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COMPARATIVE STUDY ON THE GROWTH PERFORMANCE OF THE HYBRID CATFISH *Heteroclarias clariidae* REARED IN CONCRETE AND EARTHEN PONDS

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Abstract

Growth performance of the hybrid catfish *Heteroclarias* reared in concrete and earthen pond systems were investigated in a 92-day experiment. Experiment was conducted using four rectangular ponds (2 concrete and 2 earthen) each measuring 14 × 6 × 1.5 metres in duplicates. The ponds were uniformly limed, fertilized and stocked with 1,000 fingerlings each averaging 10cm and 40g (±2.0). Fish were fed at 5% body weight (BW) daily and randomly sampled monthly. Results indicated that the mean length gain, mean weight gain, relative growth rate, specific growth rate and mean condition factor were 20.59cm, 283.8g, 946%, 8.5%/day and 0.8 respectively for fishes reared in concrete ponds and 28.72cm, 623.4g, 2178%, 11.5%/day and 1.75 respectively for fishes reared in earthen ponds. All the indices of growth analysed showed a higher significant value ($P<0.05$) in fishes reared in earthen ponds than those reared in concrete ponds.

Keywords: Concrete, earthen pond, growth, performance, Heteroclarias

Introduction

Aquaculture has documented great success in some parts of the world contributing up to 30% of annual fish production in the last few decades (Edward, 1990). Constraints of power/energy, lack of operational laws guiding the use of natural resources and poor investment on this sector in Nigeria has continued to militate against its development (FAO, 2005). One obvious effect of these is that fish culture is still practised extensively in earthen ponds by most fish farmers.

The use of earthen ponds in fish culture is as old as fish farming itself and has the advantages of providing a more natural environment for the cultured fish with nutrients being easily recycled between the water medium and the bottom sediments (Noux *et al.*, 1995). Recently however, the use of concrete ponds and other artificial culture media in fish culture is gaining grounds, particularly in areas where the water retention capacity of the soil is low and therefore an intensive use of artificial water supply is practised (Balarin, 1981). The concrete pond has advantages of space economy, easy reuse of pond site and easier assessment of stocked fish during the rearing period.

Several studies in the past have been conducted on growth performance of various fish species under different culture systems (Huet, 1970; Bardach, 1972; Balarin, 1981; Viola and Arieli, 1983; Robinson *et al.*, 1998). None of such studies, however, has attempted a comparative analysis of the growth performance/

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yield of fish cultured under different culture systems. The present study therefore is a comparative work to investigate the growth performance of *Heteroclarias* reared in concrete and earthen pond systems.

Materials and methods

Four rectangular ponds (2 concrete and 2 earthen) each measuring 14 x 6 x 1.5m were used for this experiment. The ponds were uniformly limed, fertilized and stocked with fingerlings averaging 10±0.2cm and 40±0.2g at 1,000 fingerlings per pond. The fish were fed a commercial floating fish pelleted feed containing 55% crude protein for the first six weeks, then on local pressure pelleted fish feed containing 32% crude protein for the next six weeks. Fish were fed at 5% body weight twice daily and water temperature and pH were observed in each pond using a thermometer and pH meter. Fish were randomly sampled monthly and the length and weight recorded. Feed rations were also adjusted monthly based on the sample total weight of fish in each pond. The growth parameters used to assess growth performance of fish at the end of the experiment were:

Mean weight gain = Wf – Wi

Mean length gain = Lf – Li

Where Wf and Lf is final weight and length and Wi, Li are initial weight and length, respectively.

$$\text{Relative growth rate} = \frac{W_f - W_i}{t} \times 100$$

$$\text{Specific growth rate} = \frac{L_n W_f - L_n W_i}{t} \times 100$$

Where W_f is final mean weight, W_i is initial mean weight and t is growth period in months, and L_n is natural logarithm.

$$\text{Condition Factor (K)} = \frac{100W}{L^3}$$

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

Un-paired t-test was used to compare differences in fish growth rate and performance in each pond.

Results

The experiment showed variation in growth rates and performance of the hybrid *Heteroclarias* reared in the culture systems. Table 1 shows the mean length and weight gained by fishes after the experiment. Fishes stocked in concrete ponds had an average length and weight gain of 20.59cm and 283.8g respectively while those stocked in earthen ponds had 28.72cm and 623.4g respectively showing significant difference ($p<0.05$) from those stocked in concrete ponds.

The monthly variation in length and weight of fishes reared in the two systems shown in Table 2 followed a uniform rate for the first two months. However, significant difference ($p<0.05$) were shown in favour of fishes reared in the earthen ponds at the end of the third month.

The growth performance of fishes further analysed using the relative and specific growth rates, as highlighted in Table 3, were recorded as 946% and 8.5%/dy for concrete pond system and 2178% and 11.15%/dy for earthen pond system. Fishes reared in the earthen ponds again showed a highly significant difference ($p<0.05$) from those reared in concrete ponds.

The monthly mean condition factor (K) of fishes analysed during the experimental period are presented in Table 4. Fishes in earthen ponds had mean condition factors higher than 1 throughout the period (3.06, 1.08, 1.13) in contrast to those reared in concrete pond with the third month only recording a 'K' value above 1 (0.44, 0.89, 1.09). The overall mean condition factor was 0.8 for fishes reared in

concrete ponds and 1.75 for those reared in earthen ponds. This again showed significant difference ($p<0.05$) in condition factor of fishes reared in concrete and earthen ponds.

Table 1. Mean length/weight gain of fishes reared in earthen and concrete ponds

Constituents	Concrete Ponds	Earthen Ponds
Initial length (cm)	10	10
Final length (cm)	30.59	38.72
Mean length gain (cm)	20.59 (67.3%)	28.72 (90.4%)
Initial weight (g)	30	30
Final weight (g)	313.8	653.4
Mean weight gain (g)	283.8 (74.1%)	623.4 (95.4%)

Table 2. Monthly variation in mean length and mean weight of fishes cultured in concrete and earthen ponds

Months	Mean Length (cm)		Mean Weight (g)	
	Concrete Pond	Earthen Pond	Concrete Pond	Earthen Pond
1	19.22	19.73	31.48	38.21
2	27.67	27.89	190.4	226.05
3	30.59	38.72	313.8	653.4

Table 3. Growth performance of fishes reared in concrete and earthen ponds

Growth Parameters	Concrete Pond	Earthen Pond
Relative growth Rate (%)	946	2178
Specific growth Rate (%/dy)	8.5	11.15

Table 4. Variations in monthly mean condition factor (K)

Months	Concrete Pond	Earthen Pond
1	0.44	3.06
2	0.89	1.08
3	1.09	1.13

Discussion

The level of production, management, duration, productivity and general economics of an aquacultural enterprise is largely hinged on the type of culture system practiced (Ayinla, 1991). Modern fish culture techniques is one of the pivots on which aquaculture has recorded its breakthroughs (Mayor and Meye, 2007). The results from this study showed that fishes reared in earthen ponds had a better growth performance compared to those reared in concrete tanks. This may be as a result of the simulation of a natural habitat in the earthen pond which brings about easy decomposition of organic matter (Noux *et al*, 1995). The system therefore tends to provide a more fertile and hygienic environment for the fish as both the allochthonous and autochthonous organic matter are decomposed by the naturally occurring decomposers in pond soil.

The mean weight (623.4g) gained by fishes reared in earthen ponds was more than twice that of fishes in concrete ponds (283.8g). This may be due to increased natural foods made more easily available in the earthen ponds over the concrete ponds by the activities of phytoplankton, zooplankton and benthos finding their niche naturally in the earthen ponds on which fish thrive on as supplemental diets (Robinson *et al*, 1998). The study also indicates relative and specific growth rates to be in favour of fishes reared in earthen ponds. This could also be attributed to its better water quality since all organic matter are naturally decomposed giving a better condition factor for fish growth as reported in this study.

The findings of this experiment have shown that *Heteroclarias* performed better in earthen ponds than in concrete ponds. However, quite recently, the use of such improvised materials as tarpaulin, PVC and concrete ponds in fish culture has continued to gain greater acceptability due to their land space economy. Besides, the poor or low water retention capacity of most soil has made the use of these alternative culture media a compelling necessity. To improve the performance of fishes in concrete ponds, it is recommended that feeding be made more intensive (5 – 10% Body weight) and water quality regularly monitored. Also, concrete ponds can be modified to a partial running water system in which water replacement is carried out at regular intervals. On the other hand, earthen ponds could be better improved by compacting pond bottoms with adequate proportions of clay to enhance its water holding capacity.

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