



Suitable Stocking Density Ensures Best Production and Economic Returns in Floating Cage Aquaculture System

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Authors' contributions

This work was carried out in collaboration among all authors. Author NN carried the research forward. Author MIH narrow down the research design and supervised whole research throughout. Author MMR contributed during monitoring, data tabulation and data analysis. Author PKD helped in writing development. Author MSI organized research visualization and correlations accordingly. All authors read and approved the final manuscript.

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ABSTRACT

The striped dwarf catfish *Mystus cavasius* being a least concern small indigenous fish it is necessary to protect the species from extinction in the near future. An experiment on production and economic feasibility of *Mystus cavasius* in cage was conducted for a period of six months from March to August 2020 in beel hilla at Naogaon district of Bangladesh. The study was carried out in nine cages (rectangular 8x5x2 feet size) under three treatments namely T₁, T₂ and T₃ performed with the stocking densities of 46 fry m⁻², 92 fry m⁻² and 137 fry m⁻² and designed each with three replications. The fish was fed with commercial pellet feed (containing 30% crude protein) twice daily at the rate of 5-7% of fish body weight. The total production was found to be significantly (p<0.05) highest in T₃ among the three treatments. The net profit was better in T₃ than T₁ and T₂ in terms of better production and money. So, stocking density of *Mystus cavasius* at the rate of 137 fry m⁻² in cage could be an economically feasible aquaculture technique for fish farmers.

Keywords: *Mystus cavasius*; stocking density; production; cage culture; beel.

1. INTRODUCTION

Since Bangladesh is densely populated and agricultural land is regularly losing due to urbanization, closed water bodies are limited to produce fish; and production has reached to high enough of its capacity, now is the time to introduce cages into river, wetlands, canals, etc. to increase fish production in a timely manner. Huge open bodies of water are still unutilized in Bangladesh. Cage culture may be the appropriate instrument for additional fish production in other Asian countries [1]. Although Asia is leading in cage farming for the past three decades, Bangladesh was and still is far behind despite enormous water resources.

A common problem in fish farming is multiple ownership of land. This leads to conflicts in determining the ownership of the fish produced and the use of water resources. In cage culture, the question of ownership is simple because the owners of the cages own the fish in it. The advantages of using cages are the use of existing bodies of water that are not currently used for feeding, storage and collection; lower costs of treatment or prevention of diseases, technical simplicity with which farms can be established or expanded, lower costs of capital compared to onshore farms, easy inventory management and tracking. Feed waste is released into the environment, either directly or indirectly, leading to accelerated eutrophication in this water and providing food for external fish species, as cage fish are generally fed a diet high in proteins [2]. Wastes from intensive fish farming (e.g., cage culture) have been reported to be potential fertilizers that can be reused to produce natural foods for filter-feeding species such as various species of carp [3]. Fish in fixed cages show poorer growth and a higher mortality rate earlier than fish in floating cages with rigid frames [4].

Bangladesh has diverse water resources, including 260 species of freshwater fish, 24 freshwater shrimp, 475 marine fish, 36 marine or brackish water shrimp, and 12 species of exotic fish [5]. Among freshwater fish, catfish is a rich and exceptionally diverse group of fish that make up the order Siluriformes. In Bangladesh, catfish farming is a lucrative business, although it is not grown throughout the country. In our country, especially *Gagata youssoufi*, *Heteropneustes fossilis*, *Ompok pabda* and *Mystus cavasius* are

species in danger of extinction (IUCN 2015). Catfish are robust fish that can survive in all regions and are easy to breed. Small commercial catfish farms are gaining popularity every day.

Mystus cavasius is a catfish of the Bagridae family of the Siluriformes order. It is commonly known as Gangetic *Mystus*, which has been reported to be common in India, Bangladesh, Pakistan, Nepal, Sri Lanka, Thailand, and Myanmar [6]. The fish is normally found in fresh water and is mainly available in rivers (both fast and slow flowing), canals, wetlands, ponds, ditches and flooded fields [7]; Rivers and tidal lakes have also been reported. It has a high market demand as edible fish with a high market price due to the good protein content of its meat. This small indigenous fish species is rich in proteins, micronutrients, vitamins and minerals that are not normally available in other foods [8]. It is also a species of economic importance for the aquarium industry in Bangladesh. Small native fish species are a valuable source of protein and minerals in the diet of the peoples of developing countries, since the approximate composition of *M. cavasius* showed that the muscle protein content was 16.16% in matter fresh and the calcium-phosphorus ratio of 1.44. % on a basis of dry matter [9]. *M. cavasius* is locally available small fish species with high levels of vitamins A, Fe and Zn and are therefore potential sources of micronutrients. For developing cage culture, species selection, fish size and cycle cultivation are important factors. *Mystus cavasius* is one of the least worrisome fish [10]. However, although cage culture of these species is not available in our country, it is necessary. This species can be protected from extinction in the near future by cultivating. The present research was aimed to measure the production performance and the economic feasibility of small indigenous fish species *Mystus cavasius* under different stocking density and to know the suitable stocking density in cage.

2. MATERIALS AND METHODS

2.1 Location and Duration

The cage culture of *M. cavasius* was carried out in beel hilla situated in Manda Upazilla, Naogaon district for a period of six months (March to August 2020). The area of beel was about 12.14 ha with an average depth of 2m. The beel was

circular shaped and fully exposed to available sunlight. The main source of water in beel was rainfall.

2.2 Experimental Design

The experiment was conducted in nine cages (rectangular 8x5x2 feet size) under three treatments each with three replications. Cage components consist of a bamboo frame, mesh or net and feeding ring. The cages were stocked with *Mystus* fish of different stocking densities at the rate of 46 fry/m², 92 fry/m² and 137 fry/m² and the average weight of fish was 5.0 g (Table 1). Fish fry was collected from Bogura fish farmers' ponds. Fishes were kept in conditioning hapa about one week for acclimatization. During this period, the fishes was fed on starter fish feed.

2.3 Feeding and Management

In each cage feed was provided by plastic tray, in the morning and afternoon at the rate of 7% of the biomass per day and reduced to about 5% gradually. Commercial pellet feed (Mega Feed Ltd.) was used for the feeding purpose. Stocked fish was sampled in each month by lift up the cage on the pond embankment to measure the growth rate, survival rate, fish disease and to estimate the amount of feed for the next month. Water quality data was collected fortnightly until the fish was harvested. The following parameters were used to monitor the growth and production of fishes under different treatments-

2.3.1 Weight

The initial weight of all fishes was recorded and the final weight was obtained after harvesting and it was expressed as (g).

2.3.2 Weight gain (g)

The weight gain was calculated as follows: Weight gain (g) = Mean final weight (g) – Mean initial weight (g) [11]

2.3.3 Length

The initial length of fishes was recorded at the starting period and the final length was recorded after harvesting and it was expressed as (cm).

2.3.4 Length gain (cm)

The length gain was calculated by using following formula:

$$\text{Length gain (cm)} = \text{Mean final length (cm)} - \text{Mean initial length (cm)}$$

2.3.5 Specific Growth Rate (SGR, % bwd⁻¹)

SGR was calculated as follows:

$$\text{Specific Growth Rate (SGR \%)} = \frac{[\text{Ln (final weight)} - \text{Ln (initial weight)}] / \text{culture period (day)}}{\times 100}$$

2.3.6 Survival rate (%)

Survival rate was calculated on the basis of total number of fishes during harvesting and it was expressed as %. The formula is as = (No. of fish harvested/ Initial No. of Fishes) ×100 [12]

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Feed given (g)}}{\text{weight gain (g)}}$$

2.3.7 Yield/Production

Yield was calculated as: Biomass at harvest – Biomass at stock

2.3.8 Economic Analysis

Economic analysis was performed to estimate the net profit from *M. cavasius* culture by using the following formula:

$$\text{Net benefit} = \text{Total revenue (Tk.)} - \text{Total cost (Tk.)};$$

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

Table 1. Showing the stocking density of three treatments under nine cages in beel Hilla

Treatments	Replicates	Cage No.	No./3.72 m ²	Average Weight (g)	Average length (cm)
T ₁	R ₁	01	170	5.00±0.59	7.16±0.53
	R ₂	02	170		
	R ₃	03	170		
T ₂	R ₁	04	340	5.07±1.01	7.06±0.45
	R ₂	05	340		

Treatments	Replicates	Cage No.	No./3.72 m ²	Average Weight (g)	Average length (cm)
T ₃	R ₃	06	340	5.03±0.57	7.00±0.55
	R ₁	07	510		
	R ₂	08	510		
	R ₃	09	510		
Total			3060		

NB: rectangular 8 feet x 5 feet size=40 ft² =3.72 m²

2.4 Water Quality Parameters

Water quality was monitored fortnightly. HACH kit (HACH, Loveland, CO, USA) was used to record physicochemical characteristics viz. temperature, pH, dissolved oxygen and alkalinity. Transparency was measured using a Secchi disc of 40 cm in diameter.

2.5 Data Analysis

After completing the phases of collecting data from field, data was summarized and scrutinized carefully before actual tabulation was done. Revealing the findings of the study, processed data was transferred to a master sheet. Then data was entered into the computer. All data was analysed statistically using SPSS software, after they were checked for normal distribution and homogeneity of variance. One-way ANOVA was used to examine treatment effects on weight gain, survival, growth and production. Pearson correlation plots were done in Past (v3). The significance of difference among the means was evaluated by using the Duncan's multiple range tests.

3. RESULTS AND DISCUSSION

3.1 Physico-Chemical Parameters

Suitable water quality parameters are prerequisite for a healthy aquatic environment. The mean values of physico-chemical parameters i.e., Temperature (°C), Transparency (cm), Dissolved oxygen (mg/l), pH and Alkalinity (mg/l) of water in the experimental ponds during the culture period were measured periodically (Fig. 1). For aquatic organisms, water temperature is one of the most vital factors as it influences other physical and chemical factors. Fish being poikilotherm animal, it has no means of controlling its' body temperature to change with that of the environment. In the present study, temperature of the wetland water ranged from 25.66± 3.33°C to 31.16± 1.66°C with an average 28.82±0.09 °C during the investigation

period which was within the suitable range for fish growth according to Boyd [13] who suggested that the range of water temperature of 26.06 to 31.97°C is suitable for fish culture. Mondal *et al.* 2010 reported that the range of water temperature from 15.3 °C to 28.5 °C whereas Bhatnagar and Devi [14] denoted that the desirable water temperature in fish pond was 20 to 30°C which showed similarity to the present study. In the present experiment, pH values in cages maintained the suitable range for fish culture and never exit the limit of suitability according to Swingle [15], and Ahmed [16] who reported the pH suitable for fish culture, 6.5 to 9.0 and 6.6 to 8.9. In a water body most suitable range of dissolved oxygen for fish culture was suggested from 5.0 to 8.0 mg/l [17]. Banerjee (1967) reported that the ponds were unproductive when oxygen ranged from 3 to 5 mg/l. Alikunhi [18] stated that a good pond for fish culture should have 5 to 7 mg/l. dissolved oxygen while Bhuyan [19] found that the DO of water ranging from 5 to 8 mg/l was within the good productive range which was more or less similar to the findings of the present study. The mean transparency value of the present study was not out of suitable range for fish culture according to Wahab *et al.* [20] who found transparency depth ranging from 15 to 74 cm where the fish were partially dependent on natural food besides supplementary feed. Boyd [13] suggested that water transparency between 15.0 to 40.0 cm is good for fish culture. Alkalinity concentration of the present study was between the range (45 to 180 mg/l) obtained by Uddin [21] but lower than that obtained by Rumpa *et al.* (2016) might be due to the variation of local characteristics of the soil and water, way of farming etc. However all the water quality parameters was suitable range for cage culture of *Mystus cavasius* in beel.

3.2 Growth and Production Performance

The growth and production performance of *Mystus cavasius* in terms of initial weight, final weight, weight gain, initial length, final length, length gain, specific growth rate (SGR %),

survival rate, feed conversion ratio and yield among the treatments are calculated (Table 2).

At the starting period the average initial body weight of *Mystus cavasius* fish was 5.00±0.42, 5.07±0.36 and 5.03±0.60 g in T₁, T₂ and T₃ respectively which turned into 47.90±0.15, 44.20±0.28 and 42.47±0.34 g as final biomass at the end of the experiment. Throughout the study the mean body weight of *Mystus cavasius* was always upper in T₁ than T₂ and T₃ under the three stocking densities which are presented by Fig. 2. The average weight gain was 42.90±0.07, 39.13±18 and 37.44±25 g in T₁, T₂ and T₃, respectively. The uppermost weight gain was obtained in T₁ and the lowest possible weight gain was in T₃. Significant difference (P<0.05) in case of average final body weight and weight gain was found among the treatments.

Kohinoor and Rahman 2015 from their 7 months study showed that at harvest, the average weights of *Mystus cavasius* in cage attained 24.67±1.76, 22.33±1.45 and 20±1.15 g, in treatments-1, 2, and 3, respectively which was minor than that obtained from the present study most probably due to higher stocking density (500, 600 and 700 fry m⁻³) in their experiment. The findings of the present study were also larger than that of Mou et al. [22] and Rahman1 et al. [23] perhaps due to short culture period of their study.

The average initial length and final length of fish was 7.16±0.53, 7.06±0.45 and 7.00±0.55 cm and 16.21±0.56, 15.60±0.6 and 15.31±1.42 cm (Fig. 3) where length gain was 9.05±0.49, 8.54±0.55, 8.31±0.67 cm in T₁, T₂ and T₃, respectively. Significantly (p<0.05) height length gain was found in T₁. Final length of *Mystus cavasius* in the present study was lower than the findings of Begum et al. (2008) might be due to the variation of cultured species.

In the culture period specific growth rate (SGR % day) of fish was 1.26±0.02, 1.21±0.031 and 1.19±0.031 for T₁, T₂, and T₃ respectively. Insignificantly (p>0.05) higher (SGR %) was in T₁ and lower in T₃. Ara et. al. [24] obtained SGR value of Gulsa Tengra, 1.24±0.05 in cge which has similarity with the findings of the present study but it was lower than the result came from the experiment of Mou et. al. [22], Rahman et. al. [23] and Hossain, et. al. [25] might be due to difference in stocking density, culture technique, feed utilized etc. There was a negative correlation (Fig. 3) between the specific growth rate (SGR %) and stocking density with higher significance (R²=0.9452). Higher stocking density lowered the SGR in the present study. Begum et. al. [26] and Rahman et. al. [23] also noticed the similar findings in their study.

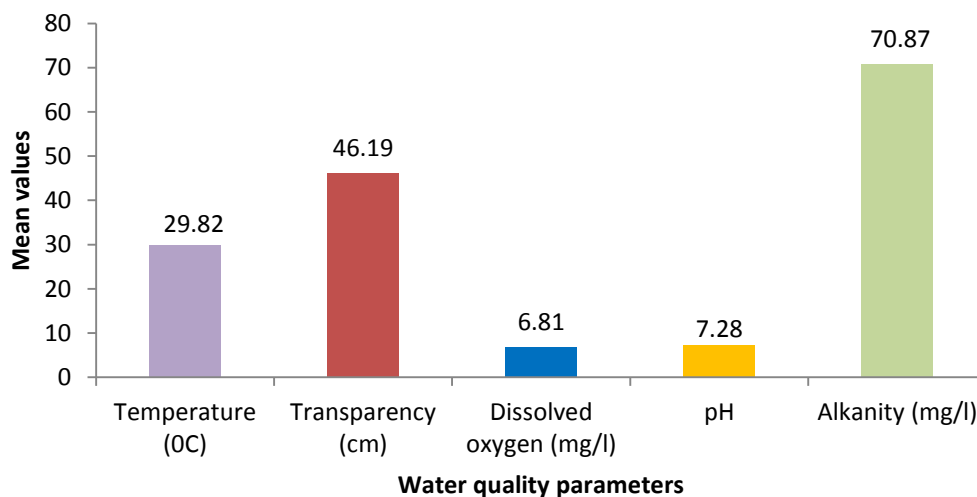


Fig. 1. Mean values of water quality parameters

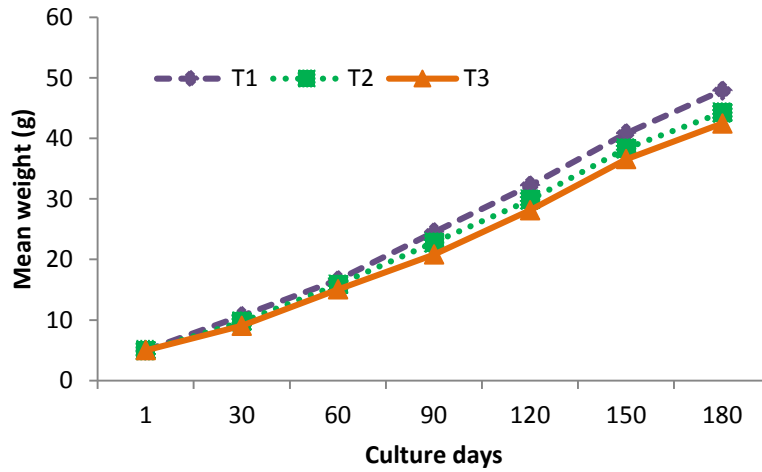


Fig. 2. Monthly mean weight (g) of *Mystus cavasius* under three treatments over a period of 180 days

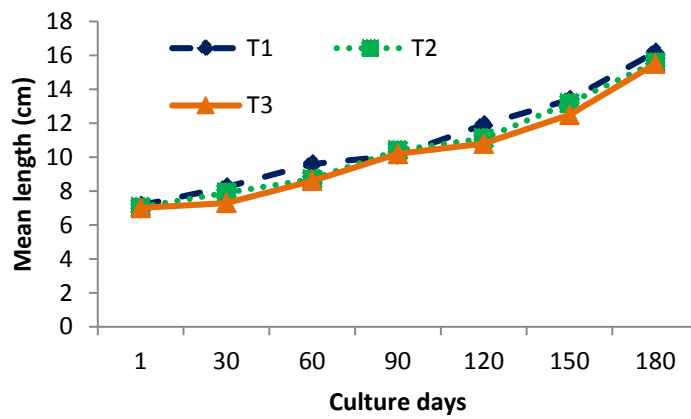


Fig. 3. Monthly mean length (cm) of *Mystus cavasius* under three treatments over a period of 180 days

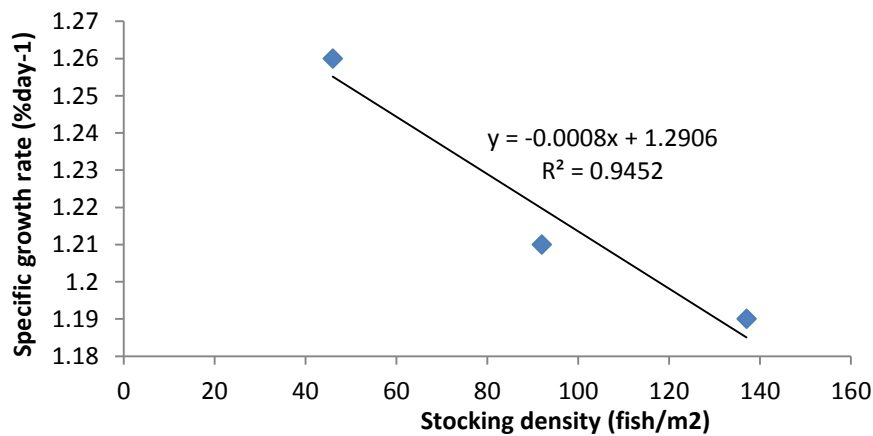


Fig. 4. Relation between specific growth rate (SGR %) and stocking density of *Mystus cavasius*

Average survival rate of *Mystus cavasius* was $98.00 \pm 2.0\%$, $96.00 \pm 3.0\%$ and $95 \pm 2.0\%$ for T₁, T₂ and T₃ respectively. Highly significant ($p < 0.05$) survival was found in T₁ and lowest was in T₃. Ara et al. [24], found survival rate of *Mystus gulio* 90.67 ± 2.00 whereas Siddiky et al. [27] found 50.17-64.41% survival rate of *Mystus gulio*. Kohinoor and Rahman (2015) also got lower survival rate of *Mystus cavasius* in cage system in the River Brahmaputra than the findings of the present study perhaps due to much higher stocking density in their experiment.

There was significant ($p < 0.05$) difference among the treatments in case of Feed Conversion Ratio (FCR) value. Higher FCR value was found in T₂ and lower was in T₃. FCR value in the present experiment found to be ranged between 3.27 ± 0.19 to 3.36 ± 0.15 among the treatments which was more or less similar to the findings of

Mou et al. [22] but higher than that obtained by Rahman et al. [23] and Begum et al. [26], perhaps due to variation in the amount and quality of utilized food. Pearson correlation were used to understand the effects of environmental parameters on growth parameters in each treatment of the experiment. Separately, Length (L2) and Weight (W2) observations during 2nd sampling showed significant positive correlations with pH and Transparency in T1 (Fig. 5A). Most of environmental parameters demonstrated positive correlations with L1 and W1 (1st Sampling) in T2 (Fig. 5B). On the other hand, temperature, transparency and DO showed correspondences with final length (L5) in T3 (Fig. 5C). Growth parameters affecting by suitable environmental conditions with favourable stocking density may be liable behind these scenario [23].

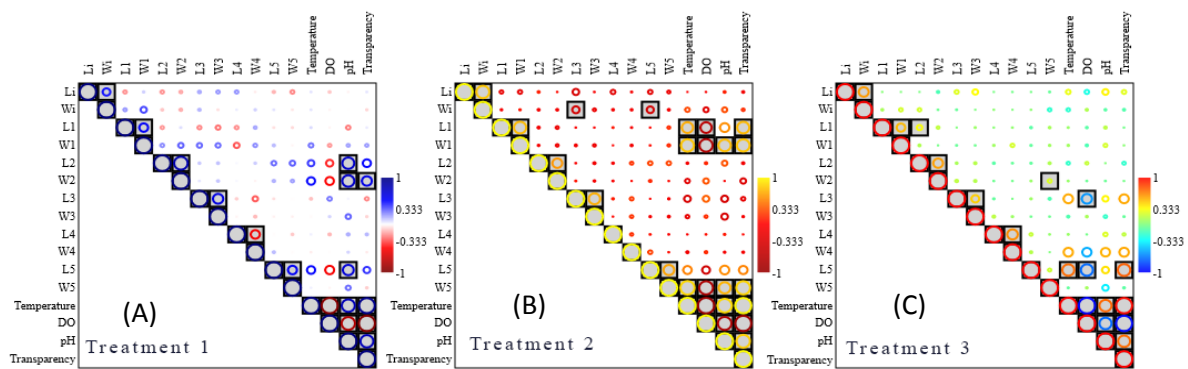


Fig. 5. Correlation among environmental factors and growth of *Mystus cavasius* in different treatments, where, Li = initial length, Wi =initial weight, L1 = length during 1st sampling, W1 = weight during 1st sampling, L2 = length during 2nd sampling, W2 = weight during 2nd sampling, L3 = length during 3rd sampling, W3 = weight during 3rd sampling, L4 = length during 4th sampling, W4 = weight during 4th sampling, L5 = length during 5th sampling, W5 = weight during 5th sampling

Table 2. Growth parameters of *Mystus cavasius* in three different treatments during 180 days of culture period

Growth Parameter	Treatment		
	T1	T2	T3
Initial average body weight (g/fish)	5.00±0.42 ^a	5.07±0.36 ^a	5.03±0.60 ^a
Final average body weight (g/fish)	47.90±0.15 ^c	44.20±0.28 ^b	42.47±0.34 ^a
Net average body weight gain (g/fish)	42.90±0.07 ^c	39.13±18 ^b	37.44±25 ^a
Initial average body length (cm)	7.16±0.53 ^a	7.06±0.45 ^a	7.00±0.55 ^a
Final average body length (cm)	16.21±0.56 ^a	15.60±0.6 ^b	15.31±1.42 ^c
Net average body length gain (cm)	9.05±0.49 ^a	8.54±0.55 ^b	8.31±0.67 ^c
SGR (% day)	1.26±0.02 ^a	1.21±0.03 ^a	1.19±0.03 ^a
Total feed apply (Kg/cage)	23.43±1.00 ^a	43.11±0.5 ^b	59.33±0.8 ^c
Survival rate (%)	98.00±2.00 ^b	96.00±3.00 ^a	95±2.00 ^a
Food conversion ratio (FCR)	3.28±0.1 ^a	3.36±0.15 ^b	3.27±0.19 ^a

Growth Parameter	Treatment		
	T1	T2	T3
Initial production (kg)	0.83±0. ^a	1.63±0.3 ^a	2.42±0.1 ^a
Gross production (kg/cage)	7.98±1.78 ^a	14.45±1.90 ^b	20.58±2.07 ^c
Net production (kg/ cage)	7.15±1.70 ^a	12.82±1.62 ^b	18.15±2.06 ^c

Different superscript letters within one row indicated statistically significant differences at $p < 0.05$.

Table 3. Production cost of *Mystus cavasius* under different treatment during the culture period

Particulars	Treatments		
	T ₁	T ₂	T ₃
Cage preparation cost (Tk)	266	266	266
Feed applies for 180 days (Kg)	23.43	43.11	59.33
Feed cost rate Tk/kg	20	20	20
Feed cost for 180 days (Tk)	468.6	862.2	1186.6
Fingerling's cost (Tk)	510	1050	1530
Labour cost (Tk)	650	650	650
Total Production cost (Tk/180 days)	1938.03	2891.31	3711.93
Total income (Tk)	3575	6410	9075
Profit	1637	3518	5363
Benefit-cost ratio	0.84	1.22	1.44

1 US\$ = BDT. 83.32 [31/08/2020]

After 180 days of the culture period, gross fish production averaged 7.98 kg against 0.83 kg of initial weight in T₁, 14.45 kg against 1.63 kg of initial weight in T₂ and 20.58 kg against 2.42 kg initial weight in T₃ (Table 2). Average net production in T₁, T₂, and T₃ was 7.15, 12.82 and 18.15 kg. Kohinoor and Rahman [28] obtained a total production of *Mystus cavasius*, as 8.14±0.22, 8.03±0.44 and 7.34±0.17 kg /m³ in their cages, whereas Begum *et al.* 2008 got a net production 54.10 kg/cage; Hossain *et al.* [25] found production of *M. gullio* as 6.81, 2.97 and 3.86 kg/ treatment in their experiment. In the present study, production was significantly ($p < 0.05$) highest in T₃ (where the stocking density was highest) subsequent T₁ and T₂. Fish production tends to increase with increasing the stocking density until the cage carrying capacity is reached. In the experiment, higher production of *Mystus cavasius* was observed at higher stocking density most probably due to being hardy species with good survival rate.

3.3 Benefit-cost Analysis

On the basis of input costs from fish seeds, feed, cage materials, labour cost and returns from total fish sale, benefit-cost ratio (BCR) of each treatment was calculated. As durable net cages were used so from the following years profit will

be higher than the initiating year, because of the fixed costs. The life time of cage is at least 20 years. Cage preparation cost was calculated by deducting scrap value from depreciation cost. Then the total cost was distributed to its life time. Total production cost was BDT. 1938.03, BDT. 2891.31 and BDT. 3711.93 for T₁, T₂, and T₃ respectively (Table 3). 23.43 kg, 43.11 kg and 59.33 kg feed were used for T₁, T₂, and T₃ respectively during 180 days of culture period. Gross production in value was BDT. 3575, BDT. 6410 and BDT. 9075 for T₁, T₂ and T₃ respectively. After economic analysis it was found that cost- benefit ratio was highest in T₃ (1.44) subsequent T₂ (1.22) and T₁ (0.84) respectively. In T₃ fishes attained smaller size due to its high stocking density compare to the other treatments but finally showed higher production by value. Increase in profit with increasing stocking density was reported in case of Asian river catfish [29]. Yengkokpam *et al.* [30] suggested that the most economic stocking density is the one which can yield higher biomass per unit area, highest net revenue and the highest BCR. Higher stocking density is better economically than the lower density reported by Zafar *et al.* [31]. The findings of the present experiment showed similarity with the findings of the above researchers.

Table 4. Comparisons of current findings with previous reports

Species	Treatments	Initial Length (cm)	Final Length (cm)	Initial Weight (gm)	Final Weight (gm)	Culture Days	Stocking Density (m ⁻³)	Survival rate (%)	Reference
<i>Mystus cavasius</i>	T1			5.1	22.67	120	100	90.67	Ara et al. (2020)
<i>Mystus gulio</i>	T1	0.4	31.15	0.003	0.46	42	200	89.25	Begum et al. (2008)
	T2		29.25		0.45		250	88.72	
	T3		25.44		0.41		350	76.20	
	T4		23.6		0.38		450	70.34	
<i>Mystus cavasius</i>	T1	1.24	7.68	0.11	3.52	56	20	65.67	Rahman et al. (2013)
	T2		6.65		2.61		25	57.67	
	T3		6.10		2.04		30	51.67	
<i>Mystus cavasius</i>	T1	1.41		0.36	21.41	120	571	99.28	Rahman et al. (2020)
	T2				22.96		714	99.25	
	T3				22.23		857	99.38	
	T4				21.87		1000	99.04	
<i>Mystus cavasius</i>	T1			1.04	24.67	210	500	66	Kohinoor et al. (2015)
	T2			1.30	22.33		600	60	
	T3			1.18	20.00		700	52	
<i>Mystus gulio</i>	T1				12.42	150	8	64.41	Siddiky et al. (2015)
	T2				12.13		12	53.26	
	T3				11.83		16	50.17	
<i>Mystus cavasius</i>	T1	7.16	16.21	5.00	47.90	180	170	98	Present Study
	T2	7.06	15.60	5.07	44.20		340	96	
	T3	7.00	15.31	5.03	42.47		510	95	

A comparison with previous studies showed that lower stocking density can increase the survival rate of catfish [32]. On the other hand, high stocking densities can lead to a comparative lower growth than other treatment [1]. It was also found that short culture periods lead to a lesser growth of length and weight of *Mystus cavasius* accordingly [2]. Present study showed that Lower stocking density increased weight and survival (Table 4). In addition, significantly low stocking density portrays higher mortality which should be investigated further for its actual cause [33,34].

4. CONCLUSIONS

It can be consolidated in conclusion that on the basis of economic return, 137 fish. m⁻² showed the maximum performance of all the stocking densities. So, stocking density of 137 fish/m² could be recommended for the effective cage culture of *Mystus cavasius*. The study has inferences of sustainable and cost-effective cage culture practices in beel environment. However, more research could be addressed on the fish stocking size and cage size.

DISCLAIMER

The products used for this research are commonly and predominantly used products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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