Stocking density, growth and survival of *Clarias gariepinus*(L) larvae in the laboratory

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ABSTRACT

Clarias gariepinus larvae were reared in the laboratory, at five different densities to assess the effects of stocking density on growth, survival rate and condition factor. Larvae (mean weight, 0.05g, mean total length, 1.63cm) were stocked in five densities 20, 30, 60, 90, 120 larvae, each with a replicate. Temperature range was 24 to 26^0 C, while oxygen content was 5.8mg/L. The experiment lasted for 30 days from 2nd September, to 1st October, 2011. The specific growth rate, survival and condition factor ($\pm$ s,e) of larvae stocked at densities of 20, 30, 69 ,90, 120-were : 29.71%,30.42%,29.81%,28.37%,and 27.00%, while condition factor were 8.13, 8.83, 7.95,8.1,and 7.77%.Mortality recorded in the various stocking densities were : 10 .00%, 16.66%,25.00%, 27.22% and 66.67%.The survival rate of the larvae were 90.00%, 83.33%, 75.00%, 72.00% and 33.33%.The result showed that stocking density of 30 fish m^{-3} had the highest specific growth rate, condition factor and mean weight gain.

Introduction

Clarias gariepinus belongs to the Family Claridae.It is a freshwater fish, and it is commercially important in Nigeria. It has accessory breathing organ which enables the fish to survive in water with low oxygen content.

Stocking is an important factor that affects fish growth. It is the volume of water or surface area per fish (Akunsungur, 2007).Stress occur among fish in a culture system when there is increase in density. This leads to higher energy requirements, causing a reduction in growth rate. The efficiency and profitability of fish culture is maximized by increasing stocking densities (Yilmaz and Arabaci 2010).The same fish species may show different growth performance at different stocking density. There is the need to identify the optimum stocking density for a species for optimum husbandry practices.

Artificial spawning usually yield large number of fry which may result in challenge of space to stock the fry. Therefore fish culturist increase the stocking density to produce more fish. However this may not be the best way of dealing with problem of space shortage. In many cultured fishes species, growth is inversely related to stocking density and this is mainly attributed to social interactions (Haylor, 1991; Bjornsson, 1994; Huang and Chiu, 1997; Irwin et al., 1999). Social interactions through competition for food and/or space can negatively affect fish growth. The stocking density alone or in combination with feeding rate is adjusted by fish farmers to obtain a particular size of fish at harvest, moreover, growth rate may be a function of available water space. Pangui et al., 2003 worked on *Chrysicthys nigrodigitatus* larvae in circular tanks.The result showed that specific growth rate, and condition factor were stocking density dependent. Sahoo et al., 2004 studied the effect of stocking size of *Clarias batrachus* on growth and survival during fingerling production and observed that specific growth

rate, and percent weight gain was significantly higher in smaller fish group. Priestley et al., 2006 assessed growth rate in relation to size group in Black widow tetras *Gymnocorymbus ternetzi* and showed that stocking did not show significant effect on the growth rate. Akunsungur et al., 2007 investigated the effects of stocking density on growth performance, Survival and food conversion ratio of Turbot (*Psetta* maxima) and showed that stocking density affected growth and survival rates. Yilmaz and Arabaci 2010 demonstrated that 44 fish m-^{3} resulted in the highest growth and feed efficiency. Yang et al, 2011 showed that growth of fish decreased with increasing stocking density. There is paucity of knowledge on the stocking density of this important fish. The objective of this study was to assess the effects of different stocking densities on growth performance and survival rate of *Clarias gariepinus* larvae and establish an optimum stocking rate for better growth and culture of the Larvae.

Materials and Methods

Clarias gariepinus larvae used in this study were hatched and reared in the laboratory at the University of Ilorin, Nigeria .Five experimental bowls were set –up.

Each experiment had a replicate and there was a control experiment. The bowls were stocked with 20, 30, 60, 90, and 120 larvae of *Clarias gariepinus,* for 30 days and the larvae were fed 4% of their body weight at two feeding. The water in the experimental bowls were changed daily. The following growth parameters were calculated:

Specific growth rate (SGR) %= $\dfrac{\log_e W_t - \log_e W_0 \times 100}{\text{Time (days)}}$

Where W_0 is the average initial weight at the beginning of the experiment, W_t is the average is the average final weight at the end of the experiment, and time is the total number of days the experiment was carried out.

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Survival (S) % = $\frac{N_1 \times 100}{N_0}$

Where N_0 = Initial number and N_1= Final number at the end of the experiment

Mortality (M) % $\frac{N_0 - N_1 \times 100}{N_0}$

Where N_0 = Initial number and N_1= Final number at the end of the experiment

Condition factor (K) = $100w / L^3$

Where W=weight, L= length

Results

The study was carried out from September to October 2011. The results showed that there was increase in the mean weight of the larvae during the experiment. The mean weight increased from 0.049g to 0.12g . The highest weight gain was observed in stocking density of 30.

Table 1, shows the specific growth rate, condition factor, mortality and survival of the larvae during the experiment.

Table.1.Effect of stocking density on Specific Growth rate, Condition factor, Survival and Mortality of *Clarias gariepinus*

	20	30	60	90	120
Specific growth rate(%)	29.71±2.62	30.41±1.85	29.81±4.59	28.37±0.65	27 0 ±2.64
Condition factor	8.13±1.18	8.83±1.19	7.95± 1.37	8.1±1.21	7.7±1.50
Mortality(%)	10%	16.66%	25%	27.22%	66.67%
Survival(%)	90%	83.33%	75%	72.22%	33.33%

Key: stocking density is represented by 20, 30, 60, 90, and 120 The specific growth rate changed with stocking rate. The highest specific growth rate was obtained from stocking density of 30 and, it gradually decreased with increase in stocking density. The fish were in good condition in all the stocking densities, and the value was approximately 8.00. Mortality was low (10 %) at a stocking rate of 20 larvae while it was 16.6% at 30.At 60, 90,and 120,stocking rate, the corresponding mortalities were 25%, 27%, and 66.67%.Survival rate was 90% at 20 stocking density, 83%, 75%,72%, and 33% at stocking densities of 30, 60, 90, and 120.

Statistical analysis using Anova showed that there was significant difference in the mean weight gained with density (P< 0.05).

Discussion

The results obtained in the *C. gariepinus* larvae reared at the highest stocking density of 120 showed slower growth rate than those held at lower stocking densities. This supports the view that increasing stocking densities have a negative impact on growth rate of *C. gariepinus.* Aksunger et al., 2007 obtained a specific growth rate of 0.68 to 0.76 at a temperature 8-22$^{0 C}$ C. In the present work higher specific growth rate were obtained (28-30).Yilmaz &Arabaci 2010 result differed from the result obtained in the present work because the highest stocking density of 44 fish m-^{3} yielded the highest growth. The result in the present work is similar to the result obtained by Yang et al., 2011 which indicated that after the optimum stocking density has been reached, growth of fish decreased with increasing stocking density.

Studies on the effects of stocking density on the growth of fish showed inverse relationship for a range of spices. Stocking density and growth rate are often reported to be related but the relationship between the two may be uniformly positive or negatively linear for a given species.

Bjornsson, 1994 reported that stocking density affected the growth of halibut only above a certain threshold level comparing to 100% coverage of tank bottom The optimum temperature for culturing *C.gariepinus* in the current work was between 24-26° C and Akunsunger et al., 2007 showed that growth rate of fishes is highly temperature dependent. In addition food demand of fish increase with temperature. This implies that at higher temperature more organic waste will be discharged by the fish and excess waste materials in the water may also reduce growth. This may be responsible for the low specific growth rate observed at higher densities.

The survival rate in the present work was high. The group with 20 fish showed the highest survival rate(Table 1).The survival rate declined significantly in the last stocking density (P <0.05) probably due to high stocking rate. The survival rate obtained by Akunsungur et al., 2007 was 89 to 98%. Significant increment was also observed in mortality with the highest motality recorded at highest stocking density, similar result was obtained by Akunsugur et al.,2007.

This research has shown that the optimum stocking density for *C. gariepinus* larvae for growth and survival was about 30 fish.

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