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CALCULATION OF PHYSIOCHEMICAL PARAMETERS OF CATFISH (*CLARIAS GARIEPINUS*) FED LOCALLY FORMULATED FEEDS (EARTH WORM)

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Abstract: This study was conducted in the biological department of the University of Abuja; to access the physiochemical parameters of catfish *(Clarias gariepinus)* fed locally earth worm fishmeal. The earth worm meal is composed of fishmeal (400g), corn (280g), rice bran (200g), and groundnut cake (120g). Proximate Analysis was analyzed as follows: Moisture (60g), Crude protein (12), Ash (10), and Crude lipid (12). The earthworm meal varies with replacement level at 0%, 30%, and 50% for Treatment A, B, and C respectively. Fishes were stocked at a density of 15 fingerlings per tank and fed twice daily at 4% body weight. From result obtained, temperature in all the treatments were within the same range (26°C-27°C), dissolved oxygen concentration for treatment A (4.98mg/l) was below the optimum level for good growth,(5.03mg/l), and pH level shows alkalinity in all the treatment ranging from 7.10 - 8.71, and nitrate level (0.01-0.04mg/l) was observed to be optimal in all treatments. Concentration of ammonia ranged from (0.01-8mg/l) in Treatment A, B, and C. Highest value of mean weight (0.33g) and mean length (0.34cm) gained was noticed in Treatment C. The result shows a significant differences ($P<0.05$) on the mean weight, mean length, specific growth rate, food conversion efficiency and survival rate. Earthworm meal is therefore considered effective, on the basis of good water quality to enhance production and survival performance.

Key Words: *Clarias gariepinus;* Earthworms and Feeding Regime

INTRODUCTION

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. He considered water to be the limiting factors to *Clarias* production, and the amount and quality of irrigation water available in this area determines the number of ponds and the amount of fish that can be produced. When the amount of fish stocked exceeds the carrying

Capacity of the water supply, water quality and the condition of the fish deteriorate and mortality increases due to rapid spread of protozoa's and bacterial diseases and parasites. (Vijai *et al.,* 2002). After oxygen, water temperature may be the single most important factor affecting the welfare of fish. Fish are cold-blooded organisms and assumed approximately the same temperature as their surroundings (LaDon, 2000). The temperature of the water affects the activity, behavior, feeding, growth and reproduction of all fishes (Boyd, 1979). Fish are generally categorized into warm water, cold water and species based on optima growth. *Clarias gariepinus* is an example of warm water species and their temperature for growth is between 23-32*C (Swann *et al.,* 1990). A temperature of 27*c is considered optimum for catfish (Boyd, 1979). According to Federal Ministry of Environment (2006), the temperature of 20-33*c is recommended as a 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. Generally, neutral or slightly alkaline water are most suitable for fish culture and according to Boyd (1976), 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, is 6.9 (LaDon *et al.,* 2000).

The measurement of dissolved oxygen in an aquatic system can be used not only to define the quality of the water but as a means of estimating the gross photosynthetic and the total community respiratory process (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 *et al.,* 2001). Like Humans, fish require oxygen for respiration. The amount of oxygen consumed by the fish is a function of its size, feeding rete, activity level and temperature. The amount of oxygen that can dissolve in water decreases at higher temperatures and decrease with increases in altitudes (LaDon *et al.,* 2000). According to Hutchinson (1975) and Payne (1986), knowledge of dissolved oxygen (DO), will go a long way in helping an aqua culturist and a limnologist know more about the nature of the lake or fish pond from series of oxygen concentration values. Federal Ministry of Environment (2006), reported that the permissible limit standard of dissolved oxygen for aquatic life is 6.8. Also, Eding *et al.,* (2001) reported

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that the standard value of dissolved oxygen for African catfish (*Clarias gariepinus)* is between 2.9 – 6.8.

Fish excrete ammonia and lesser amounts of urea in to the water as wastes. Two forms of ammonia occur in aquaculture systems, ionized and un-ionized. The un-ionized forms of ammonia are extremely toxic while the ionized form is not. Both forms are grouped together as 'total ammonia' (LaDon *et al.,* 2006). The toxicity values of un-ionized ammonia for *Clarias gariepinus* and the *Heterobranchus longifilis/Clarias gariepinus* hybrid are approximately 6.5mg/l and 9.10 mg/l respectively (EIFAC, 1970). According to Hampson (1976), the minimum indicative level of pollution of ammonia in water is 0.5mg/l.

Nitrate enters a fish culture system after fish digests feed and the excess nitrogen is converted into ammonia, which is then excreted as waste into water. Total ammonia nitrogen is then converted to nitrite which, under normal conditions is quickly converted to non-toxic nitrite by naturally occurring bacteria. Uneaten feed and other organic material also break down into ammonia, nitrite and nitrate in similar manner (Robert *et al.,* 1997). 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 for aquatic life is 0.06 mg/l. Eding *et al.,* (2001) reports that 0.01 – 0.06 mg/l of nitrite is considered non – toxic for African catfish *Clarias gariepinus* culture.

Water quality refers to the physical, chemical and biological characteristics of water (Diersing, 2009). It is the measure of the condition of water relative to the requirement of one or more biotic species (Johnson *et al*., 1997). Water characteristics such as dissolved oxygen, pH, Nitrates, Temperature, Ammonia, Turbidity, and Conductivity are known as water Parameters, which can be physical, chemical or biological in nature. (Kitt, 2000).

The dissolved oxygen of fresh water at sea level will range from 15mg/l at $0^{o}C$ to 8mg/l at $25^{o}C$ (Schwarzenbach *et al*., 2003). A pH range of 6.0 to 9.0 appears to provide protection for life of fresh water fish and bottom dwelling invertebrates (Pankow, 1991). As the pH increases, NH_3 will leave the aqueous solution by volatilization (Warrick, 2003). Nitrate - nitrogen levels below 90mg/l seem to have no effect on fish (Knepp and Arkin, 1973).

Taxonomy of earthworm

Earthworm belongs to the order *Haplotaxida* of the phylum Annelida. There are five major families of earthworm.

Taxonomic hierarchy of earthworm

Kingdom ....Animalia
Phylum..................................Annelida
Class.....................................Clitellata
Subclass................................Oligocheasta
Order.................................... Haplotaxida
Families.................................Lumbricidae
Genus....................................Lumbricus
Species..................................Terrestis

Description of earthworm

Earthworm vary in size from 90-300mm, they have no eyes and no brain. Strong day light can kill them and their bodies are scattered with light-detecting cells connected to nerves that make worms react correctly when they come to the surface. This attention to light is called phototropism.

Common earthworm (*Lumbricus terrestis*) is known to be widely spread in many parts of the world. They live in soil at depths of up to 2m and feed on decaying organic matter in the soil. Earthworm helps to fertilize the soils by bringing nutrients closer to the surface. They are frequently used as fishing bait.

The fish industry in Nigeria, typical of developing countries in general, is plagued with many challenges among which is poor knowledge of ideal management practices, nutrient and environmental requirement for optimum productivity. (Kolo, 1996) observed inadequate environmental conditions as one of the major factors that limits fish production such factors include water quality, relating to physical, chemical and biological properties of the pond.

Physical factors that are important in domestics fish farming include, shape and size of fish pond, types of substrata material, temperature, turbidity and pond transparency (Jonassen *et al*., 1999), while the chemical factors are dissolved oxygen, alkalinity, hardness of water, hydrogen ion concentration (pH), conductivity and mineral constituents such as nitrates and phosphates (Larry, 1995). In addition, there are biological factors which equally influence fish production; are factors like vegetation, predation and aquatic plants. Aquaculture has been found necessary in fish production to make enough fish/protein available to the populace. However one major constrains facing aquaculture is feeding. Early catfish producers depended primarily on natural pond organisms to provide nutrients essential for fish growth. Fish production was often enhanced by the addition of fertilizers to pond water to stimulate the growth of natural food organisms. Supplemental feeds were largely steam-pelleted (sinking) feeds that provide proteins and energy, but were generally deficient in micronutrients such as vitamins, minerals, and essential fatty acids. Requirements for some micronutrients were met from those present in feed ingredients and/or natural foods. (Edwin and Meng, 1996).

Although there has been a lot of research work on the production of fish and feeding, the use of cheap feedstuffs to replace or substitute fishmeal, farmers still rely on costly, and imported pelleted floating feeds (Omitoyin, 2007). There is high competition for foodstuffs between man and his domestic's animals. This has increased the price of fish meal, which is the sole protein source in fish feeds. It is therefore very crucial that an alternative is found (Jauncey and Rose, 1982) to reduce feeding cost, and to make aquaculture a viable and attractive venture. Earthworm (*Lumbricus terrestis*) has been found to be a good source of protein (Guererro, 1981; Tacon *et al.*, 1982; Hilton, 1983).

Lumbricus terrestis is readily available during the rainy seasons. Earthworm meal had been reported to be rich in protein. Tacon (1983) reported that it contains about 56% crude protein. Unfortunately, in the past it was considered to have little or no value until now when it had been discovered otherwise. This discovery had led to its massive culture in developed countries like Japan and China. Poor feed leads to slow growth, high feed conversion ratio, low survival, diseases and poor harvest (Eyo, 2001).

Good quality feed when feed at recommended rate and other water quality conditions that are adequate leads to profitability in fish culture managements. Despite the breakthrough with use of hormone in induced spawning; fry survival is still beset with a number of biotic factors. Those biotic factors include cannibalism, heavily predation by frogs/aquatics insects and the abiotic factors include water temperature dissolved oxygen, levels of ammonia. During the first week after stocking, the most critical factor for the successful nursing of the catfish larvae is the availability of zooplankton. Feeds and feeding of the larvae fry and fingering of the catfishes have been most studied and shown to influence the growth and survival of the fish (Olaleye, 2005). The African catfish is an excellent species for aquaculture as it is omnivorous, grows fast, and tolerates relatively poor water quality (Rad *et al.*, 2003). It is recognized by its long dorsal and anal fins, which give it a rather eel-like appearance. Catfish has a slender body, a flat body, a flat bony head, and a broad, terminal mouth with four pairs of barbells. Its prominent barbells give it the image of catlike whiskers. The fish is mostly cultured in earthen ponds.

Aquaculture has been found necessary as one approach to increase fish production to make enough fish/protein available to the populace. However one major constrains facing aquaculture is feeding. As aquaculture production becomes more intense in Nigeria, fish feed will be a significant factor in increasing the production and profitability of aquaculture (Akinrotimi *et al*., 2007).

Catfishes of the family C*laridae* comprise the most commonly cultivated fishes in Nigeria. The growth of aquaculture in Nigeria now is largely being boosted by a steady rise in catfish culture. Since the culture of *Clarias gariepinus* through hypophysation was initiated in Western Nigeria in 1973. The procedure has been widely practiced throughout Nigeria thus leading to increase of farm-raised catfishes from the 80's to date. Despite the popularity of the African catfish and its great market potentials, the production is still basically at subsistence level due majority to adequate availability of seed for stocking and feed problems. In Europe, about 75% of *Clarias* fingering demands are supplied by a few producers. In Europe, however the fingerings supplied from both the government and privately owned hatcheries are not enough to meet the catfish farmers' fingering demands. Artificial propagation of *C. gariepinus* is now carried out in hatcheries with hormonal induction. Farmers have found the homoplastic pituitary gland suspension cheaper, practical and more highly reliable than the imported synthetic hormonal analogues. The *C. gariepinus* brood stock used for artificial breeding which ranges between 0.3kg and 2kg (Olaleye, 2005).

Materials and Methods

Experimental feed formulation

Earthworms of about 10-70g were collected, washed and cleaned using blotting paper. They were introduced into boiling water at (100°C) after which was squashed/crushed using mortar and pestle. 20g of groundnut cake, corn flour, rice bran, 70g of eggs and 30g of brewer's yeast are ingredients that were added to the earthworm and mixed for closed to 30 minute to ensure homogeneity of the ingredient. Pap was used as binding agent, pelleted wet using hang pelleted machine. The pellets were collected in flats trays and sun dried to constant weight.

Experimental fingerings

The experimental catfish fingerings (*Clarias gariepinus*) of about 0-10cm and 0-20g were collected and transported from Agricultural Development Project (ADP) Gwagwalada, Abuja in a plastic transparent bowl with oxygenated water in the early hour of the morning to the site where the experiment was conducted at University of Abuja, main campus. A total number of 45 catfish fingerings were randomly distributed (15 each) into three (3) circular plastics bowls/tanks filled with water at 40l. volume. The fingerings were fed with Copen's at 2% body weight for 7 days, after which were starved for 24 hours to empty their gut/ content and prepare them for the experimental. They were fed 4% body weight twice daily, morning (8.00am), and evening (6.00pm).

Table 1: Composition of formulated feed

Type of Meal	Weight	%
Fish meal	400g	28.6
Earthworm	400g	28.6
Corn	280g	28.6
Rice bran	200g	14.3
groundnut	120g	8.6

Proximate analysis

Proximate analysis also known as nutritive value is applied to investigate if the sample could be formulated into a diet as a source of protein or energy.

Crude protein: For the amount of protein present in the food.

Crude lipid: The extraction of fat/oil from the sample using the appropriate organic solvent.

Moisture: Essential in monitoring the moisture % in powdered food and sample to avoid the risk of contamination by fungi and bacteria during storage.

Table 2: Proximate composition of earthworm

Moisture	60
Crude protein	12
Ash	10
Crude lipid	-

Tank management

The plastic circular tanks of the same size and volume capacity were bought from Gwagwalada market, washed with salt solution thoroughly, to kill pathogen, and filled with fresh water at 40 liter volume of tank capacity of 50 liters. Fifteen (15) fingerlings were introduced into each of the three tanks labeled/tagged A, B and C. After which they were covered with nets at the surface to prevent predators and escape of fish. The water in each tank was changed after 72 hours to pollution. Fishes weight and length were measured with a meter rule and divider.

Physiochemical parameters

Physiochemical parameters were carried out every week. Both surface and bottom water temperatures were measured and recorded to the nearest $0^{o}C$ with the aid of mercury in glass thermometer. pH, Ammonia, Nitrate, glucose, was determined using the combi 11 urinalysis strips. Dissolved oxygen was determined weekly by titration with 0.1 NaOH and azide modification of the winker method (American public health Association, 1976).

Statistical analysis

Data generated from the experiment were subjected to analysis of variance (ANOVA) and was carried out to test the effects of the treatment on the fish growth rate separated using Duncan multiple range test.

Growth parameters

1. Mean weight gain (%) was calculated as

$$MWG\% = \frac{final\ mean\ weight}{initial\ mean\ weight} \times 100$$

2. Mean length gain (%) was calculated as

$$MLG\% = \frac{final\ mean\ legth}{initial\ mean\ length} \times 100$$

3. Specific growth rate

$$SGR = \frac{LnWT - LnWt}{T - t} \times 100$$

Where: WT = Final weight
Wt. = Initial weight
t = Initial time
Ln = natural logarithm (Solomon, 2006)

4. Food Conversion Efficiency

$$FCR = \frac{Weight\ gain}{food\ intake} \times 100$$

5. Mean Growth Rate

$$MGR = \frac{W2 - W1}{0.5(W1 - W2)} \times \frac{100}{t}$$

Where: W1 = Initial weight
W2 = final weight
T = period of experiment in days
0.5 = constant

6. Survival Rate:

$$SR = \frac{total\ fish\ number\ harvested}{total\ fish\ number\ stocked} \times 100$$

(Akinwole *et al.*, 2006)

RESULTS

Table 3: Production Parameters for Treatment A

Parameters	Initial Wk.	Wk One	Wk Two	Wk Three	Wk Four	Wk Five	Wk Six	Wk Seven	Wk Eight	Wk Nine	Wk Ten	Wk Elev.	Wk Twel.	Total	Mean
Gross Total Weight (g)	15.22	20.82	26.15	29.19	36.23	39.27	45.31	50.38	55.42	61.51	67.51	73.49	79.61	600.05	46.15769
Mean Weight (g)	1.01	1.38	1.74	1.94	2.41	2.61	3.02	3.32	3.69	4.09	4.5	4.89	5.3	39.9	3.069231
Gross Total Length (cm)	28.9	31.48	37.21	42.31	49.37	54.43	59.49	65.51	70.56	76.61	81.42	87.41	92.55	777.25	59.78846
Mean Length (cm)	1.92	2.09	2.48	2.82	3.29	3.62	3.96	4.36	4.7	5.1	5.42	5.82	6.17	51.75	3.980769
Weight Gain (g)	0	0.37	0.36	0.2	0.47	0.2	0.41	0.3	0.37	0.4	0.41	0.39	0.41	4.29	0.33
Length Gain (cm)	0	0.17	0.39	0.34	0.47	0.33	0.34	0.4	0.34	0.4	0.32	0.4	0.35	4.25	0.326923
Gross Specific Growth Rate (g)	0	1.94	0.7	0.22	0.33	0.1	0.14	0.09	0.07	0.07	0.05	0.04	0.04	3.79	0.291538
Food Conversion eff. %	0	9.25	0.09	0.05	11.75	0.05	10.25	7.5	9.25	10	10.25	9.75	10.25	88.44	6.803077
Mean Growth Rate	0	0.28	0.057	0.063	0.015	0.019	0.011	0.007	0.006	0.005	0.003	0.003	0.002	0.471	0.036231
Survival Rate	100	100	100	100	100	100	100	100	100	100	100	100	90	1290	99.23077
Total														**2860.2**	**220.0147**

Table 4: Physiochemical Parameters for Treatment A

Parameters	Initial Wk	Wk One	Wk Two	Wk Three	Wk Four	Wk Five	Wk Six	Wk Seven	Wk Eight	Wk Nine	Wk Ten	Wk Elev.	Wk Twel.
Water Temperature (°C)	27	26	26	27	27	26	27	26	27	26	27	27	26
Dissolved O_2 (mg/l)	5.42	5.6	5.3	5.24	5.3	5.1	4.98	5.9	5	5.97	6	6	6.32
pH	8	7.3	7.9	8.1	8.3	8.6	8.2	7.7	7.6	7.8	8.3	8	8.3
Ammonia (mg/l)	0.02	0.26	0.36	0.42	0.43	0.49	0.54	0.57	0.55	0.56	0.54	0.57	0.56
Nitrite (mg/l)	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02

Table 5: Production Parameters for Treatments B

Parameters	Initial Wk	Wk One	Wk Two	Wk Three	Wk Four	Wk Five	Wk Six	Wk Seven	Wk Eight	Wk Nine	Wk Ten	Wk Elev.	Wk Twel.	Total	Mean
Gross Total Weight (g)	17.6	21.22	29.61	30.42	36.51	41.38	58.57	63.61	69.68	59.43	55.38	62.42	70.89	616.69	47.438
Mean Weight (g)	1.16	1.41	1.97	2.02	2.43	2.75	3.9	4.24	4.64	3.96	3.96	4.16	4.72	41.32	3.178
Gross Total Length (cm)	22.14	28.2	34.44	39.52	43.58	49.62	52.67	58.64	66.31	69.2	72.31	77.43	85.52	699.58	53.814
Mean Length (cm)	1.47	1.88	2.29	2.63	2.9	3.3	3.51	3.9	4.42	4.64	4.82	5.16	5.7	46.62	3.586
Weight Gain (g)	0	0.25	0.56	0.05	0.41	0.32	1.15	0.34	0.4	-0.68	-0.27	0.47	0.56	3.56	0.274
Length Gain (cm)	0	0.41	0.41	0.34	0.27	0.4	0.21	0.39	0.52	0.22	0.18	0.34	0.54	4.23	0.325
Gross Specific Growth Rate (g)	0	1.19	1.03	0.05	0.28	0.15	0.38	0.07	0.07	-0.11	-0.04	0.07	0.06	3.2	0.246
Food Conversion eff. %	0	6.25	1.4	1.25	10.25	0.08	28.75	8.5	10	-17	-6.75	11.75	14	68.48	5.268
Mean Growth Rate	0	1.191	0.011	0.031	0.015	0.025	0.005	0.004	0.007	0.003	0.003	0.005	0.004	1.304	0.100
Survival Rate	100	100	100	100	100	100	100	100	100	90	90	80	80	1240	95.385
Total														2724.984	209.614

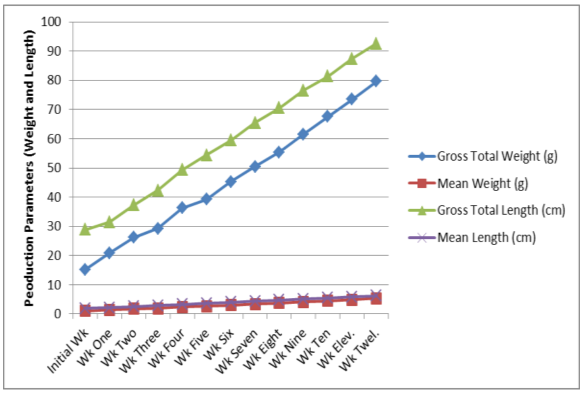

Figure 1: Production Parameters for treatment A

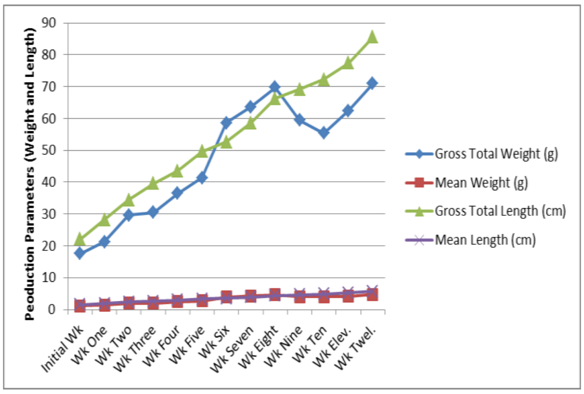

Figure 3: Production parameters for treatment B

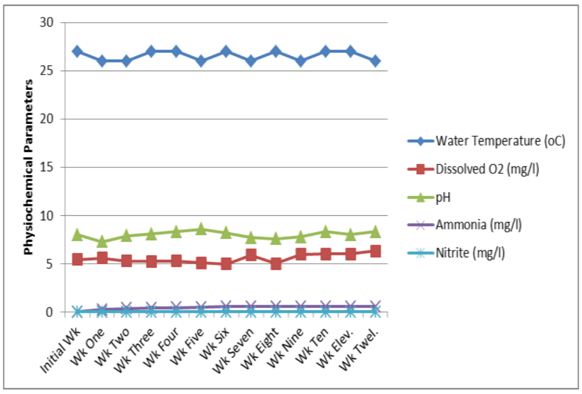

Figure 2: Physiochemical Parameters for treatment A

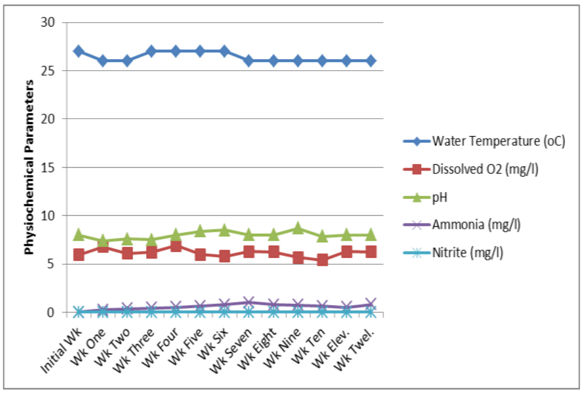

Figure 4: Physiochemical parameters for treatment B

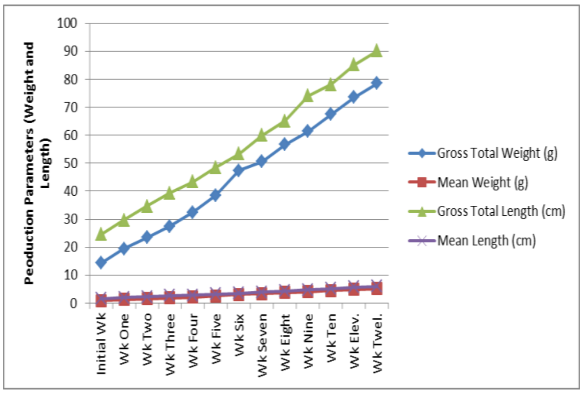

Figure 5: Production parameter for treatment C

Table 5: Physiochemical Parameters for Treatment B

Parameters	Initial Wk	Wk One	Wk Two	Wk Three	Wk Four	Wk Five	Wk Six	Wk Seven	Wk Eight	Wk Nine	Wk Ten	Wk Elev.	Wk Twel.
Water Temperature (°C)	27	26	26	27	27	27	27	26	26	26	26	26	26
Dissolved O_2 (mg/l)	5.94	6.8	6.11	6.22	6.9	6	5.81	6.29	6.25	5.67	5.43	6.31	6.25
pH	8.01	7.41	7.6	7.5	8	8.4	8.5	8	8	8.71	7.85	8	8
Ammonia (mg/l)	0.01	0.27	0.36	0.45	0.51	0.63	0.78	1.01	0.78	0.74	0.63	0.54	0.81
Nitrite (mg/l)	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04

Table 6: Production Parameters for Treatments C

Parameters	Initial Wk	Wk One	Wk Two	Wk Three	Wk Four	Wk Five	Wk Six	Wk Seven	Wk Eight	Wk Nine	Wk Ten	Wk Elev.	Wk Twel.	Total	Mean
Gross Total Weight (g)	14.25	19.43	23.47	27.51	32.42	38.48	47.32	50.61	56.67	61.41	67.49	73.51	78.51	591.08	45.468
Mean Weight (g)	0.95	1.29	1.56	1.83	2.16	2.56	3.15	3.37	3.76	4.09	4.49	4.9	5.23	39.34	3.026
Gross Total Length (cm)	24.58	29.61	34.68	39.34	43.41	48.54	53.31	59.94	65.11	74.12	78.16	85.21	90.11	726.12	55.855
Mean Length (cm)	1.63	1.97	2.31	2.62	2.89	3.23	3.55	3.94	4.34	4.74	5.21	5.68	6	48.11	3.701
Weight Gain (g)	0	0.34	0.27	0.27	0.34	0.4	0.59	0.22	0.39	0.33	0.4	0.41	0.33	4.29	0.330
Length Gain (cm)	0	0.34	0.34	0.31	0.27	0.34	0.32	0.39	0.4	0.4	0.47	0.47	0.32	4.37	0.336
Gross Specific Growth Rate (g)	0	1.92	0.58	0.32	0.25	0.21	0.21	0.05	0.08	0.05	0.06	0.51	0.36	4.6	0.354
Food Conversion eff. %	0	4.25	10.25	10.25	15.25	14.25	10.5	17.25	12.75	15.25	14.75	15.25	14.5	154.5	11.885
Mean Growth Rate	0	0.053	0.012	0.059	0.039	0.028	0.023	0.005	0.007	0.004	0.004	0.003	0.002	0.239	0.018
Survival Rate	100	100	100	100	100	100	90	90	90	80	80	80	75.5	1185.5	91.192
Total														2758.149	212.165

Table 7: Physiochemical Parameters for Treatment C

Parameters	Initial Wk	Wk One	Wk Two	Wk Three	Wk Four	Wk Five	Wk Six	Wk Seven	Wk Eight	Wk Nine	Wk Ten	Wk Elev.	Wk Twel.
Water Temperature (°C)	27	26	26	26	26	27	27	27	26	26	27	27	26
Dissolved O_2 (mg/l)	5.4	5.6	6.01	6.41	5.04	6	5.8	5.9	5.9	5.8	5.8	6	6
pH	8.2	7.6	7.5	8.4	8.3	8.1	7.8	7.1	8	8.4	8	7.9	8.01
Ammonia (mg/l)	0.01	0.25	0.34	0.41	0.54	0.62	0.74	0.8	0.8	0.9	0.94	8	8
Nitrite (mg/l)	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04

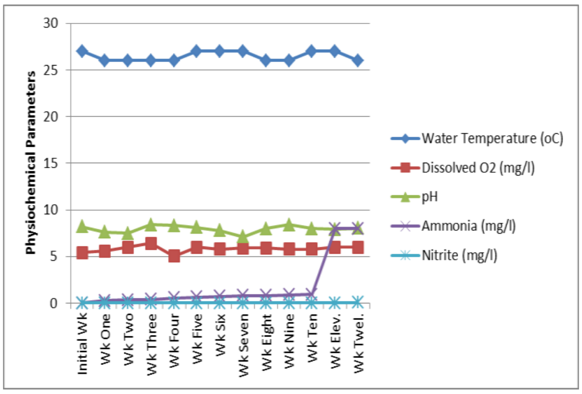

Figure 6: Physiochemical parameters for treatment C

Discussion

Physiochemical parameters such as dissolved oxygen, and ammonia were noticed as unfavorable through the rearing period. Numeration and density stress are additional parameters that might have resulted to fish mortality.

The result of the water quality variables in the experimental tanks indicated that mean value of PH ranged from 7.10-8.71, water temperature ranged from 26°C-27°C, Dissolved oxygen range from 4.98-6.9 mg/l, nitrite 0.01-0.04mg/l and ammonia 0.01-8mg/l. pH recorded for treatment C (7.10) has the lowest pH Value, while treatment B (8.71) has the highest pH value. This shows that the alkalinity of the pH concentration in all the treatments. Due to stocking density, high level may have influenced elevation of some of the water quality parameters (Akinwole and faturoti, 2006).

The temperature readings in all the treatment were within the same range (62^{O}C-27^{O}C). The nitrite level did not reach an extent of affecting the fish growth. It was higher in treatment B (0.04mg/l) and treatment C (0.04mg/l) while in treatment A, it was lower. Nitrite levels, greater than 0.06mg/l are considered toxic for the culture of catfish as recommended by the federal ministry of environment (2006). Higher concentration of ammonia occurred towards the end of production period which could be attributed to increase in biomass. Ammonia value less than 8.8mg/l are considered tolerable for the culture of catfish (Eding *et al*., 2001). Dissolved oxygen actually fluctuated in all treatment; highest value was seen in treatment B (6.9mg/l) while lower in treatment A (4.98mg/l) and moderate in treatment C (6.01mg/l). Value lower than 5.03mg/l is considered frequently below the optimum for good growth (Oyewole *et al*., 2008). The survival of catfish is not dependent on oxygen in water since it is equipped with barbells to obtain energy by gulping air (Brown, 1975).

The results obtained from the various production parameters in the three treatments (A, B and C). The circular tanks with the stocking density of 15 fishes fingerings each for the three tanks shows the mean weight gain and mean length gain for the experimental formulated diet at 0% (Treatment A), 30% (Treatment B), and 50% (Treatment C) of earthworm meal. A (0.33g and 0.33cm), B (0.72g and 0.33cm). C (0.033g and 0.34cm), respectively. It is obvious that the mean weight gain and mean length gain is highest in Treatment C. Specific growth rate for the treatment are: A (3.79), B (3.2), C (4.6). Percentage survival for treatment A (99%), B (95%), C (95%) and highest mortality was recorded in treatment C. This may be due to accumulation of physiochemical parameters or handling stress as most of it occurs after the weekly sampling. The growth performance in catfish was statistically analyzed using the one way ANOVA.

One way ANOVA for Treatment A shows significant differences. (f=0.170, $p<0.05$, df=129) in Appendix 1.

One way ANOVA for Treatment B shows a significant difference. (f=0.128, $p<0.05$, df=129) in Appendix 2.

One way Anova for Treatment C shows significant differences. (f=0.140, $p<0.05$, df=129) in appendix 3. P- value for all treatment is approximately 1.000.

Conclusion

On the basis of results obtained, good water quality is necessity for the improvement of survival and growth and it determines ultimately, the success or failure of aquaculture operations. Hence, a general understanding is needed from fish farmers to manage water quality as it relates to feed.

References

1. Ainrotimi OA, Gabriel UU, Owhonda NK, Opara DN, Anyanwu, PE and Cliffe PT, 2007. Formulating an environmental friendly fish feed for sustainable aquaculture development in Nigeria, Agriculture journal, 2 (5): 606-612.
2. Akinwole AO and faturoti EO, 2006. Biological performance of African Catfish (*Clarias gariepinus*) cultured in recruiting system in Ibadan, Adva. Cultural. Engineering, 36: 18-23.
3. Boyd CE, 1982. Water quality in warm water fish ponds, Agriculture Experiment Station, Auburn, Alabama, pp 359.
4. Brown ME, 1957. The Physiology of Fishes, Vol 1, Academic Press, Inc, New York, pp,447.
5. Brown ME, 1975. Experimental studies on growth, The physiology of fishes in: Brown ME, ed. Volume i Academic press, London pp401.
6. Caffrey S, 2012. Water watch coordinator, Naomi catchment management authority ph, 67645961, www.waterwatch.nsw.gov.au
7. Deirsing N, 2009. Water quality: Florida Keys natural marine sanctuary, keys west. fl. vol, 2. Pp 54,
8. Eding C and Kamstra G, 2001. Design and Performance of Recirculation Systems for European eel Anguilla and African catfish *Clarias gariepinus* in: Proceeding of AES Workshop, Florida, USA pp, 18-28.
9. Editing, E, and Kamstra, A, 2001. Design and the performance of recirculating systems for European eel, Angullla and African catfish *Clarias gariepinus* in proceeding of AES workshop, Florida, USA, Pp18-28.
10. Edwin HR and Meng HL, 1996. A practical guide to nutrition, feed and feeding of catfish, Mississippi agricultural forestry experiment station bulletin, 1041.
11. Eyo AA, 2001. Fundamental of fish nutrition and diet development in: Eyo, AA, Eds. National workshop on fish feed development and feeding practices, Pp80.
12. Federal Ministry of Environment, 2006. National Guideline and Standard for Water Quality in Nigeria, 40 pp.

13. Guerroro RD, 1981. Culture and use op of peronya excaratus as a protein Resources in the Philippines', Darwin centenary symp, On Earthworm Ecology, Institution of terrestrial Ecology U.K, pp250.

14. Hampson BL, 1976. Ammonia Concentration in relation to Ammonia Toxic during a Rainbow Trout Rearing Experiment in a closed fresh water seawater system, Aquaculture, 9:61-70.

15. Hutchinson GE, 1975. A treatise on Limnology, Chemistry of Lakes, 1:575-654.

16. Hilton JW, 1983. Potential of freeze dried worm meal as a replacement for fishmeal in trout diet formulation, Agriculture, 32: 227-283.

17. Jauncey K and Ross B, 1982. A guide to Tilapia feeds and feeding, Institution of Agriculture, University of Stirling Scotland, University press pp111.

18. Johnson DL, Ambrose SH, Basselt TJ, Bowen ML, Crummey DE, Isaacson JS, Jonson DN, Larib P, Saul M and Nelson AE, 1997. "Meaning of environmental terms", Journal of environmental quality, 26:581-589.

19. Jonassen TM, Sland AK and steffansson SO. 1999. The interaction of temperature and size on growth of juvenile Atlantic habitat, Journal of fish biology, 54:556-572.

20. Kitt FP, 2000. A river is the report card for its watershed, Alan levere Connecticut department of environmental protection, pp23-31.

21. Knepp GF and Arkin GF, 1973. A progressive fish culture, Ammonia Toxicity levels and nitrate tolerance of channel catfish, pp, 221

22. Kolo RJ, 1996. The limnological studies of Shiroro Lake and its major tributaries, PhD thesis submitted to the department of water resources, aquaculture and fisheries technology, federal university of technology, Nigeria, pp143.

23. LaDon S, 2000. A fish farmers guide to understanding water quality, department of animal sciences Illinois, Indiana sea grant programme, Purdue University, pp 34-56,

24. Larry ER, 1995. Automated water quality monitoring and control in Aquaculture, World Aquaculture Journal, 26 (2): 35-37.

25. Mallya YJ, 2007. The effect of dissolved oxygen on fish growth in aquaculture, The United Nations University fisheries training programmer, Final project, pp30.

26. Odum HT, 1959. Analysis of Diural Oxygen curves for the essays of Marine Bays, In: Proceedings of the first International Conference on Waste Disposal in the Marine Environment, Programme Press, N York, pp, 432.

27. Olaleye VF, 2005. Are view of Reproduction and gamete management in the African catfish (*Clarias gariepinus*. (burchell. Ife J. Sci. 7(1): 65-70.

28. Oyewole OO, Momoh GN, Anyasor AA, Ogunnowo CA, Ibidapo OA, Oduola JB, Obansa and Awololala, 2008. Physiochemical characteristics of Anopheles breeding site, African Journal of Environmental science and Technology, Vol. 3, 12. pp447-452.

29. Omitoyin BO, 2007. Introduction to fish farming in Nigeria, University of Ibadan press, 3(2): 86-91.

30. Payne AL, 1986. Ecology of tropical Inland waters, John-Wiley Publications, New York, pp, 432.

31. Pankow JF, 1991. Aquatic chemistry concepts, 11:2-7.

32. Rad F, Kurt GI and Bozaoulu AS, 2003. Effects of spatially localized and dispersed patterns of feed distribution on the growth, size dispersed and feed conservation of the African catfish (*Clarias gariepinus*). Turk J veterinary Animals science, 28, 851-856.

33. Schwarzenbach RP, Gschwend PM and Imboden DM, 2003. Environmental organic chemistry 2nd edition, Volume Washington, USA pp422.

34. Solomon JR, 2006. Poly culture of heterobranchusclarias hybrid with tilapia niloticus using extensive semi intensive feeding regime, Biology and Environmental science journal for the tropic, 5 (1) pp66.

35. Tacon AG, Heaster JV, Feathstone PB, Ker K and Jackson AJ, 1982. Studies on the utilization of full fat soya bean and solvent extracted from soya bean meal in complete diet for rainbow trout pp30.

36. Vijai R and Pathipath S, 2002. Water quality conditions as disease related sressors in Clarias pond culture IN, Programme for the development of pond management techniques and disease control, DOF-UNDP/FAO, THA/75/012.Thailand,pp, 25-33.

37. Warrick AW, 2003. Soil dynamics, Oxford University press, World health organization, water assessments; Aguide to the use of biota, sediments and water in the environmental monitoring, 2nd edition, Vol.1 Academic press, pp 116.

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