

**Keywords**

Length-Weight Relationship (LWR), Allometric Growth Pattern, Condition Factor, *Chrysichthys* Species

Received: June 15, 2015

Revised: June 29, 2015

Accepted: June 30, 2015

Length-Weight Relationship and Condition Factor of Three *Chrysichthys* Species of the Mid Cross River Flood System, South Eastern Nigeria

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Citation

Uneke Bilikis Iyabo. Length-Weight Relationship and Condition Factor of Three *Chrysichthys* Species of the Mid Cross River Flood System, South Eastern Nigeria. *AASCIT Journal of Biology*. Vol. 1, No. 3, 2015, pp. 29-33.

Abstract

The length-weight relationship (LWR) and condition factor of three *Chrysichthys* species of the mid Cross River, South eastern Nigeria were studied. The total number of fishes sampled were four hundred and thirty three (433). Samples of *C. nigrodigitatus* was two hundred and twelve (212), *C. auratus* was one hundred and twenty one (121) and *C. aluuensis* was one hundred (100). The parameters a and b of the length-weight relationship and correlation r , of the form $W = aL^b$ and monthly condition factor, K were calculated. *C. nigrodigitatus* had total length 10.1-29.0 cm TL (mean value, 18.8 cm TL) and total weight 16.0-157.0g (mean value, 62.8g). *C. auratus* had total length 10.2-18.1 cm TL (mean value, 14.8 cm TL) and total weight 16.0-81.0g (mean value, 34.8g) and *C. aluuensis* had total length 10.1-18.0 cm TL (mean value, 13.8 cm TL) and total weight 16.0-81.0g (mean value, 34.8g). The values of b significantly ($P = 0.05$) rose from 1.355 to 3.686 in *C. nigrodigitatus*, 2.302 to 3.477 in *C. auratus* and 1.402 to 2.839 in *C. aluuensis*. The overall length-weight relationship, b values of *C. nigrodigitatus*, *C. auratus* and *C. aluuensis* are 2.597, 2.512 and 2.446 respectively indicating negative allometric growth pattern for the three species. The condition factor values for *C. nigrodigitatus* ranged from 0.63 to 1.33 with overall mean value of 1.13, *C. auratus* had C.F. values of 0.98-1.35 (overall mean value 1.21) and *C. aluuensis* had C.F. values of 1.06-1.84 (overall mean value 1.32). These values indicate that the three populations are in good condition.

1. Introduction

Length-weight relationship (LWR) is of great importance in fishery assessment (Garcia *et al.*, 1998; Haimovici and Velasco, 2000). Length and weight measurements in conjunction with age can give information on the stock composition, age at maturity, life span (Diaz *et al.*, 2000). Condition factor is used as an indicator of the health of a fish population. This could be denoted as K , if K values are high then there is probably plenty of food available to support both somatic and gonadal growth. If condition factor is more than 1, it means that the fish species are in good health condition. But if these condition factors are less than one, it implies that the fish species are not in a good condition (King, 1996). Length-weight relationship, data for fresh water and brackish water fish resource of Nigeria are limited and the present contribution is aimed at compensating for this. Also the fact that most of these fish species are in high demand in the country, the use of

length-weight relationship (LWR) for assessment of their maturity, growth and production is important. Therefore, this study examines the length-weight relationship and condition factor of *Chrysichthys nigrodigitatus*, *Chrysichthys aluuensis* and *Chrysichthys auratus* in Cross River basin.

2. Materials and Methods

2.1. Study Area

Cross River is a major component of the inland waters of South Eastern Nigeria and its role to the fishery of the area is quite significant (Okoh *et al.*, 2007). Cross River originates from Cameroon and flows through Ebonyi State and Cross River State into the Atlantic Ocean. The river (Fig. 1) (Okoh *et al.*, 2007) lies in the area between 5°57" latitude 5°30'20" North and 7°58" longitude 5°30'20" East. The approximate surface area of the Cross River is 3,900,000 ha (Ita *et al.*, 1985). The rainy season and the dry season are the two main seasons of the area.

2.2. Sample and Data Collection

The samplings of the three species of *Chrysichthys* were made by random samples of the catch of the commercial artisanal fishers. The fish samples were collected each month from four sampling locations, Enohia, Ozizza, Ndibe and Uwana in the Cross River basin at Afikpo, Southeastern Nigeria (Fig. 1). The catches were made using gill nets, cast nets, lift nets, fishing baskets and traps. The samples were sorted and identified to species level using the guides of Olaosebikan and Raji (1998). Fish samples were preserved in 100% ethanol as voucher specimens. Total length (TL) measurements were to the nearest 0.1cm with a meter rule measuring board. Weight measurements were made with a FEJ-1500A electronic compact weighing balance to the nearest 0.1g.

2.3. Data and Statistical Analysis

The relationship between length and weight was determined using the power curve:

$$W = aTL^b \text{ (Sparre and Venema, 1998).}$$

Where W = Body weight in grams

TL = Total length (cm)

b = Slope of the regression line (regression constant).

a = Intercept of the regression with the y - axis (regression coefficient).

Regression analysis was used in the estimation of the a and b values and the level of significance of the value of coefficient of correlation (r).

Fulton's condition factor was computed according to Pauly (1984) is $K = 100W/L^3$

3. Results

The total number of fishes sampled were four hundred and

thirty three (433). Samples of *C. nigrodigitatus* was two hundred and twelve (212), *C. auratus* was one hundred and twenty one (121) and *C. aluuensis* was one hundred (100). *C. nigrodigitatus* had total length 10.1-29.0 cm TL (mean value, 18.8 cm TL) and total weight 16.0-157.0g (mean value, 62.8g). *C. auratus* had total length 10.2-18.1 cm TL (mean value, 14.8 cm TL) and total weight 16.0-81.0g (mean value, 34.8g) and *C. aluuensis* had total length 10.1-18.0 cm TL (mean value, 13.8 cm TL) and total weight 16.0-81.0g (mean value, 34.8g).

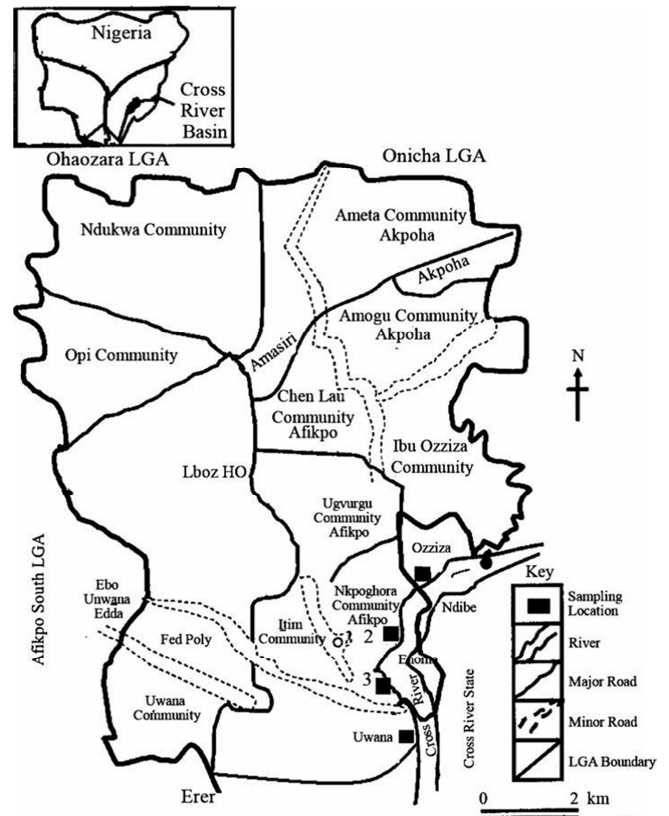


Fig. 1. Map of Afikpo North Local Government Area showing the sampling locations in the Cross River basin (Okoh *et al.*, 2007).

The total catch distribution, mean weight, mean length, parameters of a, b and r of the LWR and the condition factor values of the three fish species are as shown in tables 1-3 below. The values of b significantly (P = 0.05) rose from 1.355 to 3.686 in *C. nigrodigitatus*, 2.302 to 3.477 in *C. auratus* and 1.402 to 2.839 in *C. aluuensis*. The overall length-weight relationship, b values of *C. nigrodigitatus*, *C. auratus* and *C. aluuensis* are 2.597, 2.512 and 2.446 respectively. The overall length-weight relationships of the three species are as seen in figures 2-4 below.

The condition factor values for *C. nigrodigitatus* ranged from 0.63 to 1.33 with overall mean value of 1.13, *C. auratus* had C.F. values of 0.98-1.35 (overall mean value 1.21) and *C. aluuensis* had C.F. values of 1.06-1.84 (overall mean value 1.32) (Tables 1-3).

Table 1. Length-weight relationship and condition factor values of *C. nigrodigitatus*.

Month	n	Length			Weight			a	b	r	C.F.
		Min.	Max.	Mean	Min.	Max.	Mean				
July 2011	36	11.5	18.3	15.1	19.0	81.0	38.2	-0.069	2.525	0.952	1.11
Aug. 2011	37	10.4	17.7	14.5	18.0	60.0	36.5	-0.049	1.372	0.905	1.21
Sep. 2011	41	10.6	17.6	14.0	16.0	56.0	32.2	-0.048	1.355	0.918	1.19
Oct. 2011	34	10.5	17.5	14.3	16.0	80.0	38.5	-0.584	2.535	0.779	0.63
Nov. 2011	33	10.1	29.0	18.8	18.0	157.0	65.1	-0.956	3.229	0.892	1.33
Dec. 2011	31	10.2	17.7	14.4	16.0	62.0	38.2	-1.412	3.686	0.962	1.28
Total	212							-0.091	2.597	0.923	

Table 2. Length-weight relationship and condition factor values of *C. auratus*.

Month	n	Length			Weight			a	b	r	C.F.
		Min.	Max.	Mean	Min.	Max.	Mean				
July 2011	18	10.8	17.5	15.4	16.0	50.0	36.2	-0.046	2.545	0.976	0.98
Aug. 2011	16	12.0	16.2	14.2	25.0	46.0	34.1	-0.019	2.302	0.977	1.19
Sep. 2011	18	12.0	18.1	14.6	16.0	81.0	35.7	-0.064	3.477	0.953	1.15
Oct. 2011	20	10.7	17.1	13.5	17.0	59.0	32.9	-0.016	2.511	0.913	1.35
Nov. 2011	20	10.2	15.2	13.2	17.0	51.0	29.4	-0.042	2.643	0.923	1.33
Dec. 2011	20	10.2	17.4	14.2	22.0	62.0	35.6	-0.029	2.543	0.958	1.25
Total	121							-0.041	2.512	0.943	

Table 3. Length-weight relationship and condition factor values of *C. aluensis*.

Month	n	Length			Weight			a	b	r	C.F.
		Min.	Max.	Mean	Min.	Max.	Mean				
July 2011	18	13.0	18.0	14.7	18.0	53.0	34.1	-0.033	2.799	0.963	1.07
Aug. 2011	18	12.0	17.5	14.8	19.0	81.0	41.6	-0.050	1.402	0.955	1.29
Sep. 2011	20	11.2	17.5	14.2	16.0	52.0	33.2	-0.036	2.977	0.955	1.17
Oct. 2011	18	10.2	16.2	14.3	16.0	47.0	31.7	-0.009	2.353	0.958	1.84
Nov. 2011	19	10.1	17.5	13.1	16.0	81.0	33.6	-0.026	2.839	0.938	1.50
Dec. 2011	7	14.2	17.9	15.4	34.0	48.0	38.4	-0.001	2.525	0.998	1.06
Total	100							-0.020	2.446	0.973	

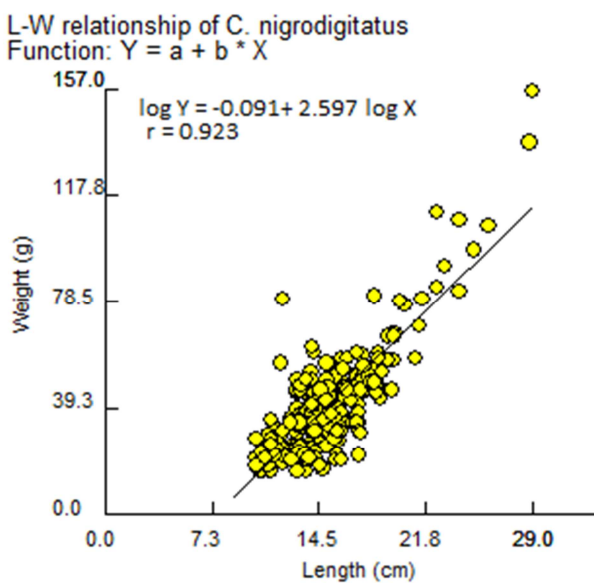


Fig. 2. L-W relationship of *C. nigrodigitatus*.

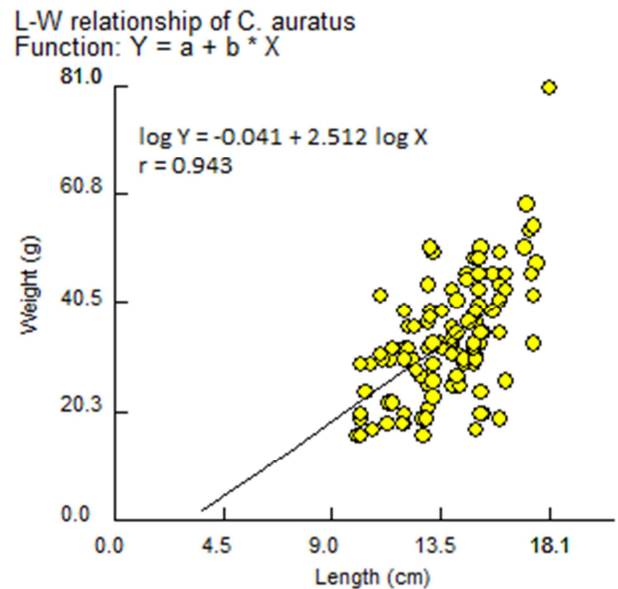


Fig. 3. L-W relationship of *C. auratus*.

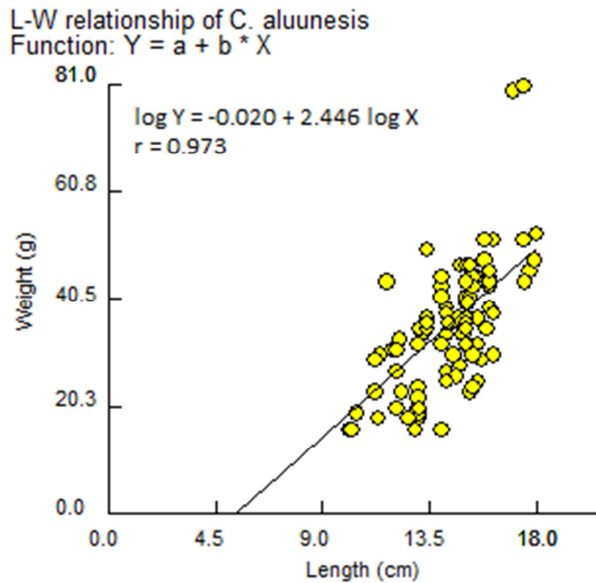


Fig. 4. L-W relationship of *C. aluunesis*.

4. Discussion

Length-weight relationship and condition factor is an important term in the study of feeding habit and growth rate of different species of fish. The total number of fishes sampled were four hundred and thirty three (433). Samples of *C. nigrodigitatus* was two hundred and twelve (212) having total mean length and weight of 18.8 cm TL and 62.8g respectively, *C. auratus* was one hundred and twenty one (121) (total mean length, 14.8 cm TL and weight 34.8g) and *C. aluunesis* was one hundred (100) (total mean length, 13.8 cm TL and weight 34.8g).

b values of the overall length-weight relationship of *C. nigrodigitatus*, *C. auratus* and *C. aluunesis* indicate negative allometric growth pattern for the three species. As stated by Pauly and Gayanilo (1997), b values may range from 2.5 to 3.5 indicating that result of this study is valid. According to Abowei and Ezekiel (2013), The “ a ” and “ b ” values of *Chrysichthys nigrodigitatus* were 0.00471 and 3.21 respectively. The “ r ” value was positive (1.01) which exhibited isometric growth. The value of b for *Chrysichthys nigrodigitatus* Epe lagoon, Nigeria (3.042) show positive allometric or approximate isometric growth when compared with the mean exponent $b = 3.00072$ (Fafioye and Oluajo, 2005). These findings showed variations. Growth pattern of *Chrysichthys nigrodigitatus* and *C. auratus* from Aiba Reservoir, Nigeria using the length-weight regression relationship between weight (W) and standard length (SL), with weight in grams and length in millimeters. This indicated negative allometry for male (2.76), female (2.81) and combined sex (2.78) of *Chrysichthys nigrodigitatus* and isometric growth pattern for male (2.99), female (2.95) and combined sex (2.98) of *C. auratus* (Atobatele, 2013) which is in agreement with the finding of this work. The b value of the length-weight regression relationship for *C. aluunesis* of Ogudu Creek, Lagos, Nigeria was 1.64 indicating negative

allometry (Lawson *et al.*, 2013). This is also in line with the findings of this work. Marked variability in estimates of b is usually observed among different populations of the same species, or within the same population at different times. On the one hand, this may reflect changes in the condition of individuals related to feeding, reproductive or migratory activities (King 1995). On the other hand, sampling related factors or calculation methods may often account for the significant difference in estimates (King 1996). Bagenal and Tesch (1978) reported that if the condition factor “ k ” ≥ 0.5 , the fish is in a good condition. Condition factor values for the three species showed that they were all in good condition. The condition index value *Chrysichthys nigrodigitatus* range from 0.97-1.00 and the condition factor value was 0.99. There was strong association between length and weight of the fish which was in a good condition (Abowei and Ezekiel, 2013). The exact relationship between length and weight differs within species condition sometimes reflects food availability and growth within the period prior to sampling. However, these conditions are variable and dynamic, individual average condition of each population varies seasonally and yearly. The scattered plots show the relationship between length and weight of the fish for the months under study and the correlation coefficients.

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