E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2021; 9(3): 32-36

www.fisheriesjournal.com
Received: 15-02-2021
Accepted: 19-03-2021

Ikongbeh OA
Dept. of Fisheries & Aquaculture, University of Agriculture, Makurdi, P.M.B. 2373 Makurdi, Nigeria

Ogbe FG
Dept. of Biological Sciences, Kogi State University, P.M.B. 1008, Anyigba, Kogi State, Nigeria

Solomon SG
Dept. of Fisheries & Aquaculture, University of Agriculture, Makurdi, P.M.B. 2373 Makurdi, Nigeria

Corresponding Author:
Ikongbeh OA
Dept. of Fisheries & Aquaculture, University of Agriculture, Makurdi, P.M.B. 2373 Makurdi, Nigeria

Length-weight relationship and condition factor of *Clarotes laticeps* (RUPPEL, 1829) from Lake Akata, Benue State, Nigeria

Ikongbeh OA, Ogbe FG and Solomon SG

Abstract
Length-weight relationship and condition factor of 505 specimens of *Clarotes laticeps* were collected and analyzed in May 2012 - April 2013 from Lake Akata. The Length-Weight relationship equation for male and female of *Clarotes laticeps* was described by the equation: LogW= –1.9219 + 3.1203 Logl and LogW= –1.7068 + 2.9733 Logl, respectively. The combined length weight relationship for both sexes was Log W = –1.9599 + 3.1530 Logl. The growth exponent (b) of both male and female *Clarotes laticeps* in Lake Akata exhibited isometric growth pattern. Condition factor (k) of *Clarotes laticeps* for each season was greater than one. The mean condition factor for *Clarotes laticeps* in dry season months pooled together (1.79±0.03) was significantly lower than that (1.81±0.03) in wet season months (p>0.05). The correlation coefficients were all positive and highly significant in both male and female *Clarotes laticeps* in Lake Akata.

Keywords: Growth pattern, seasonal condition, *Clarotes laticeps*, Lake Akata

1. Introduction
Catfish are extensively exploited and widely cultivated. They are the fourth most widely cultivated freshwater fish after Carp, Salmon and Tilapia [7]. The wide head catfish *Clarotes laticeps* are pelagic bagrids belonging to the family; Claroteidae found in Africa, [16]. They play an important role in the ecology and fisheries of inland waters and lakes of Africa. Distribution includes the Nile River basin and most of west and central Africa south to the tropic of Capricorn, including the East African lakes. Family Claroteidae was carved out of the traditional Bagridae to reflect a monophylectic group of African catfishes [3]. The most commonly known species are the giraffe catfish, *Auchenoglanis occidentalis* and the African big eye catfish, *Chrysichthyes longipinnus*, *Chrysichthyes*, *Leptoglanis*, and *Parauchenoglanis.* There are about 13 genera and 86 known species of Claroteids in two subfamilies. The sub families are Claroteinae and Auchenoglanidinae. The subfamily Auchenoglanidinae is sometimes classified as a separate family Auchenoglanidinae. This group was also often formerly placed in Bagridae, [16]. *Clarotes laticeps* is found in the Nile, Niger, Senegal, and Volta Rivers; also in Lake Chad. *Clarotes laticeps* inhabit the rivers and swamps. Juveniles of 100-150mm length were common in commercial catches in November and December, [6]. *Clarotes laticeps* are economically important fish species of Akata Lake.
The length-weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group [4] and in assessing the relative well being of a fish population [5]. Many researchers have studied the length-length and length-weight relationships of various fish species from different waters. Notable among these are the reports of [20] for *Hydrocynus forskalli* and *Alestes nurse* in Lower River Benue, [1] *Clarotes lateceps* from the fresh water reaches of the lower Nun river, [10] for *Chrysichthyes nigrodigitatus* and [11] for *Distichodus rostratus* in Lake Akata.
Condition factor compares the wellbeing of a fish and is based on the hypothesis that heavier fish of a given length are in better condition [2]. Condition factors decreases with increase in length [8]. Condition factors of different species of cichlid fishes have been reported based on size, sex, maturity stages as well as seasons. Notable among these are the reports of [19] *Auchenoglanis occidentalis* from the Lower Benue River, [20] *Malapterurus electricus* from the Lower Benue River, Ikongbeh *et al* [10] and [11] for *Chrysichthyes nigrodigitatus* and

Distichodus rostratus from Lake Akata.
Despite the importance of these species to the Lake Akata fisheries, information on the biology of fish species of Lake Akata is limited and has been poorly investigated. It is therefore necessary to carry out a comprehensive study on the biology of fishes of this very important recreational lake aimed at good management. The aim of the present study provides information on the length-weight relationship and condition factor of *Clarotes laticeps* in Lake Akata

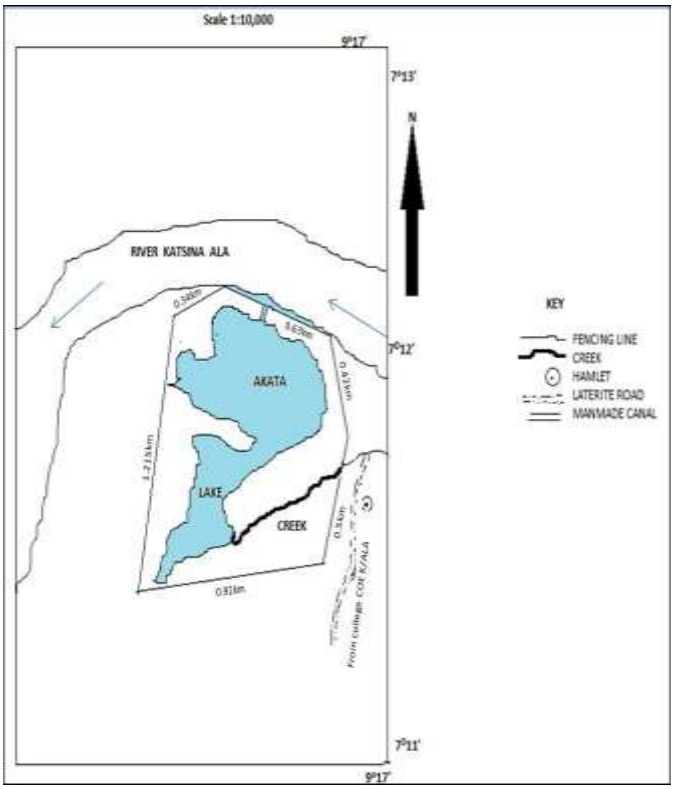
2. Materials and methods

2.1 Study area

The study area, Lake Akata is an ox-bow lake of the River Katsina-Ala and lies between longitude 9º16´ and 9º17´ East and latitude 7º11´ and 7º13´ North (Figure 1). The host town, Katsina-Ala is a riverside resort with a unique feature and the scenic beauty of savannah landscape, supplemented by the famous River Katsina-ala with extensive fadama flood plain covered by numerous lakes scattered over the flood plain one of such lake is the Lake Agbo [15].

2.1.2 Sample Collection

A total of 505 individuals of *Clarotes laticeps* were randomly sampled monthly for one year and usually in the mornings between 07.00hr –0 9.00hr and in the evenings between 16:30hr – 18:30hr. The period of the study was from May, 2012 to April, 2013. The fish specimens used for the study were obtained from fishermen operating on Lake Akata. These fishermen use various fishing gears including hand nets, cast nets and gill nets of various standard mesh sizes (20.2, 25.4, and 30.5mm).



Source: Ministry of Agriculture and Natural Resources, Makurdi, Benue State.

Fig 1: Map of Lake Akata

Canoes were used as fishing craft. Length and weight measurements were taken directly from the landing sites.
The total and standard lengths were measured with a meter rule on measuring board according to [22]. The sex of each fish sample was determined by visual observation using genital evidence.
Length-weight relationship of fish was estimated from the equation: $W = a.L^b$ [24]. The relationship was transformed into a linear form using the logarithm equation: $LogW = a + bLogL$. Where, W = weight of fish (g), L = standard length of fish (cm), a = regression constant and b = the allometric coefficient.
For males and females and both combined sexes by least square regression method.
The condition factor, (k) was determined using the equation: $K = 100.W/L^3$ after [27]. Where, K = the condition factor, W = Weight of fish in (g) and L = Standard Length of fish (cm).
According to [30], fish in good condition will have high K-value greater than 3, than those in poor condition.

3. Results

3.1 Length-Weight Relationship

The Log-Log graphs showing the regression analysis of males, females, and combined sexes were Figures 2, 3 and 4 respectively.
The "a" value for male and female *Clarotes laticeps* was –1.9219 and –1.7068 respectively, while the combined value for both sexes was –1.9599. All the three exponents of ("b") obtained for males, females and both sexes combined were less than 3; this means the growth pattern was allometric. The exponent ("b") values for male and female of the species were 3.1203 and 2.9733 respectively. Both males and females exhibited isometric growth pattern.
The Length-Weight relationship equation for male and female *Clarotes laticeps* is expressed by the regression equation: LogW= – 1.9219 + 3.1203 Log l (r^2 = 0.9371) and LogW = –1.7068 + 2.9733 Logl (r^2 = 0.9477), respectively. The combined length weight relationship for both sexes is expressed by the regression equation: Log W = – 1.9599 + 3.1530 Logl (r^2 = 0.9563). There was a higher correlation coefficient value in the length-weight for both sexes of *Clarotes laticeps*. The correlation coefficients were all positive and highly significant. The males weighed more than the females.

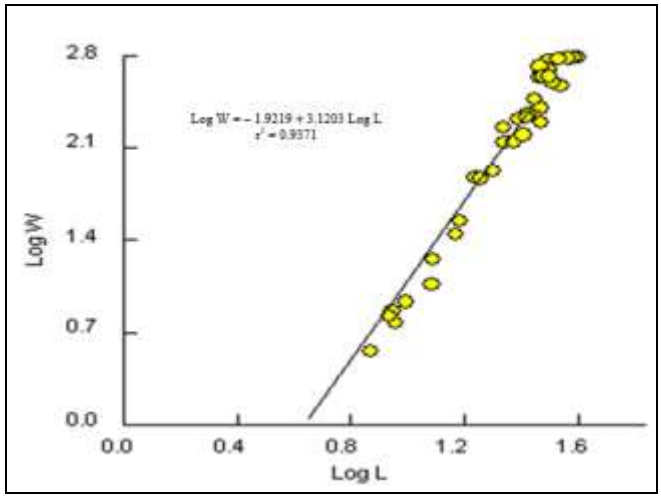


Fig 2: Length-Weight Relationship of *Clarotes laticeps* Males from Lake Akata, Katsina-Ala

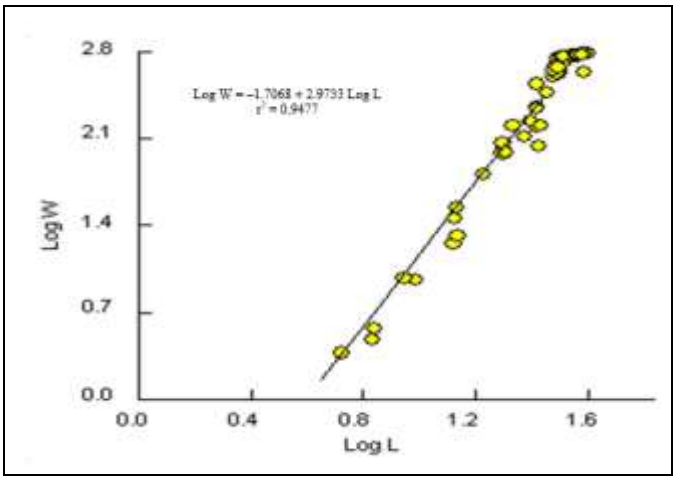


Fig 3: Length-Weight Relationship of *Clarotes laticeps* Females from Lake Akata Katsina-Ala.

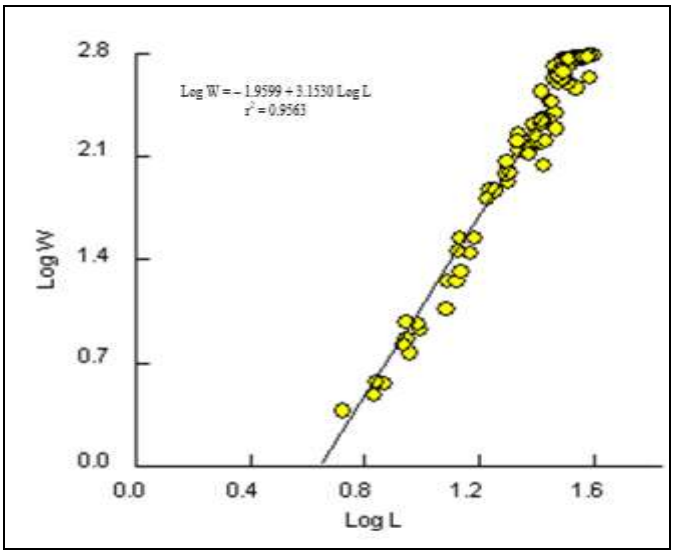


Fig 4: Length-Weight Relationship of *Clarotes laticeps* (Combined Sexes) from Lake Akata, Katsina-Ala

3.1.2 **Condition Factor**

The mean condition factor (k) of *Clarotes laticeps* is presented in (Table 1). The mean condition factor was 1.80±0.02 for *Clarotes laticeps* (combined Sexes). The results indicated that there were no significant differences between the condition factors of male and female of *Clarotes laticeps* (p>0.05). Figure 5 show the seasonal variation in mean monthly condition factor (k) of *Clarotes laticeps.* The males had high k-values of 1.91 in December and 1.93 in February, while that of females were 2.06 in January and 2.08 in April. The k-value equally dropped to a minimum of 1.62 in June for males, while that of females was 1.61 in October. The mean condition factor for *Clarotes laticeps* in dry season months pooled together (1.79±0.03) was significantly lower than that (1.81±0.03) in wet season months (p>0.05) (Table 2).

Table 1: Mean Condition Factor of *Clarotes laticeps* in Lake Akata, Katsina-Ala.

Sex	N	Condition Factor (K)	T-test	P value
Male	249	1.77±0.03	1.50	0.14
Female	256	1.84±0.03		
Combined	505	1.80±0.02		

Table 2: Seasonal Variation in Condition Factors of *Clarotes laticeps* in Lake Akata, Katsina-Ala.

Season	N	Condition Factor (K)	T-test	P value
Wet	284	1.81±0.03	-0.47	0.637
Dry	221	1.79±0.03		

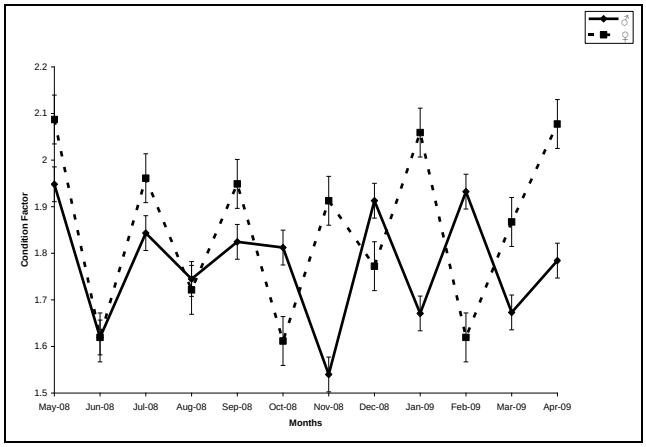


Fig 5: Monthly Variation in Condition Factor of *Clarotes laticeps* from Lake Akata in Katsina-Ala.

4. Discussion

There was observed variation in the "b" value of the fish species under study, it showed that the rate of increase in body length is not proportional to the rate of increase in body weight. Parameters 'b' is an expression of the type of growth and usually falls between 2.5 and 3.5 [26]. According to [25], "b" values may range from 2.5 to 3.5 suggesting that result of this study is in line. [14] reported an approximately isometric growth pattern for *Chrysichthyes nigrodigitatus* from Epe Lagoon in Lagos, Nigeria with "b" value of 2.82. [10] reported isometric growth for *Chrysichthyes nigrodigitatus* from Lake Akata, Nigeria. They reported an isometric growth pattern with "b" values of 3.0340 and 2.8011 for male and female *Chrysichthyes nigrodigitatus* respectively. This agrees with that in the present study (3.1203♂ and 2.9733♀). There was a higher correlation coefficient value in the length-weight for both sexes of *Clarotes laticeps*. The graph of log transformation show that the weight increases faster at lower lengths than at higher lengths. The variation in "a" value could be due to number of factors known to influence the length-weight relationship in fishes, including sex, gonad maturity, growth phase, health, stomach fullness, seasonality size range, health and general fish condition and preservation techniques [9]. Both sexes of *Clarotes laticeps* exhibited isometric growth, several authors have reported isometric growth pattern for different fish species from various water bodies. [17] reported isometric growth pattern for *Distichodus species* from Anambra River, Nigeria. [20] also reported isometric growth pattern for *Malapterurus electricus* from Lower Benue River. In a similar study [18] reported isometric growth for *Chrysichthyes nigrodigitatus* from Cross River.

It was observed in the present study, that mean condition factor for the fish species were of values of "1" and above which indicate that fish species are doing well in the Lake. When "K" is greater than unity, the fish species is heavy. The condition factor of the fish species in this study is favourably comparable with condition factors of different tropical fish species investigated and reported by [21] for *Hydrocynus forskalli* and *Alestes nurse* in Lower River Benue, [1] *Clarotes*

lateceps from the fresh water reaches of the lower Nun river, [10] for *Chrysichthyes nigrodigitatus*, and [11] for *Distichodus rostratus* from Lake Akata. The condition factors of male and female sexes of *Clarotes laticeps* (K= 1.77, and 1.84 respectively) in Lake Akata is lower than values (2.26 and 2.27 respectively) reported for *A. occidentalis* in River Rima, North western Nigeria by [29].

The result of the current study indicated that there was no significant differences between the monthly condition factors of males and females of *Clarotes laticeps* ($p>0.05$), on the contrary to *Brycinus nurse* [28], but the study was in agreement with the values reported for different cichlid fish in Nigeria.

It was found that the wet season condition factor of *Clarotes laticeps* was higher than dry season values The condition factor for the combined sexes of *Clarotes laticeps* in dry season (1.79±0.03) was significantly lower than that (1.81±0.03) in wet season ($p>0.05$). The higher 'k' recorded during the rains may be due to more food availability, favourable environmental condition and gonadal development. The seasonal condition factor of the fish species showed that there was no significant differences in the condition factor between dry and wet seasons ($p>0.05$). Seasonal variation in condition factor of fish has been reported for *Leuciscus lepidus* [13] and *Brycinus nurse* Saliu [28, 11] reported *Distichodus rostratus*, [12] reported *Auchenoglanis occidentalis*. This is contrary to the finding of the study. These differences not withstanding [23] noted that condition factor is not constant for a species or population over a time interval and might be influenced by both biotic and abiotic factors such as feeding regime and state of gonadal development [28].

5. Conclusion

In conclusion, both sexes of *Clarotes laticeps* exhibited isometric growth pattern. There was a higher correlation coefficient value in the length-weight for both sexes of *Clarotes laticeps*. The correlation coefficients were all positive and highly significant. The condition factor of *Clarotes laticeps* in dry season (1.79±0.03) was significantly lower than that (1.81±0.03) in wet season ($p>0.05$).

6. Acknowledgements

The authors appreciate the Department of Fisheries and Aquaculture, University of Agriculture, Makurdi, for approving the use of the laboratory and providing necessary facilities for this study.

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