African Journal of Agriculture and Food Science
ISSN: 2689-5331
Volume 3, Issue 3, 2020 (pp. 38-46)
www.abjournals.org

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTORS OF SOME FISH AND CRAB SPECIES FROM BADAGRY CREEK, LAGOS, NIGERIA

Aderinola O.J.[1], Adeboyejo O.A.[2] and Mekuleyi G.O.[2*]

[1]Department of Zoology and Environmental Biology, Faculty of Science, Lagos State University, Nigeria.
[2]Department of Fisheries, Faculty of Science, Lagos State University, Nigeria.
*Correspondence Author: tosingabriel76@yahoo.com

ABSTRACT: *This study was carried out in Badagry creek, Lagos, Nigeria, between January and December 2018, to assess the health status of some species of fish (Kribia nana, Sarotherodon galilaeus, Eleotris vitata, Cynoglossus senegalensis, Kribia kribensis, Chrysichthys filamentosus, Tillapia zilli, Monolene mertensi, Sardinella maderensis, and Pellonula leonesis) and Crab (Nematocarcinus africanus, Solenocera africana, Callinectes pallidus, and Pegusa lascaris) using their Length-Weight Relationship (LWR) and Condition Factor (K). Length and weight of four hundred and fifty-four (454) fishes and crabs belonging to nine (9) families, 13 (thirteen) genera and 14 (fourteen) species were measured in standard units. The results obtained showed that the growth pattern of the species was negative allometric. Sardinella maderensis and Monolene mertensi had the lowest and highest b value of -0.62 and 0.94 respectively. The least Intercept (a) value of 1.29 was recorded for M. mertensi while highest (a) value (12.83) was recorded in Sarotherodon galilaeus. The peak correlation value (R^2) (0.75) of the length-weight relationship was obtained in M. mertensi and the least (0.00) in Tilapia zilli. The condition factor (K) ranged between 0.81 and 2.30 with Pellonula leonesis and Kribia kribensis having the lowest and highest k factors respectively. 57% of the specimens had their k factor greater than 1 and this indicated that majority of the fishes and crab's species were thriving well in the water body. The results of the present study could serve as baseline data for these species and for comparisons with future studies.*

KEYWORDS: Health Status, Morphometric, Fin and Shell Fishes, Badagry Creek, Nigeria

INTRODUCTION

Fishes and crabs play important roles in the development of a nation. Apart from being a cheap source of highly nutritive protein, it contains other essential nutrients required by the human body (Sani *et al.*, 2010). In fish, size is generally more biologically relevant than age, mainly because several ecological and physiological factors are more size-dependent than they are age-dependent. Therefore, variability in size has important implications in fisheries science and population dynamics and is one of the most common measurements in fisheries data (Mendes *et al.*, 2007).

The relationship between body length and weight of fish presents great importance in fisheries biology and population dynamics where many stock assessment models require the use of Length-weight parameters. Knowledge of length-weight relationships is useful for the

African Journal of Agriculture and Food Science
ISSN: 2689-5331
Volume 3, Issue 3, 2020 (pp. 38-46)
www.abjournals.org

prediction of weight from length values, condition of fish, stock assessment, and estimation of biomass (Erzini, 2008, Hossain *et al*. 2006). Fish condition factor (K), defined as the robustness or wellbeing of an individual fish is also an essential component of fishery biology used to assess the general health of populations (Sani *et al.*, 2010). Condition factor is a useful index for monitoring of feeding intensity, age, and growth rates in fish. It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to assess the health status of the aquatic ecosystem in which fishes live (Oni *et al*., 2008). Due to the deleterious effects of human activities on the ecosystem, it is vital to monitor the status of biota as this will give an indication of the temporal and spatial variation in morphological, physiological and ecological diversity in aquatic habitats.

Therefore, this study is aimed at assessing the length-weight relationships of 14 species of fishes and crabs from Badagry creek, Lagos, Nigeria; to provide broader understanding of fish conditions and give an opportunity to compare studied population with other parts of its area; and to determine the condition factors and other weight-length parameters of fishes and crabs.

MATERIALS AND METHODS

Study Area

The Badagry creek is shown below in Figure 1. It is approximately 60 km long and 3 km wide and lies between longitude 2^0 42^1 and 3^0 23^1E and latitude $6^0 23^1$ and $6^0 28^1$ N. It is part of a continuous system of lagoons and creeks along the coast of Nigeria from the border with the Republic of Benin to the Niger delta. Its water depth ranges from 1- 3m. The creek experiences two broad seasons: the dry season (December - May) and the wet season (June - November). Most of the year, it is characterized by fresh and slightly brackish water. The creek is approximately equidistant from the entrances of Lagos and Cotonou harbours. As a result, it is influenced by tides and floods from the Lagos Lagoon and Cotonou harbour through Lake Nokue and Lake Porto-Novo (Anyanwu and Ezenwa, 1988).

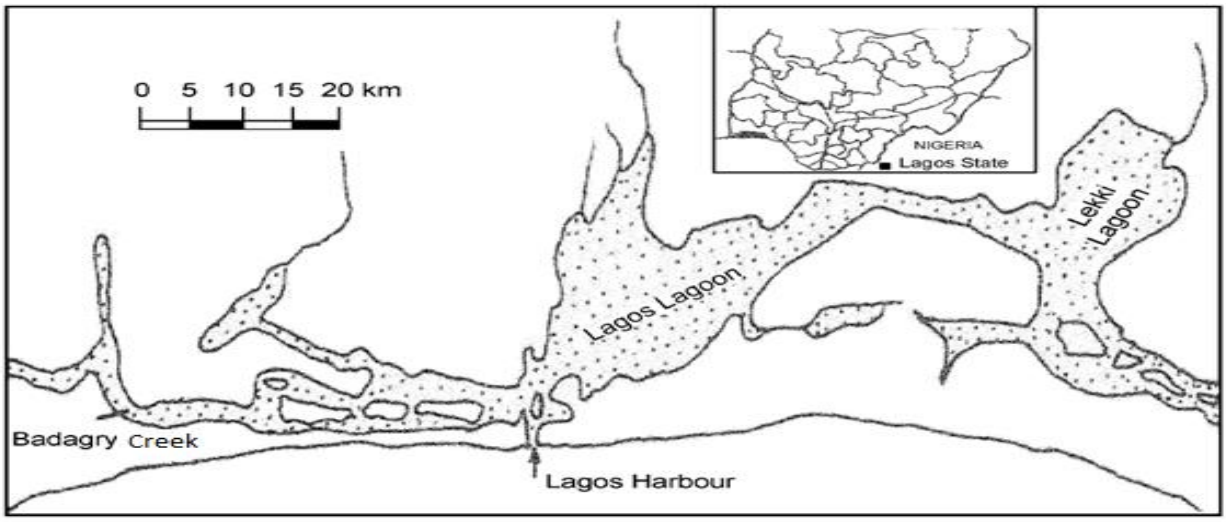

Figure 1: Map of Badagry creek in Lagos, Nigeria.

Collection of Fish Samples

A total of four hundred and fifty-four (454) specimens (fishes and crabs) were collected from fishermen at Badagry Creek between January and December 2018. Specimens collected were kept chilled in an ice chest to reduce post humus digestion of the stomach contents to the minimum while in transit to the laboratory. Specimens were identified in the laboratory of the Department of Fisheries, Lagos State University, Lagos, with the aid of standard reference texts of Holden and Reed (1972), Idodo-Umeh (2003) and Olasebikan and Raji (2004). Also, confirmation of the identified species was performed by fisheries experts in the Department.

Morphometric Measurement

The lengths were taken with measuring board to the nearest 0.1 cm. Body weight of individual fish was measured to the nearest 0.1 g with an electric balance after removing the adhered water and other particles from the surface of body. Total length (TL) was measured from the tip of the snout (mouth closed) to the extended tip of the caudal fin.

Length-Weight Relationship

The length-weight relationship (LWR) was estimated by using the equation: $\mathbf{W = aL^b}$ where W= weight (g), L= total length (cm), a = constant, b= growth exponent. A logarithmic transformation (log $\mathbf{W = log\ a + log\ bL}$) was used to make the relationship linear.

Condition Factor

Estimation of species condition factor (K) was computed using the formula: $\mathbf{K= 100\ W\ /L^3}$ (Pauly, 1983).The values of the compiled growth exponent were used for the calculation of condition factor: Where K= condition factor, W= total body weight (g), L= total length (cm).

Statistical Analysis

For each species, the slopes of length-weight regressions were compared to 3 using students't-test (Sokal and Rohlf, 1987) to determine whether species grew isometrically or allometrically. Student's t-test was used to ascertain whether seasonal changes in condition factor for the species were statistically significant.

RESULTS

Relative Species Catch Composition from Badagry Creek

The 454 specimens of fish and crab species caught from Badagry creek belonged to nine (9) families, 13 (thirteen) genera and 14 (fourteen) species (as shown in Table 1).The percentages of each catch composition included: *Nematocarcinus africanus* (18.72%), *Kribia nana* (13.22%), *Solenocera africana* (11.23%), *Kribia kribensis* (8.14%), *Chrysichthys filamentosus* (6.83%), *Eleotris vitata (6.17%*), *Tillapia zilli* (5.95%), *Pegusa lascaris* (5.95%), *Sarotherodon galilaeus* (4.63%), *Monolene mertensi* (4.63%), *Sardinella maderensis* (4.635), *Callinectes pallidus* (3.74%), *Cynoglossus senegalensis* (3.52%) and *Pellonula leonesis* (2.42%).

African Journal of Agriculture and Food Science
ISSN: 2689-5331
Volume 3, Issue 3, 2020 (pp. 38-46)

www.abjournals.org

Table 1: Relative Species Abundance Composition of Badagry Creek

Family Name	Species	No	Percentage Composition
Eleotridae	*Kribia nana*	60	13.22
Cichlidae	*Sarotherodon galilaeus*	22	4.85
Solenoceridae	*Nematocarcinus africanus*	85	18.72
Solenoceridae	*Solenocera africana*	51	11.23
Eleotridae	*Eleotris vitata*	28	6.17
Cynoglossidae	*Cynoglossus senegalensis*	16	3.52
Eleotridae	*Kribia kribensis*	37	8.14
Bagridae	*Chrysichthys filamentosus*	31	6.83
Cichlidae	*Tillapia zilli*	27	5.95
Bothidae	*Monolene mertensi*	21	4.63
Portunidae	*Callinectes pallidus*	17	3.74
Solidae	*Pegusa lascaris*	27	5.95
Clupeidae	*Sardinella mederensis*	21	4.63
Clupeidae	*Pellonula leonesis*	11	2.42
	N	**454**	**100%**

No= sample size of each species, N= Total number of species

Length-Weight Relationships

Length weight relationships obtained from Badagry creek is shown in Table 2. The value of b shows that the pattern of growth was negative allometric pattern. *Sardinella maderensis* and *Monolene mertensi* had the lowest and highest *b* value of -0.62 and 0.94 respectively. However, all the fish species have *b* value lower than 3. The regression (*r*) values ranged from 0.002 – 0.75 with *M. mertensi* having the peak correlation value (0.75) and the least (0.00) in *Tilapia zilli.* More so, the length of fishes and crabs caught ranged from 3.0 to 43.14 cm with *Kribia nana* having the least and *Cynoglossus senegalensis* having the highest length value. Body weight ranged between 3.56 -83.93 with *Kribia kribensis* and *Nematocarcinus africanus* having the highest and least weight range values respectively. The values of their various intercepts (*a*) ranged from 1.29 to 12.83 with *M. mertensi* and *Sarotherodon galilaeus* having the lowest and highest intercepts value respectively.

African Journal of Agriculture and Food Science
ISSN: 2689-5331
Volume 3, Issue 3, 2020 (pp. 38-46)

www.abjournals.org

Table 2: Summary of Length-Weight Relationship of Fish and Crab Species from Badagry Creek, Lagos.

Species	No	LWR (Y = a + bX)	Total Lenght (Range)	Body Weight (Range)	b	a	R^2
Kribia nana	60	Y= 3.48+0.54x	3.92-20.42	6.22-23.9	0.54	3.48	0.23
Sarotherodon galilaeus	22	Y=12.83+0.01x	7.22-2.92	5.08-72.19	0.01	12.83	0.004
Nematocarcinus africanus	85	Y=8.58+0.18x	5.20-35.24	3.56-67.14	0.18	8.58	0.09
Solenocera africana	51	Y=4.82+0.54x	5.41-34.81	5.8-29.11	0.54	4.82	0.18
Eleotris vitata	28	Y=7.09+0.29x	6 -19.22	8.4 -15.48	0.29	7.09	0.11
Cynoglossus senegalensis	16	Y=7.79+0.15x	8.12-31.34	4.87-82.66	0.15	7.79	0.66
Kribia kribensis	37	Y=8.67+0.10x	6.66-41.16	7.71-83.93	0.10	8.67	0.14
Chrysichthys filamentosus	31	Y=9.06+0.29x	8.15-42.15	4.85-69.88	0.29	9.06	0.23
Tillapia zilli	27	Y = 12.12-0.01x	3.66-37.66	6.66-19.98	-0.01	12.12	0.00
Monolene mertensi	21	Y=1.29+0.94x	7.11-43.14	6.62-40.44	0.94	1.29	0.75
Callinectes pallidus	17	Y=12.42+0.12x	8.20-24.44	6.66-72.85	0.12	12.42	0.14
Pegusa lascaris	27	Y=9.59+0.18x	3.0-22.44	6.11-32.19	0.18	9.59	0.16
Sardinella maderensis	21	Y=1.47-0.62x	4.05-18.44	7.77-18.51	-0.62	1.47	0.22
Pellonula leonesis	11	Y=9.63+0.33x	4.52-19.41	6.12-15.54	0.33	9.63	0.07

LWR = length-weight relationship, a = intercept, b = slope of graph, r = correlation coefficient, y = weight (g) and x = length (cm)

Morphometric Characteristics and Condition Factors of the Fish and Crab Species

The mean body weight varied from 10.93 - 31.80 with *P. leonesis* and *Sarotherodon galilaeus* having the least and highest values respectively. Similarly, the mean of length varied from 10.00 - 16.72 with *Cynoglossus senegalensis and Kribia nana* having the highest and least values respectively. There were variations in the mean condition factors (k) of the fish and crab species from Badagry creek (Table 3). Mean K values for all species ranged from 0.81–2.30. 57% of the total specimens had K – value greater than 1. Eight (8) species had their k values > 1 with *K. kribensis* having the highest at 2.30, *K. nana* at 2.05, *S. africana* with 1.67, *S. galilaues* with 1.56, *E. vitata* at 1.53, *C. filamentosus* with 1.34, *T. zilli* at 1.11, *S.maderensis* with 1.06 and *A. capensis* at 1.03. On the hand hand, six (6) species had k < 1. *M. mertensi* had 0.99, *P. lascaris* with 0.98, *N. africana* at 0.93, *C. senegalensis* at 0.91, *C. pallidus* with 0.89, and *P. leonesis* at 0.81.

Table 3: **Morphometric Characteristics and Condition Factors of Fish and Crab Species from Badagry Creek, Lagos**.

Species	Total lenght (cm) (means±SD)	Body weight (g) (means ± SD)	Mean K- Factor
Kribia nana	10.00 ± 0.47	12.11 ± 0.42	2.05
Sarotherodon galilaeus	13.31 ± 0.83	31.80 ± 4.47	1.56
Nematocarcinus africanus	11.53 ± 0.55	14.16 ± 0.911	0.93
Solenocera africana	11.97±0.80	13.22 ±0.63	1.67
Eleotris vitata	10.78 ± 0.66	12.93 ± 0.77	1.53
Cynoglossus senegalensis	16.72 ± 1.85	27.47 ± 5.70	0.91
Kribia kribensis	10.56 ± 0.81	18.32 ± 2.90	2.30
Chrysichthys filamentosus	13.96 ±1.45	19.59 ±3. 04	1.34
Tillapia zilli	13.17 ± 1.15	12.16 ± 0.89	1.11
Monolene mertensi	13.45 ±1.70	16.13 ± 3.32	0.99
Callinectes pallidus	14.16 ±1.13	17.16 ± 3.74	0.89
Pegusa lascaris	12.47±0.74	13.93 ± 1.46	0.98
Sardinellamaderensis	12.73 ±0.80	13.02 ± 0.70	1.06
P. leonesis	13.19 ±1.34	10.93 ± 5.70	0.81

g= grams, cm= centimeter, k-factor= condition factors.

DISCUSSION

The effective management of any fishery requires considerable knowledge of population parameters such as length-weight relationship. This relationship is very important in fisheries biology because it allows estimation of average weight of the fish of a given length group, to assess the well-being of individuals and to determine possible differences between separate unit stocks of the same species (King, 2007). The relationship is also important in fisheries management for comparative growth studies (Moutopoulos and Stergiou, 2012). Pauly (1993) stated that length-weight relationship (LWR) provides valuable information on the habitat where the fish lives; while Kulbicki, *et al*. (2005) stressed the importance of LWR in modeling aquatic ecosystems.

The result of the present study showed that the growth of the species was negative allometric. This means that the fishes do not grow symmetrically (Tesh, 1968) or the fish becomes thinner with increase in length (King, 2007). This was similar with documented works from Inland water bodies in Nigeria. Notable among them includes the findings of Olatunde (1984) in commercial fish landings in Zaria central market and Abowei and Hart (2009) in an investigation of some morphometric parameters of 10 fish species of Lower Nun River in Niger Delta. Also, Ibrahim *et al*. (2009) observed allometric growth pattern in Kontagora

Reservoir while Ude *et al.* (2011) made similar findings in an evaluation of length-weight relationship of fish species of Ebonyi River.

The *b* values in length-weight relationships determine the growth pattern of the fish species. When b is equal to 3 or close to 3, growth in the fish is said to be isometric i.e. fish becomes more robust with increasing length (Bagenal and Tesch, 1978). Similarly, when *b* is far less or greater than 3, growth in the fish is positive allometric i.e. the fish becomes thinner with increase in length (King, 2007). The b value range in this study are lower than that reported by Imam *et al*. (2010) with a recorded range of between 1.4 and 2.5 in Wasai Reservoir in Kano. The differences in the results of these studies could be attributed to the age, sex, fecundity of the fishes, sampling methods, and sampling sizes as well as the prevailing ecological conditions in the water body at different times. On the other hand, the negative allometric length-weight relationship of the fish species in this study agreed with the findings of Miranda *et al*. (2006), Ayoade and Ikulala (2007) and Abowei and Hart (2009) which recorded similar results from 12 and 11 species respectively. However, the findings of the present study did not connote with the findings by Miranda *et al*. (2006) and Ayoade and Ikulala (2007).

In fisheries science, the condition factor is used in order to compare the condition, fatness or wellbeing of fish (Ahmed *et al*., 2011). This is based on the hypothesis that heavier fish of a particular length are in better physiological condition (Bagenal and Tesch, 1978). Condition factor is also a useful index for monitoring of feeding intensity, age and growth rates in fish (Ndimele *et al*., 2010). It is strongly influence by both biotic and a biotic environmental condition and can be used as an index to assess the status of the aquatic ecosystem in which fish live (Anene, 2005). The condition factors (K) of the species in the present study that varies between 0.81– 2.30; was similar to what was obtained in other tropical water bodies. For example, in Nigeria, a range of between 0.49 - 1.48 was recorded by Nwadiaro and Okorie (1985) in Oguta Lake. Kumolu-Johnson and Ndimele (2011) obtained a K-value of between 0.91 and 8.46 from Badagry creek in Lagos, while Ibrahim *et al.* (2009) recorded a mean K-value of 1.98 in Kontagora Reservoir in Niger State. Also, in Sudan, Ahmed *et al*. (2011) recorded a K-value range of 0.506 and 3.415. The mean K-values of most fish and crab species sampled in this study that had their value greater than 1 indicated that the fish and crab species were doing well in the creek. However, the value of the condition factor for *Nematocarcinus africanus, Cynoglossus senegalensis, Monolene mertensi, Callinectes pallidus, Pegusa lascaris and Pellonula leonesis* being less than one, implies a bad state or well-being. A similar result was reported by Obasohan *et al.* (2012) where two out of five fish species condition factors were below one, and the remaining were above one. According to literatures, many factors such as sex, age, state of maturity, size state of stomach, illness, sampling methods, sample sizes and environmental condition affects fish condition and parameters of length-weight relationships in fish. With respect to above observations, it could be concluded that most of the fishes and crab's species were in good nutritional state, conducive environmental conditions and fairly satisfactory physiological conditions. Fisheries activities could continue in and around this creek while other anthropogenic activities (Industrial and effluent discharges) especially on a large scale, should be discouraged. Therefore, the results of the present study could serve as baseline data for these species and for comparisons with future studies.

REFERENCES

Abowei, F.N.and Hart, A.I. (2009). Some morphometric parameters of ten fin-fish species from the lower Nun River, Niger Delta Nigeria. *Research Journal of Biological Sciences*, **4**(3): 282-288.

Ahmed, E.O., Ali, M.E. and Aziz, A. A. (2011). Length-weight Relationships and Condition factors of six fish species in Atbara River and Khashm el- girba Reservoir, Sudan. *International Journal of Agriculture Sciences*, **3**(1): 65-70.

Anene, A. (2005). Condition factor of four Cichlid species of a man-made Lake in Imo State, South-eastern Nigeria. *Turkish Journal of Fisheries and Aquatic Sciences*, **5**: 43-47.

Anyanwu, A. J. and Ezenwa, B.I.O. (1988). Incidence of parasitic infection of pond raised Tilapia spp. and some cultivable fish species from three ecological areas of Lagos state. Nigeria Institute of Oceanography and Marine Research, *Technical Paper* No. 32.

Ayoade, A.A. and Ikulala, A.O.O. (2007). Length weight relationship condition Factor and stomach contents of *Hemichromis bimaculatus*, *Sarotherodon melanotheron* and *Chromidotilapia guntheri* (Perciformes: Cichlidae) in Eleiyele Lake, South Western Nigeria.*Revista de Biologia Tropical*, **55**:3-4.

Bagenal,T.B. and Tesch, A.T. (1978). Conditions and growth patterns in fresh water habitats.Blackwell Scientific Publications, Oxford, UK, pp75 -89.

Erzini, K. (2008). An empirical study of variability in length at age of marine fishes. *Journal of Applied Ichthyology*,**10**: 17-41

Hossain, M.Y., Ahmed, Z.F., Leunda, P.M., Jasmine, S., Oscoz, J., Miranda, R. and Ohtomi, J. (2006). Condition, length-weight and lengthweight relationships of the Asian striped catfish Mystus vittatus (Bloch, 1794) (Siluriformes: Bagridae) in the Matahabhanga River, Southwestern Bangladesh. *Journal of Applied Ichthyology*, **22**(4): 304 – 307.

Imam, T.S., Bala, U., Balarabe, M.L. and Oyeyi, T.I. (2010). Length-weight relationship and condition factor of four fish species from Wasai Reservoir in Kano, Nigeria. *African Journal of General Agriculture*,**6**(3): 125-130.

King, R.P. (2007). Length-weight relationship of Nigeria freshwater fishes. *Naga ICLARM Quarterl* , **19**(3):49-52.

Kulbicki, M., Guillemot, N. and Amand, M. (2005).A general approach to length-weight relationships for New Caledonian Lagoon fishes. *Cybium*, **29**:235- 252.

Kumolu-Johnson, C. A. and Ndimele, P. E.(2011). Length-weight relationships of nine fish species from Badagry creek, Lagos, Nigeria. *African Journal of Biotechnology*. **10**(2): 241-243.

Mendes, B., Fonseca, P. and Campos, A. (2007). Weight-length relationships for 46 fish species of the Portuguese west coast. *Journal of Applied Ichthyology*, **20**: 355- 361.

Miranda, R.,Oscoz, J.,Launda, P.M. and Escala, M.C. (2006). Weight-Length Relationships of Cyprinid fishes of Liberian Penninsula. *Journal of Applied Ichthyology*, **22**(4): 297-298.

Moutopoulos, D. K. and Stergiou, K. I. (2012). Length-weight and length-length relationships of fish species from Aegean Sea (Greece). *Journal of Applied Icthyology*,**18**: 200–203.

Ndimele,P. E., Kumolu-Johnson, C. A., Aladetohun, N. F. and Ayorinde, O. A. (2010). Length-weight relationship, condition factor and dietary composition of Sarotherodon melanotheron, Ruppell,1852 (Pisces: Cichlidae) in Ologe Lagoon, Lagos, Nigeria. *Agriculture and Biology Journal of North America*, **1**: 584-590.

Obasohan, E.E., Obasohan, E.E., Imasuen, J A. and Isidahome, C.E. (2012). Preliminary Studies of the length- weight relationship and condition factor of five fish species

from Ibiekuma Stream, Ekpoma, Edo State, Nigeria. *Journal of Agricultural Research and Development*, **2**(3): 61 - 69

Olatunde, A. A. (1984). The Biochemical Composition and Nutritional Value of Eutropius niloticus, Schilbe mystus and Physailia pellucida. Family Schilbeidae (Osteichthyes: Siluriformes) from Lake Kainji, Nigeria. Arch. *Hydrobiology*, **88**: 500 – 504.

Oni. S.K.,Olayemi, J.Y. and Adegboye, J.D. (2008). Comparative physiology of three ecologically distinct fresh water fishes, *Alestesnurse* Ruppell, *Synodontisschall* Broch & Schneider and *Tilapia zilli* Gervais. *Journal of Fish Biology*, **22**: 105-109.

Pauly, D., (1983). Some simple methods for the assessment of tropical fish stocks. FAO Fisheries Technical Paper, (234), FAO, Rome, Italy. Relationship and condition factor of Barilius niloticus (Family: Cyprinidae) in Kontagora Reservoir, Niger State, Nigeria. *Biological and Environmental Sciences Journal for the Tropics*, **9**(2):155- 158.

Sani, R., Gupta, B.K., Sarkar, U.K., Pandey, A., Dubey, V.K. and Lakra, W.S. (2010). Length weight relationship of 14 Indian freshwater species from river Betwa (Yamuna River tributary) and Gomti (Ganga river tributary). *Journal of Applied Icthyology*,**26**: 456-459

Tesch, F. W. (1968).*Age and growth.* In: Ricker, W.E. (ed). Methods for Assessment of fish production in freshwater. Blackwell Scientific Publication, Oxford, UK, pp93 - 123.

Ude, E.F., Ugwu, L.L.C., Mgbenka, B.O. and Nwani, C.D. (2011). Evaluation of length-weight relationship of fish species of Ebonyi River, Nigeria. *Nigerian Journal of Fisheries*,**8**(1): 136-144.