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Comparative Study of Growth Performance of *Heterobranchus Longifilis* (Valenciennes, 1840), Reared With Two Organic Fertilizers in Earthen Ponds

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Abstract

The performance of *Heterobranchus longifilis* reared in earthen ponds fertilized with two organic fertilizers (meadow grasses and chicken droppings) was investigated. The study was carried out in 6 earthen ponds measuring 24.9 square meters each at Nigerian Institute for Oceanography and Marine Research (NIOMR) fish farm Ijoyi-Badore Lagos. Results obtained showed better food conversion ratio value in treatment 1 (1.28 ± 0. 11) fertilized with meadow grasses and chicken droppings in combination with commercial extruded feed than in treatment 2 (1.72 ± 0.32) fertilized with only chicken droppings in combination with commercial extruded feed. The total weight gain were 665.39 ± 22.05Kg and 623.93 ±40.64kg respectively for treatment 1 and 2 while the daily growth rate was 4.01 ± 0.13g and 3.76 ± 0.24g for treatment 1 and 2 respectively. *H. longifilis* in treatment 1 performed better than treatment 2 probably due to the efficiency of the organic fertilizers in treatment 1 than treatment 2. Fertilizer used in treatment 1 could be used in fish ponds to reduce cost of pond fish production.

Keywords: *Heterobranchus longifilis;* Growth performance; Organic manure; Fertilizer; Feed;

Introduction

In Nigeria, fish culture is one of the predominant aquaculture activities and most of the culture is land based. Heterobranchus longifilis (Plate 1) belongs to the catfish family clariidae that has gained widespread recognition as promising specie in aquaculture production (Lennient, et al. [16]). *H. longifilis* is an economically important food fish cultured primarily in fresh water ponds in tropical countries (Babalola and Aputa, [6] and Akinwole and Faturoti, [3]). This specie exhibits many qualities which makes it suitable for commercial culture. These include such as hardiness, rapid growth, high disease resistance, high yield potential, high fecundity, air breathing characteristics and good market potentials (Ayinla, et al. [5]). The traditional and extensive fish cultures is dependent on the natural pond productivity, while the semi-intensive and intensive fish culture system developed than extensive by using of various inputs such as manures, fertilizers and supplementary feed (Charabarty et al. [8]). Moreover, Charabarty, et al. [8] reported that the in freshwater fish ponds, total primary fish production, mainly depend upon the availability of nutrients, nutrient recycling and primary nutrients in the form of organic and inorganic fertilization and artificial feed .Attention has been paid to enhance the natural productivity of the pond through the application of different types and dosages of manures and fertilizers, fish species to be stocked and their compatibility (Britz, et al. [21]).Fish production can be increased by feeding and pond fertilization. Optimum fertilization rate is the amount of organic matter that should be cost effective and can be utilized in a pond ecosystem without having harmful effect on water quality as well as on fish growth (Abass, et al. [1]). To improve the productive efficiency of fish ponds and to have a maximum yield from the limited resources of fresh water bodies, it is necessary to fertilize the fish ponds with balanced food in sufficient quantities. Pond fertilization using both organic manure and inorganic fertilizers is the latest management protocol to enhance the biological productivity of treated waters (Dhawan and Kaur, [10]; Bhakta, et al. [7]). The basic principle behind the fertilization of a fish pond with suitable manure is to actually increase the production of beneficial phytoplanktons, the key component of aquatic food chain which is responsible for increasing the amount of harvestable fish. It is estimated that pond fertilization can enhance the fish harvest of the given water body up to 2.8 times of an unfertilized pond (Hayat, et al. [14]; Godara, et al. [13]).

Plate 1: *Heterobranchus longifilis* specie

The types of fertilizers used are organic and inorganic fertilizer which boost the nutrient content of ponds and promote the yield of natural food required by the aquatic organisms, especially fish. Conte, [11] stated that organic fertilizers like hay, straw and manure are among the earliest sources of fertilizers and are commonly used throughout the world to initiate alga blooms in fish pond and is important for pond productivity. The aim of this work is to carry out a comparative analysis of two organic compositions and evaluate fish growth performance.

Materials and methods

This study was carried out in the Nigerian Institute For Oceanography and Marine Research (NIOMR) Integrated Fish Farm at Ijoyi - Badore along Ajah road, Lagos State, Nigeria. It lies approximately between longitude 06º 30′ 25′′ E and 06º 32′ 28′′ E, Latitude 03º 36′ 19′′ N and 03º 39′ 17″ N (Figure 1).Six earthen ponds of 24.9 m3 each (Plate 2) which comprise two treatments, were used. In treatment 1, a combination of organic chicken droppings were applied weekly at the rate of 0.7 kg ha^{-1} (278 kg ha^{-1}) per pound (Ita, [15]) while the hay /meadow were applied at the rate of 1.2 kg-500 kg ha^{-1} weekly (Boyd, et al. [20]). The hay (meadow) used (Plate 3) in the fertilization were *Eleusine indica, Setaria longiseta, Panicum repens, Kyllinga bulbosa, Kyllinga squamutata, Panicum laxum and Eragrostisa trovirens.*

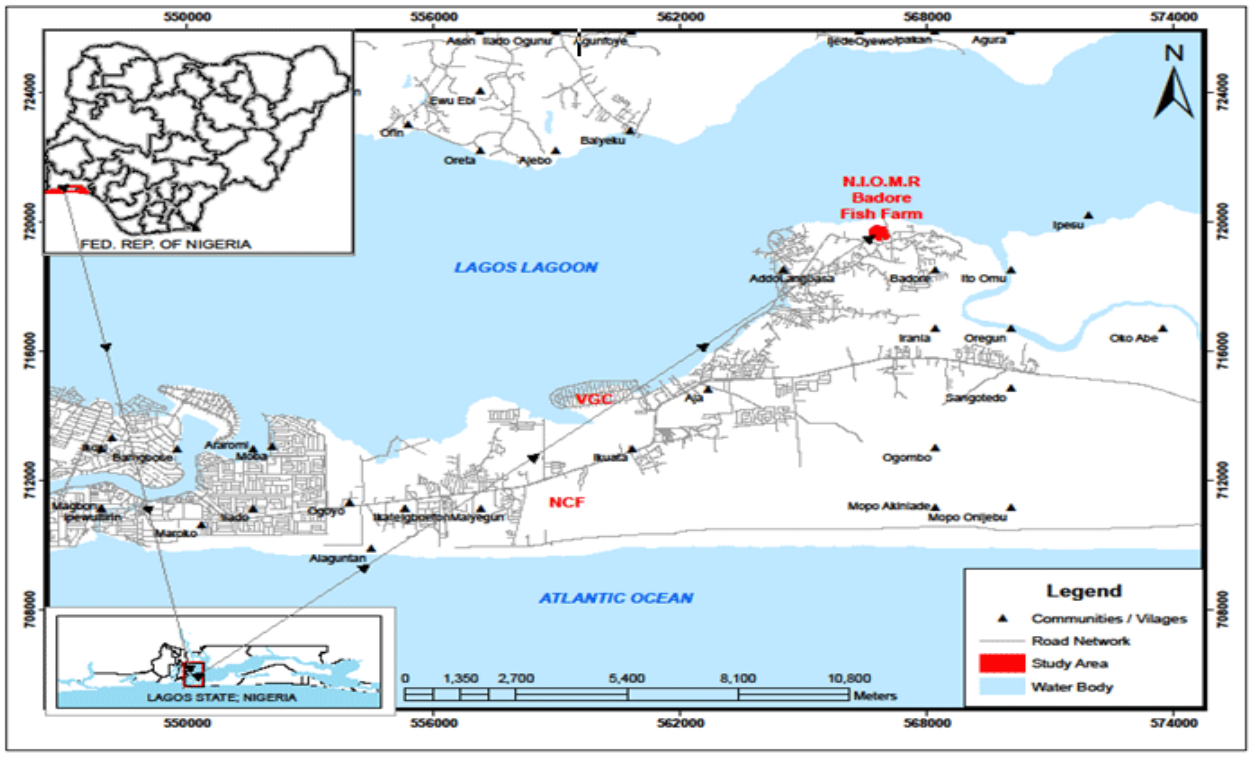

Figure 1: Project location in Lagos State

Plate 2: Layout of Earten ponds used in the Study

Plate 3: Meadow grasses used for the hay infusion

Post fingerlings of *H. longifilis* were stocked in the six earthen ponds of 24.9 m3at a stocking density of 20 fish/m3. The *H. longifilis* post fingerlings with an initial mean total length of 7.73 ± 0.58 cm and an initial mean weight of 3.67±0.037g were stocked. The fish species was randomly stocked in each of the replicated experimental units and reared for 166 days. Coppens feed was used throughout the duration of this experiment. Composition of the feed was as stated by the manufacturer. Feeding was at the rate of 1.5% fresh body weight given three times (07.00, 13.00 and 19.00 hours) daily using 45% crude protein diet, for the first 3 months. Thereafter from the fourth month, feeding was reduced to 1% fresh body weight using 42% crude protein till the attainment of one kilogram average body weight. The body weight of the fish were measured to the nearest 0.0lg using a digital weighing scale (Model DT-302) and an analog weighing balance (Model- camry weighing scale 0-100kg) as the weight increased.The Physico-chemical parameters such as air and surface water temperature were measured with mercury in glass thermometer (100^0 C max). Other physico-chemical parameters such as Hydrogen ion concentration (pH), Dissolved Oxygen (DO), Conductivity, salinity, alkalinity, nitrite, ammonia and turbidity were determined according to Forth, [12] with LaMotte fresh water aquaculture test kit.

Results and Discussion

The highest total mean body weight gain of 665.39kg was obtained in Treatment 1 followed by fish cultured in Treatment 2 (623.93kg). Details of the results are presented in Table 1. There were no significant differences ($p > 0.05$) in Weight Gain (WG), daily Growth Rate (GR), Specific Growth Rate (SGR), Survival Rate (SR) and Mortality Rate (MR) between the treatments. This could be attributed to the fertilizer used (meadow grasses and chicken droppings) in combination with the commercial extruded feed. The value of FCR was lower in Treatment 1 (1.28± 0.11) than in Treatment 2 (1.72±0.32) which showed a better FCR of 1.28 than 1.72. The lower the FCR value, the better the FCR. The FCR obtained in this study were better than those of Adewolu et al. [2] for *H. longifilis* (1.82) and its hybrid (1.75). However they were within the range of 1.33-1.79 recorded by Ofor and Onuoha (2011) for *H. longifilis* fed different commercial feeds. But higher than the range of 0.9 - 1.20 recorded for *Clarias gariepinus* by Anyanwu et al. [4].

The specific growth rates (SGR) of 3.54 and 3.52% (Table 1) obtained from the two treatments respectively in this study were within the range of 2.74 - 3.57% obtained by (Bichi and Ahmad, [18]) for C. gariepinus but higher than value range 1.25 - 1.94% obtained by Ofor and Onuoha,[17]. The daily growth rates of 4.01 and 3.76 g (Table 1) obtained in treatments 1 and 2 respectively were within the range of 2.34 - 6.01 g obtained for C. gariepinus by Bichi and Ahmad, [18], Adewolu, et al. [2] in their experiment obtained 5.05, 4.47 and 5.40 g SGR for C. gariepinus, *H. longifilis* and their hybrid respectively which was higher than the SGR (3.42 – 3.54%) obtained in this study.

The survival rate of 96.73 and 93.47% (Table 1) obtained for this study are within the range of 67.0-97.5% as obtained by (Anyanwu, et al. [4]) for C. gariepinus. The difference between Treatments 1 and 2 could be due to the combined fertilizer applied in treatment 1 which produced more food items than in Treatment 2, resulting in better living conditions. There were no significant differences ($p > 0.05$) in the physico-chemical parameters however they were numerically not the same, which may be attributed to, different fertilization levels, as Treatment 1, had meadow grasses and chicken droppings while Treatment 2, had only chicken droppings. The values of water temperature obtained in this study were within the range of 28.6-31.80C and 26.9-31.60C for Treatments 1 and 2 respectively; pH values were 7.03 and 7.00 respectively; Dissolved Oxygen obtained in Treatments 1 and 2 were 4.21 and 4.20 mg/l respectively; mean total ammonia obtained in this study for Treatments 1 and 2 were 0.75 and 0.65 mg/l, the toxic unionized ammonia obtained were 0.006 and0.005 mg/l which were within tolerance range of 0.2-2.0 of unionized ammonia ; Nitrite concentration obtained were 0.06 and 0.05 mg/l respectively according to Body (1998) .

Table 1: Mean Values of Some Growth Parameters o*f H. Longifilis*

Growth Parameters	Treatment	Mean values ± S.D.
Food Conversion Ratio	T1	1.28 ± 0.11^{b}
	T2	1.72 ± 0.32^{ab}
Weight Gain (kg)	T1	665.39 ± 22.05^{a}
	T2	623.93 ± 40.64^{a}
Daily Growth Rate (g)	T1	4.01 ± 0.13^{a}
	T2	3.76 ± 0.24^{a}
Survival Rate (%)	T1	96.73 ± 0.70^{a}
	T2	93.47 ± 1.40^{a}
Mortality Rate (%)	T1	3.27 ± 0.70^{a}
	T2	6.53 ± 1.40^{a}
Specific Growth Rate (%)	T1	3.54 ± 0.07^{a}
	T2	3.52 ± 0.04^{a}

Means of the growth parameters with different letters as superscript are significantly different between and within the treatments ($p < 0.05$). Means values are followed by ± S.D (Standard deviation).

The mortality rate (%), did not give significant difference within the Treatments due to the wide gap in their values.

The value for the nutrient utilization parameters are presented in Table 2 while protein intake (g) values obtained were 355.865 and 472.659 g for Treatments 1 and 2 respectively. These values are higher than the values obtained by Adewolu, et al. [2] for *C. gariepinus,* 81.07g, *H. longifilis* 59.33 g and their hybrid, 98.99 g. The protein efficiency ratio (PER) (g) obtained in treatment 2 was 1.321 g which was lower than the values obtained by Adewolu et al., (2008) for C. gariepinus (1.59) and Hybrid (1.63) but the value obtained for treatment 1 was higher than those of Adewolu, et al. [2] for *H. longifilis* (1.87). The apparent net protein utilization (ANPU) (%) obtained were 0.953 and 0.791% in treatments 1 and 2 respectively (Table 2).

Table 2: Protein utilization of H. Longifilis

Parameters	Trt 1	Trt 2
Protein(Protein Intake(g)	355.865	472.659
Protein Efficiency Ratio (PER) (g)	1.87	1.321
Apparent Net Protein Utilization (ANPU) (%)	0.953	0.791

Conclusion

The physico-chemical parameters obtained in this study were within tolerance range the performance of *H. longifilis* reared in the two treatments were, very good since the result showed rapid growth rate and efficient feed utilization. Data obtained from the study indicated that meadow grasses can be effective in pond culture of *H. longifilis* leading to lower production cost.

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