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Effects of Stocking Density on the Growth and Survival of the Fingerlings of *Clarias gariepinus* (Burchell, 1822)

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Abstract: Experiments were conducted in aquaria tanks (62.5×29.5×30 cm) for a period of 12 weeks to investigate the effect of stocking density on the growth and survival of *Clarias gariepinus* fingerlings. The fingerlings (average weight of 0.60 g) were stocked in densities of 5, 10 and 15 fish per tank in duplicate and were fed with a diet containing 35% crude protein diet at 5% body weight twice daily. Feed intake increased at increasing densities. The survival, mean body weight, mean total length and specific growth rate were stocking density dependent. Best growth and survival rates were recorded in stocking density 5 than 10 and 15. This study showed that increased stocking density results in increased activity (air breathing, swimming) and decreased aggression.

Key words: Stocking density, growth, *Clarias gariepinus*, fingerlings, fish, body weight

INTRODUCTION

The production of fast-growing fingerlings is very vital for the development of a viable aquaculture venture. Aquaculture practices in Nigeria have increased drastically as seen in other parts of the world because of the increasing demand of fish protein. Rivers state, Nigeria has a great potential for sustainable aquaculture development, the initiation of fish culture seems to be one means of providing cheap animal protein to the increasing population. However, the increasing demand for fish protein can be met when capture fishery is supplemented by aquaculture. African walking catfish *Clarias gariepinus* is a successful aquaculture species in Nigeria. The species is widely accepted by fish farmers and consumers because of some biological reasons (high food conversion ratio, fast growth rate, readily accepting artificial feeds, ease of artificial propagation, disease resistance), social reasons (good market price, good table food quality) and physical reasons (tolerant to a wide range of environmental conditions). These catfish is an important contributor to both inland fisheries and aquaculture in Nigeria. Fish growth differs according to culture density. Aggressiveness seems to increase at lower densities and decrease at higher ones in some species while others show greater levels of aggression and even cannibalism when stocking densities increases (Stickney, 1994). There is a clear relationship between stocking density, oxygen requirements and metabolic waste production. The determination of stocking density for catfish culture is essential for the maximization of its production, profitability and sustainability. Stocking density is known to have a profound influence on growth, survival and behavior of fish (Boujard *et al*., 2002). However, in larvae and early fingerlings of *Clarias gariepinus* stocking density has an opposite effect (Sugunan and Katiha, 2004). The effects of stocking density on growth and survival have been studied on some African catfishes such as *Clarias gariepinus* (Haylor, 1992) and *Heterobranchus longifilis* (Ewa-Oboho and Enyenihi, 1999; Coulibaly *et al*., 2007).

This study was therefore designed to investigate the stocking density on the growth and survival of *Clarias gariepinus* fingerlings reared in tanks with a view of complimenting existing information to assist fish farmers on better culture methods. It is hoped that the results will contribute significantly to the knowledge of culture requirements of the species.

MATERIALS AND METHODS

Experimental location and system: The study was conducted at the Rivers State University of Science and Technology, Port Harcourt, Rivers state, Nigeria fisheries

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Table 1: Composition of experimental diets

Diets	Crude protein (%)
Fish meal	35.00
Shrimp meal	17.02
Soya bean meal	16.54
Yellow maize	24.46
Vitamin premix	19.32
Rice bran	0.600
Vegetable oil	15.75
Salt	5.000
Starch (Binder)	0.250
Proximate Composition (% Dry Matter)*	1.000
Crude protein (%)	36.82
Crude fibre (%)	7.280
NFE	32.30
Ash (%)	18.24
Crude lipid (%)	5.360

laboratory. The fingerlings used for the experiment were procured from Jay-Ess Consultants fish farm in Port Harcourt Rivers state. Individuals of fairly uniform size (2.0 mm) and initial body weight of 0.60 g were used. Fish fingerlings were stocked at densities of 5, 10 and 15 per tank. The stocking density trials were conducted in aquarium tanks with a dimension of 62.5×29.5×30 cm supplied with aerated water.

The experimental fish were fed with a diet containing 35% crude protein. Feeding was done at 5% body weight twice daily (Table 1). The ration was split into two and dispensed at 09:00 and 16:00 h. Feed intake increased at increasing densities. During the experimental period weekly behavioral records were made. The fish in each aquaria tank was batch-weighed fortnightly and from the data the quantity of feed to be dispensed was adjusted to reflect the new weight. During this period undigested food particles and waste products were siphoned out with rubber hose daily. The experiment lasted for 12 weeks after which the fish were individually measured for standard length and weight. Dead fish in each tank were recorded and the tanks were uniformly erated. Water temperature, dissolved oxygen (Oxy meter model WTW OXI 330) and pH (pH meter model WTW pH 330) were measured daily at 7 h. After 12 weeks of culture, all surviving fingerlings were collected, weighted and counted from each tank and individual total length and body weight were recorded.

Statistical analysis: Result of the fish growth and specific growth rates were pooled for each treatment computed and analyzed using One-way-Variance (ANOVA) and difference between means was examined using Duncan's multiple range test.

RESULTS AND DISCUSSION

Water quality characteristics monitored during the study period are shown in Table 2. The mean water temperature was between 26.50±0.12°C and 27.00±0.10°C.

Table 2: Summary of water quality during the culture period

	Stocking density (No. of fish per tank)		
Parameters	5 F	10 F	15 F
Temperature (°C)	26.80±0.10	26.50±0.12	27.00±0.10
pH	7.45±0.03	7.10±0.01	6.97±0.01
Dissolved oxygen (mg L^{-1})	5.82±0.20	5.57±0.40	5.19±0.20

Temperature values were not affected by treatments ($p>0.05$). The pH mean values varied between 6.97±0.02 and 7.45±0.01 and decreased with increasing stocking density. Values of dissolved oxygen ranged between 5.19±0.20 and 5.82±0.20 mg L^{-1}. The water quality is thus considered suitable for fish production.

Stocking density showed a clear influence on final body weight, specific growth rate, food consumption as indicated by the statistical significance (Table 3). Stocking density 5 showed significantly high food intake and growth rate than stocking density 10 and 15 which did not differ significantly from each other. The result of Specific Growth Rate (SGR) showed that higher stocking densities resulted in lower specific growth rate. The best value was obtained in stocking density 5. The mean body weight, mean total length and specific growth rate were stocking density dependent. At the end of the experiment best growth performances were recorded in stocking density 5. Survival rates were high in densities 5 than 10 and 15, ranging between 81.10 and 91.20%.

The water quality parameters observed during the experimentation were within the range not toxic to fish life in pond (Boyd and Litchtkoppler, 1979; Viveen *et al*., 1986). The growth rates were found to be inversely related to stocking density. The differences in survival rate, growth and food conversion efficiency of *Clarias gariepinus* at three different densities were not statistically significant (Table 3) ($p<0.05$). This indicates optimum production performance at stocking density 5, where yield is significantly higher at stocking density 10 and 15. In fact, under crowded conditions at higher stocking densities, fish suffer stress as result of aggressive feeding interaction and eat less resulting in growth retardation (Bjoernsson, 1994). Stocking density has been considered to be chronically stressful to reared animals (Sugunan and Katiha, 2004). Several studies have also demonstrated that increased stocking density has a negative effect on survival and growth (Rowland *et al*., 2004; Schram *et al*., 2006) except in some fish species that exhibit schooling behavior. This impaired growth by stocking density may be attributed to reduced food consumption, lower food conversion rates or increased metabolic cost. However, survival rates were highest for stocking density 5 than 10 and 15. This study showed that increased stocking density results in increased activity (air breathing, swimming) and decreased

Table 3: Mean growth parameters and feed utilization of *Clarias gariepinus* in the different stocking densities during the study period

	Treatments (No. of fish per tank)		
Parameters	5 F	10 F	15 F
Mean initial body weight (g)	0.60±0.200	0.60±0.250	0.60±0.210
Mean final body weight (g)	2.25±0.100	1.84±0.120	1.80±0.180
Mean weight gain (g)	1.65±0.150	1.24±0.200	1.20±0.200
Specific growth rate (% day^{-1})	0.058±0.02	0.040±0.03	0.036±0.02
Food conversion ratio	2.45±0.210	2.76±0.200	2.84±0.200
Survival rate (%)	91.20±0.200	86.40±0.100	81.10±0.400

aggression. Specific growth rate varies as a result of numerous factors among which the most important are the species, size, type and amount of food ingested, temperature and stocking density.

CONCLUSION

Stocking density had a significant effect on growth, survival and food conversion. Similar study must be realised in different structures such as concrete tanks, cages and ponds in order to determine the appropriate stocking densities for fingerlings.

REFERENCES

Bjoernsson, B., 1994. Effect of stocking density on growth rate of halibut (*Hippoglossus hippoglossus* L.) reared in large circular tanks for three years. Aquaculture, 123: 259-270.

Boujard, T., L. Labbé and B. Aupérin, 2002. Feeding behaviour, energy expenditure and growth of rainbow in relation to stocking density and food accessibility. Aquac. Res., 33: 1233-1242.

Boyd, C.E. and F. Litchtkoppler, 1979. Water Quality Management in Pond Fish Culture. International Centre for Aquaculture, Auburn, Al., pp: 30.

Coulibaly, A., I.N. Ouattara, T. Kone, V. N'Douba, J. Snoeks, G. Goore-Bi and E.P. Kouamelan, 2007. First results of floating cage culture of the African catfish *Heterobranchus longifilis* Valenciennes, 1840: Effect of stocking density on survival and growth rates. Aquaculture, 263: 61-67.

Ewa-Oboho, I. and U.K. Enyenihi, 1999. Aquaculture implications of growth and variation in the African catfish: *Heterobranchus longifilis* (Val.) reared under controlled conditions. J. Applied Ichthyol., 15: 111-115.

Haylor, G.S., 1992. Controlled hatchery production of *Clarias gariepinus* (Burchell, 1822): Growth and survival of fry at higher stocking density. Aquac. Fish. Manage., 22: 405-422.

Rowland, S.J., G. Allan, M. Hollis and T. Pontifex, 2004. Production of silver perch (*Bidyanus bidyanus*) fingerlings at three stocking densities in cages and tanks. Aquaculture, 229: 193-202.

Schram, E., J.W. van der Heul, A. Kamstra and M.C.J. Verdegem, 2006. Stocking density dependent growth of dover sole (*Solea solea*). Aquaculture, 252: 339-347.

Stickney, R.R., 1994. Principles of Aquaculture. John Wiley and Sons Inc., New York, pp: 502.

Sugunan, W. and P. Katiha, 2004. Impact of stocking density on yield in small reservoirs in andra-pradesh, India. Fish. Manage. Ecol., 11: 193-202.

Viveen, W.J.A.R., C.J.J. Richer, P.G. van Oordt, J.A.L. Janseen and E.A. Huisman, 1986. Practical Manual for Culture of African Catfish, *Clarias gariepinus*. Directorate General International Cooperation of the Ministry of Foreign Affairs, The Hague, Netherlands, pp: 121.