found different which might be due to different stocking densities of *H. fossilis*. From the present study, it can be suggested that the stocking density of *H. fossilis* is advisable 148200 pieces/ha when culture with *O. niloticus* and *B. gonionotus* in ponds for better economic efficiency. So, further study is needed to optimize the culture technique (such as nutrient requirements, effects of physiochemical parameters and feeding frequency) for better growth, more production and benefit.

Table 4: Growth performances and production of shing (*H. fossilis*) under the three treatments during the culture period

Morphometric parameters	Species	T1	T2	T3
Initial mean wt. (g)	*H. fossilis*	3.15±0.06[a]	3.13±0.05[a]	3.10±0.12[a]
	O. niloticus	5.18±0.06[a]	5.21±0.16[a]	5.10±0.08[a]
	B. gonionotus	6.11±0.13[a]	5.95±0.07[a]	5.86±0.62[a]
Final mean wt. (g)	*H. fossilis*	59.70±1.47[a]	54.65±1.18[a]	45.38±0.64[b]
	O. niloticus	328.82±5.77[a]	310.48±1.70[b]	298.83±2.40[b]
	B. gonionotus	227.58±3.17[a]	208.12±2.89[b]	190.63±5.90[b]
Mean weight gain(g)	*H. fossilis*	56.55±1.53[a]	51.52±1.13[a]	42.28±0.52[b]
	O. niloticus	323.64±5.71[a]	305.27±1.54[b]	293.73±2.47[b]
	B. gonionotus	221.47±3.30a	202.18±2.96[b]	184.77±5.28[b]
Specific growth rate (%/day)	*H. fossilis*	3.46±0.04[a]	3.37±0.02[a]	3.19±0.01[b]
	O. niloticus	4.48±0.01[a]	4.82±0.04[b]	4.80±0.02[b]
	B. gonionotus	4.43±0.03[a]	4.35±0.05[b]	4.27±0.02[b]
Survival rate (%)	*H. fossilis*	80.65±0.63[a]	78.47±0.58[b]	72.84±1.72[c]
	O. niloticus	90.13±1.68[a]	85.47±1.39[b]	80.44±1.49[c]
	B. gonionotus	86.01±1.44[a]	82.90±1.10[b]	79.71±1.15[c]
FCR (Feed conversion ration)	*H. fossilis*	2.84±0.07[c]	3.04±0.03[b]	3.46±0.12[a]
Species-wise production (Kg/ha/6 month)	*H. fossilis*	7133.74±120.39[b]	7415.12±214.22[a]	6529.45±62.12[c]
	O. niloticus	1463.57±1.60[a]	1311.01±2.04[b]	1187.28±2.47[c]
	B. gonionotus	483.59±4.82[a]	426.05±3.29[b]	375.14±5.19[c]
Total production (Kg/ha/6 month)		9080.90	9152.18	8091.87

Values in the same row having the same superscript are not significantly different ($p > 0.05$).

Table 5. Cost and profit from analysis of Shing (*H. fossilis*) culture with *O. niloticus* and *B. gonionotus* from one hectare ponds for a period of 6 months

Item	Amount (TK)/ha/6 months			Remarks
	T1 (BDT)*	T2 (BDT)	T3 (BDT)	
A. Cost				
1.Pond lease value	32,110	32,110	32,110	Tk. 260.00/decimal/year (Local rate, Mymensingh region)
2.Interest of operating capital	1,605	1,605	1,605	10% interest according to Bangladesh Krishi Bank, Bangladesh
3. Price of fingerlings				
1. Shing	296,400	345,800	395,200	@TK. 2.00/Piece
2. GIFT	9,880	9,880	9,880	@TK. 2.00/Piece
3. Sharpunti	2,470	2,470	2,470	@TK. 1.00/Piece
4. Feeds	11,14,290	12,39,808	12,42,554	
5. Lime	9,880	9,880	9,880	
6. Fertilizer	5,950	5,950	5,950	(Urea, TSP and Cowdung)
5. Human labour cost	72,000	72,000	72,000	02 labour (@TK. 6000/month)
8. Miscellaneous	25,000	25,000	25,000	Oxy flow, carrying, netting etc
Total Cost	**156,9585**	**174,4503**	**179,6649**	
B. Return				
1. Shing	28,53,496	28,17,746	22,85,308	Market price related with size (TK. 400, 380 and 350/kg of shing in T1, T2 and T3, respectively)
2. GIFT	160,993	131,101	106,855	(TK. 110, 100 and 90/kg GIFT in T1, T2 and T3, respectively)
3. Sharpunti	62,867	51,126	41,265	(TK. 130, 120 and 110/kg of Sharpunti in T1, T2 and T3, respectively)
Total return	**30,77,356**	**29,99,973**	**24,33,428**	
Net Profit (B-A)	**15,17,771**	**12,55,470**	**6,36,779**	

*BDT 80.00 =1 US$

ACKNOWLEDGMENT

I wish to thank the Satota Fish Breeding Center and Hatchery and pond owners of Md. Mofazzol Hossain who helped for successfully conducting the experiments.

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