E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 76.37
(GIF) Impact Factor: 0.549
IJFAS 2022; 10(4): 13-16

www.fisheriesjournal.com
Received: 09-07-2022
Accepted: 10-08-2022

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Growth performance of *Pangasius sp.* cultured at different stocking density in floating net cages in Bijuri coalmine pond of Anuppur district (M.P.) India

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DOI: https://doi.org/10.22271/fish.2022.v10.i6a.2743

Abstract
The study deal with the comparative growth performance of *Pangasius sp.* cultured at different stocking density in floating net cages in Bijuri Coalmine pond of Anuppur district (M.P.). The experiment was conducted in 05 replications at 03 stocking densities in 15 floating net cages of the size -3.65 x 3.65 x 5.48 m (L x W x D). The stocking densities were- T_1 (2600 fish fingerling/cage), T_2 (2800 fish/cage) and T_3 (3000 fish/cage). During experiment of 60 days, the fingerlings of pangas (*Pangasius hypophthalmus* were fed on commercial floating pelleted feed given to fish @ 5 % of their body weight per day. The fishes were properly maintained for good health by regular feeding schedule and use of prophylactic measures and probiotics. The results indicated that the weight gain (NWG), specific growth rate (SGR), food conversion ratio (FCR) and gross conversion efficiency (GCE) were significantly different ($p < 0.05$) in all the treatments. Still, the significantly higher growth performance was observed in T_1. In this treatment NWG, SGR and GCE were the highest $289.570^c \pm 0.928$g, $1.698^c \pm 0.019$ and $0.852^c \pm 0.00$ respectively. The lowest FCR ($1.174^a \pm 0.004$) was also recorded in T_1 compared to all other treatments. The net yield in 60 days was maximum in T_3 (9.080/m^3) and per cent increase in biomass was maximum (176.955 %) in T_1. The fish growth was maximum at 30-45 days of observation which corresponds with water temperature of 24.56±2.16 °C, pH-8.02±0.11 and dissolved oxygen 8.28±0.14 mg/l. The higher Ponderal index was noticed in T_1 *i.e.* $2.403^b \pm 0.057$ indicating wellness of fish. Through this study we can recommended that in above conditions 2600 fingerlings of *Pangasius hypophthalmus* stocked in each floating net cage gives maximum growth and per cent increase in fish yield.

Keywords: Growth, *Pangasius sp*., cultured floating, net cages, Bijuri, Coalmine pond, Anuppur district.

Introduction

Cage culture is an emerging technology through which fishes are reared from fry to fingerling, fingerling to table size or marketable size while captive in an enclosed space that maintains the free exchange of water with the surrounding water body. A cage is enclosed on all sides with mesh netting made from synthetic material that can resist decomposition in water for a long period of time. The on-growing and production of farmed aquatic organisms in caged enclosures has been a relatively recent aquaculture innovation. However, the origins of the use of cages for holding and transporting fish for short periods can be traced back almost two centuries ago to the Asian region (Pillay and Kutty, 2005) [10]. Modern cage culture in open water-bodies, probably originated in Japan in early 1950s.

Among various candidate fish species, *Pangasius sp*. is cultured due to its good market demand and fast growth. Few countries dominate its culture production. Being the third most important freshwater fish group within aquaculture sector, Pangasius is now cultured in several countries in the world like Thailand, Nepal, Pakistan, India, Bangladesh, Vietnam, Laos, Maynmar, Indonesia, and Cambodia. Pangasius is an air-breathing fish that can tolerate low dissolved oxygen (DO) content in the water and can be cultured in ponds, concrete tanks, fish cages or pens.

Government of India defines reservoirs as man-made impoundments created by obstructing surface flow, by erecting a dam of any description on a river, stream or any water course. However, water bodies less than 100 ha in area have been excluded from this definition.

The Ministry of Agriculture, Government of India has classified reservoirs as small (5000 ha) for the purpose of fisheries management, although different states have varied classifications.
The estimated cumulative areas are 1,485,557 ha, 507,298 ha and 1,160,511 ha of small, medium and large reservoirs, respectively (Sugunan, 1995) [12].
The present study has been selected for evaluating the growth performance of Pangasius hypophthalmus cultured in floating net cages installed in Bijuri Coalmine pond of Anuppur district (M.P.). The present study also bears its importance as this fish species is being recently cultured in Rajasthan. Further, the culture and yield performance of net cages also need to be evaluated as this time these cages have been installed for the aquaculture on large scale in Madhya Pradesh waters. Recently State Fisheries Department of government of Madhya Pradesh & Chhattisgarh has installed 15 floating cages in Bijuri Coalmine pond for culture of *Pangasius hypophthalmus*. The project has been launched under the technical supervision of the Central Inland Fisheries Research Institute (CIFRI), Barrackpore, (West Bengal) for aquaculture with the funding of Rs 2 crores from the Union Government. Presently, the cages have been stocked with fingerlings of exotic Pangas in cages at high density of 2000-3000 per cage. The fish is fed with floating feed pellets.

Material and Methods

Experimental fish: The fish selected for the present study is Sutchi catfish *Pangasius hypophthalmus* which was very recently introduced as culture fish in newly established floating net cages installed in Bijuri Coalmine pond.

Experimental feed: The experimental fish were fed with commercial fish feed *i.e.* in the form of floating pellets. The feed was given once a day in the morning hours between 7.00-8.30 by broadcasting evenly over the cage at fixed time every day. The fishes were fed at the rate of 5% of their body weight each day.

Experiment setup: The proposed experiment was conducted by intervening the currently ongoing cage culture in 15 net cages with three different stocking densities of *Pangasius hypophthalmus* being cultured in Bijuri Coalmine pond by the private authority. The size of the cage was 3.65×3.65m. With a depth of 5.48m. There were three densities of fishes viz. 2600, 2800 and 3000 fingerlings per cage. The mesh size, material of net and structure of net cages was recorded while performing the study. The observations for mean weight and length of experimental fish along with feed given was recorded initially and then at every fortnight for a period of 45 days. The steps undertaken for maintenance of cages and prophylactic measures for prevention of fish disease were also recorded during study period.

Water Quality Analysis: Water quality parameters such as temperature, pH, dissolved oxygen total alkalinity, free CO_2, electrical conductivity and total dissolved solids were analyzed on initial day and subsequently at fortnightly intervals following standard methods.

Growth Parameters: The growth performance of experimental fish weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR) and gross conversion efficiency. Were estimated at fortnightly intervals.

1. Weight Gain: The body weight of *Labeo rohita* (Ham.) fingerling was obtained initially and thereafter at fifteen days interval upto completion of the experiment *i.e.* 60th days.

The weight gain (g) was calculated as given below:
Weight gain (g) = Final weight (g) - Initial weight (g)

$$\text{Weight gain in }\% = \frac{Final\ weight - Initial\ weight}{Initial\ weight} \times 100$$

2. Specific Growth Rate (SGR)

$$SGR\ (\%) = \frac{(In\ wt - In\ Wo)}{D} \times 100$$

3. Feed Conversion Ratio (FCR)

$$FCR\ (\%) = \frac{Weight\ of\ food\ given\ (g)}{Weight\ gain\ of\ fish\ (g)}$$

4. Gross Conversion Efficiency (GCE)

$$GCE\ (\%) = \frac{Weight\ gained\ (g)}{Food\ given\ (g)}$$

5. The Condition factor or Ponderal Index of the experimental fish in each cage was determined following LeCren (1951) [7].

$$\text{Condition factor or Ponderal Index} = \frac{W \times 100}{L^3}$$

Where, W = Observed weight of fish in gram L = Total length of fish in cm

Yield Analysis

The mean initial weight of the total biomass in a cage was calculated using the following formula.
Initial Biomass (kg) = Mean weight of fishes during commencement (kg) × Stocking density (no. of fishes in each cage).
The final biomass (Gross yield) in each cage was determined as,
Final Biomass (kg) = Mean weight of fish during final observation (kg) × Stocking density (no. of fishes in each cage).
The net yield in each cage was determined by –
Net Yield (kg) = Final Biomass (kg) – Initial Biomass (kg)
Proximate composition of commercial floating pelleted feed.

Feed No.	Feed Code	Die size-mm	Crude (protein min. %)	Crude fat (min. %)	Crude (fibre max. %)	Moisture (max. %)
5	25322518	1.8	32	5.0	5.5	11

Result and Discussion

Fish growth is a complex process governed by many parameters like fish species, nutrient present in the feed, feed additives and rearing environment individually or in combination. In the present study, the weight gain, specific growth rate, food conversion ratio and gross conversion efficiency were significantly different ($p < 0.05$) in all the treatments. Still, the better growth performance was observed in treatment T_1 (stocking density 2600 fish/cage). In this treatment the net weight gain (NWG) was 289.570^c±0.928g and specific growth rate (SGR) was also highest (1.698^c±0.019). The lowest FCR (1.174^a±0.004) was recorded in T_1 compared to all other treatments. The gross conversion efficiency (GCE) for this treatment was (0.852^c±0.002). In T_3 (stocking density 3000 fish/cage) the overall growth of fish was the lowest. The statistical analysis of data has revealed significant variations in the result of weight gain, SGR, FCR and GCE.

Influence of stocking densities on growth (weight gain) have been evaluated with sutchi catfish by (Islam *et al.* 2006) [4] have found higher stocking density resulted in higher yield per unit of production cost and lower cost per unit of yield, with a net revenue being higher with increasing stocking density. They reported that at the end of 150 days, the growth and yield parameters were studied and a simple economic analysis was performed to calculate profitability. The net yield in the present study varied from 642.660^a±2.603, 703.330^b±3.613 and 748.630^c±4.046 at density of 2600, 2800 and 3000 fish/cage respectively. This figure when converted to per m^3 with size of 73.40 m^3/cage turns to be 8.630, 8.893 and 9.080 kg/m^3. However (Islam *et al.* op cit) [3] found a Gross yields were 15.6 ± 0.27, 17.1 ± 0.31, 19.5 ± 0.30, 21.9 ± 0.29, 26.8 ± 0.22, 28.6 ± 0.40, 30.0 ± 0.37, 31.1 ± 0.45, 32.7 ± 0.31, and 34.5 ± 0.44/kg m^{-3}; Net yields were 15.2 ± 0.22, 16.7 ± 0.28, 19.0 ± 0.29, 21.3 ± 0.21, 26.2 ± 0.19, 27.9 ± 0.33, 29.3 ± 0.33, 30.3±0.37, 31.8 ± 0.29 and 33.5 ± 0.36 kg/m^{-3}, respectively, with stocking densities of 60, 70, 80, 90, 100, 110, 120, 130, 140, and 150 fish/m^3. The authors noted that the mean weights of fish at harvest were inversely related to stocking density which in similar to the results of present study. Both gross and net yields were significantly different and were directly influenced by stocking density, but the survival rates and feed conversion were unaffected.

Rowland *et al.* (2006) [14] reported that silver perch fingerlings (range mean weights, 109.3–115.4 g) were stocked at densities of 12, 25, 50, 100 or 200 fish/m in cages (1 m^3) in an aerated, 0.32ha earthen pond, with four replicate cages for each density. Fish were fed a formulated diet containing 32% crude protein and 13 MJ/kg energy and cultured for 210 days. Water temperatures ranged from 20.6 to 29.8°C. The high survival, relatively fast growth, low variation in weight and high production rates of silver perch stocked at 100 or 200 fish/m^3 demonstrate that cages are a viable alternative to ponds for the commercial production of silver perch.

Net weight gain of *Pangasius hypophthalmus* fingerlings cultured in cages

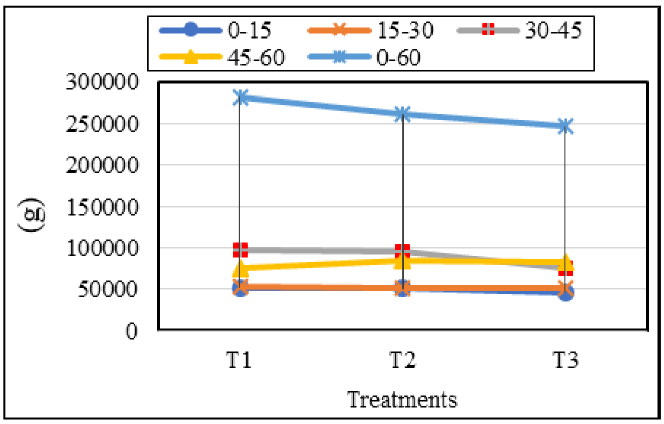

Fig 1: Weight gain of *Pangasius hypophthalmus* fingerlings in cage culture

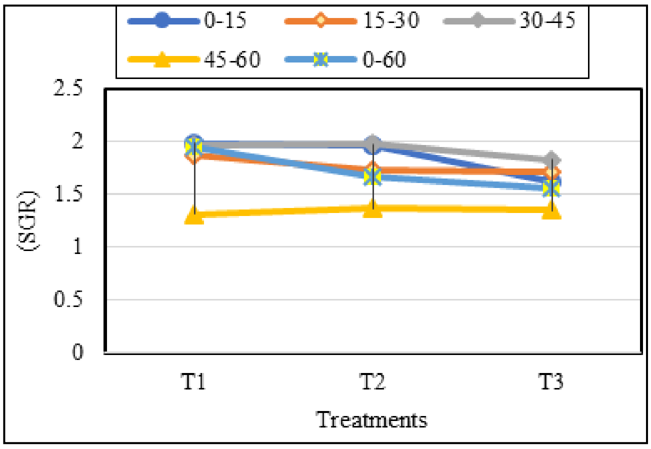

Fig 2: SGR of *Pangasius hypophthalmus* fingerlings in cage culture

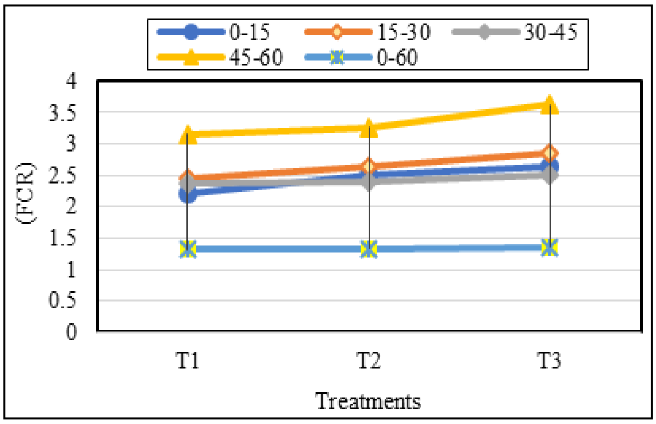

Fig 3: FCR of *Pangasius hypophthalmus* fingerlings in cage culture

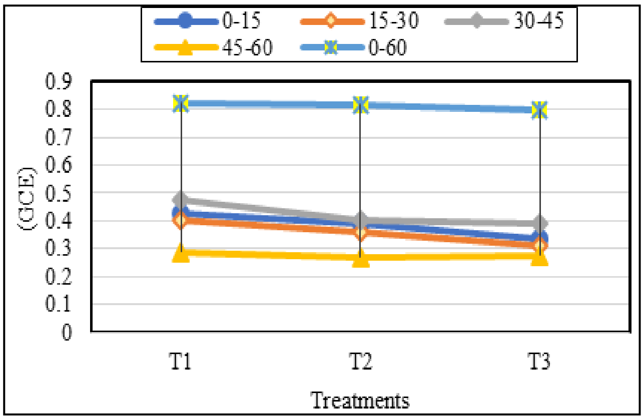

Fig 4: GCE of *Pangasius hypophthalmus* fingerlings in cage culture

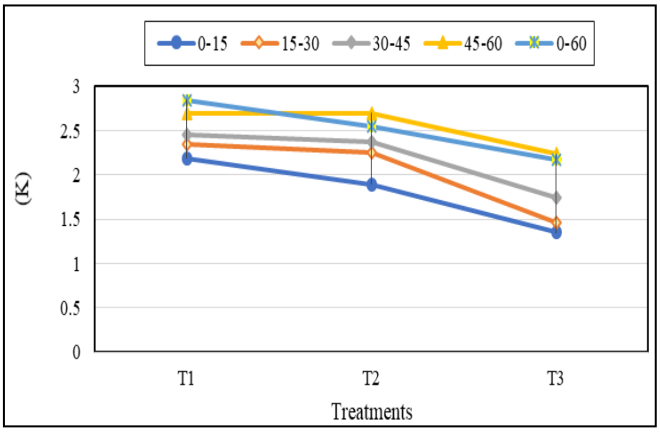

Fig 5: Condition factor (Ponderal Index) of Pangasius hypophthalmus fingerlings in cage culture

Conclusion

The fish growth was higher in the lowest density (T_1) i.e. 2600 fish/cage or 35.42/m^3. The percent increase in biomass was maximum *i.e.* 59.63% in the lowest density (T_1) i.e. 2600/cage. The fish growth was maximum at 30-45 days of observation which corresponds with water temperature 24.56±2.16°C, pH-8.02±0.11 and dissolved oxygen 8.28±0.14 mg/l.

Through the findings of present study we can recommended that 2600 fingerlings of *Pangasius hypophthalmus* stocked in each cage gives maximum fish growth and maximum % increase in fish yield with properly maintaining the feeding schedule and fish health.

Acknowledgement

The authors are thankful to contractor for providing about the fish culturing.

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