Adamawa State University Journal of Scientific Research
ISSN: 2251-0702 (P)
Volume 6 Number 1, April, 2018; Article no. ADSUJSR 0601015
http://www.adsujsr.com

Length-Weight Relationship and Condition Factor of *Auchenoglanis occidentalis, Clarias gariepinus* and *Oreochromis niloticus* in Upper River Benue, Yola- Adamawa State, Nigeria

Edward, A.
Department of Fisheries and Aquaculture, Adamawa State University, Mubi –Nigeria
Contact: *abigail8887@gmail.com*

Abstract

The study of Length-weight relationship and Condition factor of *Auchenoglanis occidentalis, Clarias gariepinus* and *Oreochromis niloticus* was conducted in Upper River Benue, Yola- Adamawa State, Nigeria. Weight-Length data reported in this study were collected for the period of eighteen months (May, 2016 and October, 2017) from the Upper River Benue. The result of length-weight regression analysis revealed that, from the "b" values, A. *occidentalis, C. gariepinus* and *O. niloticus* exhibited negative allometric growth. The "b" values obtained during the period of the study showed that increase in length is not in equal proportion with the weight under constant specific gravity. There was a significant correlation ($P<0.05$) between length and weight of *A. occidentalis* exhibiting linear relationship in all the Sites. *C. gariepinus* and *O. niloticus* did not correlate significantly ($p>0.05$) between length and weight exhibiting linear relationship. The mean value of Condition factor in this study was significantly different between Sites and fish species ($P>0.05$). Monthly Condition factors showed that all the fish were in good Condition

Keywords: Allometric growth; Condition factor; Robustness; Plumpness; *Auchenoglanis occidentalis; Clarias gariepinus; Oreochromis niloticus;* Upper River Benue

Introduction

The length-weight relationship parameters are important to fish biology and give information on stock condition (Fafioye and Oluojo, 2005; Froese, 2006). The length-weight relationship is very important for proper exploitation and management of the population of fish species (Anene, 2005) To obtain the relationship between total length and other body weight, it is very much essential for stabilizing the taxonomic characters of the species (Pervin and Mortuza, 2008). Length and weight data are a useful and standard result of fish sampling programs. These data are needed to estimate growth rates, length and age structures, and other components of fish population dynamics (Kolher *et a*l., 1995). Length-weight relationships allow fisheries scientists to convert growth- in-length equations to growth-in-weight in stock assessment models (Morato *et al*., 2001; Steegiou and Moutopoulous, 2001) estimate biomass from length frequency distributions (Petrakis and Stagiou, 1995 ; Duli and Kraljevi 1996), compare life history and morphological aspects of populations inhabiting different regions (Steegiou and Moutopoulous, 2001) and calculate fish condition (Petrakis and Stagiou, 1995). This research aims at determining the Length-weight relationship and condition factor of *Auchenoglanis occidentalis*, *Clarias gariepinus* and *Oreochromis niloticus* in Upper River Benue, Yola- Adamawa State, Nigeria

Materials and Methods

Weight-Length data in this study were collected for the period of eighteen months (May, 2016 and October, 2017) from the Upper River Benue. Upper Benue River in this study was divided into four Sites (A, B, C and D). Site A (Njoboliy), Site B (Boronji) and Site C Jimeta under Bridge and Site D (Numan Bridge). Fish species were collected from fishermen at the landing Sites. Fish species were identified using the guides in Olaoseibikan and Raji (2010), Froese and Pauly (2012). The individual fish species were weighted with a digital balance (model: EK-4100i) to an accuracy of 0.01 g and measured with a precision of 0.1 cm for their total length using a meter rule. The relationship between the length and weight of a fish is usually expressed by the equation, $W=aL^b$. Where W is body weight (g), L is total length (cm), a is a coefficient related to body form and b is an exponent indicating isometric growth when equal to 3 (Edwards, 1976.,

Draper and Smith, 1981; Beverton and Holt, 1996) as adopted by Levent, (2007).

The condition factor K was determined for each fish using the conventional formula as described by Warthington and Richardo (1931). The ratio of the length to the weight of the fish was determined as: Condition Factor: (K) = W x100/ L3 .Where K = Condition factor, W = Weight in grams and L = Length in cm.

Results

Length – Weight relationship

The result of length-weight regression analysis of *A.occidntalis* (Table 1) showed that 'b' values for Site A (1.30), Site B (1.22), Site C (0.85) and Site D (1.15) all showed allometric growth. The length-weight relationship of Site A, Site B, Site C and Site D showed linear relationship with significant Correlation Coefficient of 0.83, 0.60, 0.58 and 0.72 as recorded in Site A, Site B, Site C and Site D respectively. (P>0.05).

The result of length-weight regression analysis of *C. gariepinus* (Table 2) showed that 'b' values for Site A (1.50), Site B (2.65), Site C (1.36) and Site D (1.50), showed allometric growth. The length-weight relationship of Site A, Site B, Site C and Site D showed linear relationship with no significant Correlation Coefficient of 0.31, 0.18, 0.14 and 0.12 recorded in Site A, Site B, Site C and Site D respectively (P<0.05).

The result of length-weight regression analysis of *O. niloticus*(Table 3) show that 'b' values for Site A (1.02), Site B (1.43), Site C (0.36) and Site D (0.12) all showed allometric growth. The length-weight relationship of Site A, Site B, Site C and Site D showed linear relationship with no significant Correlation Coefficient of 0.11, 0.01, 0.11 and 0.01 in Site A, Site B, Site C and Site D respectively (P<0.05).

Condition factors

Condition factor values for fish species with respect to Sites (Table 4) showed that the lowest value 0.89 was observed in *C. gariepinus* from Site B while the highest value 2.34 was observed in *O. niloticus* from Site C. Monthly Condition Factor (Table 5) revealed that *A. occidentalis* ranged from 1.02 to 3.12 in September and January, *C. gariepinus* ranged from 1.00 to 1.86 in August and July and *O. niloticus* ranged from 1.02 to 3.20 in May and March.

Table1: Length – Weight relations of *A. occidentalis* in Upper River Benue .

Sites	No. of fish examined	log	″ b″	Coefficient. of Correlation
Site A	3	0.2568	1.3012	0.8291
Site B	3	0.3947	1.221	0.5987
Site C	3	0.8419	0.8586	0.5817
Site D	3	0.4362	1.1518	0.7212

Table 2: Length – Weight relationship of *C. gariepinus* in Upper River Benue.

Sites	No. of fish examined	Log	″ b″	Coefficient. of Correlation
Site A	3	0.4357	1.4964	0.3068
Site B	3	0.3921	2.6467	0.1844
Site C	3	0.5072	1.3554	0.1432
Site D	3	0.3829	1.4972	0.1256

Table 3: Length – Weight relationship of *O. niloticus* in Upper River Benue.

Sites	No. of fish examined	Log	″ b″	Coefficient. of Correlation
Site A	3	0.6655	1.0219	0.1138
Site B	3	4.7072	1.4258	0.0039
Site C	3	1.4302	0.3616	0.1135
Site D	3	1.6688	0.1174	0.0111

Table 4: Mean Condition Factor of some Fish species measured in different Sites of Upper River Benue.

	Site A	Site B	Site C	Site D	Mean ± SE
A. occidentalis	1.47[b]	1.41[b]	1.51[b]	1.77[a]	1.21±0.041
C. gariepinus	1.01[a]	0.89[b]	0.96[b]	1.10 [a]	1.32±0.041
O. niloticus	2.20[a]	1.82[b]	2.34[a]	2.24 [a]	1.43±0.041

Means with the same superscript are not significantly (P>0.05) different from each other
Site A-Njoboliyo;
Site B-Boronji;
Site C-Jimeta Bridge;
Site D-Numan Bridge

Table 5: Monthly variation in condition factor of some fish species from Upper River Benue (May 2016 – October 2017)

Months	*A. occidentalis*	*C.gariepinus*	*O. niloticus*	Mean ± SE
May	1.44 ± 0.33	1.03 ± 0.16	1.03 ± 0.37	1.32±0.029
June	1.43± 0.33	1.79± 0.16	2.11± 0.37	1.52±0.529
July	1.17± 0.33	1.38± 0.16	1.88± 0.37	1.32±0.029
August	2.38± 0.33	1.34± 0.16	2.30± 0.37	1.33±0.089
September	1.84± 0.33	1.01± 0.16	1.95± 0.37	1.22±0.039
October	1.09± 0.33	1.94± 0.16	1.86± 0.37	1.67±0.027
November	1.86± 0.33	1.88± 0.16	2.51± 0.37	1.32±0.029
December	1.73± 0.33	1.66± 0.16	1.47± 0.37	1.46±0.021
January	3.12 ± 0.29	1.83 ± 0.14	1.47 ± 0.32	1.23±0.045
February	2.29± 0.33	1.65± 0.16	3.07± 0.37	1.55±0.042
March	1.03± 0.33	1.02± 0.16	3.20± 0.37	1.21±0.029
April	1.73± 0.33	1.82± 0.16	2.75± 0.37	1.45±0.045
May	1.08± 0.33	1.10± 0.16	2.39± 0.37	1.47±0.030
June	1.41± 0.33	1.80± 0.16	2.75± 0.37	1.43±0.065
July	1.94± 0.33	1.86± 0.16	2.21± 0.37	1.32±0.059
August	1.27± 0.33	1.00± 0.16	2.11± 0.37	1.34±0.029
September	1.02± 0.33	1.89± 0.16	2.31± 0.37	1.52±0.023
October	1.93± 0.33	1.77± 0.16	2.39± 0.37	1.32 ±0.029
Mean	1.54	0.99	2.15	

Discussion

The result of length-weight regression analysis revealed that, from the "b" values, A. *occidentalis*, *C. gariepinus* and *O. niloticus* exhibited negative allometric growth. According to Wootton, (1992) and Enin (1994) growth is said to be negative allometric growth when the length of an organism increases more than weight (b<3), positive allometric growth when the weight of an organism increases more than the length (b>3) and isometric growth when length and weight of an organism increases at the same time (b=3). The "b" values obtained during the period of the study shows that increase in length was not in equal proportion with the weight under constant specific gravity. This is in consonance with the earlier findings (Abubakar, 2006., Haruna, 1992). It has been observed that certain factors such as increase in weight due to intake of water or food and gonad season of the year and time of day when the fish was captured, loss of weight due to the food regurgitating and spawning, can among other things affect the "b" values (Largler, 1952). There was a significant correlation (P<0.05) between length and weight of *A. occidentalis* exhibiting linear relationship in all the Sites. *C. gariepinus* and *O. niloticus* did not correlate significantly (P>0.05) between length and weight exhibiting linear relationship. This is in line with the findings of Ja'afaru, (2001), Abubakar and Edward, (2002), Abubakar, (2006), and Kefas and

Abubakar (2010). The length-weight relationship parameters are important to fish biology and give information on stock condition (Fafioye and Oluojo, 2005; Froese, 2012). Treasurer (1976) observed that gill nets can select the fatter of short fish and the thinner of long fish there by affecting the length weight relationship as observe in this study because gill nets were predominantly used by fishermen in the Sites of this study.

Condition factor is an index of condition of fish, such as well-being of the fish, relative robustness, plumpness or fatness in numerical terms. The mean value of Condition factor in this study was significantly different between Sites and fish species (P>0.05). The mean values showed that almost all the fish species were in good condition in the Sites. Monthly Condition factors also showed that all the fish were in good Condition. A fish is said to be in good condition when the "k" value is higher than 1. Wade (1992) gave 1.0 as the best natural condition factor. A number of factors (such as sex, season, pollution, environmental condition, stress and availability of food) affect the Condition of fish. Largler (1952) observed that sexual differences, age, season of the year when the fish was captured, lost of weight due to regurgitation and spawning; stomach fullness and maturity level of fish can influence the value of Condition factor. Monthly mean condition Factor of *C. gariepinus* for the period of the study revealed that, *A. occidentalis* ranged from 1.02 to 3.12 in September and January, *C. gariepinus* ranged from 1.00 to 1.86 in August and July and *O. niloticus* ranged from 1.02 to 3.20 in May and March. This supports the work of (Jaafar, 2011) who reported an increase in condition factor during dry season. This is as a result of water clarity during this period and more light penetrates the water and photosynthetic plants flourished.

Conclusion

The result of length-weight regression analysis revealed that, from the "b" values, A. *occidentalis*, *C. gariepinus* and *O. niloticus* exhibited negative allometric growth. There was a significant correlation (P<0.05) between length and weight of *A. occidentalis* exhibiting linear relationship in all the Sites. *C. gariepinus* and *O. niloticus* did not correlate significantly (P>0.05) between length and weight exhibiting linear relationship. The mean condition factor values obtained in this study showed that almost all the fish species were in good condition in the Sites and months.

References

Abubakar, K.A (2006). A study of aspect of productivity and stock status of *Oreochromis niloticus* and *Clarias gariepinus* in Lake Geriyo. Yola Adamawa State. Ph.D Thesis Federal University of Technology, Yola, Nigeria. Pp: 212.

Abubakar, K. A and Edward, A. (2002). Food and Condition of the Catfish *Synodontis* in Upper Benue River Basin, Yola Area, *Nigerian Journal of aquatic Sciences.* 17(2):105-108.

Anene A.(2005) . Condition factors of four cichlid species of a man-made lake in Imo State, Southeast, Nigeria. *Turkish Journal Fish and Aquatic Science*. 5:43-47.

Beverton, R.J.H. and Holt, S.J. (1996). On the Dynamics of Exploited Fish Populations. *Chapman and Hall, London*, 533 pp.

Draper, N.R. and Smith, H.(1981). Applied Regression Analysis. Wiley Series in Probability and Mathematical Statistics, John Wiley and Sons, USA, 709 pp.

Duli J, Kraljevi M (1996). Weight-length relationships for 40 fish species in the eastern Adriatic (Crotian waters). *Fisheries . Revisions* 28:243-251.

Edwards, A.L.(1976). *An Introduction to Linear Regression and Correlation*. W.H. Freeman and Company, USA 213 pp.

Fafioye, O.O. and Oluaja O.A. (2005). Length-weight relationship of five fish species in Epe Lagoon, Nigeria. *African Journal of Biotechnology* 4 (7) pp749-751.

Froese, P and Pauly A. (2012). Cube law, condition factor and length-weightrelationship, history meta-analysis and recommendation. *Journal of Applied Ichthyology*. 22:241-253.

Haruna, A.B (1992). Studies on Aspect of water Quality and Biology of Fish of Jakarta. M.Sc BUK 151.

Ja'afaru A (2011). Length-Weight and Condition Factor of Sarotherodon galilaeus from River Benue, Yola, Adamawa State, Nigeria. *Adamawa State University Journal of Scientific Research.* 1(2):7-12.

Ja'afaru,A. (2001). Some aspect of the biology of *Oreochromis niloticus* (Trewavas) in Lake

Gerioyo Adamawa State, *Nigeria.Bagale Journal of Tropical Agriculture*. 28 (125-131.

Kefas, M and Abubakar,K.A. (2010). Some aspects of Biological Status of *C. gariepinus* in River Ilagil, Ngurore, Yola South Local Government Area, Adamawa State, Nigeria. *International journal of Biological Science*, 2(7):82-86.

Kolher N, Casey J, Turner P (1995. Length-weight relationships for 13 species of Sharks from the western North Atlantic. *Fish. Bull* 93:412-418.

Lagler, K. E. (1952). *Fresh water fishing Biology* (2nd edition). IOWA W.M.C Brown. U S A.

Levent S., Erhan A and Mustafa A. (2007). Weight-Length Relationships for 39 Fish Species from the North-Eastern Mediterranean Coast of Turkey. Turkish *Journal of Fisheries and Aquatic Sciences* 7: 37-40.

Morato T. P, Afonso P, Lourinho P, Barreiros JP, Santos RS, Nash RDM (2001). Length-weight relationships for 21 coastal fish species of the Azores, *North-Eastern Atlantic. Fish. Res* 50:297-302.

Olaosibikan, B. D and Raji. (1998). Field guide to Nigerian Freshwater Fisheries. Federal Collage Freshwater Fisheries Technology, New Bussa, Niger State. Pp 106.

Pervin MR, Mortuza MG (2008). Notes on length-weight relationship and condition factor of fresh water fish, *Labeo boga* (Hamilton) (Cpriniformes: Cyprinidae). *Uni. J Zool Rajshahi Univ*. 27:97-98.

Petrakis G, Stergiou K (1995). Weight length relationships for 33 fish species in Greek waters. *Fish. Res* 21(3-4):465- 469.

Stergiou K. I, Moutopoulos D, K (2001). A review of length-weight relationships of fishes from Greek marine waters. Naga, *ICLARM Quart* 24(1-2):23-39

Treasure, J.W. (1976).The Age, Growth and Length- Weight relationship of Brown Trout, *Salmon Truntta* (L) in the Loch of Strathbeg, Aberdeemshire. *Journal of Fish Biology 8, 241-247.*

Wade, J. W. (1992) the relationship between Temperature, Food Intake and Growth of Brown Trout, *Salmon Trutta* (L) Fed National and Artificial pelted Diet in Earthen Ponds. *Journal of Aquatic Sciences, 7:59-71.*

Warthington, B. E, and Richardo, C. K. (1931). Scientific Result of the Camdridge Expenditure to the East Africa Lakes No. 15 the fishes of Lake Rud off and Lake Breringo. *Journal of Lin. Zoology*. 267:353-389.

Wotton. R.J. (1992). *Fish Ecology*. Blakie and Sons Ltd. Glasgow