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GROWTH AND SURVIVAL OF *HETEROBRANCHUS LONGIFILIS* FRY IN DIFFERENT STOCKING DENSITIES

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Abstract

Heterobranchus longifilis (0.63±0.0g) fry were reared in four stocking densities in hapas immersed in concrete tanks for 42 days. There were significant variations ($P<0.05$) in the condition factors, mean final weights and the specific growth rates of the fish stocked at different densities. Optimal growth was observed in fish stocked at 10 fish/m^3 which had mean weight gain, 8.6g, specific growth rate, 6.36 and condition factor, 0.77. There was no significant ($P>0.05$) effect of stocking density on food conversion ratio which ranged from 0.81 to 0.87. There was an inverse relationship in the weight gain with stocking densities. Production of fish showed higher biomass with higher stocking density but higher individual weight with lower stocking densities. The survival of fish during the study was high (96.6% – 100%) in all four stocking densities

Keywords: Stocking density, Growth, Survival, *H. longifilis.*

Introduction

Stocking density in any rearing system is very important and dependent on level of culture (i.e. whether extensive, semi-intensive and intensive), size of fish, species of fish, and size of rearing compartment. The success of fish culture in water bodies depends on appropriate stocking densities and management procedures. Excessive stocking of fish per unit area of rearing compartment may result in stunting of some fishes like the tilapia (Dambo and Rana 1992) *Oreochromis. niloticus* (Dambo and Rana 1992) and cannibalism in others like catfishes (Dada *et al.*, 2000). In natural water bodies, there are prey-predator relationships set up to check excesses. In culture, especially in polyculture of tilapia and catfishes there is a simulation of this relationship but where hatchery and nursery management are monocultures, the stocking densities for optimal growth and survival should be established along with other managerial procedures of feeding and maintenance of suitable water quality. Variation in growth rates and relative sizes attained by fish in a given space is a well known phenomenon (Frenderson and Carpenter 1971; Amberker and Doyle, 1990).

There have been various studies on the effects of stocking densities on growth and survival of various fish species including, channel catfish (Kenneth, 1974); trout (Trzebiatowski *et al.,* 1981); *Sarotherodon galilaeus* (Otubusin *et al.,* 1990); *Oreochromis niloticus* (Otubusin 2000); *Clarias gariepinus* (Inyang and Odo 1996); *Heterobranchus bidorsalis* (Dada *et al.,* 2000). Studies on the appropriate stocking density for nursery and grow – out of *H. longifilis* are yet to be carried out. Otubusin *et al.* (1990) observed that there is an inverse relationship between stocking densities and mean daily weight gain. In cage culture, Trzebiatowski *et al.* (1981) observed that stocking densities of 150 to 900 fish /m^3 of water resulted in production, weight gain/ m^3, food conversion and individual growth rates being inversely proportional to the stocking densities.

Dada *et al.* (2000) reported that the development of jumpers increased as stocking densities increased. This study investigates the effects of stocking density on the growth and survival of *H. longifilis* fry.

Materials and Methods

H. longifilis fry with initial mean weight, 0.63 ± 0.0g were stocked in eight hapas in duplicates at 10, 20, 30, and 40 fish per hapa. The hapas were mounted on ropes such that they were immersed in a tank to the depth of 0.41 - 0.57m. Each hapa measured 1m x 1m x 1m.

They were fed with a diet of 44% crude protein at 5% body weight twice daily for 42 days. Sampling was carried out weekly. Mean weight gain, mean total length and percentage survival of the fish was calculated along with other growth parameters during sampling as follows:

Mean Weight Gain = Wf – Wi

Where Wf is mean final weight and Wi mean initial weight

Food Conversion Ratio = Dry food intake/weight gain

Specific Growth Rate =100 (In Wf – In Wi)/growth period

where Wf is mean final weight while Wi is mean initial weight

Condition Factor (K) = 100 W / L^3

Where W is final mean weight and L is final mean total length.

Percentage Survival (PS) = 100 Wh/Ws

Where: Wh is total no. of fish at harvest while Ws is total number of fish stocked.

Some water quality parameters such as temperature, dissolved oxygen, pH, and conductivity were monitored throughout the experimental period using A.P.H.A (1980) methods. Statistical analysis was done using one-way Analysis of Variance (ANOVA) using the computer package, Microsoft word SPSS Version 10.

Results

Table I shows the growth performance of *H. longifilis* fingerlings stocked at varying densities. There was significant variation (P<0.05) in the mean final weight (6.15g – 8.6g). There was significant variation in the specific growth rate of fish stocked at the two lower densities (6.36 and 5.99) and that stocked at the two higher densities (5.56 and 5.43). There was no significant variation (P>0.05) in the food conversion ratio (0.81 – 0.87) of the fish stocked at varying densities. The fish stocked at 10 fish /m^3 had a higher condition factor (0.77) although it was not significantly different from that of fish stocked 20 fish/m^3 (0.72) but there was significant difference (P<0.05) between these and the condition factors (0.69 and 0.70) of higher stocking densities. The mean final weight showed the same trend as the specific growth rate. Figure 1 shows the growth of *H. longifilis* stocked with varying densities.

Production of *H. longifilis* ranged from 802.13g/m^3/yr for stocking at 10 fish /m^3 to 2137.86g/m^3/yr for stocking at 40 fish/m^3. Figure 2 shows the relationship between production and stocking densities.

The survival rate of the fish was high throughout the rearing period. It ranged from 96.6% to 100%. Mortalities were observed only in the treatment of 30 fish/ m^3 in the fifth and sixth week.

Temperature ranged from 28.8^{0}C - 28.9^{0}C while dissolved oxygen ranged from 2.4 mg/l - 5.6mg/l. Conductivity was 140 - 160µ ohms/cm while pH was 7.0 - 7.4.

Discussion

Fish growth, feed conversion and survival were apparently influenced by several factors including stocking densities. Fish density determines the level of competition for food and mates in the rearing compartment. Competition involves the healthier and stronger fish reaching out for the distributed food faster and this will result in differential growth (Refstie, 1977). The results from this study showed that the fish stocked 10 fish /m^3 had the best growth. This observation agrees with earlier studies (Inyang *et al.,* 1996, Dada *et al*., 2000). The higher the stocking density the lower the weight gain and this may have been due to competition for food or space (Canario *et al*., 1998; Papoutsoglou *et al.,* 2006). Gokcek and Akyurt (2007) citing Vijayan and Leatherland (1988); Alanara and Brannas (1996); Montero *et al.* (1999, 2001) reported that lower growth in higher stocking densities were related to poor water quality, competition for food, social interaction, aggressive behavior, or neurohormonal and/or met abolism – related changes associated with high stocking density.

Table I: Growth performance of *H. longifilis* reared at varying stocking densities

Parameters	STOCKING	DENSITIES/HAPA		
	10	20	30	40
Mean Initial Weight (g)/fish	0.63±0.0	0.63±0.0	0.63±0.0	0.63±0.0
Mean Final Weight (g)/fish	9.23±2.16^{b}	7.87±2.2^{b}	6.51±0.35^{a}	6.15±0.11^{a}
Mean Weight Gain (g)/fish	8.60±2.16	7.18±0.33	5.88±0.35	5.52±0.11
Mean Initial Length (cm)	4.23±0.00	4.23±0.00	4.23±0.00	4.23±0.00
Mean Final Length (cm)	10.58±0.81	10.27±0.33	9.76±0.20	9.42±0.21
Total Feed Supplied(g)	7.08	6.25	4.74	4.80
Specific Growth Rate (%)	6.36±0.57^{b}	5.99±0.1^{b}	5.56±0.13^{a}	5.43±0.05^{a}
Food Conversion Ratio	0.84±0.06^{a}	0.87±0.06^{a}	0.81±0.07^{a}	0.87±0.0^{a}
Condition Factor	0.77±0.01^{a}	0.72±0.04^{ab}	0.70±0.08^{b}	0.69±0.01^{b}
Percentage Survival	100	100	96.6	100
Production g/ m^3/yr	802.13	1357.45	1640.67	2137.86

Figures in the same row with the same superscript are not significantly different (P>0.05)

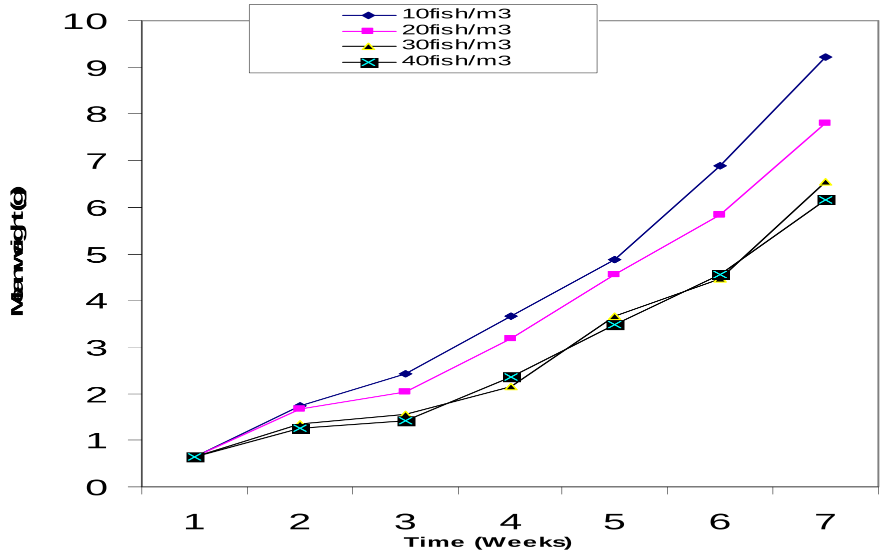

FIG 1: Growth of *H. longifilis* stocked at varying densities

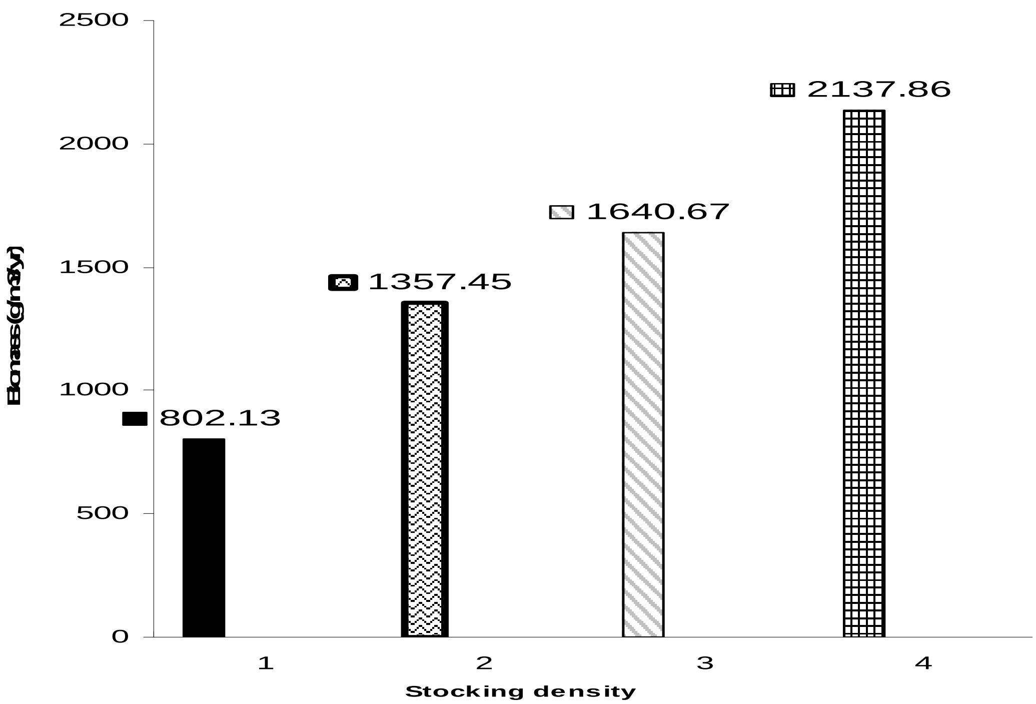

Fig 2: Production of *H. longifilis* stocked at different densities

Fish in the lower stocking density will achieve table size faster and hence early harvest and reduction in operational cost. Cho and Bureau (2005) reported that feed cost represented a high proportion of the operating expenses. The inverse relationship between stocking density and fish growth in this study compares well with Otubusin (2000) and Otubusin *et al.* (1988, 1990). In the present study, growth showed significant variation such that the stocking densities that were lower, 10 and 20 fish/m^3 varied from the higher stocking densities, 30 and 40 fish/m^3. The fact that there were no significant difference in food conversion ratio between fish at all the stocking densities shows that the food was similarly utilized at all the stocking densities.

There was higher biomass with the fish stocked 40 fish /m^3 while those stocked at 10 fish /m^3 gave higher individual weight. In considering the high biomass of the fish stocked 40 fish/m^3 for production ponds, *H. longifilis* should be of the same size so as to avoid cannibalism. The growth curves of the fish stocked at varying densities are typical of young fish showing clearly the superior growth of the fish stocked 10 fish /m^3.

Survival of the fish in this study was high in the four stocking densities. This may probably be as a result of the fish being of the same size at stocking. The consistent growth of the fish prevented differential growth in each treatment throughout the rearing period and because the water quality was also at conducive levels this favoured high survival rate. This does not compare well with Dada *et al*. (2000) who observed an increase in the development of jumpers as stocking densities increased. Another reason for high survival may be because of adequacy of food supplied since the low feed conversion ratios observed implies high conversion efficiency. Dada *et al.,*(1998) reported decrease in the percentage survival with increase in stocking of *H. bidorsalis*.

Although survival was not significantly different (P>0.05) in all densities the fastest growing fish were those stocked at density of 10 fish/m^3 and so this level of stocking would be more economical in pond culture system.

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