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Research Paper

Physiochemical parameters of Catfish (*Clarias gariepinus*) fed a combination of rice bran and Irish potatoes

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ABSTRACT

Twelve weeks (three months) experimental was conducted in the department of biological science at University of Abuja main campus, to monitor the study of physiochemical parameters affecting the growth rate of Catfish (*Clarias gariepinus*) fed a combination of rice bran and Irish potatoes. It was conducted between October to December 2012 using circular tanks of diameter 63 cm, radius 31.5 cm and circumference 198 cm with water retention capacity of seventy (70 litre). Sixty (60) fingerlings of catfish (*Clarias gariepinus*) of mean weight 0.59 g and mean length 0.8 cm were divided into three treatments A, B, C, with each tank having 20 fishes. Fishes in tank A were fed with coppens (control) with approximate analysis of (42% crude protein, 13% crude fibre, 6.7% ash). 50% of rice bran with 50% of Irish potatoes in tank B with proximate analysis of (13% moisture, 15% crude protein, 8% fat, 7% crude fibre, 14% ash) and a combination of (16% crude protein, 14% moisture, 6% fat, 7.5 crude fibre, 12% ash). They were fed at 4% body weight twice daily (6-8 am) and (6-8 pm). The physiochemical parameters showed that the highest concentration of dissolved oxygen was observed in treatment A (6.43 mg/l) followed by treatment B with (6.12 mg/l). The highest Ammonia concentration was observed in treatment C with (0.82 mg/l) which surpassed that of treatment A and B. The water temperature of the treatment ranged between 26°C to 27°C. Treatment B showed the highest pH value of 8.51.

Key word: Catfish, rice bran and Irish potatoes, Physiochemical parameters

INTRODUCTION

Fish has long been considered as an important source of high quality nutrient in human diet, 16% of the animals protein consumed by the world's population (FAO, 1997), Fish is rich in thiamine, riboflavin, minerals, poly saturated fatty acid and vitamin A, D, and K which are essential for healthy living. The absence of this minerals and vitamins in diets result in dangerous consequences (FAO, 1997).

The catfishes from the world captures fisheries was expected to reach 100 million by the year two thousand (2000), after that the gap between demand and supply would have to be field by aquaculture (Chambelain, 1993). Aquaculture is the growing and cultivation of different species of fish including other aquatic animals for the purpose of feeding, decoration, ornamental and for advance research. This branch of agriculture has become very important being that they are good source of protein, vitamins, oil, etc.

Since pre-historic times, aquaculture stood at about 15.3 million in 1990 (De Silva and Anderson, 1995).

Aquaculture scientist and farmers throughout Africa and in Europe and Asia have benefited immensely from the wealth of biological and ecological research which has been undertaken in different fish species. There are however, great species of fish that can grow in the pond cages. All warm water fish can grow in the ponds. But some are predominantly fresh water while some are brackish water fish. It is observed that fresh water fish do better in fresh water ponds and Brackish water grows better in Brackish water ponds though in some cases, fresh water fishes can be acclimatized to grow in brackish water and vice versa. The fin fishes that have been successfully raised in the pond are; Clarias, tilapia, crabs, mullets etc. Since the last three decades, clariid species has been considered to hold great interest for fish farming in Africa and Nigeria in particular. The fishes having a wide geographical spread, a high growth rate, resistance to handling and stress and we appreciated in a wide number of African countries (Clay, 1979). The objective of fish farming is to obtain the maximum increase in weight (biomass) of fish/ unit area of volume/unit with a specific level of management practice. These require the knowledge of fish growth, carrying capacity, nutrition yield and water quality parameters. The sharp tooth *Clarias gariepinus* (catfish) is an important aquaculture species in the tropics. Huisman, (1985) reported that the number of the characteristics which confer on this species have been reported. The story of Aquaculture in Nigeria is essentially the story of catfish culture. Recent trends all over the world, point to a decline in landing front capture fisheries, an indicator that fish stock have approached or even exceeded the point of maximum sustainable yield. 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 the year two thousand (2000) catfish were more abundant next to tilapias, (FAO, 1992) reported that 27, 488MT of cat fishes produced in 2000 were consumed locally. This implies that there is still great need for high production for both local and international markets. In aquaculture, fish require adequate food supply in the right proportions and with proper nutritional contents needed for growths, energy, reproduction, movement and others activities which they carry out. The African catfish (Clarias garipinus) are choice food species in Nigeria. It demands high from consumers and is mostly preferred by aquacuturists. This is due to the idea characteristics of this species (Ending and kamstra, 2001), which include high growth rate at high stocking densities, a high food conservation, food meat quality and smoking characteristics as we as year round production (Ita, 2005).

Fish culture production in Nigeria includes stocking of lakes and production in ponds, cages and tanks (Ita, 2005). Pond culture is the most prevalent (Akinwole et al., 2006) in Nigeria has been developed and documented to ensure profitable production of the species. The appreciable quality of water and large expanse of land require for pond culture has however limited the expansion of Africa catfish culture in Nigeria (Akinwole et al., 2006). Intensive culture of fin fish in Recirculation Aquaculture System (RAS), a production technique that uses fish culture water more than once, thereby saving space and water for fish culture, has been adapted to African catfish (Akinwole et al., 2006). Ending and kamstra, (2001) confirmed that RAS has been adopted successfully in culture of African catfish (*Clarias gariepinus*) at full commercial scale in Denmark (Akinwole et al., 2006).

Nigeria has high potential to develop its fish farming so as to increase the amount of fish production in the country because of its high demand and favourable scale price. Fish performs all their bodily function in water because fish are totally depending upon water to breath, feed and grow, excrete wastes, maintain a salt balance and reproduce, understanding the physical and chemical parameters is critical to successful aquaculture. To a great extent, water determines the success or failure of an aquaculture operation (Ladon, 2000).

Over the years, rapid increase in population has become an issue of utmost concern in both developed and developing countries of the world. This is owing to the fact that man is faced with the problem of how to provide both qualitative and quantitative food for himself and his family. To this end, adequate conservation of resources to make provision for both present and future consumption needs is deemed necessary. The quantity and quality of food placed either from land or water is inadequate with the teeming population which appears to be doubling every 35years (Bel and cauterbery, 2000), this rapid increase in population has resulted in the search for cheaper protein source and other nutritional requirement (Olatunde, 1982). The commonest source of protein for the rural populace has been from crops such as cowpea, soybeans and animals protein such as Beef, pork, and Milk. Of recent, the supply of such products has been insufficient as a result of population growth and has needed to develop other sources of protein such as aquaculture.

Aquaculture is the growing and cultivation of different species of fish including other aquatic animals for the purpose of feedings, decorating, ornamental and for advance research (FAO, 1998). Fish carry out its bodily function in water. The quality of a given water body is governed by its physical, chemical and biological factors which interacts with one another and directly influences its productivity. Therefore, in order to access the full potential of such aquatic ecosystem for their management and productivity, there is need to study these influences with a view to controlling and maintaining them within tolerable range. The aim of this study is to determine the effect of physiochemical parameters on the growth rate *Clarias gariepinus* fed a combination of rice bran and Irish potatoes.

Aquaculture in Africa is a relatively new industry; it is not practiced on a large scale. Fish pond culture in sub-saharan started in Kenya in 1924 and later spread to other parts of the continent (Huisman, 1986; Jackson et al., 1982). FAO, (1998) stated that fish supplied over 50% of the total animals protein consumed in developing countries. However, in Nigeria, fish constitute 40% of animal protein intake (Olatunde, 1982).

In Nigeria today, aquaculture practices seek to improve fish yield and fish productivity. Its benefit ranges from development, income generation, as well as farm sustainability. This practice also makes use of land which is considered unsuitable for agriculture such as swamps or saline areas, Anyinla, (1988) stated that over 9.57% of all fish protein consumed in Nigeria comes from the wild. Eyo, (2001) reported that since aquatic resources are finite although renewable, every effort should be made towards increasing fish production through improved resources management and conservation and also intensive aquaculture practice.

Brown, (1957) analyzed the management and water supply of the Clarias culture ponds and specified problems, which markedly reduce production and endanger the economic success of the operation. Brown, (1957) considered water to be the limiting factors to clarias production and the amount and quantity of irrigation water available in this area determine the number of ponds and the amount of fish that can be produced. Currently aquaculture production in Nigeria has witnessed slow space of development. Aquaculture contributes only about 25000 MT of fish annually which is about 69% of domestic fish production, whereas the projected requirement for fish products by the year 2010 was 12million MT (Ita, 2005).

Nigeria has high potentials in aquaculture which is hardly tapped. Anyinla, (1988) stated that aquaculture provided food of animal protein, generate income and employment, thereby promoting the socio-economic development of Nigerians. Fish production when combined with improved inland fisheries management to eliminate fish importation and earn substantial foreign exchange. *Clarias gariepinus* family Claridae is generally considered to be one of the most important tropical catfish species for aquaculture in West Africa (Clay, 1979). Other species include; Heterobranchus and their hybrids. The reasons for their culture are based on their fast growth rate, disease resistance, high stocking density, aerial respiration, high feed conversion efficiency among others. Catfishes inhabits calm fresh water ranging from lakes, streams, rivers, swamps to flood plains, many of which are subjected to seasonal drying. The most common habitats of catfish are floodplain, swamps and pools.

Catfishes can survive during the dry seasons due to the possession of accessory air breathing organ (Bruton, 1979; Clay, 1979). Catfishes are cultured conveniently under monoculture and poly-culture system. The mono-culture is the culture of the same fish species while poly-culture is the culture of two or more fish species of different habitats and ecological niches. This type of culture is favored in pond system (Maar et al., 1966).

However, with the intensification of tank culture where fish culturist relies solely on artificial feed as the only food to feed their fish, the advantages of poly-culture therefore diminish. There are therefore, the culture of two species of fish; a system that could be referred to as duo-culture. Also, there is the culture of three closely related species is of the same family and the same feeding habitat, this type of culture could be referred to as trio-culture system. There is the culture of only one single species mono culture. Most culturists in Africa especially in Nigeria have practiced any of this culture system for their fish. These farmers believe that culturing different species of catfish together or separately have little or no effect on their growth performance. Studies on the growth performance of fish especially the salmon species on the mono and duo-culture system have been reported. The work of Ogunsanmi, (2008) shows that clariid catfish culture under the monoculture system gave weight gain followed by the duo-culture and last in the tri-culture system. The results also show that the hybrid had the best weight gain in all the three culture systems followed by *Clarias gariepinus* and least with *heterobranchus longifillis*.

Temperature is another factor affecting the welfare of fish. Fish are cold blooded organisms and assume approximately the same temperature as their surroundings (La Don, 2000). The temperature of the water affects the activity, behaviour, feeding, growth and production of all fishes (Boyd, 1982).

The water quality parameters were within the acceptable range for fish culture (Swann, 2006). According to Federal Ministry of Environment FME (2006) the temperature of 20 - 33°C is recommended as permissible limit standard for aquatic life.

The quality of water can also be evaluated by measuring the pH, which gives an indication of its acidity or alkalinity. The pH of water is a measure of acidity or alkalinity of the water. The principal reason of regulating pH in natural water is the carbonate system, which is composed of carbon dioxide, carbonic acids bicarbonates, and carbonate ions (Tailing and Rzoska, 2005) high pH values as a result of increase in the concentration of carbon dioxide resulting from decomposition of organic matter.

Buttner et al. (1993) reported that pH fluctuate by one or two unit daily, in the morning, carbon dioxide values are high and pH is low as a result of respiration during the night. After sunrise, algae and other given plants produce carbohydrate and oxygen from carbon dioxide and water by photosynthesis. As the carbon dioxide is removed, the water pH increases and the lowest pH are usually associated with lowest dissolved oxygen and vice versa. Decrease pH is important in the ecosystem because it favours prolong extension tenure of some metals (Boyd, 1982),

Generally, neutral or slightly alkaline water are most suitable for fish culture and according to Boyd (1982), water with pH values between 5 and 9 are proper for fish ponds. Also according to Federal Ministry of Environment FME (2006), the pH value of 6.0-9.0 is considered the permissible limit standard for aquatic life. The average pH value which is sufficiently basic for catfish (*Clarias gariepinus*), is 6.9 (La Don, 200).

Oxygen distribution is important in ponds in relation to the behaviour, growth and distribution of aquatic organism. Different organisms have different oxygen requirements and as such dissolved oxygen concentration is important factor which determines their distribution. Volume of oxygen increase as the temperature decreases. Dissolved oxygen is essential for the metabolism in all aquatic organism that posses abiotic biochemistry and its commonly taken as an indicator of potential production rates of primary production (FAO, 1998).

The measurement of dissolved oxygen in an aquatic system can be used not only to define the quality of water but as a means of estimation of the gross photosynthetic and the total community respiratory processes (Odum, 1959). Dissolved oxygen is by far the most important chemical parameters in aquaculture. Low dissolved oxygen levels are responsible for more fish kills, either directly or indirectly, than all other problems combined (Ridha or Cruz, 2001). Like humans, fish is a function of its size, feeding rate, activity level and temperature. The amount of oxygen that can dissolve in water decreases at higher temperature and decrease with increase in latitudes and surliness (La Don, 2000).

According to Hutchinson, (1975) and payne (1986), knowledge of dissolved oxygen (DO) will go a long way in helping an aqua culturist and limnologist know more about the nature of the lake or fish ponds from series of oxygen concentration values. Also, Eding and kamstra, (2001) reported that the standard value of dissolved oxygen for African catfish (*Clarias gariepinus*) is between 2.9-6.8 (FME, 2006) reported the permissible limit standard of dissolved oxygen for aquatic life is 6.8.

Conductivity is a physiochemical parameter of a water body which is a measure of the amount of ions present in a water body and thus can be used as a measure of the conductivity and fisheries potential of the water body. Conductivity and mean depth can be used to calculate the potential fish yield of a pond (Ryder et al., 1990). The electrical conductivity of water is affected by the total concentration of the ions.

Fish excretes ammonia and lesser amount of urea into the water as waste. Two forms of ammonia occurs in aquaculture systems, ionized and un-ionized. The un-ionized forms of ammonia (NH_3) are extremely toxic while the ionized form (NH_4^+) is not. Both forms are grouped together as "total ammonia" (La Don, 2006). The toxicity of un-ionized ammonia for *Clarias gariepinus* is approximately 6.5 mg/l.

Nitrite enters a fish culture after fish digest feed and the excess nitrogen is converted into ammonia, which then excreted as waste into water. The total ammonia nitrogen (TAN; NH_3 and NH_S^+) is then converted to nitrite (NO_2), which under normal condition is quickly converted to non-toxic nitrite (NO_3) by natural occurring bacteria. Catfish and tilapia for example are fairly sensitive to nitrite (Boyd, 1982). According to Federal Ministry of Environment (2006) the permissible limit standard of nitrite (NO_2) for aquatic life is 0.06 mg/l. Eding and kamstra (2001) report that 0.01-0.06 mg/l of nitrite is considered non-toxic for African catfish (*Clarias gariepinus*) culture. The aim of this study is to determine the effect of physiochemical parameters on the growth rate *Clarias gariepinus* fed a combination of rice bran and Irish potatoes

MATERIALS AND METHODS

Circular tank management

Three circular tanks were bought at Gwagwalada market. The tanks are of the same size each having a capacity of seventy (70) litres. Before the introduction of the fishes, the tanks were thoroughly washed with salt to kill all pathogen. The tanks were then filled with dichlorinated tap water of forty (40) litres capacity.

Study population

Sixty fingerlings of *clarias gariepinus* were bought from Ajima farms in kuje area Councils and were transported in plastic containers to the University of Abuja main campus. The fishes were allowed to acclimatize for seven days. Twenty (20) fingerlings were then introduced into each of the tanks system. The circular tanks were then covered with nets to prevent the fishes from jumping out of the tanks and to also prevent reptiles and insects from getting to the fish.

Feeding and measurement

Treatment (Tank A) culture treatment was fed with coppens (floating diets) containing 42% protein, 13% fat, 1.0% calcium, 0.9% phosphorus, 6.7% ash, 2.5% fibre, 0.2% sodium was used as control feed for treatment A (Tank A). A combination of the rice bran and Irish potatoes containing 13% moisture, 15% crude protein, 8% fat, 43% carbohydrate, 7% crude fibre, 14% ash was used as feed for treatment B (Tank B), a combination of rice bran and Irish potatoes of 3:7 was used as feed for

Treatment C (Tank C). The fingerlings were fed 4% of their body weight twice daily, morning (6.00am - 8.00 am) and evening (6.00 pm - 8.00 pm).

Laboratory measurement

The weights of the fishes were taken using automated weighing balance (Ohaus E 400 ohaus precision plus) and the lengths of the fishes were taking using a divider and a meter rule.

Physiochemical parameters

Both surface water temperature and atmospheric temperature were read daily to the nearest °C with the aid of a mercury in-glass thermometer. Dissolved oxygen was determined once a week by titration with 0.1 NaOH the azide modification of the wrinkle method (American Public Health Association, 1976). Ammonia (NH_3) was determined by the use of comb-II urinalysis strips.

Proximate analysis of formulated fed

Proximate analysis of the formulated feed was carried out at the Institute for Agricultural Research, Zaria. The proximate analysis also known as Weende analysis. Quantitative method was used to determine different micro-nutrients in a feed. They are categorized into moisture (Crude water), crude ash (CA), Crude protein (CP), Fats and lipids and crude fibre.The sample was initially dried at 103°C for 4 h, the weight loss of the sample was determined and the moisture content calculated.

Ashing the sample at 550°C for 4 h removes the carbon from the sample, all organic compounds are removed. Also calculating the weight loss of the feed sample (rice bran and Irish potatoes) from the dry matter to crude ash content mathematically determines the organic matter fraction. The nitrogen content of the food is the basis for calculating the crude protein content of the feed. The method established by Kjeidahi converts the nitrogen present in the sample to ammonia which is determined by titration. The carbohydrate in the feed sample was retrieved in two fractions; crude fibre and nitrogen-free extractives by proximate analysis. The fraction which is not soluble in a defined concentration if alkalis and acids is the crude fibre (CF), the fraction which contained cellulose, lignin, sugar, pectin and hemicelluloses are the Nitrogen-free extractive (NFE).This fraction was therefore calculated by subtracting crude protein, crude ash and crude fibre from the organic matter.

Length weight relationship

$W=al^b$.. (1)
Log W =log a + log b log l .... (2)

Where

W = weight of fish (g)

L = standard length of the fish (cm)

a = constant

b = exponent

Statistical analysis

Analysis of growth data using analysis of variance (one-way, ANOVA) was used for this study.

RESULTS

The result of the production parameters for the three Treatments A,B, and C are presented in (Appendix 1, 2, and 3) while the physiological parameters are ranged between their tolerable range. All values of the measurement of various production parameters in the three treatment showed that Treatment B had the highest mean weight (g) and length (cm) with the values 4.64 g and 4.45 cm, C 4.49 g and 4.32 cm while A had the lowest values with the value of 4.04 g and 3.98 cm and the survival rate of A is (80%), B (90%) and C had the highest (100%) and the final mean weight gain (%) in all the three treatments, A and C had the highest (0.31) and while treatment B had the lowest 0.03 (*Clarias gariepinus*). The water temperature throughout the study period varied between 26°C and 27°C, while oxygen occurred between 5.43°C and 6.5°C. The highest water temperature occurred at the week 12 because of the increase in atmospheric temperature.

The highest concentration of dissolved oxygen for all the three treatment was recorded in treatment A which varied between 6.43 mg/l and 6.5 mg/l while an increase in dissolved oxygen 5.94 mg/l and 6.12 mg/l was recorded in treatment B, pH values in all three treatment has more or less similar reading ranged between 8.0 and 8.3 ppm. Whereas biological oxygen demand showed similar concentration throughout the study period for the three treatments ranged between 3.0 and 6.0mg/l (Tables 1-7 and Figures 1-9).The length-weight regression analysis gave a coefficient of regression "b" value of 0.825 for treatment A, 0.907 for treatment B and 0.783 for treatment C, 0.840 for all the treatment. These indicated an allometric growth for all the treatments.

DISCUSSION

Adverse concentration of water quality parameters especially oxygen and unionizing ammonia were noticeable through the rearing period. Apart from serving

Table 1: Production parameters for Treatment A.

Parameters	INITIAL WEEK	WK ONE	WK TWO	WK THREE	WK FOUR	WK FIVE	WK SIX	WK SEVEN	WK EIGHT	WK NINE	WK TEN	WK ELEV.	WK TWELV.	TOTAL	MEAN
gross total weight (g)	16	21.1	28.3	35.4	39.45	43.5	49.5	54.59	59.62	63.7	69.7	74.8	80.9	636.58	48.96769
mean weight (g)	0.8	1.06	1.42	1.77	1.97	2.18	2.57	2.73	2.98	3.18	3.48	3.73	4.04	31.91	2.454615
gross total length (cm)	11.2	17.3	22.3	29.36	35.4	40.45	45.5	50.55	57.61	63.7	68.4	74.8	78.9	596.39	45.87615
mean length (cm)	0.56	0.86	1.12	1.46	1.77	2.03	2.28	2.53	2.88	3.18	3.44	3.74	3.99	29.84	2.295385
weight gain (g)		0.26	0.36	0.35	0.02	0.21	0.39	0.16	0.25	0.02	0.03	0.25	0.31	2.61	0.200769
length gain (cm)	0	0.03	0.26	0.34	0.31	0.26	0.25	0.25	0.35	0.03	0.26	0.03	0.25	2.62	0.201528
gross specific grth rate (g)	0	1.71	0.92	0.46	0.16	0.12	- 9.95	-9.75	-9.26	0.04	0.05	0.04	0.04	-25.42	-1.95538
food convers. eff. %	0	0.04	0.02	0.067	0.5	5.25	9.75	4	6.25	0.5	0.75	6.25	7.75	41.127	3.163615
mean grth rate	0	0.28	0.06	0.063	0.015	0.019	0.01	0.007	0.06	0.01	0	0	0	0.471	0.036231
survival rate	100	100	100	100	100	100	100	100	100	100	80	80	90	1250	96.15385
Total														2566.1	197.3945

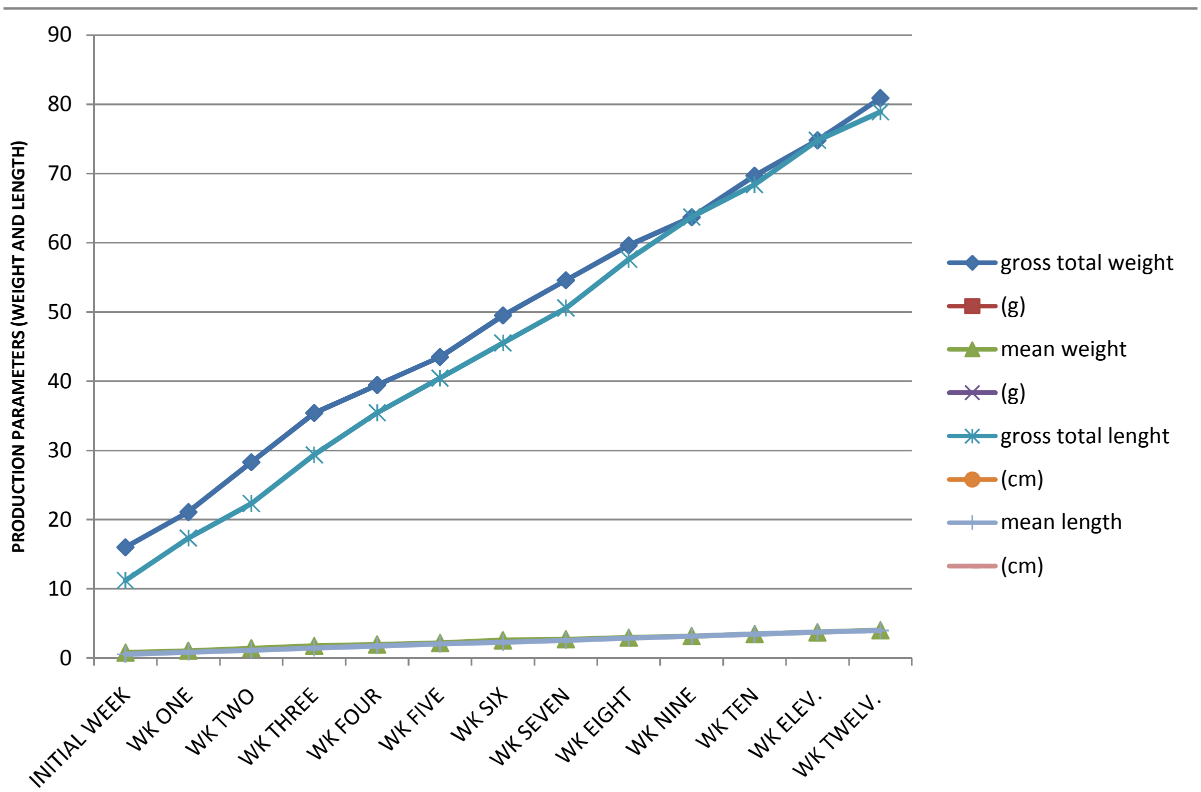

Figure. 1. Production parameters for Treatment A

as likely stressors, some of the stressors could have been direct causes of death. The water temperature recorded during the experimental period ranged between 26°C to 27°C and the temperature reading in all the treatment were within the tolerable range for the culture of catfishes as recommended by Swann, (2006), the acceptable range of temperature of catfish (*Clarias gariepinus*) is between 23 - 32°C. The hydrogen ions concentration pH recorded during production cycle for three treatments range 7.7 and 8.3. These show that the concentration of pH in all the three treatments were alkaline and were within the tolerable range (6.0 - 9.0) for the culture of cat fish. Although high level may have influenced elevation of some of the water quality parameters (Akinwole et al., 2006).

At the beginning of the study period, concentration of oxygen was initially very high but gradually reduced as growth of fingerlings were achieved especially in Treatment C, dissolve oxygen fell as low as 6.0 and this could be considered frequently below the optimum for

Table 2: PRODUCTION PARAETRS FOR TREATMENT B

PARAMETERS	Wk0	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	Wk9	WK10	WK11	WK12	TOTAL	MEAN
gross total weight (g)	17.11	22.19	29..25	35.29	40.1	46.17	51.12	59.18	62.25	78.35	87.4	93.45	99.52	724.38	55.72154
mean weight (g)	0.85	11	1.47	1.76	2.01	2.3	2.55	2.95	3.26	3.92	4.37	4.67	4.97	36.18	2.783077
gross total length (cm)	11.7	18.75	25.61	31.68	39.5	45.56	50.12	56.19	61.25	70.42	76.5	80.12	89.12	656.53	50.50231
mean length (cm)	0.59	0.93	1.28	1.58	1.98	2.77	2.5	2.8	3.06	3.52	3.82	4.01	4.45	33.29	2.560769
weight gain (g)	0	0.25	0.37	0.29	0.54	0.2	0.25	0.4	0.31	-3.7	0.45	0.03	0.03	-0.58	-0.04462
length gain (cm)	0	0.34	0.35	0.03	0.04	-0.22	0.03	0.03	0.26	0.15	0.03	0.19	0.44	1.67	0.128462
gross specific grth rate (g)	0	0.62	0.85	0.38	0.19	1.74	0.11	0.12	0.08	0.06	0.06	0.03	0.04	4.28	0.329231
food conv. eff. %	0	6.25	9.25	7.28	1.35	0.5	6.25	0.7	7.75	9.25	11.25	0.75	0.75	61.33	4.717692
mean growth rate	0	0.08	0.03	0.056	0.025	0.019	0.096	0.011	0.005	0.004	0.003	0.003	0.002	0.334	0.025692
surviva rate	100	100	100	100	100	100	100	100	100	100	100	100	90	1290	99.23077
Total														2807.414	215.9549

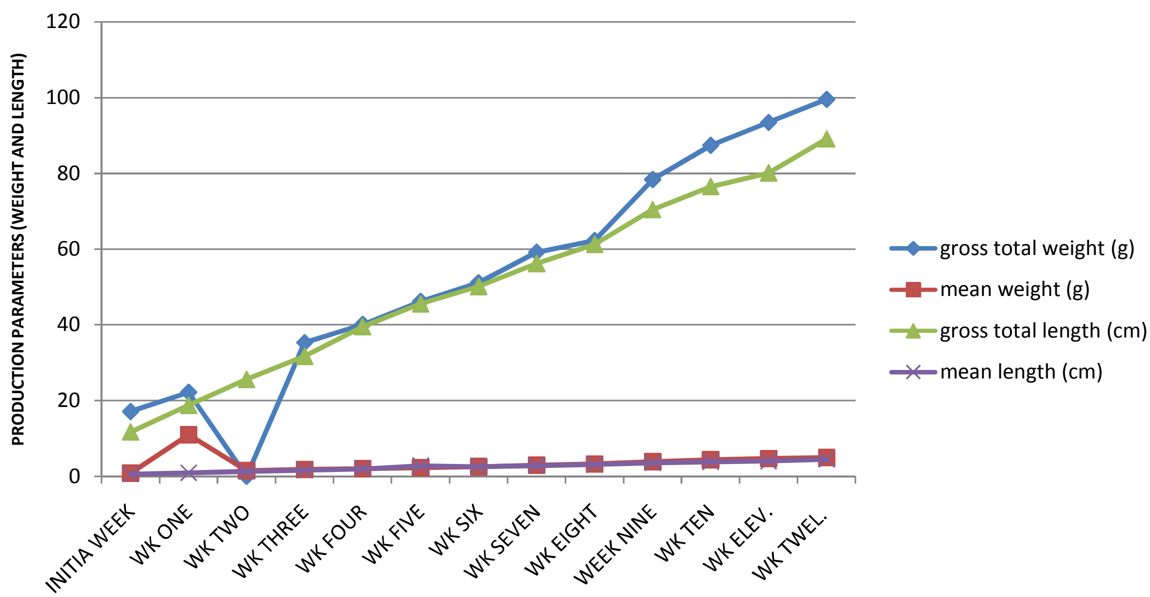

Figure. 2: Production parameters for treatment B.

Table 3: PRODUCTION PARAMETRS FOR TREATMENT C

parameters	IWk0	Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	Wk8	Wk9	Wk10	Wk11	Week12	Total	Mean
gross tota weight (g)	18.21	28.31	31.34	37.4	42.45	49.5	56.55	60.59	65.63	71.52	78.59	83.67	89.7	713.46	54.8815
mean weight (g)	0.91	1.42	1.57	1.87	2.12	2.48	2.83	3.03	3.28	3.57	3.92	4.18	4.49	35.67	2.74385
gross total ength (cm	12.11	18.21	22.29	29.35	36.4	42.46	49.5	56.56	60.65	67.5	70.61	77.63	86.59	629.66	48.4354
mean length (cm)	0.61	0.91	1.11	1.47	1.82	2.12	2.48	2.82	3.02	3.38	3.53	3.88	4.32	31.47	2.42077
weight gain (g)	0	0.51	0.15	0.03	0.25	0.36	0.35	0.02	0.25	0.29	0.35	0.26	0.31	3.13	0.24077
length gain (cm)	0	0.03	0.02	0.36	0.35	0.03	0.36	0.34	0.02	0.36	0.15	0.35	0.44	2.81	0.21615
gross specific grth rate (g)	0	2.74	0.32	0.36	0.19	0.19	0.14	0.06	0.07	0.06	0.05	0.03	0.04	4.25	0.32692
food conv. eff. %	0	12.75	3.75	0.75	6.25	9	8.75	0.5	6.25	7.25	8.75	6.5	7.75	78.25	0.32692
mean grth rate	0	0.055	0.048	0.049	0.023	0.019	0.011	0.005	0.04	0.003	0.003	0.003	0.003	0.263	0.02015
survival rate	100	100	100	100	100	100	100	100	100	100	100	100	100	1300	100
Total														2799	215.305

good growth of cat fish. This low level was attained as a result of metabolism of the fish and of bacteria decaying organic material such as under - utilized food were the major contributors to these demands. As stated by Brown (1957), the survival of *clarias gariepinus* is not dependent on oxygen in the water since it is equipped to attain energy by gulping air while inadequate dissolve oxygen is not itself lethal. It may seriously affect the health of fish and facilitate the spread of disease. Mayer, (1970) for example indicates that the role of low dissolve oxygen levels in promoting bacterial infection is often unsuspected. Whatever the condition that prevailed in the aquarium, it is apparent that the production in the aquarium was minimal during the last few weeks and

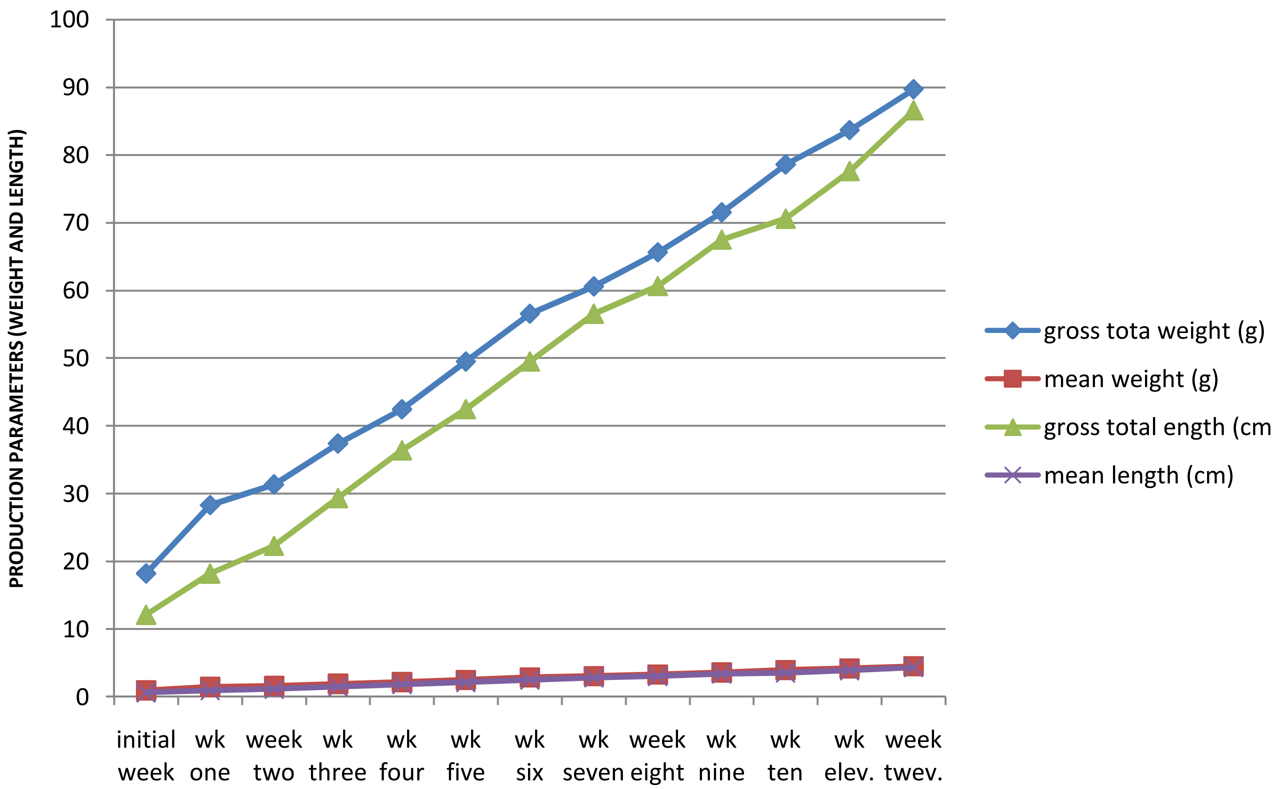

Figure 3: Production parameters for treatment C.

Table 4: PHYSIOCHEMICAL PARAMETERS FOR (TREATMENT A)

parameters	Initial wk	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10	wk 11	wk 12
water temp.	27	26	26	27	27	27	27	26	26	26	26	27	27
Dissolved O_2	6.43	6.61	6.31	6.25	6.3	6.11	5.99	5.91	6	6	6.23	6.4	6.5
PH	8	7.3	7.9	8.1	8.3	8.5	8	8	7.4	7.5	7.6	7.6	7.7
Ammonia mg(l)	0.2	0.25	0.35	0.41	0.42	0.49	0.52	0.56	0.54	0.56	0.49	0.57	0.59
Nitrite mg(l)	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.01	0.01	0.02	0.02

may have affect performance of fish. Ammonia concentration throughout the study period for the three treatment prevailed 0.7 and 0.59 and the highest level was recorded in Treatment C 0.82 while the lowest level was obtained in Treatment B 0.7. High concentration of ammonia occurred towards the ends of the production period which code be attributed to increase in biomass. Although the concentration were within guidelines from Ending and kamstra, (2001) which stated that the value less than 8.8 mg/l are considered tolerable for the culture of catfish (*Clarias gariepinus*).

Throughout the production period the nitrite level reached significant that could affect the fish's health or growth. They ranged between 0.04 g/l and 0.05 mg/l and acceptable limit less than 4 mg/l (DWAMD, 1994). Value of the treatment of the various growth performance in the three different Treatment A,B and C shows that the mean weight gain of Treatment C 3.13 exceeds that treatment A 2.61 g and the mean weight gain for treatment B 0.58, which shows that treatment C has the lowest weight gain. Also the main length gain for Treatment C 2.81 exceeds that of Treatment A 2.62 and for treatment B the mean length gain is 1.62 which shows that it has the lowest value in length gain.

The differences in both mean weights gain and mean length gain in the three treatment show that fingerlings in Treatment C grew faster. The specific growth rate for Treatment B 4.25 surpassed that of treatment C 4.28 cm and A has lowest which is -25.42, respectively.

The percentage survival was higher in Treatments C (100%), B (90%) and C (80%).The highest mortality was recorded in treatment A, this may be due to handling stress as most of it occurred after the weekly samplings and the reduced oxygen level towards the end of the

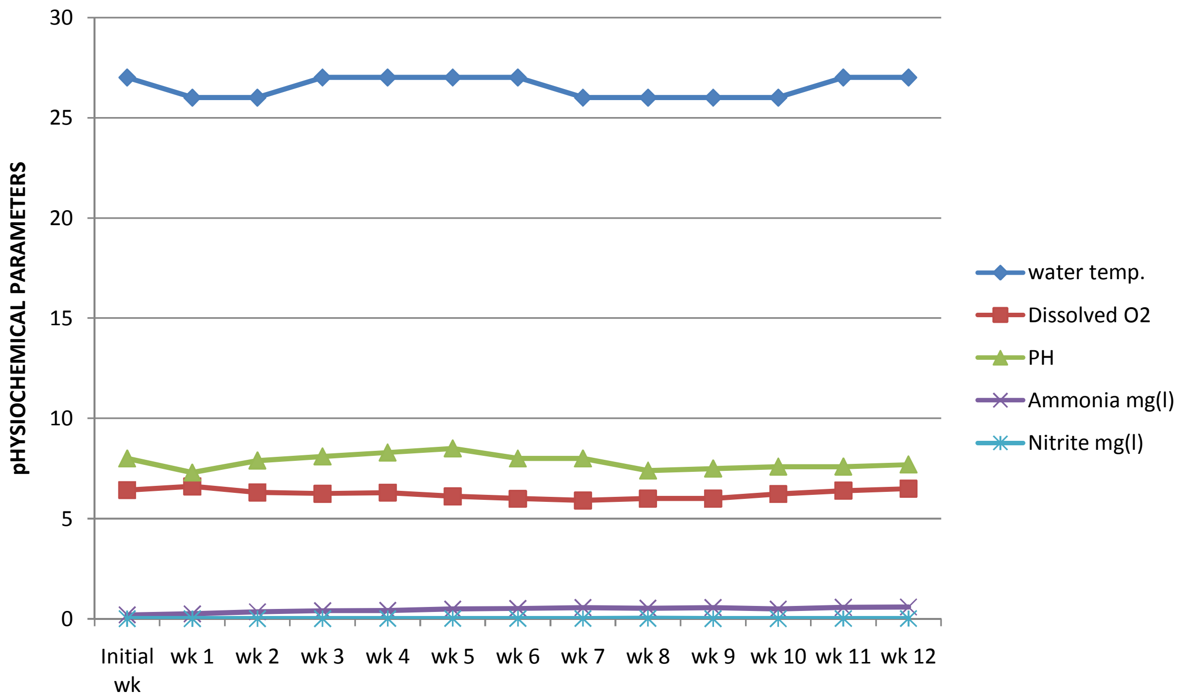

Figure. 4: Physiochemical parameters for Treatment A.

Table 5:Physiochemical parameters for (Treatment B)

Parameters	Initial wk	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10	wk 11	wk 12
water temp.	27	26	26	27	27	27	26	26	26	27	27	26	27
Dissolved O_2	5.94	6.81	6.31	6.21	6.11	6.01	5.81	6.32	6.25	6.27	6.3	5.91	6.12
PH	8.0	7.41	7.71	7.61	8.0	8.51	8.4	8.0	8.0	8.3	8.4	8.0	8.0
Ammonia mg(l)	0.01	0.28	0.34	0.4	0.5	0.62	0.74	1.0	0.74	0.81	0.75	0.69	0.7
Nitrite mg(l)	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04

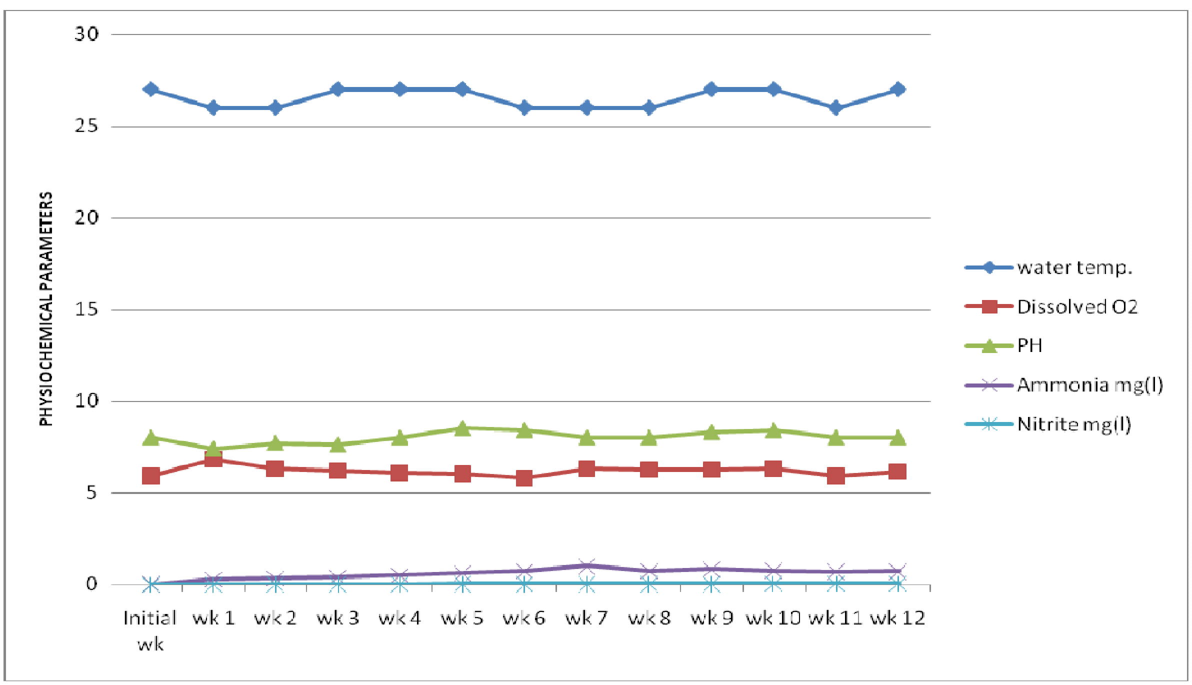

FIgure 5: Physiochemical parameters for Treatment B

Table 6: Physiochemical parameters FOR (TREATMENT C)

Parameters	Initial wk	wk1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10	wk 11	wk 11
water temp.	27	27	26	27	27	27	27	27	26	26	26	26	26
Dissolved O_2	5.6	5.8	6.0	5.9	6.0	5.3	6.0	6.0	6.0	6.0	5.4	6.0	6.0
pH	8.0	7.5	7.9	8.1	8.0	7.8	8.2	8.1	8.0	8.1	8.2	8.0	8.3
Ammonia mg(l)	0.01	0.34	0.36	0.42	0.54	0.6	0.7	0.84	0.8	0.8	0.8	0.82	0.82
Nitrite	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.05

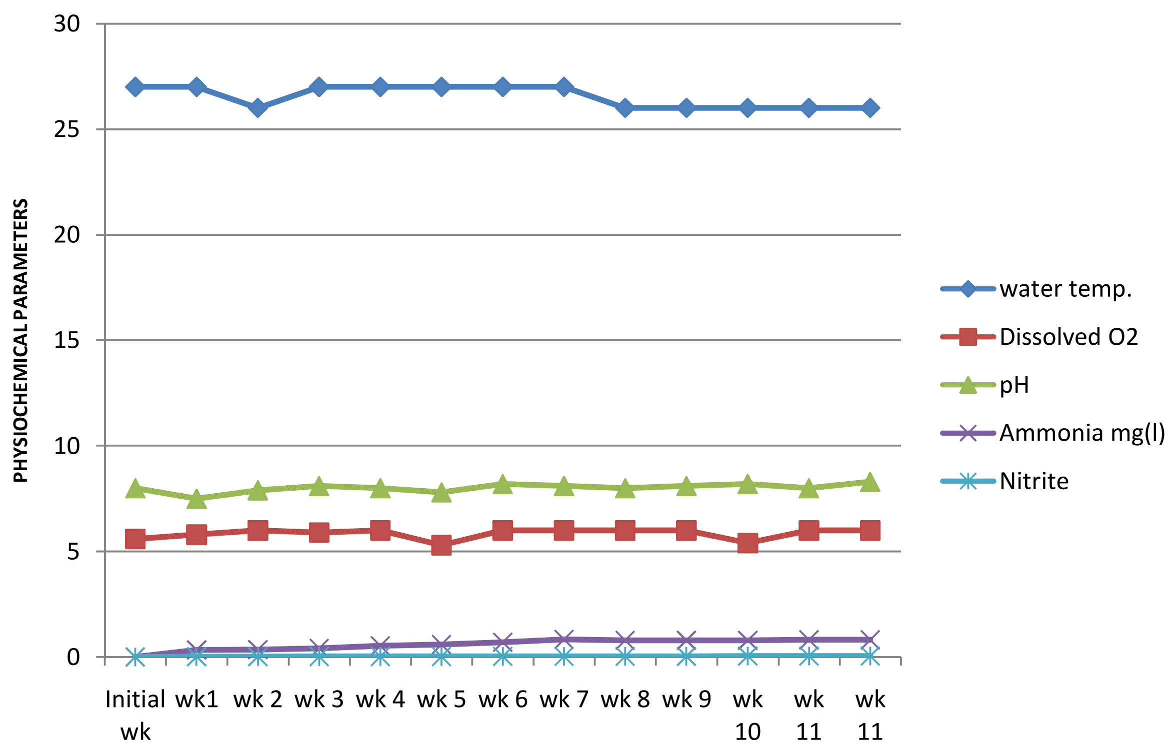

Figure 6:Physiochemical parameters for Treatment C.

Table 7: Length -Weight regression analysis of production parameters for all Treatments.

Treatments	Log a	"b"	Standardized error of "b"	Correlation Coefficient
A	0.327	0.825	0.013	0.996
B	0.201	0.907	0.038	0.996
C	0.429	0.783	0.019	0.998
ALL	0.317	0.840	0.019	0.987

production period. The performance of growth was statistically analyzed using the one way ANOVA. The analysis shows a significant differences in A p= 1.919: p -value 0.011: df = 129 fcrit. 1.94.

Appendix 4 Treatment B no significant difference.

df = 129,f = 1.248,p-value 0.242, curt 1.94,

p = >0.5% Appendix 5 and treatment C had no significant difference

df 129 = f = 1.837

p-value = 0.015; fcrit = 1.94 p = >0.05%

Conclusion

Regular monitoring of physiochemical parameters will make possible an evaluation of current pond management and practices. Although there are economics advantages to the fish famers, there is the

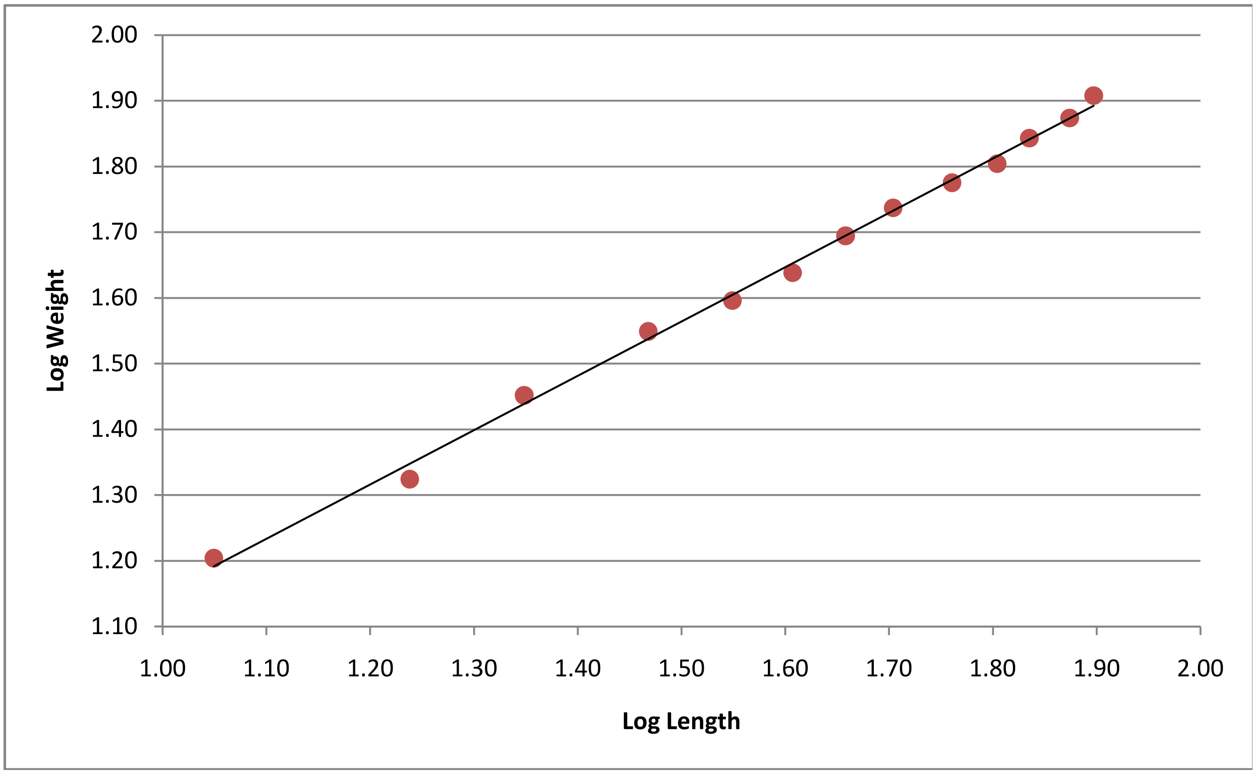

Figure 7: Length - weight regression for Treatment A.

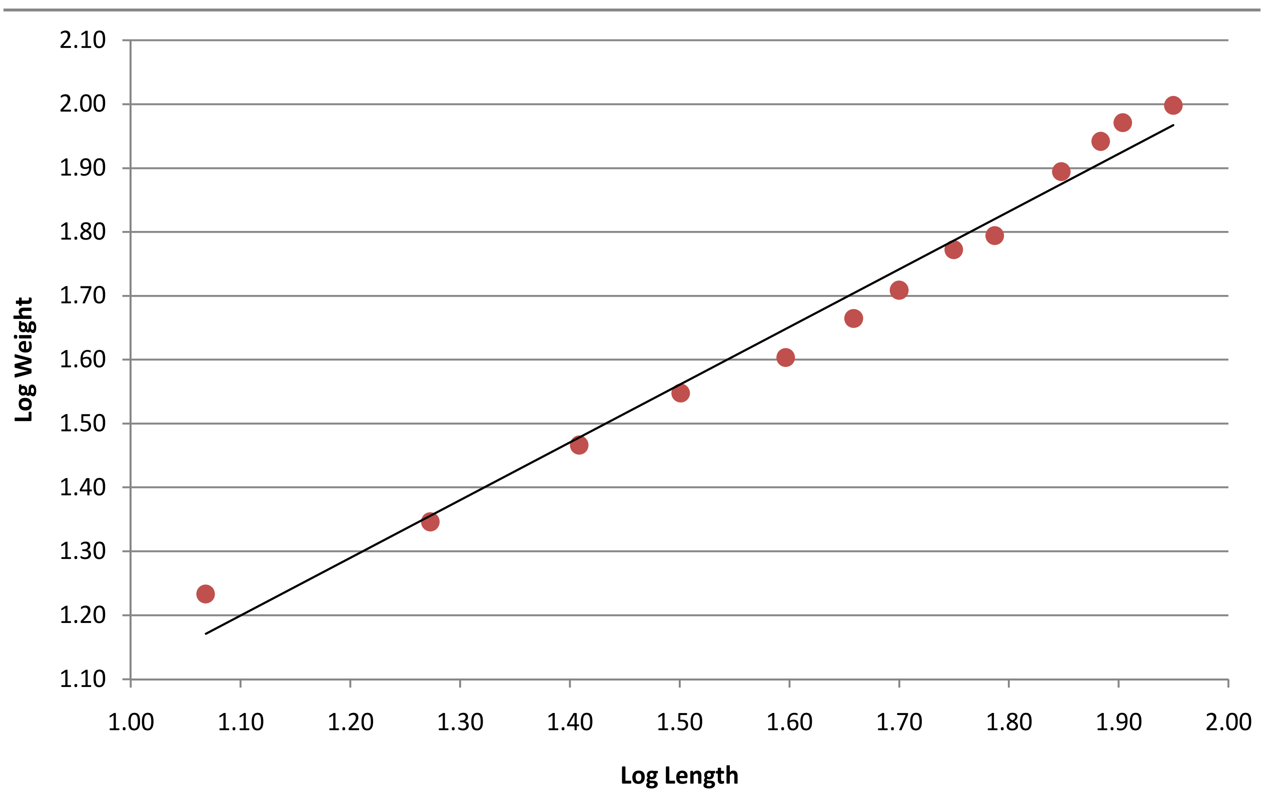

Figure 8: Length Regression for Treatment B.

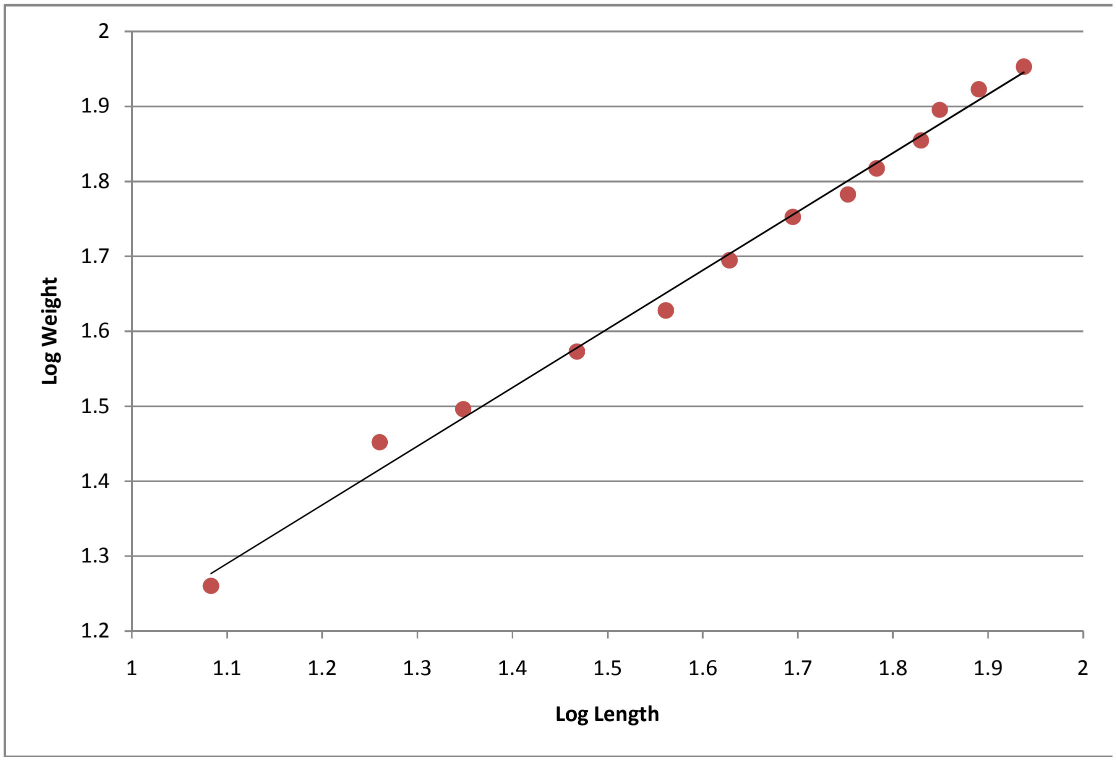

Figure 9: Length - Weight regression for Treatment C.

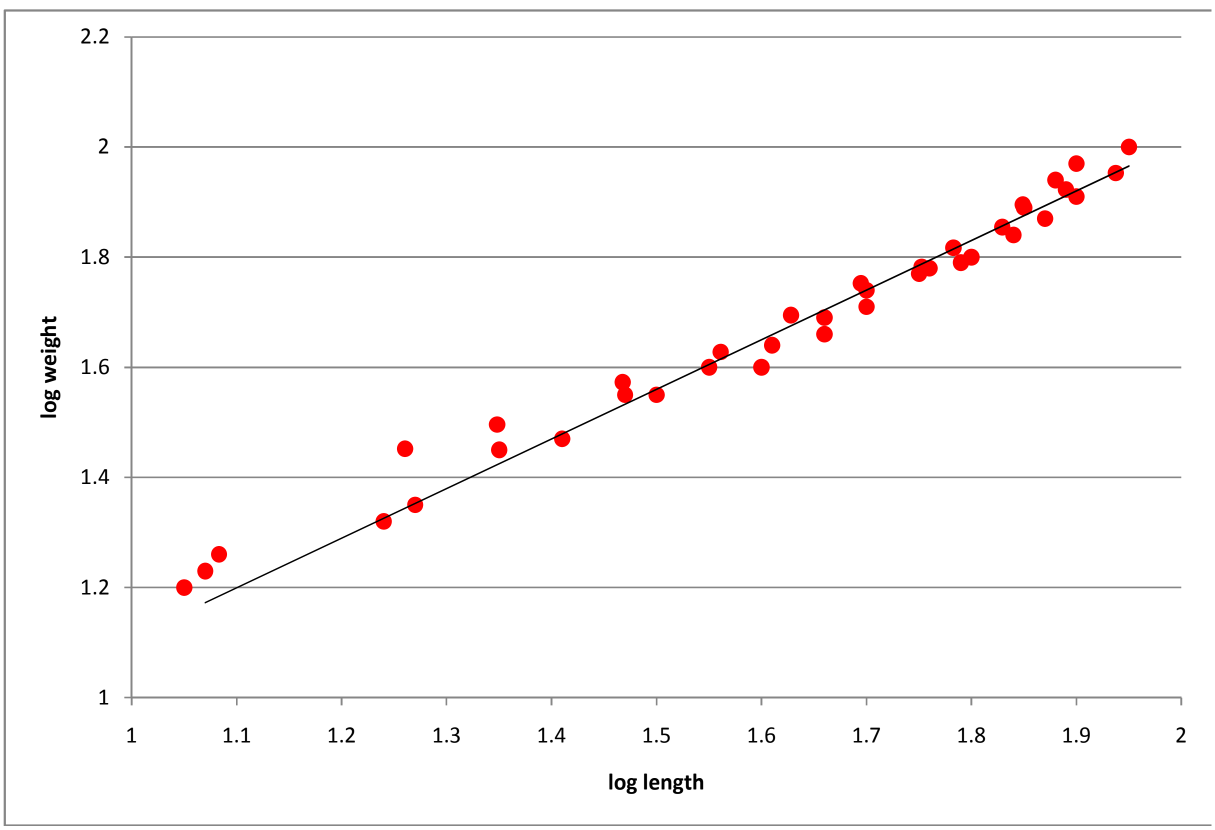

Figure 10: Length - Wight regression for all the Treatments

desirable need to analyze the fish pond water at regular intervals. This is a quality assurance process to ensure that there are no toxic substances in the ponds heading to possible bio-accumulation and magnification. In this way the good health of the aquatic ecosystem, humans and environment can be guaranteed. It is in view of these that this present research work was carried out to provide information on physiochemical parameters.

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Appendix 1: Summary of the analysis of variance (ANOVA) on table one
ANOVA

	sum squares	**df**	**mean square**	**F**	**Sig.**
Between groups	1503.876	92	16.346	1.919	.011
Within groups	315.117	37	8.517		
Total	1818.992	129			

$F_{0.05,8,81}$=1.94

Since F=1.919 is not at least $F_{0.05,8,81}$=1.94 at 0.05 level of significance. H_O is not rejected; hence we accept H_O and assert that there is mean relationship among the observed parameters at 5% level of significance.

Appendix 2: Summary of analysis of variance (ANOVA) of treatment B

ANOVA

	sum of squares	**df**	**mean square**	**F**	**Sig.**
Between Groups	1438.576	97	14.831	1.248	.252
Within groups	380.417	32	11.888		
Total	1818.992	129			

$F_{0.05,8,81}$=1.94

Since F=1.28 is not at least $F_{0.05,8,81}$=1.94 at 0.05 level of significance. H_O is not rejected; hence we accept H_o and assert that there is mean relationship among the observed parameters at 5% level of significance.

Appendix 3:Summary of Analysis of Variance of Treatment C

ANOVA

	Sum of squares	**df**	**mean square**	**F**	**Sig.**
Between Groups	1429.853	86	16.626	1.837	.015
Within Groups	389.140	43	9.050		
Total	1818.992	129			

$F_{0.05,8,81}$=1.94

Since F=1.837 is not at least $F_{0.05,8,81}$=1.94 at 0.05 level of significance. H_o is not rejected; hence we accept H_O and assert that there is mean relationship among the observed parameters at 5% level of significance.

Appendix 4: Summary of length - weight regression (ANOVA) for Treatment A.
ANOVA

Model	sum of square	df	mean square	F	Sig.
	.0693	1			
1 Regression			.693		
Residual	.014	11		555.874	.000[a]
Total			.001		
	.706	12			

a. Predictors: (Constants), log L

Appendix 5: Summary of length-weight regression (ANOVA) for Treatment B.

ANOVA

Model	sum of squares	df	mean square	F	Sig.
1Regression Residual	.559	1	.559	3.9253	.000[a]
Total	.002	11	.000		
	.560	12			

a. Predictors: (Constant), log L

Appendix 6: Summary of length-weight regression (ANOVA) for Treatment C

ANOVA

Model	sum squares	df	mean square	F	Sig.
1 Regression	.513	1	.513	1.650E3	.000[a]
Residual	.003	11	.000		
Total	.517	12			

a. Predictors: (constant), log L