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Research Article

Effect of stocking density on growth and survival rate of *Cirrhinus mrigala* reared in cemented cisterns

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Abstract

To study the effect of stocking density on growth and survival rate of *Cirrhinus mrigala*, an experiment of three months was conducted from March 2013 to May 2013. Three different stocking densities *viz*; 10, 15 and 20 Fish/cisterns were assigned as treatment I, II and III respectively. The experimental fish were fed with formulated feed with 35% protein. The result of the density experiment showed significantly ($p<0.05$) highest growth and survival rate in treatment II (15 fish/ aquaria). While significantly lowest growth and survival rate was recorded in treatment III. The water quality parameters and their monthly fluctuations recorded throughout the study period were found within the suitable ranges for the fish culture.

Keywords: Stocking density, *Cirrhinus mrigala*, growth and survival rate.

INTRODUCTION

The productivity of the aquatic system is thus increased by more efficiently utilizing ecological resources within the environment. *Cirrhinus mrigala* contribute substantially to the inland production. Although, carp culture is widely practiced, the non-availability of appropriate compounded feed to meet the demands of the species still remains as a major constraint. Fish require adequate nutrition in order to grow and survive. Nature offers a great diversity of food to fish including plants and animals. Artificial feed plays an important role in semi intensive fish culture where it is required to maintain a high density of fish than the natural fertility of the water can support (Jhingran, 1991).Stocking density is an important parameter in fish culture operations, since it has direct effect on the growth and survival and hence production (Backiel and LeCren, 1978). For the development and rearing techniques of any fish species, stocking density might play a very important role. The present study was initiated to study the effect of stocking density on growth and survival rate of *Cirrhinus mrigala*, one of the major carps of commercial value for the pond culture in this region, reared in cemented cisterns fed with prepared feed.

MATERIALS AND METHODS

Collection and stocking of experimental fish

The experiment was conducted for three months in 2012. Three different densities 10, 15 and 20 fish / Cisterns (size 2.5m^2) were assigned as treatments I, II and III respectively with three replicates each. Fish samples of same age group 1.5 ± 0.65g were collected from local hatchery, District Thatta (Sindh). Water of Cisterns was replaced with freshwater on every alternate day to prevent the accumulation of the growth inhibitory ammonia.

a) Preparation of pellet feed

To prepare formulated feed for feeding the experimental fish, poultry waste, rice protein, rice bran, rice milling, wheat flour and vitamin premix were ground thoroughly and sieved to pass through 0.5 mm mesh size. An experimental diet was formulated containing 35% protein. All ingredients were mixed together according to the formulae, and then put into the manually operated pellet machine for the preparation of pellet feed of size 1mm. The composition of pellet feed is shown in (Table 1).

Table 1. Ingredients and composition of the experimental diet

Ingredients	Protein Content (%)	Amount (g/kg) Rice
Poultry protein	35	100
Rice bran	50	350
Rice protein	10	500
Wheat flour	04	48
Salt+ Vitamin premix	1	2
Total	**100**	**1000**

b) Feeding and Sampling

Feeds were supplied to fish twice daily at 9.00 AM and at 5.00 PM at a rate of 8% of the wet body weight. Sampling was done at an interval of one month to adjust the feeding rate, by measuring the weight of fish and to observe the health condition of fish. The length of experimental fish was measured to the nearest mm with an ordinary scale graduated with tenth of centimeters. Weight was measured to the nearest gm by a sensitive portable electronic balance (Model AK-3000H AFD), with the help of small plastic bucket, while an ordinary wooden fish measuring board was used for length measurement in mm.

c) Water Quality Parameters

The water quality parameters like temperature, dissolved oxygen, pH, alkalinity, ammonia and nitrite was recorded monthly throughout the study period with the help of digital portable water quality kit (JENCO Model No. 2631N).

d) Statistical Analysis

One way analysis of variance (ANOVA) was used to determine the effects of stocking density on the growth and survival rate of *Cirrhinus mrigala.*LSD was determine using Tukey's method (Zar, 1984)

RESULTS

The growth parameters of *Cirrhinus mrigala* in different treatments in terms of mean weight gain, mean length gain, % weight gain, % length gain, SGR/day, FCR, survival (%) and production (kg/m/90 days) were calculated and are shown in Table 2. Growth of *Cirrhinus mrigala* in cisterns indicated that the growth rate varied in different stocking densities. Treatment II (15 fish/aquaria) showed significantly ($p<0.05$) highest growth and survival rate among the treatments. The net length and weight gain of individual fish in treatment II was higher (128 mm and 16.4 g) than those of Treatment I (108 mm and 11.7 g) and (88 mm and 8.8 g) in treatment III respectively. The survival and specific growth rates were also found highest in treatment II (100% and 0.48 respectively) followed by treatment I (90% and 0.36). While significantly ($p<0.05$) lowest survival rate and SGR was recorded (80% and 0.31) in treatment III (Table 2). The water quality parameters and their monthly fluctuations recorded throughout the study period were found within the suitable ranges for the fish culture as shown in (Table 3).

Table 2. Growth parameters of mrigala, *Cirrhinus mrigala* with different stocking densities reared in glass aquaria fed with formulated feed

Parameters	Treatment I	Treatment II	Treatment III
Mean initial length (mm)	$52a^{1} \pm 0.66^{2}$	$52a^{1} \pm 0.38^{2}$	$52a^{1} \pm 0.24^{2}$
Mean final length (mm)	161b ± 0.28	170a ± 0.70	150c ± 0.65
Mean length gain (mm)	$109^{b} \pm 0.34$	$129^{a} \pm 0.56$	$89^{c} \pm 0.23$
% length gain	$209.96^{b} \pm 2.39$	$246.16^{a} \pm 2.39$	$169.25^{c} \pm 2.40$
Mean initial weight (g	$9.4a^{1} \pm 0.332$	$9.4a^{1} \pm 0.57^{2}$	$9.4a^{1} \pm 0.15^{2}$
Mean final weight (g)	$20.1^{b} \pm 0.28$	$25.8^{a} \pm 0.84$	$18.20^{c} \pm 0.42$
Mean weight gain (g)	$11.7^{b} \pm 0.35$	$16.4^{a} \pm 0.53$	$8.8^{c} \pm 0.28$
% weight gain	$114.82^{b} \pm 2.57$	$175.46^{a} \pm 2.06$	$83.97^{c} \pm 1.75$
SGR % per day	$0.36^{b} \pm 0.014$	$0.48^{a} \pm 0.014$	$0.31^{c} \pm 0.013$
FCR	$3.62^{b} \pm 0.19$	$2.57^{c} \pm 0.23$	$4.08^{a} \pm 0.13$
Survival rate (%)	$90.0^{b} \pm 1.0$	$101.0^{a} \pm 0.0$	$81.0^{c} \pm 2.0$
Production (kg/m3/90 days	$0.308^{b} \pm 0.0013$	$0.206^{c} \pm 0.003$	$0.406^{a} \pm 0.002$

Table 3. Month-wise variation in water quality parameters in cemented cisterns throughout the study period

Month	Parameters					
	Temperature (ºC)	pH	D.O mg/L	Alkalinity mg/L	Ammonia mg/L	Nitrite mg/L
March2013	29	7.30	4.5	160	0.38	0.169
April 2013	30	7.39	4.2	170	0.44	0.172
May 2013	32.2	7.45	4.3	159	0.50	0.170

DISCUSSION

The present study was initiated to determine the effect of stocking density on growth and survival rateof *C. mrigala*. Growth rate of *C. mrigala* in cemented cisterns varied in different stocking densities. Treatment II (15 fish/aquaria) showed significantly ($P<0.05$) highest in growth among the treatments. The net weight gain of an individual fish in treatment II was higher (16.4 g) than those of treatment I (11.7 g) and (8.8 g) in treatment III. The present results coincide with the findings of Alikunhi (1957), Kawamoto *et al*. (1957) and *Haque et al.* (1984) who achieved best growth at lower stocking densities. The lowest stocking densities provide more space, food and less competition, which were reported by various authors like Ahmed (1982); Hassan *et al*. (1982); Haque *et al*. (1984) and Narejo *et al.* (2005). This phenomenon indicated that there might be lower community feelings among the fishes, which influence them to consume feed properly, and it might be absent in the treatments with higher stocking densities. The percentage of survival as recorded in the present study was 100, 90 and 80% for treatment II, I and III respectively. Survival was found to be negatively influenced by stocking densities. It might be due to the high competition and space among the fishes. Mollah (1985) reported that the lower density gave larger size and higher survival rate in *Clariasmacrocephalus*. Ita *et al.* (1989) studied that the lower stocking density showed higher survival of *Clariasangullaris*. Barua (1990) calculated that the survival rates were higher in the larvae of *Clariasbatrachus* raised at the stocking densities of 2, 4 and 8 fish per liter as compared to those obtained 16 fish/liter. Narejo *et al*. (2005) reported that highest weight gain and survival rate of *Heteropneustes fossilis* in lower stocking density. The above findings support the results of the present study. Significantly ($P<0.05$) higher net production was obtained from the treatment III (0.406 kg/m3/90 days). It might be due to higher number of fish stocked (20 fish/cisterns). These results are in agreement with the findings of Dimitrov (1976); Mollah (1985); Narejo *et al*. (2005) and Narejo *et al*. (2008). The results of the present study indicated that a stocking density of (15Fish/Cisterns) is suitable for the culture of *C. mrigala* in cemented cisterns (size $2.5m^2$).

CONCLUSION

The results of the present study indicated that a stocking density of (15Fish/Cisterns) is suitable for the culture of *C. mrigala* in cemented cisterns (size $2.5m^2$).

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