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Economic Value of *Clarias batrachus* and Variation in Weight at Different Time Interval with Respect to Year 2019 to 2021

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ABSTRACT: The present study was performed to analyze the economic importance and determine the effect of constant light (LL) and constant dark (DD) on weight of the animals in different time interval of the year 2019, 2020 and 2021 in Indian fish *Clarias batrachus*. The fingerlings of *C. batrachus* were collected and harvested in a pond. The fishes were fed with rich protein content feeds. Weight of sampled fish was measured. The fishes were acclimatized to work place before conducting the experiment. They were divided into three groups each contacting 48 fishes and maintained under photoperiods of natural day-night (control), LL and DD for 60 days. The experiment was performed for during different phases of *C. batrachus* reproductive cycle i.e., resting, pre-monsoon, monsoon, and post monsoon for three consecutive years. Four fishes from each group were examined during the experiment at every 15 days to take the body weight of animals. Results were analyzed using ANOVA for four different factors including "Year" (1, 2 and 3), "Treatment" (normal day-night, LL, and DD) "Phase" (resting, pre-monsoon, monsoon, and post monsoon), and "Time interval" (15, 30, 45 and 60 days) on body weight of *C. batrachus*. Increased body weight was seen DD group as compared to control group. LL has also shown increased body weight but lesser that DD group. It can be concluded from the study that under DD condition body weight of fishes increases and their economic value can be increased by proper farming and maintenance.

Keywords: Catfish, Feed, Fish farming, Market size, Nutrition, Reproductive cycle.

INTRODUCTION

Fishes are important vertebrate species that cover around 25,000 species and possess numerous diversities in sensory system, breeding system, and life history patterns (Desjardins and Fernald 2009). Thus, fishes provide test bed for study of link between physiology and behavior. The government has been promoting fish farming in the country, in the next five year, the government aim to invest nine billion in the fisheries sector under PM Matsya Sampada Yojana has estimated to raise the production of fish to 220 lakh tons by the year 2024-25 (PMMSY, 2020). The Indian fresh water catfish, *Clarias batrachus* is very famous fish known as Magur. It is highly preferred fish by the Indians and having huge demand in the global market. Its global market value is near around 800000 dollars (Debnath *et al.,* 2011). Fig. 1 shows the global market value of catfish worldwide. It is commercially important fish in great demand because of its taste and nutritional benefits. The origin of *C. batrachus* is from India and spread to South-East Asia (Khedkar *et al.,* 2016). It burrows during cold and dry months to survive in poor weather. Catfish can grow to 8-47 cm long and 1.2 kg approx. weight. The average life span of catfish is 16.2 years. *C. batrachus* pray on algae, worms, insects, and small fishes. It is used in commercial fisheries, aquariums, and aquaculture. It is widely consumed in Asian countries (Rosli and Isa 2012). It has reported that *C. batrachus* has easily digestible protein, good cholesterol, and minerals in the meat (Nasir *et al.,* 2020). This is a well-adapted species according to Indian aquatic ecosystem; however, the production remains low. Thus, the article has articulated on the research findings of economic value of *C. batrachus* and its weight variation in three consecutive years. The most challenging thing is that their weight increases in DD condition, but it is very difficult to create such a situation for the *C. batrachus* naturally.

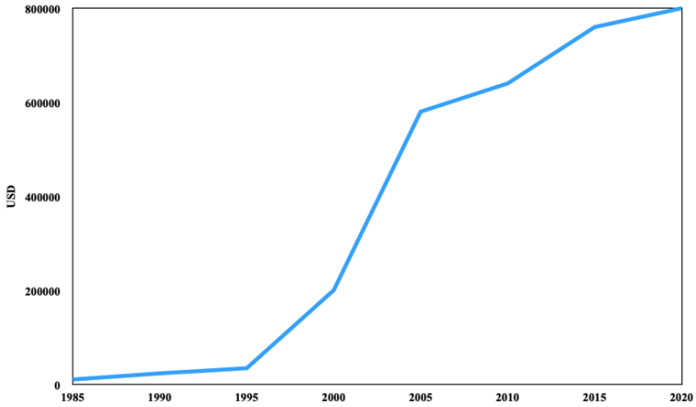

Fig. 1. Global market data of *C. batrachus* producing worldwide.

MATERIALS AND METHODS

A. Collection of fishes

The fingerlings of *C. batrachus* were collected from a private hatchery of the Raipur, Chhattisgarh, India.

B. Feeding of fishes

The fishes were fed with rich protein content feeds (30% protein) at a rate of 5% body weight daily. Feed requirement was calculated and adjusted after sampling of fishes once in a month.

C. Growth sampling of fish

Fishes were sampled fortnightly using seine net to assess their growth and health condition. At least 10% fish from each pond were taken to make assessment of growth trends and to readjust feeding rate. Weight of sampled fish were measured. Fishes were handled carefully to avoid stress during sampling.

D. Fish harvesting

Harvesting was done in the month of January 2019 by dewatering after completion of the trial.

E. Weight variation in C. batrachus

C. batrachus live fishes of both sex (70±5 g b/w) were from the aquarium different phases (pre spawning, spawning and post spawning) of its annual reproductive cycle. We kept the fishes in stock aquarium for acclimatization before starting the experiment. Fishes were divided into three groups, each group containing 16 fishes and maintained under photoperiods of natural day-night (control), constant light (LL) and constant dark (DD) for 60 days. This experiment was performed in three consecutive years i.e. 2019, 2020 and 2021. Four fishes from each group were examined during the experiment at every 15 days to take the body weight of animals. The water inside the aquarium was renewed at each alternate day and fishes were feed ad libitum.

F. Growth parameters

Several parameters (weight gain, specific growth rate (SGR), survival rate, production of fishes) were used to evaluate the performance of fishes under different treatments. Growth data collected from different treatments during the trial were calculated and analyzed using the following equations:

Weight gain (g) = Mean final weight- Mean initial weight

Survival rate (%) = No. of fish harvested/ No. of fish stocked × 100

SGR = [ln (final weight)- ln (initial weight) × 100] / culture period (days)

G. Production of fishes

Production was calculated based on average final weight of the harvested fishes and was expressed kg/ha. The formula is as follows:

Production= No. of fish harvested x final weight of fish.

H. Economics analysis

A simple economic analysis was done to estimate the economic return in each treatment. The total cost of inputs was calculated and the economic return was determined by the differences between the total return (from the current market prices) and the total input cost. The cost in rupee per unit production was calculated and was expressed as the cost in Rp/kg of fishes produced.

I. Data analysis

Data are represented as mean ± SD. The weight variation in fishes in the sampling years were analyzed using GraphPad Prism one-way ANOVA. The significance value was set at $p<0.05$.

RESULT

A. Weight variation in C. batrachus at different time interval

Table 1 shows the weight variation in *C. batrachus* at different time interval with respect to year. Results exhibited that weight of *C. batrachus* was significantly higher in DD upto 60 days in comparison to the control group. However, LL group also showed rise weight of the fishes but less than DD group. Interestingly, weight of the fishes was high during pre-monsoon and monsoon phases and then declined at post-monsoon phase.

Table 1: Variation in weight of *C. batrachus* at different time interval with respect to year.

	Phase	15 Days				30 Days				45 Days				60 Days			
		2019	2020	2021	Avg.	2019	2020	2021	Avg.	2019	2020	2021	Avg.	2019	2020	2021	Avg.
Control	Resting	72.3	72	73	72.4 ± 0.34	74.6	75.1	75.6	75.1 ± 0.32	75.5	75.7	76.6	75.9 ± 0.35	78.6	78.3	78.3	78.4 ± 0.22
	Pre Mansoon	76.7	76.6	76.1	76.4 ± 0.12	81.6	80.1	80.6	80.7 ± 0.32	82.6	82.5	82.7	82.6 ± 0.19	83.1	82.6	83.8	83.1 ± 0.47
	Mansoon	76.3	76.5	76.2	76.3 ± 0.21	80.5	80.3	81.2	80.6 ± 0.20	83.7	83.6	83.3	83.5 ± 0.18	83.6	83.6	83.3	83.5 ± 0.20
	Post Mansoon	70.6	70.8	70.5	70.6 ± 0.10	73.2	73.7	73.5	73.6 ± 0.22	75.8	76.1	76.2	76 ± 0.32	77.1	77.7	77.7	77.3 ± 0.29
LL	Resting	75.5	75.3	75.3	75.3 ± 0.22	80.3	80.1	79.7	80 ± 0.12	81	80.5	80.2	80.5 ± 0.24	80.7	80.6	80.5	80.6 ± 0.17
	Pre Mansoon	74.2	73.7	73.6	73.8 ± 0.27	76.7	75.6	77.2	76.5 ± 0.37	79.2	79.5	79.8	79.5 ± 0.19	80.5	79.6	80.2	80.1 ± 0.24
	Mansoon	72.6	71.8	72.5	72.3 ± 0.22	75.5	76.1	75.6	75.7 ± 0.23	78.6	79.6	78.1	78.7 ± 0.19	81.2	81.5	81.5	80.4 ± 0.31 *
	Post Mansoon	70.3	70.7	70.5	70.5 ± 0.30	71.5	71.8	72.3	71.8 ± 0.28	73.6	74.1	74.8	74.1 ± 0.23	75.6	75.2	75	75.2 ± 0.22
DD	Resting	78.1	78.3	78	78.1 ± 0.15	82.5	82.7	82.8	82.6 ± 0.21	90	89.1	91.2	90.1 ± 0.30 *	92.7	93	93.3	88.9 ± 0.19 *
	Pre Mansoon	79.2	79.5	79.3	79.3 ± 0.28	85.1	85.2	84.1	84.6 ± 0.20	90	90	90.3	90.1 ± 0.38 *	93.3	93.5	93.8	93.5 ± 0.30 *
	Mansoon	78.1	78.6	78.3	78.3 ± 0.11	84.2	83.3	83.3	83.6 ± 0.23	90.3	91.3	91.5	91 ± 0.29 *	93.7	93.2	92.7	93.2 ± 0.30 *
	Post Mansoon	72	73	73.2	72.7 ± 0.22	75.2	76	75.3	75.5 ± 0.37	78.7	78.2	76.8	77.9 ± 0.31	80.5	81.2	80.6	80.7 ± 0.35 *

Data are represented as mean ± SD (n=16), significantly different at *p<0.05 as compared to control group.

B. Growth and production performances of C. batrachus

Growth in weight and length, FCR value, SGR, and net production of *C. batrachus* after 60 days rearing under different treatments are presented in Table 2. No significant (P>0.05) variation was recorded in initial weight of fishes among the treatments. The highest final weight was observed in DD (70.2±2.34g) and lowest in LL. Final weight and net weight gain were statistically significant among the treatments. Similarly, no significant (P>0.05) variation was recorded in initial length of fishes among the different groups. Length increments were not statistically significant.

C. Economic analysis

The cost of different inputs and economic return from the sale of fishes in different treatments are summarized in Table 3. The total cost of inputs and economic return per hectare were significantly different (*P<0.05) among different groups. The cost of input was the lowest in control group followed by DD and LL. The net economic return was the highest in DD than LL and control group. The cost per unit of yield ranged from 170.21-245.44 Ru/kg. The highest was in DD (245.44Ru/kg) followed by LL (201.49 Ru/kg) and control (170.21 Ru/kg). Similarly, the net profit per unit of yield was highest in DD (209.32 Tk/kg) than LL and control, which was significantly different among the groups. Cost and benefit ratio were calculated as 1:1.22, 1: 0.81 and 1: 0.52 with DD, LL and control group, respectively.

DISCUSSION

The catfish species *C. batrachus* is very popular table fish in India. It makes almost 30% of India's fresh-water production with *C. batrachus* accounting for about 90% of that amount. Demand for both fish is very strong and growing rapidly despite their high price.

Table 2: *C. batrachus* growth and production.

Parameters	Control group	LL group	DD group
Initial weight (g)	32.4 ± 0.34	32.4 ± 0.35	32.4 ± 0.36
Final weight (g)	78.4 ± 0.22	80.6 ± 0.17 *	88.9 ± 0.19 *
Net gain weight (g)	46 ± 0.1	48.2 ± 0.12 *	56.9 ± 0.21
SGR % (g/day)	0.76 ± 0.11	0.8 ± 0.01	0.94 ± 0.12 *
Survival rate (%)	94.13 ± 1.23	93.12 ± 1.33	93.23 ± 1.02
Net production (Kg/ha)	2847 ± 233.0	2901 ± 254.9 *	2994 ± 265.3 *

Data are represented as mean ± SD, significantly different at *p<0.05 as compared to control group.

Table 3: Economic value and cost return from *C. batrachus.*

Parameters	Control group	LL group	DD group
Fingerlings (Ru/ha)	145432	145432	145432
Feed and miscellaneous cost (Ru/ha)	27430	28923 *	29230 *
Total cost (Ru/ha)	172862	174355	174662
Total return (Ru/hr)	431762	498421 *	536518 *
Net profit (Ru/ha)	258900	324066 *	361856 *
Cost per unit yield (Ru/Kg)	60.8	60.1	58.34 *
Net profit per unit of yield (Ru/Kg)	90.96	111.70	120.88 *
Cost and benefit ratio	1:1.49	1:1.85 *	1:2.07 *

Data are represented as mean ± SD, significantly different at *p<0.05 as compared to control group.

C. batrachus is the preferred species for its appearance and eating qualities and commands a higher price particularly in what appears to be a lucrative export market. In our study, it was observed that weight of *C. batrachus* was significantly higher in DD; weight of the fishes was high during pre-monsoon and monsoon phases and then declined at post-monsoon phase. The weight of the *C. batrachus* increases with protein rich diet and feed supplements (Bhaskar *et al.*, 2015). A study was performed by (Kumar *et al.*, 2017) to evaluate length-weight relationship in *C. batrachus* from samples of Kawardha, Chhattisgarh, India. The researchers also defined their study that weight of the fishes were highest in August and September, which were proportional to their length. Ramesh *et al.* (2016) also supported similar study based on length-weight relationship in *C. batrachus.* Jordan (1976) described that weight variation also vary oxygen exchange in *C. batrachus*. Air breaths number per unit time doubles at night, however, it is inversely proportional to the weight of the fishes.

Dietary protein is always considered to be of primary importance in fish feeding (Jauncey & Ross 1982), thus sufficient supply of dietary protein is needed for rapid growth (Lovell, 1989). Growths of *C. batrachus* obtained from the experiment indicated that the growth rate varied with different lighting conditions. Along with the increase in production, the purpose of aquaculture practices is to earn a profit. Wyban *et al.* (1988) indicated that stocking density, growth rate, survival and market price are the most sensitive factors to increase profit. After the fry price of feed constituted the highest operational cost and make a positive relation with the net profit among the treatments. The total cost of inputs and economic return per hectare were significantly different (P>0.05) among the treatments. The application of low-cost on farm fish feed have much potential for reducing feed cost without affecting growth rate and yield. Considering, the growth performance, overall production and net profit, the best result was obtained from DD. Therefore, DD condition is suitable diet for culture of *C. batrachus*. Further studies using different fish species are needed to find out the most suitable and economically viable model.

CONCLUSIONS

C. batrachus is a highly demanded and economically important fish species. The nutritious value of catfish is very useful and rich source of protein and nutrients. Increase weight of catfish was observed in DD during pre-monsoon and monsoon phases. Thus, proper farming and maintenance of *C. batrachus* may grow the market and enhance their economic value.

REFERENCES

Bhaskar, P., Pyne, S. & Kumar, A. (2015). Biweekly changes in body length and weight of *Clarias batrachus* (linn.) by the effects of poultry viscera in compound diet. *Int J Bio-Resource, Environ Agric Sci., 1*(4), 140–145.

Debnath, S. (2011). *Clarias batrachus*, the medicinal fish: An excellent candidate for aquaculture & employment generation. *International Conference on Asia Agriculture and Animal, 13*, 32-37.

Desjardins, J. K., & Fernald, R. D. (2009). Fish sex: why so diverse? *Curr. Opin. Neurobiol., 19*(6), 648–653.

Jauncey, K. & Ross, B. (1982). A guide to tilapia feed and feeding. University of Stirling.

Jordan, J. (1976). The influence of body weight on gas exchange in the air-breathing fish, *Clarias batrachus*. *Comp Biochem Physiol Part A Physiol., 53*(3), 305–310.

Khedkar, G. D., Tiknaik, A. D., Shinde, R. N., Kalyankar, A. D., Ron, T. B., Haymer, D. High (2016). Rates of substitution of the native catfish *Clarias batrachus* by *Clarias gariepinus* in India. *Mitochondrial DNA Part A., 27*(1), 569–574.

Kumar A., Jakhar, J., & Vardia, H. K. (2017). Length-Weight Relationship and Relative Condition Factor of *Clarius batrachus* (Linnaeus, 1758) from Gaurmati Fish Farm, Kawardha, Chhattisgarh, India. *Int. J. Curr. Microbiol. Appl. Sci., 6*, 1425–1431.

Lovell, T. (1989). Nutrition and feeding of fish. AVI Book, Van Nostrand Reinhold, New York. 260.

Nasir, M. F., Naeem, M., Shafi, J., Masud, S., & Hayat, S. (2020). Proximate composition of farmed walking catfish *Clarias batrachus* (linnaeus, 1758) from multan, Pakistan. *IJBPAS, 9*(1), 2496-2512

PMMSY (2020). https://www.nfdb.gov.in/PDF/PMMSY-Guidelines24-June2020.pdf

Ramesh, I., Kiran, B. R., & Dhananjaya, S. G. (2016). Length-weight relationship of catfish *Clarias batrachus* (Linn.) in Bhadravathi Area, Karnataka. *International Journal for Innovative Research in Multidisciplinary Field*, 209–212.

Rosli, N. A. M., & Isa, M. M. (2012). Length-weight and Length-length Relationship of Long snouted Catfish, *Plicofollisar gyropleuron* (Valenciennes, 1840) in the Northern Part of Peninsular Malaysia. *Trop life Sci Res., Dec., 23*(2), 59–65.

Wyban, J. A., Sweeney, J. N. & Kanna, R. A. (1988). Shrimp yields and economic potential of intensive round pond system. *J. World Aquaculture Soc., 19*(4), 201-217.

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