COMPARATIVE STUDY OF FEED UTILISATION AND GROWTH RATE IN *HETEROCLARIAS.*

OLUWASHINA. M. M. AND SOLOMON. R. J.

DEPARTMENT OF BIOLOGICAL SCIENCES, UNIVERSITY OF ABUJA
FEDERAL CAPITAL TERRITORY. NIGERIA.
E-MAIL: johnsol2004@yahoo.com.

ABSTACT: An experiment lasting eight weeks (two months) was conducted in the Botanical garden of the Department of Biological sciences, University of Abuja, to evaluate the growth performance of *Heteroclarias* in circular tanks each having a capacity of sixty liters. Fishes were divided into three groups, with 16 fishes per tank. The fingerlings stocked were of the same size and length. Fishes In tank A were fed Coppen feed, while in B, a local made feed with a combination of Soya bean and maize while for C, groundnut cake and guinea corn was used. The fingerlings were fed 4% of their body weight twice daily, from 6.00 to 8.00am and from 6.00 to 8.00pm. Growth performance and physiochemical parameters were monitored weekly. The results showed that treatment B had the best growth performance with a mean weight and length gain which exceeds that of treatment A and treatment C. There was a significant difference (p>0.05) between growth rate and different feeds.

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INTRODUCTION

The primary constraint to commercial catfish production has been the lack of reliable cost effective methods for producing large quantities of fish for commercial practice and has been for years. This is the growing and cultivation of different species of fish including other aquatic animals for various purposes such as feeding, decoration, ornamental and for advanced research. This branch of Agriculture has become very important being that they are good sources of protein, Vitamins, oils etc. (Bard et. al., 1976). Pond culture is not a traditional farming practice in most parts of Africa, but was introduced after the Second World War, since then catfish culture has not made much further progress and has in some cases even declined resulting in the abandonment of fish pond by discouraged farmers due to the use of poor husbandry techniques (De Grace et. Al 1996).

Fish farming also known as Aquaculture play a major role in Agriculture in Africa and especially in Nigeria. This could be practiced in either their natural habitat or by artificial methods, most especially to boost fish production in Nigeria and the world as a whole. Artificial fish farming could be carried out with the use of ponds, tanks and aquarium, making available facilities which will enhance fish growth. The art of artificial fish farming may perhaps encourage research and studies on the various species of fishes with the aim of improving growth yield, prevention of diseases, improved quantities and other areas of study. (Bard et. al., 1976). In the review of Ita. (1998), it was stated that early fish farmers in Nigeria raised their fish in burrow pits, abandoned minefields and in earthen ponds on extensive production system. The introduction of concrete tanks allows for manageable pond size and modification of the environment through a water flow, through system and supplementary feeding thus allowing for higher fish yield. The advent of the indoor water re-circulatory system (WRS) has ushered in a new created a turning point in the production of catfish in Nigeria. Fish stocking density is the number of fish stocked per unit area or volume, fish stocking has been recommended as a magic measure to almost every problem we have is fresh water fisheries, from low production to over exploitation and to habitat degradation fisheries are usually exploited on a trial and error bases and assessment of stocking effectiveness are rarely conducted of great importance is the maintenance of correct stocking densities, the objective in fish culture is to obtain the maximum increase in weight (biomass) of fish/unit area or volume/unit time with a specific level of management practice. Aquaculture therefore remains the only viable alternative for increasing fish production in order to meet the protein need of the people. It was observed that of the over 30,000mt of various fresh water and brackish water fish species caught in year 2000, catfishes were more abundant next to tilapias FAO (1993) reported that 27, 88mt of catfishes produced in 1990 were consumed locally. This implies that there is still great need for higher production for both local and international markets. In aquaculture, fish requires adequate food supply in the right proportions and with proper nutritional contents needed for growth, energy, production, movement and other activities which they carry out. According to Hepher (1990), fish yield and profitability per pond area of a culture unit depends, to a large extent and on the amount of the supplementary feed used. Weatherly and Gill [I977] started that fish meal is commonly used in food formulation to supplement the high cost of protein in culture diets due to its nutritive value. Due to the increase in fresh water farming in Nigeria and globally, there could be intense competition for fish meal and fish oil. Hence he need for alternative source of protein to replace fish meal without reducing the quality of the feed. Through animal by product e.g. blood meal, hydrolyses feather meal, bone meal and some plant protein are good alternative, and they are less expensive and have differences. The excess amino acids may contain some anti nutritional factors that may impair proper fish growth and however, these meals can be mixed up in certain proportion to produce balanced nutritional and economic diets.

The yearnings of farmers and scientists to have a farmed catfish that combines together the fast growth traits of Heterobranchus spp and early maturing traits of C. gariepinus led to the development of a hybrid 'Heteroclarias' spp. The technology was widely accepted as it gave 58% internal rate of return (IRR) on investment (Faturoti et. al., 1986). Popma (1978) stated that the positive effect of Tilapia polycultured with predatory fish species is an additional source of food for the latter represented by Tilapia larvae. In past few years increased interests is aquaculture and polyculture has been witnessed due to spurred interests of many people in fish farming and this will continue to play an important role in meeting the demand for fish. Most production in Nigeria realized from pond based, tanks and water recirculatory culture system, using polyculture farming techniques. Artificial feeding of fish has many known advantages which include enhancement of high stocking density especially in polyculture system resulting in high yield, promotion of growth and enables the farmer to observe the behavior of his fish during feeding in order to detect any abnormality (Schoonbee and Prinsloo, 1988). Unlike in the past when fish depend on natural food in the pond, the production of fish feed is becoming popular with each passing day in the country. The objective in fish culture is to obtain the maximum increase in weight (Biomass) of fish/unit area or volume/unit time with a specific level of management practice. This requires the knowledge of; fish growth, carrying capacity, nutrition, yield, water quality (Prof. Edwards 2000).

Fish Growth

Fish growth is proportional to an exponent or quotient therefore we need to consider the carrying capacity. The carrying capacity is the maximum biomass of fish sustained in the culture facility under a given set of environment condition that is:
Biomass (weight) = mean individual X stocking density (Salam et al 2005).

- *Slow because the biomass is small*
- Fast because biomass has increased
- Slow because population is approaching carrying capacity.

The biomass of fish population at the carrying capacity is balanced with the environment (De Graff 1996).

The objective in fish farming management is to increase the biomass in the culture facility within the shortest possible time. This means avoiding the two slow growth phases. The first slow phase is due tote low biomass and underutilization of space and food, the second slow growth phase is because the fish population has reached its carrying capacity. Therefore there is need to stock a high density of small especially when rearing fingerlings (awrb 1999).

Nutrition and Yield

Fundamental laws governing the growth rate of animals, which decreases as age increase, prescribe that the amount of food acquired increases as size increases, but the percentage require decrease (UNDP/FAO 1981). Increasing the level of nutrition input in static water ponds leads to increase in growth rate and yield, although pond which are heavily fed may have problem with low dissolved oxygen and high ammonia (especially de-ionized ammonia). Nutritional diseases are as a result of feeding the fish-stock with sub-optional feed, poor with ingredient concentration. These feeds are not appetizing for the fish as a result, they are underutilized. This results in underutilization and deposits at the pond bottom (Ndukwe2006). In general four to six weeks after stocking, two distinct groups of fingerlings can be recognized within the pond. A large group (80-90% total biomass) Consisting of small sized fingerlings (2-3g) and a small group of fingerlings (10-20% of total biomass) consisting of large sized fingerlings (8-10g). Cannibalism will occur; the larger sized fish will eat up the smaller ones resulting in only a small number of larger fish being harvested. However, under adequate fish farming management, an average survival rate of 30-40% can be obtained (Salam et al

2005). Fish culture in Nigeria includes stocking of lake and production in ponds and cages, etc.

Two major aspects need to be considered when catfish production is concerned; the fish size at harvest and the total yield with increase in stocking density:

- Weight of individual fish declines due to competition for resources
- Yield increases.

A low stocking of 1 fish/m2 gives a low yield of large fish and a high stocking of 10fish/m2 gives a high yield of small fish. In most countries, market price of catfish is positively related to size. To obtain a high yield it is necessary to increase stocking as well as nutrition. (Prof. Edwards 2000).

LITERATURE REVIEW

Aquaculture in Africa is a relatively new industry and is not practiced on a wide scale. Fish pond culture in sub-Saharan Africa started in Kenya in 1924 and later spread to other parts of the continent (Huisman, 1986 and Jackson et. al., 1982). FAO (1998) stated that, fish supplies over 50% of the total animal protein consumed in developing countries. However, in Nigeria fish constitutes 40% of animal's protein intake (Olatunde, 1989). Aquaculture in Nigeria has turned a new leaf, in that becomes wide scale since the FAO introduced modern aquaculture and aquaculture technology into the system. In Nigeria today, aquaculture practices, sacks to improve fish yield and fish productivity. Its benefits range from rural development income generation, form sustainability as well as reduction in vulnerability. This practice also makes use of land which is considered unsuitable for agriculture such as swamps or saline areas. We have difference types of catfish which are *Heteroclarias, Heterobranchus* and *Claries garenpinus*, but the catfish *Clarias gareinpinus* is generally considered to be one of the must important tropical catfish species for aquaculture, has almost pan-African distribution, ranging from the Nile to West African and from Algeria to Southern African. They also occur in Asia. A study was undertaken between November, 2001 and March 2004 in the eleven based catfish in the recirculation aquaculture system (RAS) in to access. The overall performance, data on fish growth and feeding habit were collected. These data collected include, the feeding rate, amount of feeding, time of feeding, feeding composition, number of feeding/day, feed amount /tank/day, total protein and feeding patter. The growth of fish was also monitored from the time of stocking to the time of harvest.

Water temperature recorded in rearing tanks ranged from 25-35c. D.O and NH3-N concentration were 3.0mg/l and 0.01mg/l respective in rearing tanks and were within tolerable range for finger lings. Ammonia and D O did not have a significant relationship with mortality of fish in tanks. The demand for protein raises as the population increases hence, the need to invest on animals and fish species that can reproduce and grow rapidly. Examples of these are *Oreochromis niloticus* great importance to sub-sistence fish farmers in African and Asia (Bardach et.al, 1999), *Clarias* fish species, Carps and *Heterotis niloticus*. Tilapia is a good candidate of aquaculture because of its growth rate and productivity ability (prolific in nature). According to Teshima et al., (1986), *Oreochromis niloticus* is one of the fastest growing members of the Tilapia family and thrives well under culture condition throughout most farmers in Nigeria. *Heteroclarias* are in high demand by most farmers due to their hardness and fast growth. There seeds are, however, not readily available to meet the needs of large scale fish farmers because unlike tilapia, they do not readily reproduce in capacity, even when they do, the survival rate of a pond may not be sufficient to restock the pond. The protein requirement for fish has shown to vary not only with species of fish but also with life stages. Hence, the determination of protein requirement for maximum growth of any species is a logical first step to development of a cost effective feed for the fish.

There are several works on the determination of optimal protein requirements for *Tilapia*. Winfree and Stickney (1981); recommended 34% protein for *Tilapia* area of 7.5g body weight. Jauncey (1982) found 40% crude protein to be optimal for *Sarotherodon mossambicus* of 2g body weight in aquaria, Solomon et.al,. (1996) said that there is a wide array of food and feed stuff that are suitable for fish feeding and there quality is primarily assessed on their nutrient composition such as protein level.

Heteroclarias are omnivorous feeding on insects and fish materials more than any other in relation to the sizes and age of the fish and season are biological phenomena which are common to many species of fish in the tropics and temperature area of the world. The success of *Heteroclarias* can be attributed to its ability to colonize the variety of habitués created by the formation of the lake (Olatundeb1997) and its ability to utilize a wide range of food.

Legendre et.al, (1991) in his investigation of the food preferences of the commercial fishes of Lake Volta, noted that *Heteroclarias* feed mainly on insects and fish materials. Edwards et.al (1989), stated that food plays a very important roles in the husbandry of animals, including fish. The fish under culture receive their nutrient and energy required for the maintenance of life and growth from food eaten.

Foods supplied to the cultured fish are of two types; natural feed and artificial feeds. The artificial feeds play a vital role in intensive aquaculture, where the objective is to produce optimum density of fish per unit Area of water.

Much conventional protein feed such as fish meal, soybean meal and groundnut cake used in fish diet formulation in Nigeria are scarce and expensive. Lim and Dominy (1989) state that, the high cost and availability has made it imperative to source for an alternative. Animal source like fish meal, blood meal and plant product, like soybean, groundnut cake, Bambara nuts have been used in the past as good source of protein to formulate fish feed (Eyo, 1995). However, their demand for consumption by man and in formulating other animals feeds might affect their availability for fish formulation (Eyo, 1995) Hence the need to look into other availabity plant protein source for possible use in fish feed formulation plant materials have progressively been analyzed for fish feed formulation and their limitation due to inferior protein content have been evaluated (Ddevandra 1985). Ufodike et. al., (2006), carried out a research on the utility of pear seed, mango seed, and bean seed coat in fish production and he observed that the superiority of protein in the fish meal (58.58+-0.7%) showed that animal tissue generally contained more protein than plant tissue such as rice bran (8.7%), cassava leaves (7%), plantain peels (12.3%), (Halver 1960, Gohl 1981, and Millkin 1982).

In order to reduce the cost of a balanced fish diet, locally available ingredients such as agricultural by product and plant protein source. Bambara groundnut (Bam-nut) is a leguminous plant similar to the common groundnut/peanut (Vigna unguilata). It is found in abundance in the south eastern part of Nigeria and is commonly known as Okpa. Like the groundnut, it is grown for its underground seeds (Ashenafi and Busse, 1991). The seeds may be eaten raw when immature but the hard mature seeds need to be roasted or boiled to produce sweet and pleasant tasting meal. The seed contains 14-24% protein, about 60% carbohydrate, and it is higher in essential amino acids, methionine than most other grain legumes. (Brough et. al, 1993). It contains 6-12% oil, which is lesser than the amount in peanuts. Bambara groundnut, though underutilized African legume, has global availability especially in hostile tropical environment (Linneman, 1997). Bam-nut is one of the indigenous grains of sub-Saharan African, favored in terms of nutritional value and tolerance to adverse environment conditions. It is the third most important legume after groundnut and cowpea. Despite these, its full economic significance has not been determined (FAO, 2003).

Bambara groundnut (Vigna subterranean (L.) Verde) is a legume grown mainly in the middle Belt region and Enugu state of Nigeria (Doku and Karikari, 1971). Bambara groundnut seed has been reported to contain 14-24% crude protein (Rachie and Roberts, 1974; Temple and Aliyu, 1994; Olomu, 1995). The protein of the nut is of high biological value (FAO, 1982; Olomu, 1995) with a high amount of calcium and iron, though poor in phosphorus and with fairly high contents of thiamine, riboflavin, niacin and carotene, but very low in ascorbic acid (Oyenuga, 1968). It also contains minimum amount of trypsin and chymotrypsin inhibitors (Doku and Karikari, 1971).

Ofejukwu et. al., (2003) showed that 20% sesame cake can be used with 30% fish meal in the diet of juvenile Oreochromis niloticus. The extent to which nutrient, particularly protein are utilized by fish is regulated by an interplay of dietary and environment factors which include content of the diet (Garling and Wilson, 1976). Jauncey (1981) indicated that growth was proportional to the amount of protein in the diet of juvenile Sarotherodon mossambicus. Faturoti et.al (1986) reported that the optimum protein content of diet for juvenile clarias lazar was 40%.

Shepherd (1988) stated that difference in growth increments between monoculture of one polyculture of several species within the same period. However one specie might affect the environment to improve the growth condition for the other specie i.e. C=(a-b)/a. Individual specie could be used as a predator for recruitment control under different shocking ratio(Bedawi,1985).Guerrero et.al.,(1979) found out that the production of a tilapia monoculture system was lower than in polyculture with *Macrobrachium.* Dunseth and Bayne (1978) observed that, the highest stocking ratio (*C. managuense: T. aurea* 1: 4 and 1: 8) had a huge yield but lower individual weight gain. Vivien et. al., (1985) recommended an initial stocking weight of 1-3g for catfish and 5-15g for *Tilapia*.

Feed and feeding of catfish in grow outs ponds are perhaps the most document in literature. Various efforts have been made to establish the crude protein and amino acid requirement of *Clarias gariepinus*. Ayinla (1988) recommended 35% and 40% crude protein (Cp) for raising table size and brood stock respectively. Of the 10 essential amino acids (EAA) required by warm water fish species, only 3 EAAs studied have been documented and these are arginnie, methionine and lysine. In order to formulate and compound aqua feeds that will meet the nutrient requirements of the catfish at affordable cost, several conventional and non-conventional animal by-product and plant residues have been tested to substitute or replace fishmeal. Feeding development has moved from the use of single ingredient, broadcasting un-pelleted meal to pellet and in fact the use of pelleted floating feed which has made a big difference to aquaculture development in Nigeria as *Clarias gariepinus* is being raise to maturity within six months. Before randomly stocking the fish, the initial total length (cm) of individual fish and mean weight of the fish was recorded before placing them in the rearing containers. The aquariums were covered with mosquitoes net to prevent fingerlings from jumping out, intrusion of insects and other foreign bodies (Lizards, geckos, e.t.c.) All expenmental tanks or aquarium were cleared daily by scrubbing siphoning accumulated waste and disinfecting with 3ml/l potassium permanganate and rinse with clean water.

MATERIALS AND METHODS

Aquariums and Treatments.

Heteroclarias were transported from Ajima farms, Kuje, Abuja (FCT) in plastic bowls with oxygenated water between 5to 6pm to avoid mortality due to high temperature. They were assigned randomly into 3 replicate bowls at 16 fingerlings per treatment, designed as one (stocking ratio) by one (specie combination factorial). There were 3 treatments with the same stocking density. Each of the bowls was stocked with 16 *Heteroclarias* fingerlings respectively. The fingerlings stocked in each of the bowl are of the same sizes to avoid cannibalism. Dechlorinated tap water was used. No prophylactic treatment was given before acclimatization. The fingerlings were acclimatized for seven days and fed experimental floating diets at 4% body weight. The bowls were well aerated. At the end of acclimatization period, the fishes were starved for 24 hours to empty their gut content and prepare them for experimental feed. This also helps to make the fish hungry and thus receptive to the new diet. Before randomly stocking the fish, the initial total length (cm) of individual fish and mean weight of the fish was recorded before placing them in the rearing bowl. The bowl were covered with mosquito net to prevent fingerlings from jumping out, intrusion of insects other foreign bodies (Lizards, geckos, etc). All experimental tanks were cleaned daily by scrubbing, siphoning accumulated waste and disinfecting with 3ml/L Potassium permanganate and rinse with clean water.

Feeding and Measurement

Tanks C served as the control treatment using Coppen feed (floating diet) containing 42% crude protein, 13% crude fat, 1.9% crude fiber and 8.9% ash was used as control feed for the first treatment. Tank B contain Guinea corn 5-18%, groundnut cake 10-45%, fish meal 10-72%, wheat oil 20-20%, bone meal 0.1, lysine 0.1, methylamine 0.1. (Tank A) maize 5kg, soya bean 10-42%, blood meal 5-50%, fish meal 10-72%, wheat oil 20-20%, bone m 0.1, lysine 0.1 and methianine 0.1. The fingerlings were fed 4% of their body weight twice daily, morning (6 to 8am) and evening (6 to 8pm). Samplings of fish for weight and length measurement were initially done using a scoop net. However due to difficulties in collecting the fish with the net, the water volume was reduced with a rubber siphon before the fishes were collected with the scoop net. Fish weight (g) was taken using a top loading balance (Model: Ohaus precision plus). The fingerlings were weighted in group once a week. The standard length of the fish was taken to the nearest cm with the aid of a measuring ruler. This was done once a week. Depleted water was replaced with fresh water to an effective depth of 20cm after each cleaning.

Food Utilization Parameters:

Specific growth rate (SGR}:

This was calculated from data on changes of the body weight over the given time intervals according to the method of brown(1957) as follows;

1. $$SGR\ \% = \frac{Ln\ W_2 - Ln\ W_1}{T-t} X\ 100$$

Where: W_1 is the initial weight (gram at time t).
W_2 is the final weight (gram at time T) (Brown, 1957).

2. **Food conversion ratio**:-

$$FCR = \frac{\text{Weight of food consumed per fortnight (g)}}{\text{Weight gained by fish per fortnight (g)}}$$

Weight gain (g)

Weight gain (g) is calculated as the between the initial and final mean weight values of the fish in the bowl.

$$\text{Weight gain (\%)} = \frac{\text{Final weight}}{\text{Initial weight}} X\ 100$$

3. **Survival rate {SR};**

The survival rate, SR was calculated as total fish number harvested/total fish number stocked expressed in percentage.

$$\textbf{Survival}\ (\%) = \frac{\text{Total fish number harvested}}{\text{Total fish number stocked}} X \frac{100}{1}$$

4. **Relative weight gain**;-

$$\text{Relative weight gain (RWG)} = \frac{W_2 - W_1}{W_1} X\ 100$$

5. **Mean growth rate{MGR};-** This was computed using the standard equation;

$$MGR = \frac{W_2\text{-}W1}{0.5(w1W2)} x\ 100$$

Where; W1 = Initial weight
W2 = Final weight
t = Period of experiment in days,
0.5 = Constant

7. Percentage weight gain (%WG):- This is expressed by the equation:

% WG= $\frac{W_t - W_0}{W_0}$ X 100

Where; W_0 =weight
W_t = Weight at time t.

Statistical Analysis:
1. Analysis of the growth data using analysis of variance (ANOVA).

RESULTS

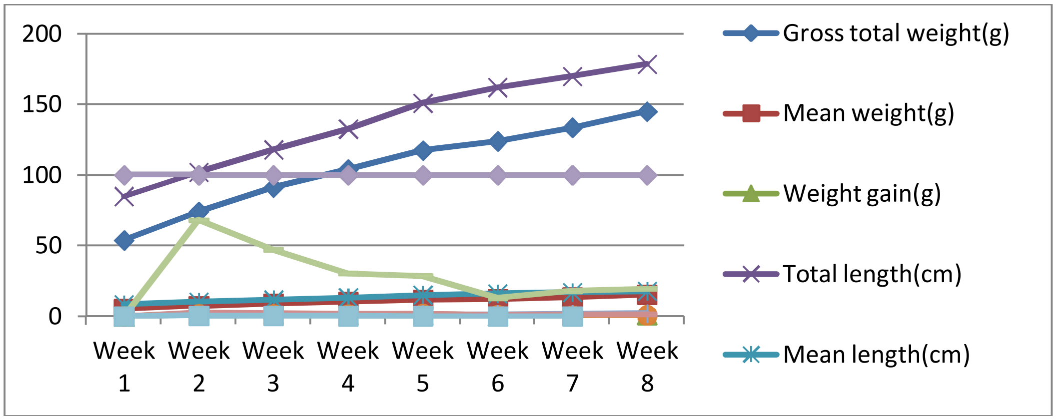

Figure 1: Production Parameters for Treatment A.

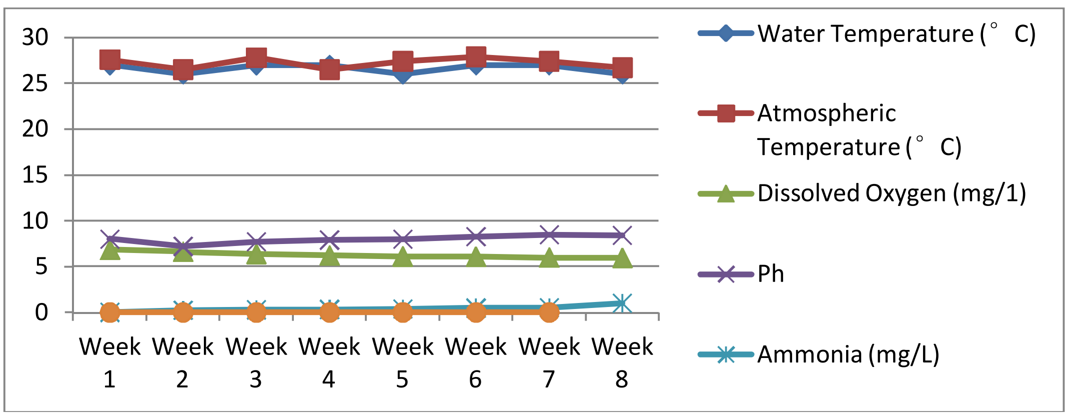

Figure 2: Physiochemical Parameters for Treatment A

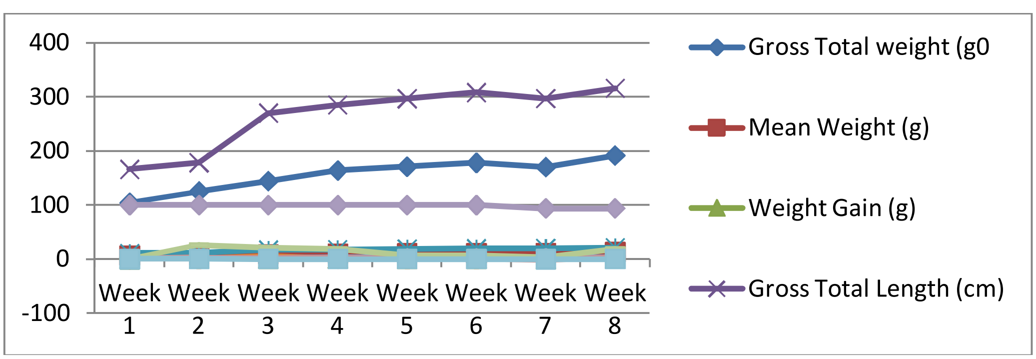

Figure 3: Production Parameters for Treatment B

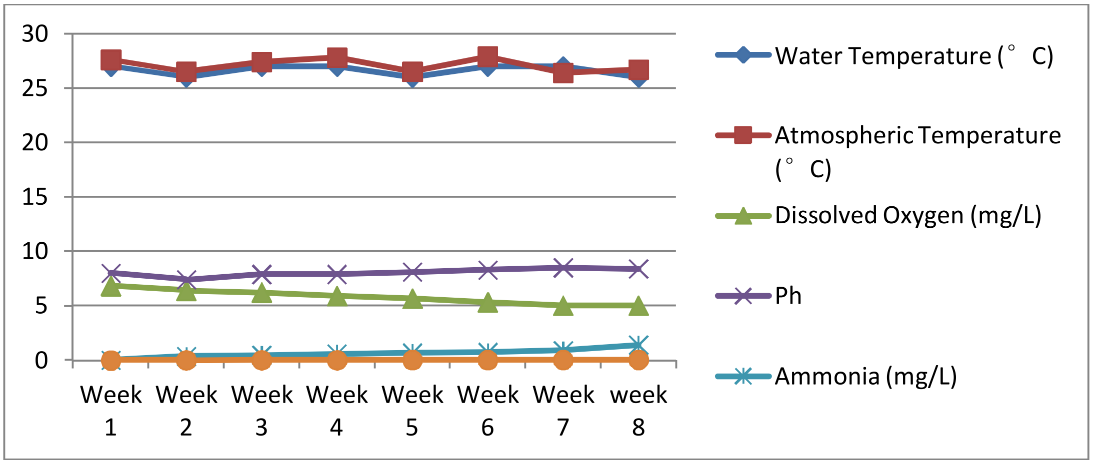

Figure 4: Physiochemical Parameters for Treatment B

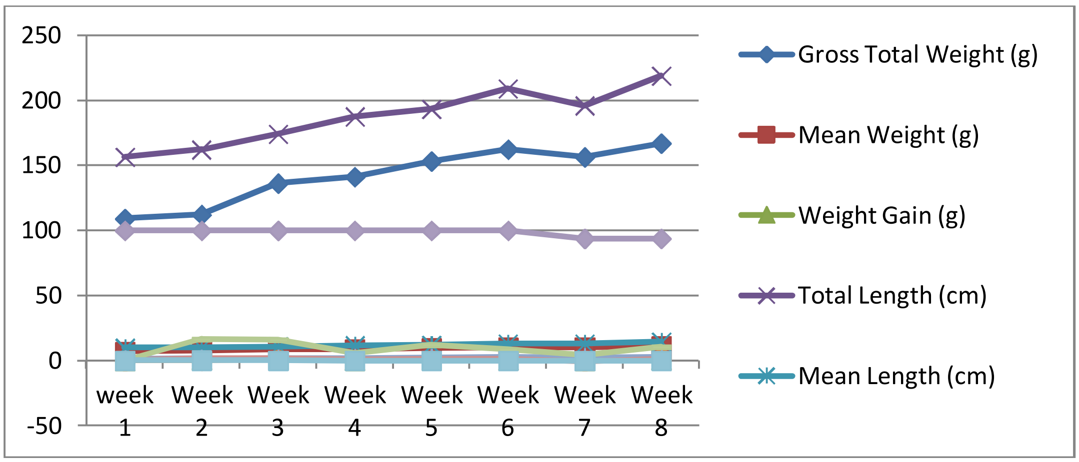

Figure 5: Production Parameters for Treatment C

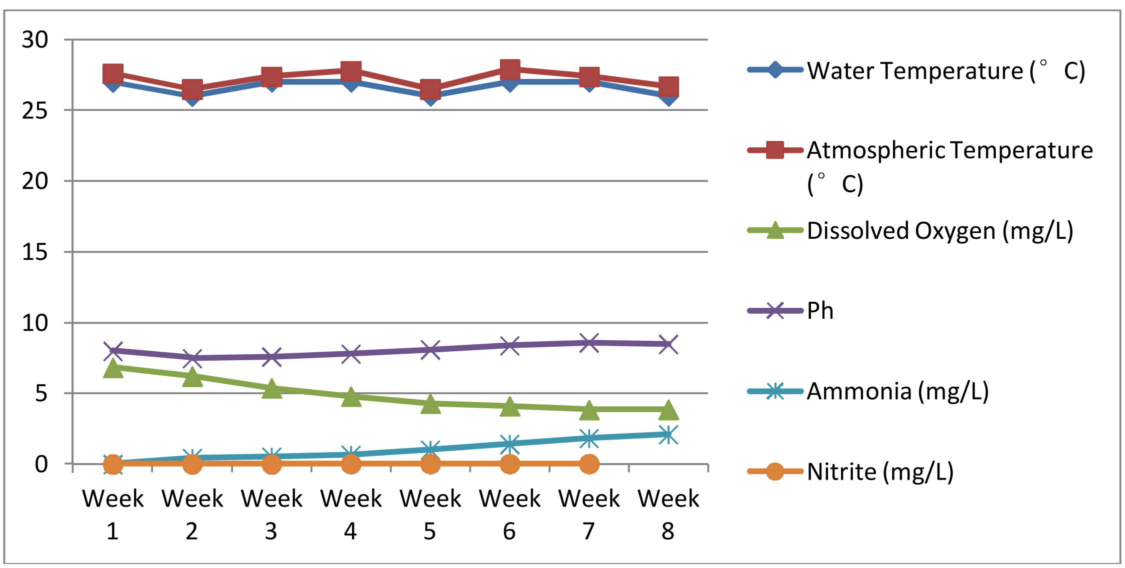

Figure 6: Physiochemical Parameters for Treatment C

General Rearing Aquarium Conditions

Adverse concentration of water quality parameters especially oxygen and unionized ammonia were nature able through parts of the rearing periods, apart from serving as likely stressors some of these concentration could have been direct causes of death. In addition, nutritional and density stress may have also been in play through a part of the rearing cycle.

TEMPERATURE

Both water temperature and atmospheric temperature recorded during the experimental period ranged from 26^0C to 28^0C and 26.5^0C to 28.6^0C respectively (table 2, 4, and 6, fig 1, 3 and 6). The temperature readings in all the facilities were within the same range for various treatments and this shows that the readings were within the tolerable range for the culture of catfish as recommended by Swann et al, (1990), that the acceptable range of temperature for catfish (Heteroclaria) culture is between $23\text{-}32^0$C.

HYDROGEN – ION CONCENTRATION (pH)

The hydrogen ion concentration pH recorded during the production cycle for the three treatment ranged between 7.2 and 8.6 with treatment A (control) had the lowest pH value of 7.2 while treatment c had the highest value of 8.6 (Fig. 2, 4, and 6) and this attributed to the difference in stocking densities. These results 3shows that concentration of pH in all the three treatments were alkaline and were within the tolerable range (6.0 – 9.0) for the culture of catfish, although high levels may have influenced the evaluation of some of the water quality parameters (Akinwole et al, 2006).

NITRITE (NO_2)

Throughout the production cycle the nitrite level never reached significant level that could affect the fish health or growth. The readings ranged between 0.01m.g/1 and 0.06mg/1 with treatment A had the lowest value of 0.01mg/1 while the highest value occurred in treatment C (Fig. 2, 4 and 6). High nitrite levels are dependent on nitrifying bacteria, which are generally slow growers. Nitrite levels greater than 0.06mg/1 are considered toxic for the culturing of catfish (*Heteroclarias)* as recommended by the Federal ministry of environment, (2006).

AMMONIA (NH_3)

Ammonia concentration throughout the study period for the three treatments prevailed at 0.23mg/l to 2.11mg/l and the highest level was recorded in treatment C (2.11mg/l) while the lowest level was obtained in treatment A (0.23mg/l) (Fig. 6 and 2). High concentration of ammonia occurred towards the end of the production cycle, which could be attributed to increase in biomass. Although the concentration were within the tolerable range and these results agreed with guideline from Eding et al, (2001), which stated that value less than 8.8mg/l are considered tolerable for the culturing of catfish (*Heteroclarias*).

DISSOLVED OXYGEN (DO)

At the beginning of the study period concentration of oxygen were initially being higher but gradually reduced as growth of fingerlings were achieved especially in treatment C, dissolved oxygen fell as low as 3.74mg/l (Fig. 6) and this could be considered frequently below the optimum level for good growth of catfish (Oyewole et al, 2006). These low levels were attained as a result of metabolism of the fish and bacteria decaying organic material such as underutilized feed were the major contributors to these demands. As stated by Brown, (1957), the survival of *Heteroclarias* is not dependent upon oxygen in the water since it is equipped to obtain energy by gulping air, while inadequate oxygen is not itself lethal, it may seriously the health of the fish and facilitate of disease. Mayer, (1970) for example indicates that the role of low dissolved levels in promoting bacteria's infections is often unsuspected. Whatever the condition that prevailed in the aquariums, it is apparent that the production in the aquarium was minimal during the last few weeks and may have affected performance of fish, as indicated by reduced slope of mean weight curves (Fig. 1, 3 and 5).

DISCUSSION

Values of the measurement of various production parameters in the three different Tanks each containing 16 fishes/m^2 (treatment A, B and C) shows that the final weight gain of treatment A (4.32g) exceeded that of treatment B (1.44g) and treatment C (4.32g), also the final length gain of treatment C (10.7cm) exceeded that of treatment A (9.4cm) and treatment C (4.8cm). (Fig. 1, 2 and 3). The disparity in both the final weight gain and the final length gain for the three treatments could be related to the fact that fewer fish had more supplementary feed and space and such reduced competition among fish in the aquarium. The gross specific growth rate of treatment A (11.4) at harvesting exceeded that of treatment B (10.9) and treatment C (7.3) while gross food conversion efficiency was equally higher in treatment A (225.3) than in treatment B (100.1) and in treatment C (74.1). These results may be as a result of less competition and minimal stress. Teng et al, (1978) among others have demonstrated that survival decreases as stocking density increases. The principle as also demonstrated to hold in this study. The fishes in treatment B which were fed with soya beans and maize showed higher rate of increase in body weight than tank A and C which were fed with tank A (Coppen feed) and tank C (groundnut cake and guinea corn) respectively. This was attributed to the fact that the feed were more efficient and delectable.

The effect of physicochemical parameter on the productivity of catfish *(Heteroclarias)* was statistically analysis.

CONCLUTION

From the one way ANOVA statistical analysis, it indicated that there was a statistical significant differences (P>0.05) between the growth rate and feed utilization.

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