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Full Length Research Paper

Morphometric and biomarker indices of fishes in Dangana Lake, Lapai, Niger State

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ABSTRACT: The need to understand the morphology and functions of fishes in their natural habitat has poised the study of the morphometric and biomarker profiles of fishes in Dangana Lake, Lapai Niger State, Nigeria. During the period of study, fish samples were caught with a cast net, identified, morphometric indices measured, and blood samples collected for the biomarker profiles. A total of 244 individuals from 3 families and 4 species were identified. Thus, the fishes are family Clariidae (*Clarias gariepinus*), Cichlidae (*Oreochromis niloticus* and *Tilapia zilli*), and Aridae (*Lepptocyptis niloticus*). The total length of *T. zilli, C. gariepinus, L. niloticus* and *L. niloticus* ranged from 2.40-14.0cm (9.64±0.37cm), 4.20-18.00cm (9.70±0.42cm), 8.00-37.00cm (18.93.±1.55cm), 2.40- 5.90cm (4.19±0.14cm) respectively. The body weight of *T. zilli* ranged from 5.00-55.90g (24.18±1.37), *O. niloticus* 4.00-115.00g (23.67±2.19), *C. gariepinus* 11.40-244.00g (69.62±12.31) and *L. niloticus* 2.30-6.90g (5.01±0.18). The condition factor (K) of all fish species ranged between 2.59-3.26. The body weight of *C. gariepinus* was significantly higher ($p<0.05$) than that of other species. The biomarker profiles of two sampled fishes (*Clarias gariepinus* and *Tilapia zilli*) revealed a significant difference ($p<0.05$) in haemoglobin (Hgb) and Red blood cell (RBC). However, no significant differences ($p>0.05$) were recorded in the determined electrolyte reserve concentration and enzymatic activities. *C.gariepinus* recorded the highest in Alanine aminotransferase (ALT) (33.25±3.33) and Aspartate aminotransferase (AST) (47.00±2.27), *Tilapia zilli* recorded higher values in alkaline phosphatase (ALP) (89.13±2.04). The biochemical indices recorded higher values in Cholesterol (102.74±3.38), triglycerides (119.49±4.78), glucose (73.14±1.97) and total protein (3.88±0.23) in the sampled fishes. While 137.39±17.02, 103.89±6.76, 92.08±12.76, 129.38±3.25 was recorded for urea, uric acid, bilirubin, and creatinine respectively. Thus the differences in the indices may be attributed to the feeding behaviour, lifestyle, and adaptation of the different fish species in Dangana Lake.

Keywords: Freshwater, pisces, morphological and physiological indices

INTRODUCTION

Nigeria is blessed with numerous freshwater bodies including vast networks of rivers, streams, seasonally flooded plains as well as natural and manmade reservoirs, which form habitat for fish (Idowu, 2017). In Nigeria, fish yield of most inland waters are on the decline due to inadequate management of the fisheries resources which also led to degradation of water bodies (Odo *et al*., 2009). For sustainability of these resources, an adequate knowledge of species composition, diversity and relative abundance of her water bodies must be understood and vigorously pursued (Emmanuel and Modupe, 2010). In Nigeria, people depend upon importation of fish in order to meet up with their domestic demands, whereas much of the demand could be met locally if the fisheries were better managed and the aquaculture potentials are seriously harnessed (Egwui *et al.,* 2013). In West Africa, Nigeria fresh water is the richest with 316 fish species recorded (FDF, 2008). A large number of these fish group are better known to the rural population due to the importance they attach to them as source of livelihood (Kareem *et al.,* 2015). Detailed knowledge of the form and function of the river system and the responses of fish species are needed for effective fisheries management planning (Ude *et al.,* 2011). Fishing is one of the main reasons communities settles around water bodies (Mohammed *et al*., 2020). Fishes are very important food resource worldwide and fishing pressure has caused many fish stocks to decline

or to be at risk. These water bodies are not only rich in fish biodiversity, but also support a rich source of plankton, macroinvertebrate species and among the commonly reported freshwater fishes in Nigeria is *Tilapia galilaea, T. zilli*, *Auchenoglanis occidentalis, Clarias angularis, Clarias gariepinus, Synodontis clarias, Hepsetus odoe* and *Oreochromis nilocticus* (Agbamu and Orhororo, 2007). Morphometric indices includes fish abundance, Length-weight relationship, food, feeding habits and ecological indices which gives important information on the structure, growth and overall reproductive output of fishes in the water (Oniye *et al*., 2006). Length-weight relationship of fish is widely used as an important tool in fisheries science especially in assessing ecology population dynamic and stock management (Yola *et al.,* 2016). Fish is said to exhibit isometric growth when length and body weight increases in equal proportion (Ujjania *et al.,* 2012), the regression coefficient for isometric growth is '3' and values greater than '3' indicates allometric growth (Yola *et al.,* 2017). Biomarker indices are blood test that assesses the function of internal organs. Blood indices and other physiological indices are used to assess the functioning capacity of several organs and general health status of organisms (Adamu *et al.,* 2020). Haematological parameters have been used to evaluate the health status of aquatic organisms such as Pisces (Adamu and Nwadukwe 2013; Adamu *et al.*2018). Therefore, the understanding these indices can be difficult, but it reveals a wealth of information on the health status of the organism. Haematological parameters such as Red blood cell count (RBC), White blood cell (WBC), Haemoglobin (Hgb), Packed Cell Volume (PCV) have been recognised as valuable tools for monitoring fish health (Kumar *et al*., 2011). Different authors have reported various ranges of blood parameters in fish in fish physiology and pathology (Xiaoyun *et al*. 2009). Biochemical indices such as protein, glucose, cholesterol and triglycerides are used to evaluate the effects of diets on liver functions, sex and maturation cycle and response to stressors (Tavares *et al*., 2008). They do not only provide information about the health status of a fish but also the physical and chemical parameters of the water in which they live, thus evaluate the relationship among these factors and correlate them with the status of health of organisms respect to environmental conditions (Maceda *et al*., 2010; Ayoola *et al*., 2011). Enzymatic activities such as Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and Alkaline phosphatase (ALP) are profiles that shows close enzymatic activity in energy metabolism and food availability, they also provide a strong relationship between food intake and growth rate (Kim *et al*., 2008). The electrolyte reserve concentrations such as sodium, chloride, calcium and inorganic phosphorous are the ion balance that changes within certain limits depending on metabolic activities caused by some environmental factors such as pollution (Tella, 2005). Metabolic waste products such as urea, uric acid, bilirubin and creatinine are another useful biomarker of fish health that determines the metabolic rate and functional activity of vital organs such as liver and kidney (Tella, 2005). Studies have been conducted to determine the biochemical profiles of freshwater fishes in the laboratory and pond set up (Adamu *et al*., 2013), haematological parameters in the wild species (Adedeji and Adegbile 2011; Fazio *et al*., 2013). However, little research has been reported on the understudy biomarker profiles of freshwater fish in their natural habitat. Thus this study was conducted to determine the morphometric and biomarker profiles of fishes (*Clarias gariepinus*, *Tilapia zilli*, *Oreochromis niloticus, Lepptocyptis niloticus)* in Dangana lake, in other to provide a baseline information for the health status of these fishes in their natural habitat.

MATERIALS AND METHODS

Study Area

Dangana Lake (Plate 1) is located in the Northern-western part of Lapai Local Government Area, Niger State. This lake is located within longitude 6°36'29.6′E and latitude 9°02′12.02N with elevation of 159m above the sea level. Dangana Lake serves as a useful water source for domestic activities such as drinking, washing, farming, cooking and bathing. The vegetation of the area reflects that of Savannah zone, the vegetation are mixed, prominent ones include Malaina (*Gmeilana arborea*) Locust beans (*Parkia biglobosa*) Neem (*Azadirachta indica*) and other sparsely native trees and grasses. The climate presents two distinct seasons, a rainy season between April and October, and a dry season (November-March) completely devoid of rain.

Sample collection

Samples were done monthly by the help of fishermen using gill and cast nets. Fishes caught were identified using freshwater fish keys (Olaosebikan and Raji, 1998; Idodo-Umeh, 2003) and blood samples were collected using the method describe by Adamu *et al*., (2014).

Morphometric analysis

All fish species collected were counted to determine species abundance and diversity. Length and weight measurement were taken with ruler and sensitive weighing balance (Digital scale model no: 95364). The length-weight relationship and condition factors were therefore, determined using the formula $W=aL^b$ (Thomas *et al*., 2003).

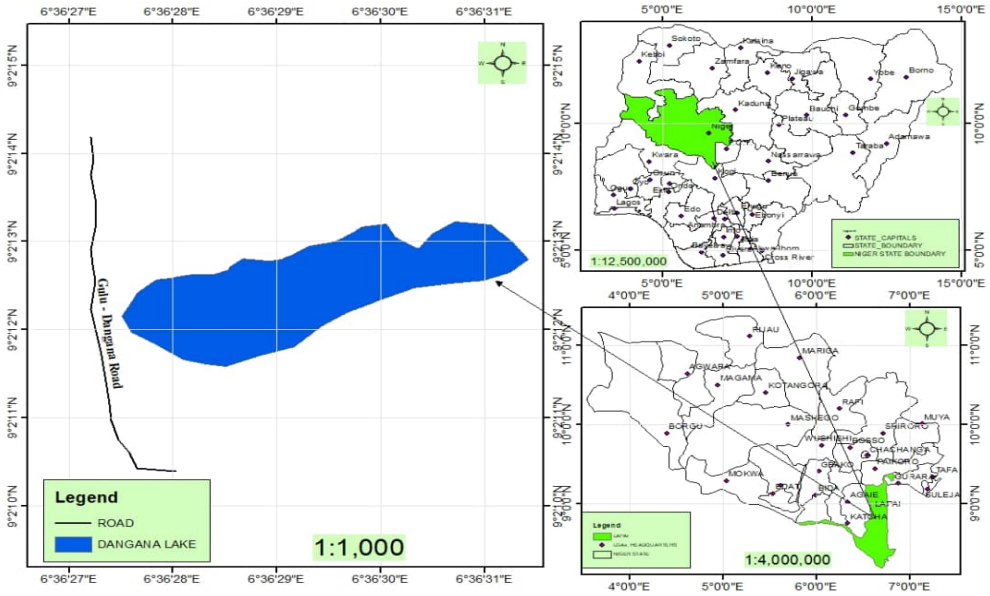

Plate 1. Schematic representation of the study area (Dangana Lake) Lapai Niger State.

Where;

W= weight of fish in gram
L=length of fish in cm
a= describe the rate of change of weight with length
b= weight at unit length

Condition factor was determine using the formula K= W/L^3 X 100 (Ricker 1975).

Where;
K= condition factor
W= Mean fish weight in grams
L= Mean total length of fish in cm.

Biomarker indices

The blood was collected as described in Adamu *et al*., (2014) in EDTA test tubes for haematological parameters and Lithium Heparin test-tubes for other biomarker indices. The haematological parameters were determined according to the method described by Svobodova *et al.* (2008). The Oxygen carrying capacity was calculated by multiplying the haemoglobin content by 1.25 oxygen combining power of Hgb (Johansen, 1970; Dacie and Lewis 1991). The blood sample in Lithium Heparin test-tube blood was centrifuged at 1500rpm for 10 minutes to obtain the plasma, which was thereafter used to determine the presence of the biomarker indices. These indices were conducted based on the instruction of the reagent kit (TECO diagnostics, Randox Laboratory Ltd and Cromatest) manufacturers' instruction with the use of spectrophotometer (Spectro 2011, PEC, Medical USA). The direct measurement of erythrocyte values (Packed cell volume PCV, Haemoglobin Hgb, and Red blood cell RBC) and absolute erythrocyte indices (MCH, MCV and MCHC) were calculated.

Data analysis

The abundance and diversity scores of the species were calculated and numbers of identified counted fishes were subjected to descriptive analysis, scatter gram, regression analysis and coefficient of regression with the aid of Microsoft excel 2003 package. Condition factor was calculated manually using the appropriate formula while ecological statistics was performed using past graph program. All data of biomarker indices were presented as mean ± standard error, data were analyzed using single factor analysis of variance, after which individual mean were compared using sidak's multiple comparisons per family. In all cases, differences were considered statistically significant at either 95% or 99% probability level. All statistical analyses were performed using graph pad prism software version 6.0 San Diego, C.A package.

RESULTS

Morphometric analysis

There are 244 individuals from three (3) families, four (4) genera, and four (4) species (Table 1). Species abundance revealed presence of family Clariidae

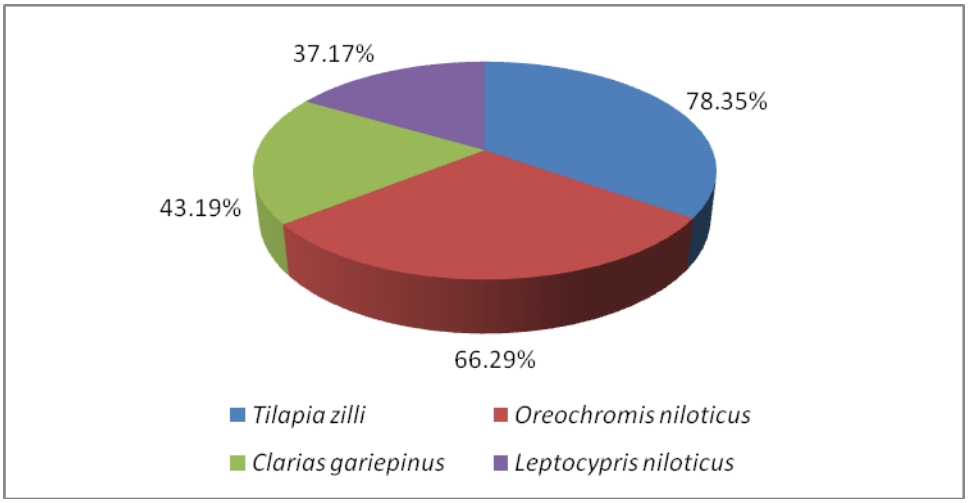

Figure 1: Percentage frequency of fish Abundance sampled from Dangana Lake, Lapai, Niger State.

Table 1: Calculated indices of fishes sampled from Dangana Lake, Lapai, Niger State.

Species	No. of samples (N)	Range (Mean standard error)		A (intercept)	B (growth exponent)	Condition factor	Growth Type
		Length (cm)	Weight (g)				
T .zilli	78	2.40-14.00 (9.64±0.37)	5.00-55.90 (24.18±1.37	1.58	1.18	3.00	Allometric (-)
O. niloticus	66	4.20-18.00 (9.70±0.42)	4.00-115.00 (23.67±2.19)	.39	1.75	3.00	Allometric (-)
C. gariepinus	43	8.00-37.00 (18.93±1.55)	11.40-244.00 (69.62±12.31)	0.44	1,59	1.02	Allometric (-)
L. niloticus	37	2.40-5.90 (4.19±0.14)	2.30-6.90 (5.01±0.18)	1.27	0.95	3.26	Allometric (-)

represented by the *Clarias gariepinus,* family Cichlidae represented by *Oreochromis niloticus* and *Tilapia zilli* and family Aridae represented by *Leptocypris niloticus*. The abundance of sampled fish revealed that *T. zilli* has the highest number of species abundance of 78(35%), *O. niloticus* with the abundance of 66 (29%); *C. gariepinus* with 43(19%) and *L. niloticus* 37(17%) as presented in (Figure 1). The total length of *T. zilli* ranged from 2.40 to 14.00cm (9.64±0.37), *O. nilocticus* ranged from 4.20 to 18cm (9.70±0.42), *C. gariepinus* ranged from 8.00-37.00cm (18.93±1.55) and *L. niloticus* ranged from 3.50-2.50cm (4.19±0.14) respectively. The body weight of *T. zilli* ranged from 5.-55.90g (24.18±1.37), *O. niloticus* 4-115g (23.67±2.19), *C. gariepinus* 11.40-244g (69.615±12.31) and *L. niloticus* 2.3-6.9g (5.01±0.18) as shown in (Table 1). The regression equations and values of the correlation coefficient 'r' of the four fish species were suggestive of a close relationship between length and weight of the fishes as shown in Figure 2,3,4 and 5 respectively. From Table 2 ecological indices such as Shannon-weiner diversity index of the sampled fishes indicates a strong relationship with over all species richness which showed variation and ranged from 1.34-1.37, the highest fish diversity was recorded at the upper part (site 2) of the lake.

Biomarker indices

The biomarker indices were conducted in two fish species (*C. gariepinus* and *Tilapia zilli*). The haematological parameters revealed that *Clarias gariepinus* recorded the highest PCV (17.75±0.85 %), Hgb (51.58±7.63 gdl^{-1}), RBC (29.43±4.78 $10^{6}\mu l^{-1}$), MCHC (28.56±5.20 g/dl), MCH (16.99±0.12 pg) values and lower in MCV (5.03±0.29 fL). The only significant difference ($p<0.05$) value was recorded in Hgb and RBC in the two sampled fishes. Other haematological parameters showed no significant difference between the two test fishes (Figure 6). The result of the biochemical indices revealed that *Clarias gariepinus* recorded higher cholesterol (102.74±3.38 mg/dl), triglycerides (119.49±4.78 mg/dl), glucose (73.14±1.97 mg/dl) and total protein (3.88±0.23 mg/dl) values. There were no significant differences ($p>0.05$) in the determined biochemical indices in the two test species as presented

Table 2: Ecological indices of fishes sampled from Dangana Lake, Lapai, Niger State.

Indices	Values
Taxa_S	4
Shannon_H	1.342
Evenness_e	0.9564
Margalef	0.5544

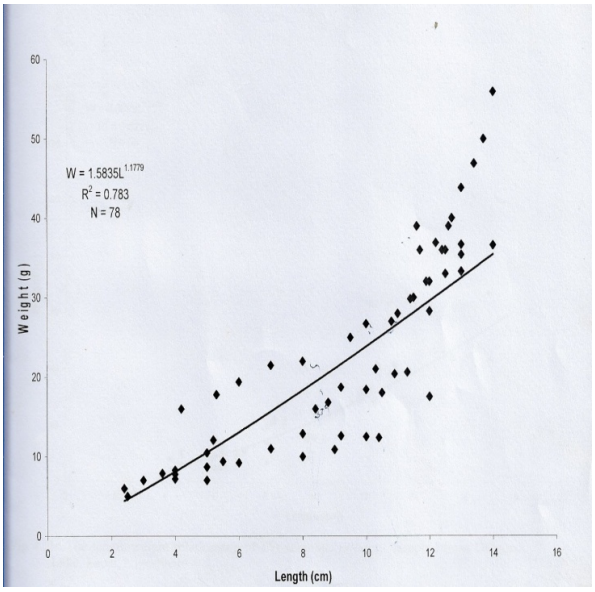

Figure 2. Length-weight relationship of *Tilapia zilli* sampled from Dangana Lake, Lapai, Niger State.

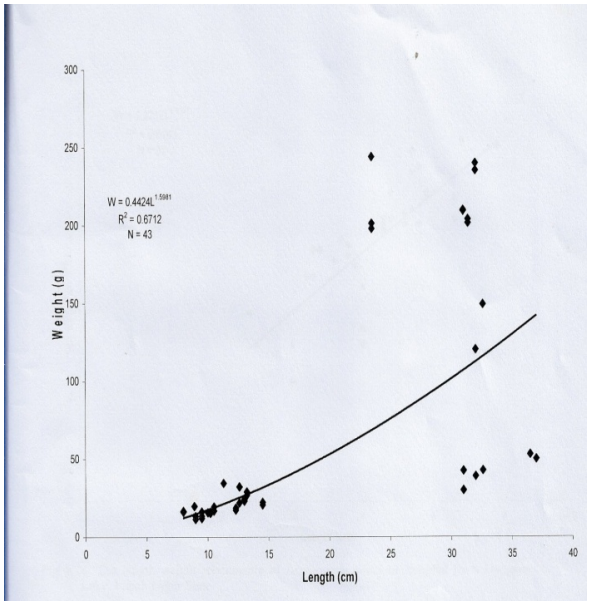

Figure 3. Length-weight relationship of *Clarias gariepinus* sampled from Dangana Lake, Lapai, Niger State.

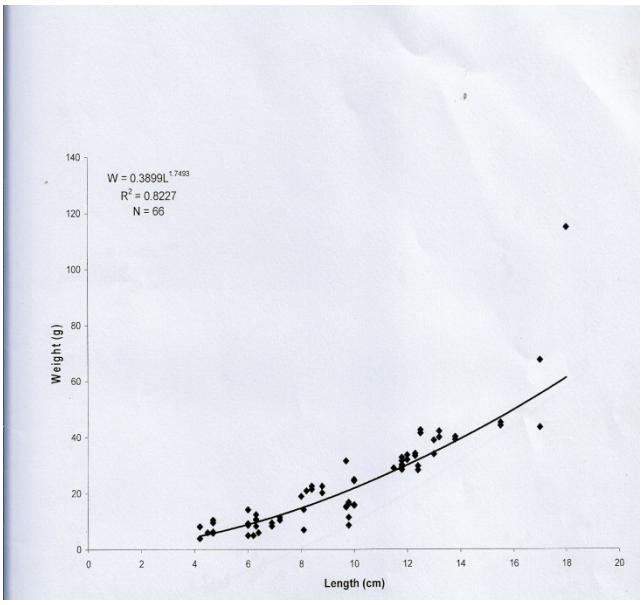

Figure 4. Length-weight relationship of *Ooreochromis niloticus* sampled from Dangana Lake, Lapai, Niger State.

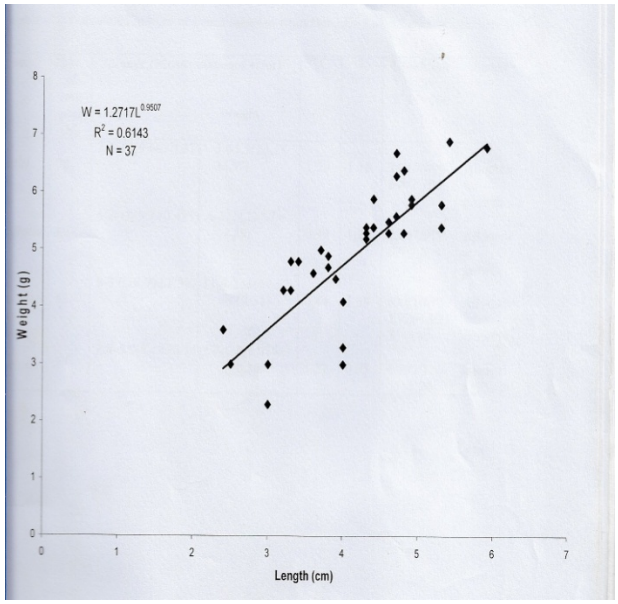

Figure 5. Length-weight relationship of *Leptocypris niloticus* sampled from Dangana Lake, Lapai, Niger State.

in (Figure 7). The electrolyte reserve concentration shows that *Clarias gariepinus* recorded the higher values in sodium (159.50±6.06 mol/l), chloride (100.53±10 mmol l^{-1}.), calcium (12.52±0.49 mg/dl), inorganic phosphorous (4.31±0.11 mmol l^{-1}). There were no significant differences ($p>0.05$) in the determined electrolyte reserve concentration except chloride in the two test fishes as shown in (Figure 8). The result of the enzymatic activities revealed that *Clarias gariepinus* recorded higher values in ALT (33.25±3.33 U l^{-1}) and AST (47.00±2.27 U l^{-1}) while *Tilapia zilli* recorded higher values in ALP (89.13±2.04 U l^{-1}). There were no significant differences ($p>0.05$) in the determined enzymatic activities in the two test fishes as presented in (Figure 9). The metabolic

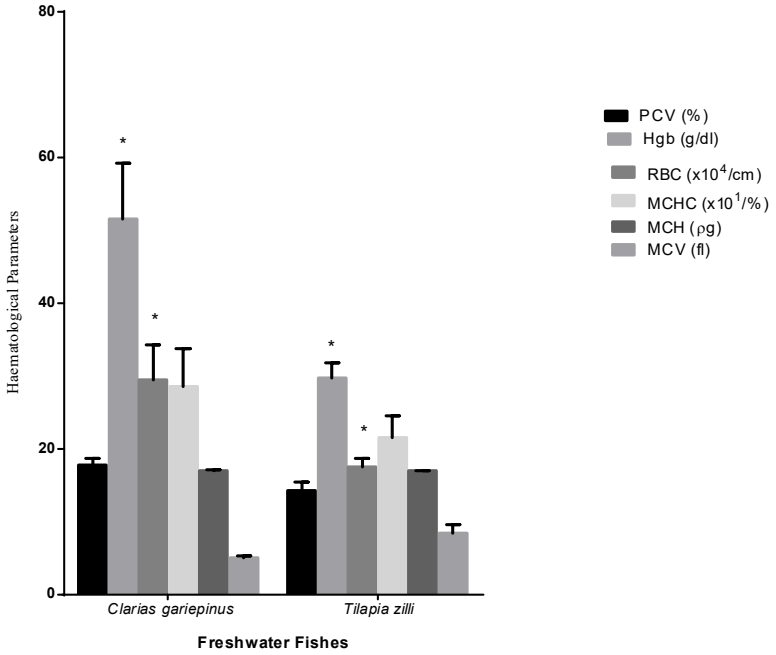

Figure 6: Haematological parameters of *C. gariepinus* and *T. zilli* sample from Dangana Lake. Each bar represents the mean, while the cross bar represents the standard error, * represents $p<0.05$.

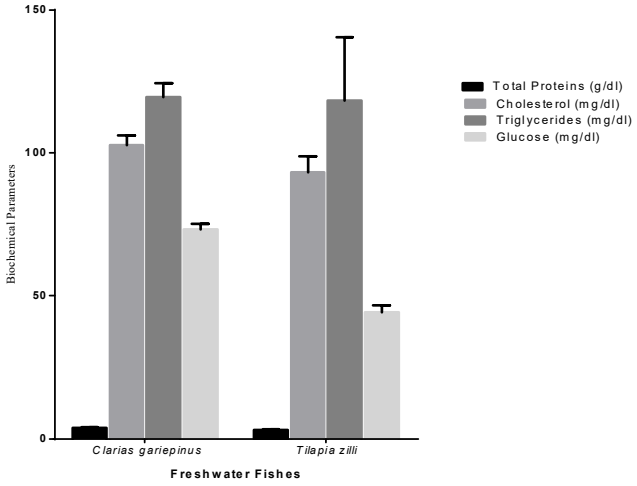

Figure 7: Biochemical parameters of *C. gariepinus* and *T. zilli* sample from Dangana Lake. Each bar represents the mean, while the cross bar represents

waste product revealed that *Clarias gariepinus* recorded the highest values in urea (137.39±17.02 nmol l^{-1}), uric acid (103.89±6.76 $nmol^{-1}$), bilirubin (92.08±12.76 $nmol1^{-1}$), and creatinine (129.38±3.25$\mu mol1^{-1}$). There were no significant difference ($p>0.05$) in the determined metabolic waste product of the test fishes as presented in (Figure 10).

DISCUSSION

A total of 244 fishes belonging to 4 species from 3 families were encountered during the study period indicating low production in richness and diversity. Seasonally this finding revealed high water volume and fish abundance during raining season. This could be

the standard error, * represents $p<0.05$.

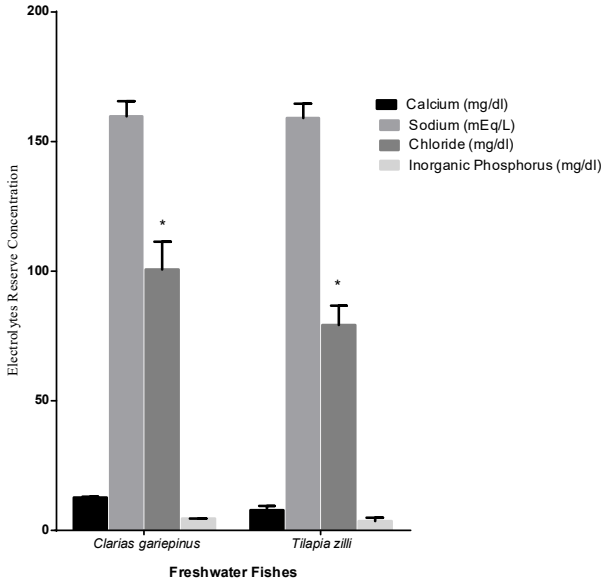

Figure 8: Electrolytes Reserve Concentration of *C. gariepinus* and *T. zilli* sample from Dangana Lake. Each bar represents the mean, while the cross bar represents the standard error, * represents $p<0.05$.

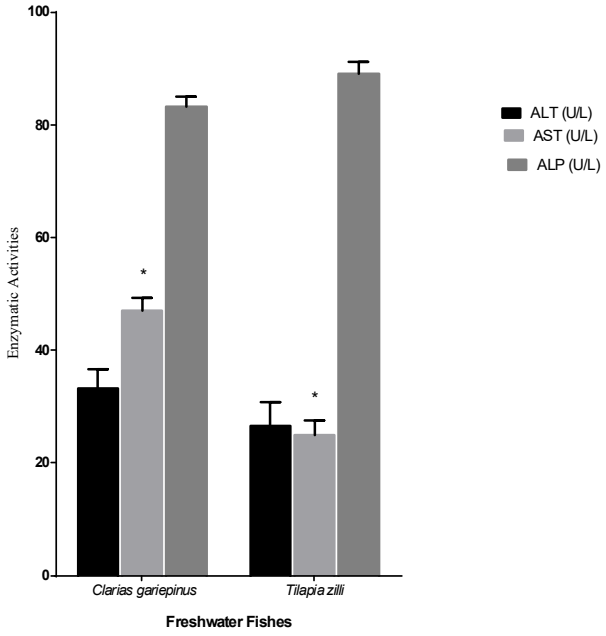

Figure 9: Enzymatic Activities of *C. gariepinus* and *T. zilli* sample from Dangana Lake. Each bar represents the mean, while the cross bar represents the standard error, * represents $p<0.05$.

attributed to season of growth, which most plants and animals reproduce abundantly due to availability and abundance of food materials (Mustapha, 2009). This study also showed that Dangana Lake Lapai Niger state

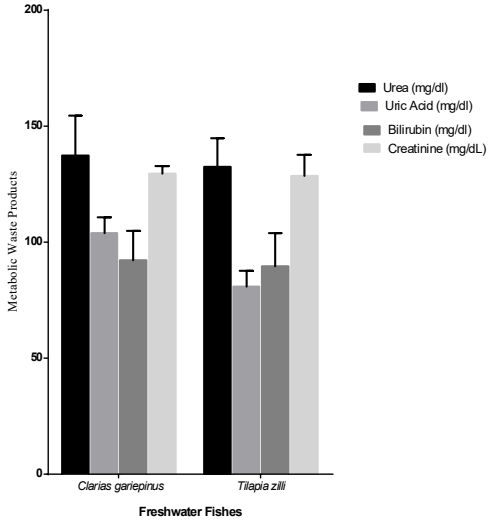

Figure 10: Metabolic Waste Products of *C. Gariepinus* and *T. zilli* sample from Dangana Lake. Each bar represents the mean, while the cross bar represents the standard error, * represents $p<0.05$.

was not rich in taxa (fish species) when compared with other inland water bodies in Nigeria. For instance Mustapha (2009) in Oyun Reservoir, Offa, Kwara state Nigeria reported 18 fishes belonging to 9 families. In contrary Abiodun and John (2017) reported a total of 142 fish species belonging to 18 families from Lower Niger River in Idah, Kogi state Nigeria. The length-weight of sampled fish species observed in Dangana Lake shows a high degree of positive correlation between length and weight, which shows that as length of the fish's increases weight of the fishes also, increases. This finding is in conformity with the study of Dan-kishiya (2013) who also reported a strong positive correlation between length and weight of fishes in lower Usuma reservoir in Abuja. Similarly Chukwuemeka *et al.,* (2014) also reported a strong positive correlation between length and weight of fishes in Tagwai lake Minna Niger state. The regression coefficients (b) values observed in all the sampled from Dangana Lake Lapai Niger state shows a negative allometric growth pattern (Onimisi and Ogbe, 2015) as the regression coefficients (b) values observe in all the fishes is less than 3 (b<3). The negative allometric growth observed in this study could be due to variation in water quality parameters, age, sex and organ development (Izah *et al.,* 2013). This findings is in agreements with the work of Imam *et al.* (2010) who also reported a negative allometric growth pattern (b<3) of fishes from Wasai reservoir Kano Nigeria. Similarly, negative allometric growth (b<3) was observed by Dan-Kishiya (2013) from lower Usuma reservoir, Abuja. Condition factor is a veritable tool for assessing the health status of the aquatic ecosystem (Abowei and Hart 2009; Ighwela *et al*., 2011). The condition factor (K) of species in this study ranged between 2.59 to 3.26. This findings is in conformity with the works (Onimisi and Ogbe, 2015) who reported condition factor of fishes in their studies to be more than 1 (k>1). This study shows that the fishes were actives physiologically and are doing well as a result of optimum environmental parameters. Biochemical parameter shows a close related response of fish to environmental and biological factors (Fernandes and Mazon, 2003). PCV value of the sampled fish species in this lake was lower than the reference value for healthy fishes; the observed decrease in PCV may be as a result of less oxygen content in the blood of the fish (Etim *et al*., 2009). Elevated Red blood cell counts and Haemoglobin concentration in fish are a response to the higher metabolic demand and physiological adaptation to different modes of life and ecological habits (Satheshkumar *et al*., 2011). The mean MCV values obtained in this study were lower than the value recorded for juvenile hybrid African catfish (240.18fl) reported by Kori-Siakpere and Ubogu, (2008) and 113.07-138.07fl for juvenile intergeneric hybrid catfishes (Diyawere *et al*., 2013). MCV is an estimate of the volume of RBCs which reflects normal or abnormal cell division during RBC production. Increase in MCV is attributed to swelling of the RBCs due to hypoxic condition, impaired water quality and somatic stress (Larsson *et al*., 1985). Reduced MCV could be linked with shrinkage of RBCs either due to hypoxia or microcytic anaemia (Alwan *et al*., 2009). MCH values in this study were within the recommended range for healthy fish (Bhaskar and Rao, 1989). The observed MCH values were lower than values obtained in earlier reports such as 24.24pg for *C. gariepinus* and 51.50pg for juvenile heteroclarias (Gbore

et al., 2006). Higher MCH indicates a good volume of haemoglobin which indicates effective oxygen transportation in the bloodstream for healthy wellbeing of the fish (Diyawere *et al*., 2013). This finding closely agreed with 35.47g/dl recorded for Heteroclarias (Kori siakpere and Ubogu, 2008). This might be due to species differences and age of the fishes that greatly influence the values of haematological indices (Docan *et al*., 2010). Protein values recorded in the present study shows *Clarias gariepinus* (3.88±0.23mg/dl) and *Tilapia zilli* (3.19±0.112mg/dl). Increase in total protein levels maybe associated to haemolysis (Hrubec *et. al.,* 2001). Since the fishes have little carbohydrates, protein is therefore used to meet the increase in energy demands. Thus it is mainly involved in the architecture of the cell, which is the chief source of energy (Umminger, 1977). Glucose is the end product of carbohydrate metabolism and it's the primary source of energy for the body. The values of glucose were relatively higher than values available in some literature (Akintayo *et al*., 2008). These values closely agree with 66.03-85.98mg/dl found in *C. gariepinus* fingerlings (Anene *et al*., 2014) and 62.075 mg/dl in Tilapia species. However, Yilmoz *et al*., (2006) reported higher blood sugar levels ranging from 153-208mg/dl in other fish species which are considerably higher than the present findings. Values of blood serum glucose ranging from 25-350mg/dl have also been reported by Ezenwaji *et al*., (2012). Differences in blood glucose could be due to variations in the chemical compositions of the diets (Ezenwaji *et al*., 2012). The levels of sodium and chloride ions in the selected organs and tissues of the test fishes were higher which could be as a result of changes in the fluxes of these electrolytes (Adeoye, 2007). Chloride ion being the major extracellular fluid in the body combines with sodium to form NaCl which helps in osmotic balance of the organisms (Adeoye, 2007). AST value observed in this study shows *Clarias gariepinus* (47.00±2.20 U l^{-1}) and *Tilapia zilli* (25.00±2.58 U l^{-1}). Adamu *et al.,* (2008) reported significant increase in aspartate amino transferase (AST) which is in conformity with this study. AST is important in the elimination of nitrogen activity and it reflects the capacity of the tissue to oxidize amino acids for energy production (Le-Francios *et al*., 2008). Increase in AST value could have resulted from the increase in the transamine activity promoting in vivo protein synthesis (Kim *et al*., 2008). A higher value of ALP (89.13±2.04) was recorded in the present study. This finding is significantly higher than the report of Palti *et al.,* (1999) for ALP (35U/l). Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities have been observed to be the most important aminotransferase relating to amino acid metabolism in fishes (Coz-Rakovac *et al*., 2008). Increase in the activities of ALT and AST in the present study could be attributed to the high accumulation of metals in fish tissues (Mohamed *et al*., 2008). The differences in most studied parameters could be attributed to variations in ecological zones which necessitate different physiological adaptation to modes of life (Bianchi *et al*., 2014). The mean creatinine value observed was within the normal range 100-500µmol 1^{-1} as reported by Hrubec *et al*., (2000). It was however, comparatively higher than 49.71±16.15µmol 1^{-1} reported for *Synodontis membranacea* (Owolabi, 2011). The differences could be attributed to varying physiological adaptation and ecological conditions (Bianchi *et al*. 2014). High values of creatinine in serum might be induced by glomerular inefficiency and indication of renal tubular damage (Elahee and Bhagwant, 2007). The increased levels of urea (137.39±17.02 nmol l^{-1}) in this study could be as a result of impaired kidney function, livers diseases and cardiac arrest (Abdelmoneim *et al*., 2008). The uric acid level observed in this study is higher than the report of Owolabi, (2011) (0.76±0.33 nmol l^{-1}). This variation might be attributed to climatic changes and temperature changes affect biochemical blood levels (Adeyemo *et al*., 2007).

Conclusion

The study revealed that Dangana Lake had few freshwater fish species. The most abundant species was the Cichlidae which may be related to presence of crocodile in the Lake. The length-weight relationship of sampled fishes from the Lake revealed negative allometric growth in all the sampled fishes. The use of different biomarkers to access the health status of two fish species revealed a baseline information on the health status of the fish.

REFERENCES

Abdelmoneim A, Abou-Shabana N, Khadre S, Abdel K (2008). Physiological and histopathological effects of catfish (*Clarias gariepinus*) exposed to dyestuff and chemical water. *International Journal of Zoological Research,* 4(4): 189-202.

Abiodun JA, John P (2017). Biodiversity and abundance of fish and some processing methods in Lower Niger River Idah, Kogi state Nigeria. *Nigerian Journal of Fisheries and Aquaculture*, 6 (2): 238-155.

Abowei FN, Hart AI (2009). Some morphometric parameters of 10 finfish species from the lower Nun River, Niger Delta, Nigeria. *Russia Journal of Biological Science,* 4(3): 282-288.

Adamu KM, Audu BS (2008). Haematological assessment of the Nile Tilapia *Oreochromis niloticus* exposed to sublethal concentrations of Portland cement powder in solution. *International Journal of Zoological Research,* 4(1): 48-52.

Adamu KM, Isah MC, Baba TA, Idris TM (2013). Selected liver and kidney biochemical profiles of hybrid catfish exposed to *Jatropha curcas* leaf dust. *Croatian Journal of Fisheries, Ribarstvo* 71(1): 25-31.

Adamu KM, Aliyu HSB, Mohammed YM, Mohammed H, Isyaku D (2020). Comparative study of plasma physiological indices and oral bacteria of selected crocodiles in Dangana Lake, Niger State, Nigeria. *Dutse Journal of Pure and Applied Sciences,* 6(1): 286-294.

Adamu KM, Audu BS, Nonyelu ON (2014). Changes in Haematological parameters of *Clarias gariepinus* exposed to century plant (*Agave Americana*) Leaf dust. *International Journal of Applied Biological*

Research, 6(1): 54-65.
Adedeji OB, Adegbile AF (2011). Comparative Haematological Parameters of the Bagrid Catfish (*Chrysichthys nigrodigitatus*) and the African Catfish (*Clarias gariepinus*) from Asejire Dam in Southwestern Nigeria. *Journal of Applied Science Research,* 7(7): 1042-1046.
Adeoye A (2007). A textbook for medical *Laboratory Practices 1st Edition. 238pp.*
Adeyemo OK (2007). Haematological profile of *Clarias gariepinus* (Burchell 1822) exposed to lead. *Turkish Journal of Fisheries and Aquatic Sciences*, 7: 163-169.
Agbamu JU, Orhorhoro WC (2007). Adoption of aquaculture management techniques in Delta State. *Food, Agriculture and Environment Journal*, 5(2): 243-246.
Akintayo IA, Obasa SO, Alegbeleye WO, Bangbose, AM (2008). Evaluation of toasted sunflower (*Helianthus annus*) seed meal in the diets of African catfish (*Clarias gariepinus*) fingerlings. *Livestock Research and Rural Development*, 20:44-49.
Alwan SF, Hadi AA, Shokr AE (2009). Alterations in Haematological Parameters of Fresh Water Fish, *Tilapia zillii*, Exposed to Aluminium. *Journal of Science and Its Applications*, 3(1): 12- 19.
Anene A (2005). Condition factor of four cichlid species of a man-made lake in Imo State, southern-eastern Nigeria. *Turkish Journal of Fisheries and Aquatic Sciences*, 5:43-47.
Ayoola SO, Kuton MP, Idowu AA, Adelekun AB (2011). Acute toxicity of Nile Tilapia (*Oreochromis niloticus*) juveniles exposed to aqueous an ethanolic extracts of *Ipomoea aquatic* leaf. *Nature and science* 9(3): 91-99.
Bhaskar BR, Rao, KS (1989). Influence of environmental variables on haematology and compendium of normal haematological ranges of milkfish, *Chanos chanos* (Forsskal) in brackishwater culture. *Aquaculture,* 83: 123-136.
Bianchi MD, Diana W, Lamar RK, Jeffrey, WMD, *et al*., (2014). DNA Sequencing versus standard prenatal aneuploidy screening. 370: 799-808. DOI: 10.1056/NEJMoa1311037.
Chukwuemeka VI, Tsadu SM, Ayanwale VA, Erhabor OF, Falusi FM (2014). Morphometrics of Selected Fish Species from Tagwai Lake, Minna, Niger State, Nigeria *Advance in Agriculture and Biology,* 2(3): 140-143.
Coz-Rakovac R, Strunjak-Perovic I, Popovic N, Hacmanjek M, Smuc T, Jadan M, Lipej ZI, Homen Z (2008). Cage culture effects on mullets (Mugilidae) liver histology and blood biochemistry profile. *Journal of Fish Biology* 72: 2557-2569.
Dacie JV, Lewis SM (1991). *Practical Haematology.* 7th edition Churchil Livingstone Edinburgh, 54-79pp .
Dan-Kishiya AS (2013). Length-weight relationship and condition factor of five species from a tropical water supply reservoir in Abuja, Nigeria. *American Journal of Research Communication,* 1: 175-187.
Diyawere MY, Haruna AB, Abubakar KA (2013). Some haematological parameters of intergeneric hybrid of African catfish (*Clarias anguillaris* & *Heterobranchus bidorsalis*) juveniles and their pure lines in north-eastern Nigeria. *Journal of Fisheries and Aquatic Science*, 8(1): 33-42.
Docan A, Cristea V, Grecu L, Dediu L (2010) Haematological response of Europian Catfish, *Sirulis glanis* reared at diufferent densities in flow through production system. *Archiva Zootecnica*, 13(2): 63-70.
Egwui PC, Okeke T, Ezeonyejiaku DC (2013). Preliminary Trials on Taming and Feeding of Young Adults of Wild African Snakehead (*Channa obscura* Myers and Shapovalov, 1932) from Anambra River, South East of Nigeria. *Journal of Biology, Agriculture and Healthcare*, 3(20): 38-43.
Elahee KB, Bhagwant S (2007). Haematological and gill histopathological parameters of three tropical fish species from a polluted lagoon on the west of Mauritius. *Ecotoxicology and Environmental Safety.* 68(3): 361-371.
Emmanuel LO, Modupe OO (2010). Fish Diversity in Three Tributaries of River Ore, South West, Nigeria. *World Journal of Fish and Marine Sciences,* 2(6): 524-531.
Etim L, Olele FN, Eriegha OJ (2009). Blood characteristics of *Oreochromis niloticus* (Nile tilapia) from Ona Lake, Asaba, Nigeria. *African Journal of Environmental Pollution & Health,* 7(1): 43-46.
Ezenwaji NE, Obiekwe EC, Nwaigwe, CO, (2012). Histological studies of some organs of squirrels (*Xerus erythropus*) in tropical ecological zone. *Journal of Animal Research International*. 10(1): 1689-1698.
Fazio F, Simona M, Arfuso F, Faggio C, (.2013). Comparative study of the biochemical and haematological parameters of four wild Tyrrhenian fish species; *Veterinarni medicina* 58(11): 576-581.
Federal Department of Fisheries (FDF, 2008). Fisheries Statistics of Nigeria Publication of Federal Ministry of Agriculture & Water Resources Abuja, Nigeria, 4th Ed 53Pp
Fernandes MN, Mazon AF (2003). *Environmental pollution and fish gill morphology*. In: *Fish adaptation* (eds. V. AL and B.G. Kapoor), Science Publishers Enfield Press USA, pp. 203 – 231
Gbore FA, Oginni O, Adewole AM, Aladenton JO, (2006). The effect of transportation and handling stress on haematology and plasma biochemistry in fingerlings of *Clarias gariepinus* and *Tilapia zillii*. *World Journal of Agricultural Science*, 2:208-212.
Hrubec TC, Smith SA, Robertson JJ (2001). Age related in haematology and biochemistry of hybrid striped bass (*Chrysops morone axatilis*). *Veterinary Clinic and Pathology* 30:8–15.
Idodo-Umeh G (2003). *Fresh water Fishes of Nigeria (Taxonomy, Ecological Notes, Diet and Utilization)*. Idodo-Umeh Publisher Limited, Benin City, Nigeria, pp: 232.
Idowu EO (2017). Aspects of the reproductive biology of African pike characin fish, *Hepsetus odoe* (Bloch, 1974) in an artificial lake, Nigeria. *Agricultural Science Research Journal*, 7(4): 154-162.
Ighwela A, Ahmed B, Abol-Munafi B (2011). Condition factor as an indicator of growth and feeding intensity of Nile Tilapia fingerlings (*Oreochromis niloticus*) fed on different levels of Maltose. *American-Eurasian Journal of Agricultural and Environmental Science,* 11(4): 559-563.
Imam TS, Bala U, Balarabe ML, Oyeyi TI (2010). Length-weight relationship and condition factor of four fish species from Wasai Reservoir in Kano, Nigeria. *African Journal of General Agriculture*, 6(3), 1595-1609.
Johansen K (1970). *Air breathing in fishes, in fish physiology volume 4*. Edited by Hoar, W.S. & Randall, D. J. New York Academic press. pp361-411.
Kareem OK, Ajani EK, Orisasona O, Olanrewaju AN (2015). The Sex Ratio, Gonadosomatic Index, Diet Composition and Fecundity of African Pike, *Hepsetus odoe* (Bloch, 1794) in Eleyele Lake, Nigeria. *Journal of Fisheries Livestock Production* 3(139): 220-229.
Kim SG, Park DK, Jang SW, Lee JS, Kim, SS, et al., (2008). Effect of dietary Benzopyrene on growth and hematological parameters in juvenile Rock fish (*Subustes Schlegeli*) *Bullet Environ Cont Toxical* 81:470-474.
Kori-Siakpere O, Ubogu EO, (2008). Sublethal haematological effects of zinc on the freshwater fish, *Heteroclarias sp*. *African Journal of Biotechnology* 7(12): 2068-2073.
Kumar V, Makkar HPS, Becker K (2011). Detoxified *Jatropha curcas* kernel meal as a dietary protein source. Growth Performance, Nutrient utilization and Digestive enzymes in common carp (*Cyprinus carpio* L) fingerlings. *Aquaculture and Nutrition*. 17(3): 313-326.
Larsson A, Haux C, Sjobeck M (1985). Fish physiology and metal pollution: results and experiences from laboratory and field studies. *Ecotoxicology, Environment and Safety*, 9: 250- 281.
Le-Francios RN, Arianne S, Chantal C, Pierre UB, (2008). Metabolic and Digestive enzyme activity profiles of newly hatched spotted wolfish (*Anarhichas minor olafsen*). *Journal of Aquaculture Research.* 39(4): 382-389.
Maceda-Veiga A, Monroy M, Viscor G, De-Sostoa A (2010). Changes in nonspecific biomarkers in the Mediterranean barbell (*Barbus meridionalis*) exposed to sewage effluents in a Mediterranean stream (Catalonia NE Spain). *Aquatic toxicology,* 100: 229-237.
Mohamed FA, Gad NS (2008). Environmental pollution induced biochemical changes in tissues of *Tilapia zilli*, *Solea vulgaris* & *Mugil capito* from Lake Qarun, Egypt. *Global Veterinary,* 2: 327-336.
Mohammed YM, Adamu KM, Ismail A, Umar M, Kanki H (2020) Prevalence of protozoan parasites in some freshwater fishes of Dangana Lake Lapai, Niger State Nigeria. *International Journal of Veterinary Sciences and Animal Husbandry,* 5(2): 13-16.
Mustapha MK (2009). *Limnology and Fish assemblages of Oyun Reservoir, Offa Nigeria*. Phd thesis, University of Ilorin Nigeria.

Odo GE, Nwani CD, Eyo JE (2009). The fish fauna of Anambra river basin, Mogeroa Species abundance and morphometry. *Revista de Biologia Tropical.* 57 (1-2): 177-186.

Olaosebikan BD, Raji A (1998). *Field guide to Nigeria freshwater fishes*. Federal College of Freshwater Fishes New Bussa, 106pp.

Onimisi M, Ogbe FG (2015). Length-Weight relationship and condition factor for fish species of River Okura, Kogi State, Nigeria. *International journal of Scientific and Engineering Studies,* 2 (7).

Oniye SJ, Adebote DA, Usman, SK, Makpo JK (2006). Some aspects of the biology of *Protepterus annectans* (Owen) in Jachi dam near Katsina, Katsina State, Nigeria. *Journal of Fishery & Aquatic Science.* 1:136-141.

Owolabi OD (2011). Haematological and serum biochemical profile of the upside-down catfish, (*Synodontis membranacea)* from Jebba Lake, Nigeria. *Comparative Clinical Patholology*, 20:163-172.

Palti Y, Tinman S, Cnaani A, Avidar Y, Ron M, Hulata G (1999). Comparative study of biochemical and nonspecific immunological parameters in two tilapia species (*Oreochromis aureus* and *O. mossambicus). Israeli Journal of Aquaculture*. 51:148-156.

Satheshkumar P, Ananthan G., Senthil KD, Jagadeesan L (2011). Haematology and biochemical parameters of different feeding behaviour of teleost fishes from Vellar estuary, India. *Comparative Clinical Pathology* 20: 105-114.

Svobodova Z, Kroupova H, Modra, H, Flajshans M, Randak T, Savina LV, Gela D (2008). Haematological profile of common carp spawners of various breeds. *Journal of Applied Ichthyology,* 4: 55–59.

Tavares F, De A, Roudrigues JSR, Fracalossi DM, Esquivel J, Roubach R (2008). Dried duckweed and commercial feed promote adequate growth performace of tilapia fingerlings. *Biotemas,* 21(3): 91-97.

Tella MA, (2005). Serum electrolytes changes in West African Dwarf (WAD) sheep with single or concurrent (*Babesia ovis* and *Trypanosome congolense*) infections. *African Journal of Biological Research,* 8: 63-65.

Thomas J, Venus S, Kurup BM (2003). Length-weight relationship of some deep sea fishes inhabiting the continental slope beyond 250m depth long west coast of Indian. *Naga ICLARMQ* 26:17-21.

Ude EF, Ugwu LLC, Mgbenka BO, Nwani CD (2012). Evaluation of Length-Weight Relationship of Fish species of Ebonyi River, Nigeria *Nigerian Journal of Fisheries,* 8 (1):122-134.

Ujjania NC, Kohli MPS, Sharma LL (2012). Length-weight relationship and condition factors of Indian major carps (*C. catla, L. rohita* and *C. mrigala*) in Mahi Bajaj Sagar, India. *Research Journal of Biology*, 2 (1): 30-36.

Umminger BL, (1977). Relation of whole blood sugar concentration in vertebrates to standard metabolic rate. *Comparative Biochemisry and Physiology*, 52: 457-460.

Xiaoyun Z, Mingyun L, Khalid A, Weinmin, W (2009) Comparative of haematology and serum biochemistry of cultured and wild Dojo loach *Misgurnus anguillicadatus*. *Fish Physiology & Biochemistry,* 35:435–441.

Yilmoz E, Akyurt I, Mutlu E (2006). Effects of energetic diets on growth, blood chemistry and liver pathology of African catfish Clarias gariepinus (Burchell 1822). *Israeli Journal of Aquaculture,* 58:191-197.

Yola IA, Getso BU, Abdullahi JM (2017). Length-Weight relationship and condition factor of *Clarias gariepinus* and *Oreochromis niloticus* of Wudil River, Kano, Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension,* 16(1): 1-4.