INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Length Weight Relationship and Condition Factor of Four Commercially Important Fish Species at ERO Reservoir, Ekiti State, Nigeria

Dr. O. Tolulope Adebola
Senior Lecturer, Department of Biology, Adeyemi College of Education, Ondo, Ondo State, Nigeria
Bello-Olusoji, O. A.
Professor, Department of Fisheries and Aquaculture Technology, Federal University of Technology, Akure, Ondo State, Nigeria
Fagbenro, A. O.
Professor, Department of Fisheries and Aquaculture Technology, Federal University of Technology, Akure, Ondo State, Nigeria
Sabejeje, T. A.
Senior Lecturer, Department of Biology, Adeyemi College of Education, Ondo, Ondo State, Nigeria

Abstract:
8464 fishes captured at Ero reservoir bimonthly using various gill net mesh sizes 50.8mm, 63.5mm, 78.2mm, 88.9mm and 101.6mm were identified into four (4) species as Oreochromis niloticus, Coptodon zillii, Tilapia guineensis and Clarias gariepinus. These fishes belong to two (2) families of Cichilidae and Clariidae. Specimens were weighed to the nearest grams and standard length were measured to the nearest centimeters and the highest species number was recorded for Cichilidae family. Growth coefficient b of the LWR ranged from 1.13 to 3.43, Coptodon zillii, Tilapia guineensis and Clarias gariepinus species showed negative allometric growth pattern while Oreochromis niloticus had positive allometric growth. Species diversity was determined by Simpsons index while dominance and evenness by Shannon weiner index of diversity. Simpsons index (D) = 0.42, Simpson's index of diversity (1-D) = 0.57, Simpsons Reciprocal index (1/D) = 0.43, Evenness = 0.57. Water quality parameter showed slight variation between rainy and dry seasons.

Keywords: *Reservoir, length weight, condition factor, species, allometric growth*

1. Introduction

Reservoirs are natural or artificial lakes, created by construction of dams on seasonal and perennial rivers. Irrespective of their main objectives, they still contribute substantially to a country's total domestic fish production; Komolafe *et al* 2014 stated that reservoirs have contributed immensely to finfish resources in Nigeria, however the effectiveness of their contributions depends largely on adequate fish assemblages and proper management of the reservoir fisheries (Mustapha, 2008). Length weight relationship (LWR) is one of the important tool in fishery assessments and fishery management (Gracia *et al* 1989; Haimorici and Velasco 2000; Fafioye and Oluajo 2005 and Lawson *et al*. 2013).

Length and weight measurements in conjunction with age data have been found to give information on the stock composition, age maturity lifespan mortality, growth and production in the relationships between the length and the weight are related with metabolism in each species and the environment where they live. (Claro and Gracia-Arteaga 1994; Cronzalez-Cranadara *et al* 2003; Fafioye 2005). Among several authors that have conducted studies in the area of fish length weight relationship in Nigeria include Fafioye and Oluajo 2005; Haruna 2006; Nyaku *et al* 2008; Imam *et al* 2020, Cetin and Ozcan 2010; and Lawson *et al*, 2013; Komolafe *et al*; 2014). Moutopoulos *et al* 2002 also reported that length weight relationship is important for comparative growth studies; also formed to provide valuable information on the habitat and aquatic ecosystem modeling (Pauly 1993 and Kulbicki *et al* 2005). The condition factor is an index reflecting interactions between biotic and abiotic factors in the physiological condition of fish. Length weight relationship of some species at Ero Reservoir are limited therefore, this study examines the length weight relationship of *Oreochromis, niloticus, Coptodon zillii, Tilapia guineensis* and *Clarias gariepinus* in Ero Reservoir, Ekiti State, Nigeria which has never been studied.

2. Materials and Methods

2.1. Description of Study Area

Ero reservoir is situated within the longitude $4^0 45'$ to $5^0 45'$ east of the Greenwich Meridian and latitude $7^0 15'$ to $8^0 5'$ North of the equator. The dam was impounded by the Ekiti State Government in 1985 at Ikun Ekiti in Moba Local Government Area of the State. Its major tributaries are Eran, GbogboOmoya. The water surface area is 450 hectares, the volume capacity in 20.9million cubic meter. The impoundment area is 4.5km. The major source of water into the river is River Orin-Ekiti. The major outflow river is river Ero. The vegetation of the area is evergreen consisting mainly of fresh tall trees and tall grasses which make it suitable for farming and the crops cultivated include cassava, yams, plantain, cocoyam, sweet potatoes and pepper. There is heavy rainfall between July and September of each year.

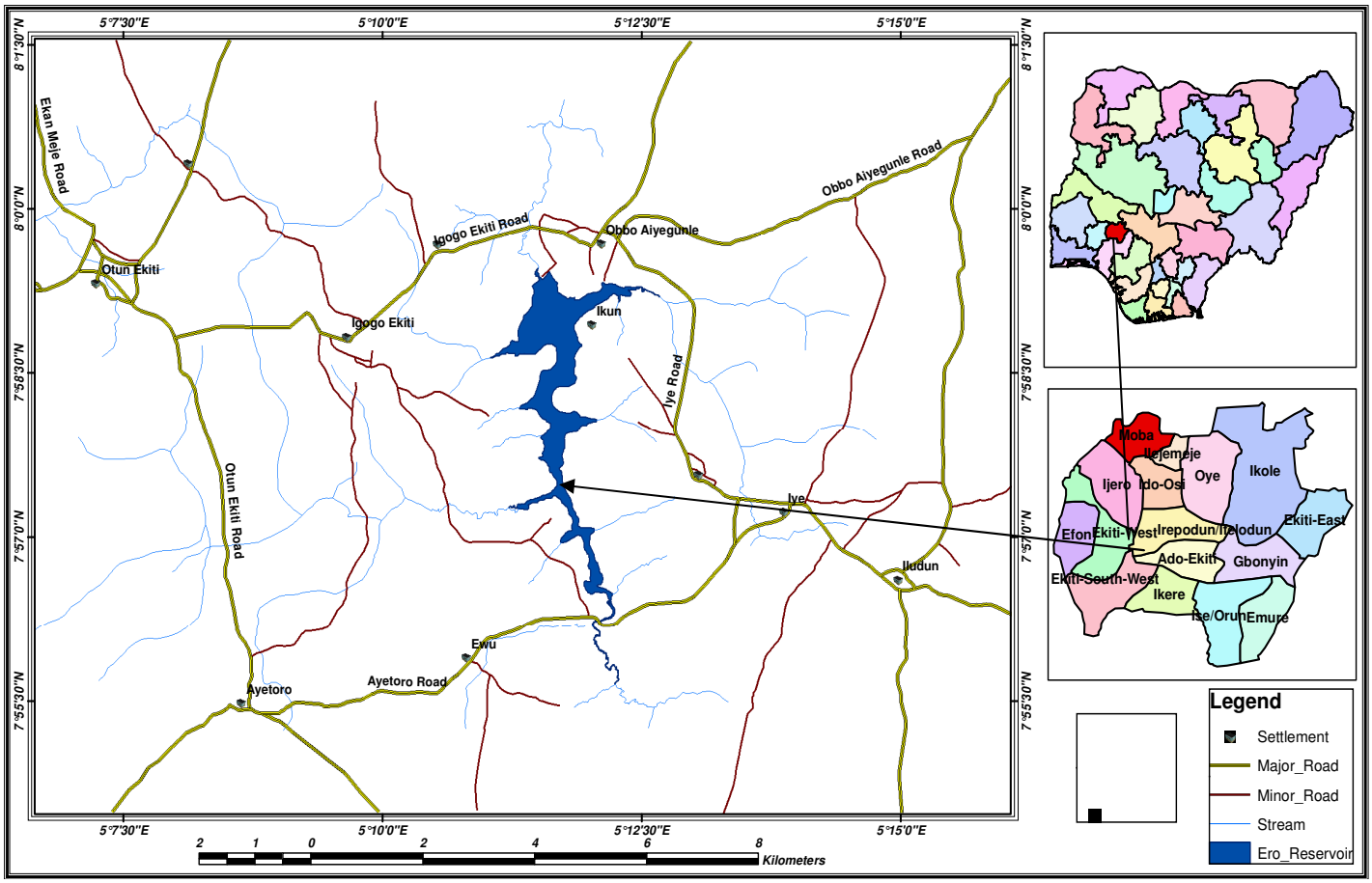

Figure 1: The map showing the Ero Reservoir in Moba Local Government Area, Ekiti State

2.2. Fish Sampling

Fish samples were collected bimonthly from April 2014 through January 2016 using five gillnet mesh sizes 50.8mm, 63.5mm, 76.2mm, 88.9mm and 101.6mm. Each net measured 30m long and 3m deep with 210/3 twine (Dan-skishiya *et al* 2013). Net setting was carried out by collaboration with four fishermen, at 6 pm in the night and hauling down at 7.00am in the morning. Fish samples were collected for species identification, this was done using standard reference texts (Adesulu *et al*, 2013). Total length of each fish was taken from the tip of the snout (month closed) to the extended tip of the caudal fin using measuring board; to the nearest 0.1 centimeter. Body weight was measured to the nearest 0.1 gram using a digital electronic weighing (Adam AFP 4100L) balance and the sex was recorded for all the fishes of the sample collected. Samples were later grouped into dry and wet seasons.

Length weight relationship were estimated by calculating $W = aL^b$ ……. (i)

(Ricker 1975) where W= the observed total weights and L = the observed total length, a and b are constants. b is the slope usually between 2 and 4 and a is the intercept on the length axis (Bagenal, 1978) and transformed into natural logarithmic form $\ln W = \ln a + b(\ln L)$.

Parameters a and b were then estimated by functional regression analysis from logarithmic transformed data as well as coefficient of determinant. (r^2)

The condition factor (k) was computed using the formula $K = 100\ W/L^3$ (Pauly, 1983).

Where W = observed total weight for each fish (g),

L = the observed total length for each fish (cm);

k = condition factor

All data on length weight relationship of the different fish species were subjected to t-test analysis at P<0.005. The following indices were used to describe the fish communities, the Shannon Index (H1), the Simpson's index of species diversity (D) and Species Evenness.

3. Results

A total of 8646 specimens belonging to 4 species (2 families) were analysed during the study. The family *Cichilidae* was the most abundant (53.4%) represented by *Oreochromis niloticus* (54.12%), *C. zillii* (35.33%) and *Tilapia guineensis* (7.24%) as presented in Table 1. The highest occurrence of the Cichilids was recorded in wet season during the study period as shown in Table 2. The family *Clariidae* was represented by only one species *Clarias gariepinus* (3.31%). Highest total length was recorded from *Clarias gariepinus*. It also recorded the highest weight more than the others as presented in Table 3 and 4. The condition factor (k) values for *O. niloticus,* T. *guineensis* and *Clarias gariepinus* which are 0.34, 2.39, and 0.67. Diversity index of Simpson index (D)= 0.42, Simpson's index of Diversity (lnD) = 0.57, Simpson's Reciprocal index (1/D) = 2.35, Shannon Weiner Index (H) = 0.01 Evenness = 0.57 and Margalef Index (Dmm) = 0.43 in Ero Reservoir

Species	Number	Percentage
Oreochromis niloticus	4676	54.12
Coptodon zillii	2903	35.33
Tilapia guineensis	636	7.24
Clarias gariepinus	281	3.31

Table 1: Percentage abundance of Dry and Wet seasons

Species	Dry	Wet season
Oreochromis niloticus	1566	3110
Coptodon zillii	1090	1813
Tilapia guineensis	127	509
Clarias gariepinus	93	188

Table 2: Seasonal abundance of the species in dry and wet seasons

Family	Species	Total length			Total weight					
		Min(cm)	Max(cm)	mean±SE	Min(g)	Max(g)	mean±SE	B	r^2	type of growth
Cichilidae	*O. niloticus*	4.50	26.01	18.4±50.35	10.0	150.0	78.45±26.45	3.43	0.83	+allometry
	C. zillii	4.10	28.0	21.0±1.12	12.0	135.0	89.63±27.60	1.13	0.63	-allometry
	T. guineensis	3.54	25.5	19.2±23.28	11.5	120.0	92.04±18.15	2.79	0.89	-allometry
Clariidae	*C. gariepinus*	4.50	30.8	24.0±62.14	12.0	250.0	89.54±4.56	2.81	0.53	-allometry

Table 3: Length weight relationship of four commercial fish species at Ero Reservoir
P<0.005

Species	K value
O. niloticus	0.34
C. zillii	2.45
T. guineensis	2.39
C. gariepinus	0.67

Table 4: Condition factor values for the fish species

Diversity indices	Values
Simpson index	0.42
Simpson's index of Diversity	0.57
Simpson's Reciprocal index	2.35
Evenness	0.57
Shannon weinner	0.01

Table 5: Species Diversity for the fish species

4. Discussion

The total number of eight thousand six hundred and forty-six (8646) fish samples were collected at the Reservoir, during the study period out of which *Oreochromis niloticus* was the most abundant followed by *C. zillii*, *Tilapia guineensis* and the *Clarias gariepinus*. Generally, the fish abundance in Ero Reservoir increased in wet season resulting in high fishing intensity by a number of full time or

part time fisher folks. A similar trend was observed by Idodo Umeh (1983) at River Ase), Meye *et al*, 2012 in river Orogodo in Nigeria.

Clarias gariepinius of all the fish species examined recorded the highest maximum length of 31.90cm followed by *Coptodon zillii* (28.0cm), *Oreochromis niloticus* (26.0cm) and then Tilapia *guineensis*, all recorded maximum length during the wet season. The variation in fish sizes indicated that the fish population ranged from immature specimens to fully matured ones, this suggests differences in their growth (Frota *et al,* 2004). The maximum weight of 150g, 135g, 120g and 250g were recorded for *O. niloticus*, *C. zillii*, *T. guineensis* and *C. gariepinus* respectively. The b values recorded for the fish species ranges from 1.13 recorded for *C. zillii* to 3.43 for *O. niloticus*. The b values recorded were *C zillii* (1.13) this is lower than the b values obtained from studies of Haruna (2006) and Bala *et al* (2009), 2.79 for *Tilapia guineensis* and 2.81 for *C. gariepinus* showed that the rate of increase in body length is not proportional to the rate of increase in body weight, these are negative allometric growth when compared with the mean exponent b = 3. The b value for *O. niloticus* (3.43) showed positive allometric growth when compared with the mean exponent b = 3 that is the fish is heavier than their lengths.

The condition factor all the species were significant different and ranged between 0.34 to obtained for *O. niloticus* 2.45 obtained for *C. zillii,* the difference in the fish species in body weights may be due to individual condition factor as it relates to the well being and degrees of fatness (Pauly, 1993), also it was observed that higher condition factor was in wet season months than the dry season, which means fishes were in better condition in the wet season than the dry season.

The condition factor (k) values for *O. niloticus,* T. *guineensis* and *Clarias gariepinus* which are 0.34, 2.39, and 0.67 were generally low and lesser than the documented values by Bagenel (2.9 to 4.8) and Tesh (1978) for mature freshwater fish. This study shows that the condition factor value k obtained for the fish population showed that the population was not in good condition, an indication of the unhealthy status of the population with less tissue energy reserves, depressed reproductive potential and low survival, also an indication of the inability of the study area to sustain the population.

The overall growth parameter, r^2 values of the length weight relationship of the fish species ranges from 0.53 for *C. gariepinus* to 0.89 for *Tilapia guineensis*, all these values are positive and highly significant with $r^2>0.60$ between and body weight measurements. The LWR parameters maybe affected by age maturity and sex (Duleic *et al,* 1996) feeding and reproduction and fishing activities (Bayham *et al*, 2008).

Diversity index gives an idea of how much a water body is in terms of fish species which indicate low species diversity and unevenness of fish. Naturally the value of D ranges between 0 and 1, between 0 and 1 represents an infinite diversity and on 1 above, no diversity.

The values of evenness (E) vary between 0 and 1 closer to 1 the more even the population of fish that form the community (Lawson *et al*, 2013).

5. Conclusion

The reports on the study serves as an additional research work to what has been reported by (Kester *et al*, 2007) on the reservoirs. The findings of this study establish that the reservoir is under exploited due to the fact that Ero Reservoir is majorly composed of fish species of low commercial value (the Cichilids) (Kester *et al,* 2007) and sparsely of commercial valuable catfish, however effective management actions to conserve and sustain the stock of fish was highly recommended, also as reported by Aramowo (2004) there was need to regulate periods of fishing during spawning seasons.

6. References

i. Adesulu, E. A. and Sydenham, D. H.J (2007): The Freshwater Fisheries and Fisheries of Nigeria. Macmillan Nigeria. Lagos, Ibadan 397pp.
ii. Awachie, J.B.E, Wilson, E. C (1978): The Attach Fishery of the lower Niger, Nigeria. CIFA (FAO) Technical Paper No5;296-311.
iii. Bayhan, B., Serer, T. M. and Taskvak, E. (2008): Lengthweight relationships of seven flat fishes (Pisces:Plaronectifornes) from Aegean sea, Turk. J. Fish and Aquat. Sci., 8:377-379.
iv. Claro, M. R. and Garcia Arteaga, J. P. (1994): Crecimicnto. In Claro, R. (Eds) Ecologia de los Peces Marinos de cuba. CIQRO Mexico pp 321-402.
v. Duleic, J. and Kraljovic, M. (1996): Age, growth and mortality of damselfish (Chromis chromis, L) in the eastern middle Adriatic Fish Res: 22:255-264. Dol:10.10/0165-7836(94)00318-Q.
vi. Daddy, F. A., Abubakar Aina E. (1991): Studies on Tatabu Floodplain vegetation and its utilization. Nigeria Institutes of Freshwater Fisheries Research, Annual Report. 6-20.
vii. Dankishiya, A. S., Olatunde, A. A. and Balogun, J. K. (2013): Ichthyofauna composition and Diversity of a tropical water supply Reservoir: A case study of Lower Usuma Reservoir in Bwari, Abuja, Nigeria. American Journal of Research Communication. Vol.1(9) 188-203.
viii. Edward, J. B. (2013): Evaluation of the Fisheries Potentials of Egbe Reservoir, Ekiti State Nigeria. Greener Journal of Biological Science. Vol.3(7) pp260-267.
ix. Fafioye, O. O. and Oluajo, O. A. (2005): Length weight relationship of five fish species in Epe Lagoon, Nigeria. African Journal of Biotechnology. 4(7):749-751.

x. Frota, L. O.,Costa PAS, Braga, A. C.(2004); Length weight relationship of marine fisheries from the Central Brazilian coast. NAGA ICLARM. 27(122) 20-26.

xi. Garcia C.B., Duarte, J. O. Sandoval, N., Von Schiller D; Melo G; Nawayas P. (1998): Length weight relationships of demersal fisheries from the Gulf of Salamanca, Colombia, NAGA, ICLARM Quart 21(3), 30-32.

xii. Haruna, M.A. (2006): Length weight relationship of four fish species (Cichilidae) from Magaga Lake, Kano, Nigeria. BEST Journal 3(3): pp 109-111

xiii. Idodo Umeh, G. (1987): Studies on the fish community of River Ase, Bendel State with special Emphasis on the food and feeding Habit of Citharinidae Bagridec, schilbeidae and Mochokidae Ph.D Thesis, University of Benin, Benin city,, Nigeria.

xiv. Imam, T. S., Bala U., Balairabe, M. L., and Oyeyi T. L. (2010): Length weight relationship and condition factor of four fish species from Wasai Reservoir in Kano, Nigeria, African Journal of Gen Agriculture vol.6 No3. pp 125-130

xv. Komolafe, O. O., Arawomo, G. A. O, Idowu, E. O., Adedeji. A. A. (2014): Status and Economic Impact of the Fisheries of Osinmo Reservoir, Ejigbo, Nigeria, Ife Journal of Science Vol. 16 no. 2 pp 309-317.

xvi. Kulbicki, M., Guillermot, N. and Amand, M. (2005): A general approach to length weight relationships for New Caleclonian Lagoon fishes Cybium 29; pp235-252.

xvii. Lawson E.O., Akintola, S. L. and Awe F. A (2013): Length weight relationship and Morphometry for Eleven (11) fish species from Ogudu Creek, Lagos, Nigeria. Advances in Biological Research 7(4): pp122-128.

xviii. Meye J. A. and Ikomi R. B. (2012): Seasonal Fish Abundance and fishing Gear Efficiency in River Orogbo, Niger Delta Nigeria, World Journal of fish and Marine Sciences. 4(2): pp191-200.

xix. Moutopoulos, D. K and Stergiou K.I (2002): Length weight and length-length relationship of fish species from Aegean Sea (Greece) J. Appli Ichtnyol. 18; pp200-203.

xx. Mustapha, A. (2008): Environment pollution in Kano: The contribution of waste water discharge from Kano old city and Bompai industrial estate to Jakara river basin system. J.Techno. African 2(1) pp83-88.

xxi. Ojo, J. A., Fagbuaro, O. (2004): Fish Fauna of Ero Reservoir Ekiti State, South western Nigeria, Journal of Biological and Physical Science 3: pp20-23.

xxii. Olaosebikan B. O. and Raji, A. (2013): Field guide to Nigerian Freshwater fishes. Federal College of Freshwater fisheries technology. New Bussa, Niger state. Unilorin University Press, 2nd Edition. pp1-105.

xxiii. Pauly, D (1993): Fishbyte section editorial, NAGA ICLARM 16:26.

xxiv. Ricker, W. K (1978): Computation and interpretation of biological statistics of fish population. Fish Res. Biol.Canada Bulletin 191.