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LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF CHRYSICHTHYS NIGRODIGITATUS (LACEPÈDE, 1803) FROM ITU, AKWA IBOM STATE, NIGERIA

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ABSTRACT

The length-weight relationship and condition factor of silver catfish (*Chrysichthys nigrodigitatus*) from Itak Nyanyangha landing site along Cross River, Itu, Akwa Ibom State were evaluated for six months (April - September, 2018). The length-weight relationship and condition factor, (k) were determined using the equations: $W=aL^b$ and $K= W*100/L^b$ respectively. The result showed that the month of August recorded the highest number (60 individual fish) of catch while April and May recorded the least number (30 each). The highest weight recorded was 9100g while the least was 8g. In terms of length, longest was 47.5cm and shortest fish was 19.5cm. The b value and Pearson's correlation coefficient, r (in bracket, 2 decimal places) of the monthly data were April: 2.14 (0.83); May: 0.88 (0.49); June: 3.27 (0.97); July: 1.00 (0.50); August: 2.41 (0.80) and September: 3.22 (0.96). Condition factor significantly increased for the months of August and September compared to the other months ($p < 0.05$). In conclusion, *C. nigrodigitatus* exhibited both positive and negative allometric growth pattern and were in good physiological condition.

Keywords: *Chrysichthys nigrogitatus,* Length-Weight, Condition factor, Lower Cross River, Itu, Akwa-Ibom

INTRODUCTION

The relationship between body length and weight is of immerse important in fishery biology, ecology, fisheries management and their stock assessment (Moslen and Miebaka, 2017). Length-weight relationship is an important fishery management tool used in estimating the average weight at a given length group and in assessing the relative well-being of a fish population (Chigeru and Amachree, 2019; Begenal and Tesch 1978). Length- weight relationship and condition factor deals with the careful study of individual in fish population which is an important aspect of fish population dynamics and fish biology. The importance of length weight relationship and condition factors in fisheries biology cannot be overstated as useful for estimating the weight of a fish of a given length, the study of gonad development (Lizama *et al*., 2002); rate of feeding (Atama *et al*., 2013); metamorphoses, maturity and condition (Silva *et al.,* 2015; Onimisi and Oniye, 2010). It is also useful when applied in estimating standing stock biomass and in comparing the development of a fish population from different regions (Ogama *et al.*, 2014; Akinrotimi *et al.*, 2009). Length weight relationships afford the conversion of growth in length equation to growth in weight which is used in stock assessment models, an estimation of biomass from length observations, an estimate of the condition of the fish (relative well-being of the fish) and in comparison purpose. Fish can attain either isometric growth, negative allometric growth or positive allometric growth. In isometric growth, there is no change of body shape as the organism grows. In negative allometric growth, the fish becomes more slender as it increase in weight while in positive allometric growth, the fish becomes relatively stouter or deeper-bodied as it increase in length (Sarkar *et al*., 2013). The condition factor is an estimation of the general well- being of fish (Oribhabor *et al*., 2011; Abowei, 2006). It is based on the assumption that heavier individuals of a given length are better conditioned than less weight fish (Ogamba *et al*., 2014; Abowei and Hart, 2007; Begenal & Tesch 1978). The condition factors have been used as an index of growth and feeding intensity. This factor is a measure of various ecological and biological factors such as degree of fitness, gonad development and the suitability of the environment with respect to the feeding condition (Abowei, 2009).

Chrysichthys nigrodigitatus commonly known as silver catfish belongs to the family of Bagridae. It is widely distributed along the tropical and sub-tropical region (Francis and Sikoki, 2012; Hart and Abowei, 2007; Holden and Reed, 1991; Erondu, 1990; FAO, 1969). In Nigeria, *C. nigrodigitatus* is highly prized food-fish and is among the principal fishes of commercial catches as well as cultivable fish species from the wild (Ezenwa *et al*., 1986). The species is of a great ecological and economic importance as they play important role in the food chain and provide food for the local communities and Nigerian as a whole (Abowei and Ezekiel, 2013). *C. nigrodigitatus* is among the most dominant

species found along the stretches of the Cross River (Francis and Sikoki, 2012; Hart and Abowei, 2007; Erondu, 1990). This research therefore aimed at establishing the length-weight relationship and condition factors of *C. nigodigitatus* in Cross River along Itu, Akwa Ibom State. The data generated will give a vital information on the length and weight as well as the general well-being of the fish during the period of study.

MATERIALS AND METHODS

Study Area

The study was carried out at Itak Nyanyangha landing site along the Cross River in Itu Local Government Area (LGA) of Akwa Ibom State, Nigeria (Fig. 1). Itu LGA is located between Longitude 5º12' 4.72" N and Latitude 7º 59' 1.43" E, and occupies a land area of approximately 606.10 km^2. Itu LGA is bounded in the north and north east by Odukpani Local Government Area in Cross River State and Arochukwu Local Government Area in Abia State, and in the west by Ibiono Ibom and in the South East by Uyo and Uruan Local Government Areas (AKSG, 2017). The Cross River flows and forms a natural boundary between Akwa Ibom and Cross River States. The people are mainly fisher folks, traders in food produce, farmers, sand miners, boat makers and timber sellers.

Samples Collection and Measurement

A total of 249 *Chrysichthys nigrodigitatus* were bought once a month (April - September 2018) from artisanal fishers at Itak Nyanyangha landing site. Samples were immediately placed on ice and measured. The total length (TL, was from the tip of the snout to the extreme of the caudal fin) was measured on a measuring board to the nearest centimeter (cm), while the wet body weight was taken to the nearest grams (g) on a weighing balance after blot drying excess water (Akuna and Amachree, 2019). The length-weight relationship and condition factor were calculated with the formula:

$W=aL^b$ and $K=W*100/L^3$ respectively.

Where: W=Weight of fish (g); a= Intercept of the regression; L=Total length of fish (cm); b=Slope of the regression and K= Condition factor.

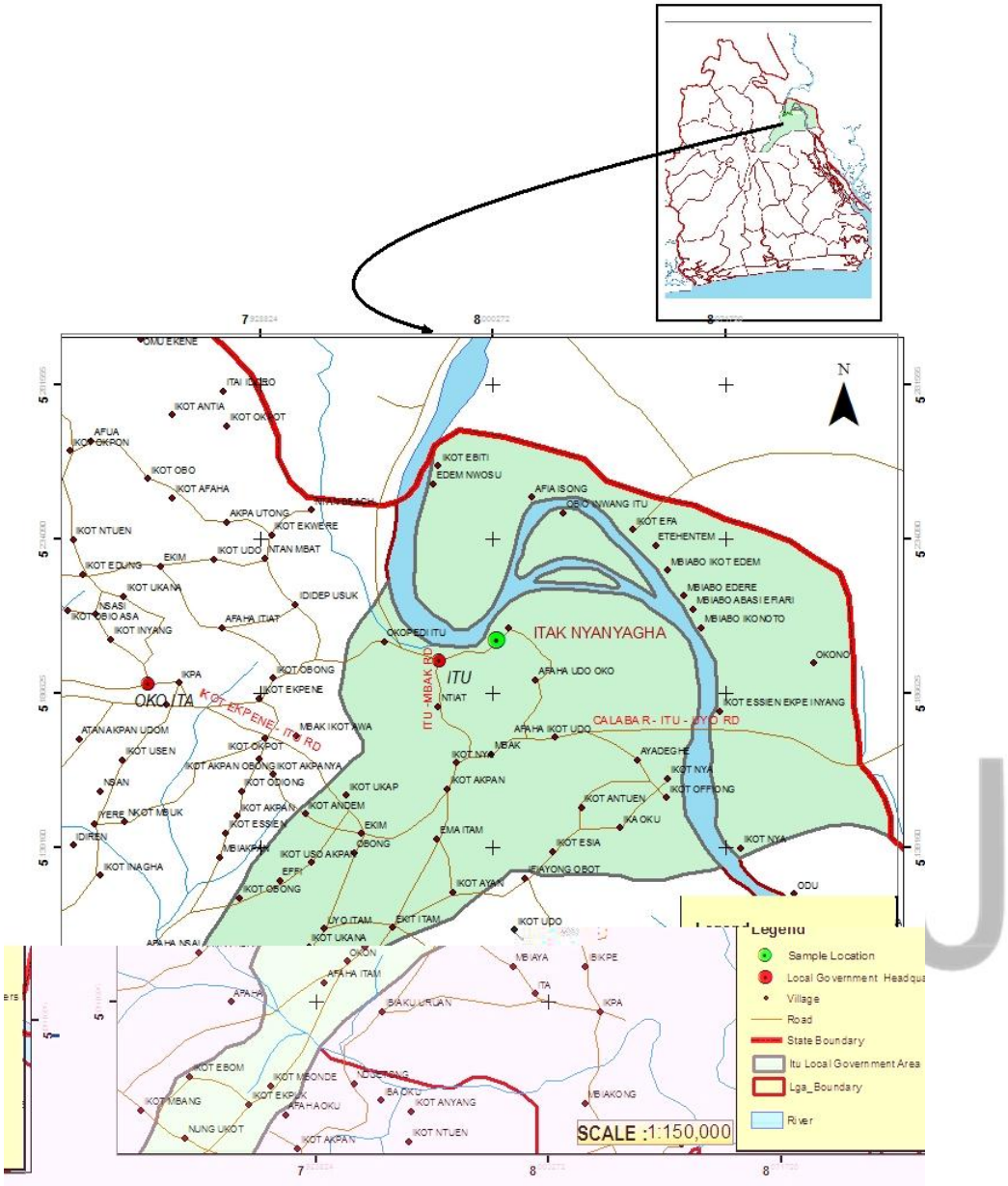

Fig. 1. Map of Itu Local Government Area showing the sampling location.

Statistical Analysis of Data

The data for length and weight were transformed (log10) and subjected to Microsoft Excel for regression analysis. The b (slope) and a (intercept) values were obtained from the linear regression equation (LogW=Loga + bLogL). Pearson's correlation coefficient, r and coefficient of determination, r^2 were also determined. Condition factor (k) was tested for monthly variations by one-way analysis of variance (ANOVA, $p<0.05$) using Minitab for Windows Version 16. The Turkey's post-hoc test was used at 95% confidence limit to provide specific information on which means are significantly different from each other.

RESULTS

Length-weight relationship and condition factor

The result of the monthly length-weight relationship and condition factor (k) of *C. nigrodigitatus* from Itak Nyanyagha landing site, Itu after six months (April - September, 2018) sampling period are shown in (Table 1). A total of 249 fish specimens of *C. nigrodigitatus* were measured for total length and weight for the study period. Table 1 shows the monthly measurements and condition factor. The minimum total length (9.5 cm) was recorded in the month of July while the maximum length (47.5cm) was in the month of April. The least wet weight (8g) was recorded in the month of July, while the highest weight (9100g) was recorded in June.

Fulton's condition factor (K) was also determined (Table 1), the results showed that the least condition factor (0.41) was observed in the month of June, while the highest of 2.76 was observed in the month of September ($p<0.05$). Condition factor significantly increased for the months of August and September compared to the other months ($p<0.05$). The results of the 'b' values is shown in Fig 2. The result showed the lowest b-value (0.8817) in the month of May and the highest (3.2215) in the month of June.

Table 1. Monthly measurements and Condition Factor (k) of *Chrysichthys nigrodigitatus* from Itu Landing Site after six months (April - September, 2018) sampling period.

Months	Total Length (cm)		Wet Weight (g)		Condition Factor (k)		Number of fish sampled
	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	
April	30.5 - 47.5	35.43 ± 4.24	300.0 - 800.0	425.50 ± 132.39	0.67 - 1.13	0.95 ± 0.18^{a}	30
May	19.0 - 30.0	24.59 ± 2.93	77.2 - 185.6	133.11 ± 26.27	0.50 - 1.84	0.94 ± 0.32^{a}	30
June	28.0 - 97.0	39.54 ± 14.96	28.0 - 9100.0	887.84 ± 1898.41	0.41 - 1.74	0.86 ± 0.17^{a}	37
July	9.5 - 19.5	14.63 ± 2.16	8.0 - 100.0	31.23 ± 18.01	0.54 - 1.48	0.87 ± 0.22^{a}	43
August	12.5 - 23.0	16.71 ± 2.13	39.9 - 160.6	76.50 ± 30.78	1.23 - 2.16	1.50 ± 0.19^{b}	60
September	12.0 - 23.8	16.96 ± 3.12	27.8 - 289.3	91.08 ± 57.24	1.21 - 2.76	1.73 ± 0.26^{b}	49

DISCUSSION

Length-weight relationship and condition factor

Length-weight relationship is useful in providing reliable data on the relative well-being and growth patterns of fish (Asuquo *et al*., 2015). In length-weight studies, the regression coefficient (b-value) indicates the growth pattern in fish (isometric or allometric) which is reported to vary between

stocks of same species (Asuquo *et al*., 2015; Ndome *et al*., 2012). When 'b' value is less than 3, it indicates a negative allometric growth in fish, when greater than 3, it indicates a positive allometric growth and when 'b' value is equal to 3, it indicates an isometric growth pattern in fish (Khairenizam and Norma-Rashid, 2002). The b value of the present study was estimated for each month (Fig. 2). The result indicated that the fish exhibited both negative and positive allometric growth patterns. The result is in agreement with earlier works of Abu and Agarin (2016) who reported a mean b valve 2.08 for *C. nigrodigitatus* from Lower Reaches of New Calabar River, Niger Delta. Also, the results agree with the work by Francis and Elenwo (2012) who reported a b-value of 2.00 in same New Calabar River from January to July and July-November, 2015 respectively. Francis (2003), reported that *C. nigrodigitatus* from Andoni River, a brackish water system in two consecutive years exhibited an isometric growth, such difference can point to a stable and more fitted nature of the brackish water environment for the development of *C. nigrodigitatus*. Ogamba *et al*. (2014) reported a negative allometric growth pattern (b = 0.0536) for *C. nigrodigitatus* collected from Odi River, Niger Delta, Nigeria; Uneke, (2013) also reported a similar finding from Ebonyi River, South Eastern Nigeria; The b values of 3.2176 and 3.2215 in the months of (June and September) which show positive allometrics growth agrees with the reports of positive allometric for some *Chrysichthys spp*. in Nigeria fresh water (e.g King 1997, 1996, reported b value of 3.05 for *C nigrodigitatus* population of Lake Asejire and b value of 3.2100 for *T. zilli* in New Calabar River, Nigeria respectively. Abowei and Ezekiel, (2013) reported b-value of 3.21 of *Chrysichthys nigrodigitatus* from Amassoma flood plains). According to Lagler *et al*. (1997) such variations in growth pattern could be attributed to sex, maturity, developmental stage, season and harsh environmental conditions. Also, Froese (2006) stated that length-weight parameters of fish are influenced by both intrinsic and extrinsic factors such as diet, season, stomach fullness, health, preservation techniques, habitat, sex, gonad maturity and annual variation in environmental conditions.

The correlation coefficients (r) of the fishes ranged from 0.4926 - 0.9771 indicated high degree of positive correlation between the total lengths and body weights. The implication is that some fishes were more slender as they increased in weight while some fishes were relatively stouter or deeper-bodied as they increased in length. Condition factor is an important index used in fisheries science to ascertain the relative wellbeing of fish species. Condition factor could be used to reflect the health status of water bodies is influenced by factors such as age, sex, food availability, and environmental conditions. Low condition factor in fish may be attributed to poor environmental conditions and reduced availability of food and prey item (Ekanem, 2000; Abowei and Hart, 2009; Atobatele and Ugwumba, 2011). The condition factor (k) value was calculated for the all the specimens.

Mean condition factor recorded in this study (K=1.16) agrees with works of Abu and Agarin, (2016); Francis and Elenwo (2012) who recorded mean of K=1.34 and 1.31 of *Chrysichthys nigrodigitatus* respectively. Okey**,** Offem and Keremah, (2017) reported mean K values of 1.31 and 1.43 respectively for male and famale *Chrysichthys furcatus* from Cross River at Ahaha. The monthly variation in condition factor (Fig. 2) revealed that August and September recorded the highest mean condition factor 1.59 and 1.66 ($p>0.05$) respectively, while the least valve 0.88 was recorded in June.

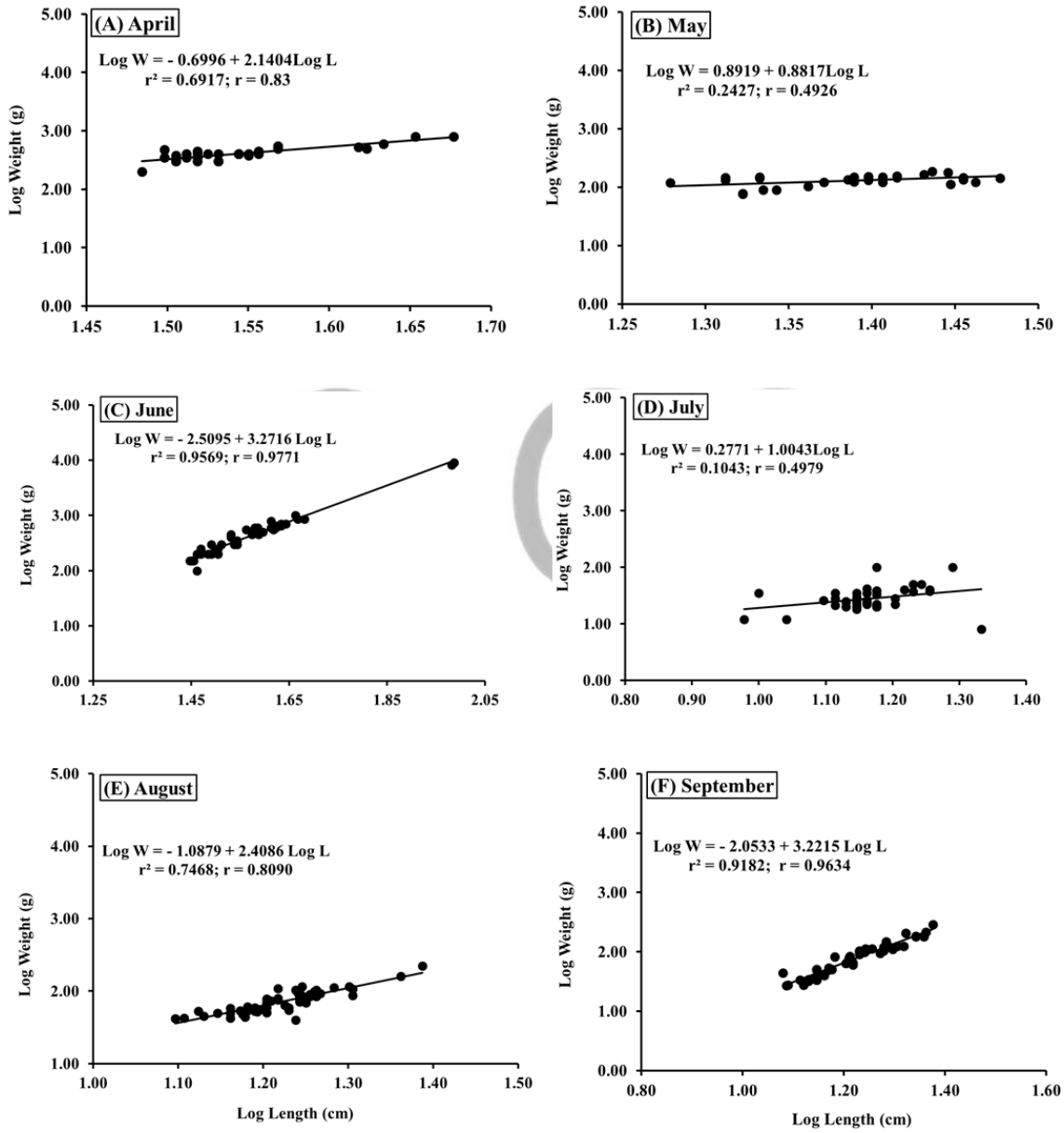

Figure 2. Monthly Length-weight relationship of *Chrysichthys nigrodigitatus* from Itak Nyanyangha Landing Site after six months (April - September, 2018) sampling period, *n*= 30-60.

However, the mean condition factor of 1.16 obtained for the population of *C. nigrodigitatus* in this is higher than 1.08, 0.9673, 0.9159 and 0.7859 reported for Epe lagoon, Badagry Lagoon, Warri River

and Imo River respectively (Ezenwa *et al*.,1986; Lawal *et al*., 2010) and 0.996 reported for Cross River (Offem *et al*., 2008). This is an indication of the good condition of the specimens (Bannister, 1976), therefore *C. nigrodigitatus* population from the lower Cross River would provide excellent brood stocks for aquaculture. The findings of this study show that *C. nigrodigitatus* in the Cross River was in a better condition which might be attributed to availability of nutrition and good environmental condition.

CONCLUSION

The study assessed the length-weight relationship and condition factor of *C. nigrodigitatus* from Lower Cross River, Itu, Akwa Ibom state. The fish exhibited both negative and positive allometric growth patterns and were generally in good condition. The study area seems to be well suited for the growth of *C. nigrodigitatus*. However, further research is needed in the area for proper management of the fish stock.

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