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Condition factor, size distribution and length-weight relationship of the *Claroteslaticeps* (Claroteidae) in the lower River Niger

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Abstract
Samples of *Clarotes laticeps* were collected biweekly for a period of 36 months (January, 2010 to December, 2012) from the lower reaches of the River Niger. The fish samples were taken to the Fisheries Laboratory of the Delta State University, Asaba Campus, where they were sexed, measured, weighed and grouped into 12 size categories. From the data gathered, the length- weight relationship and condition factor (K) were determined for males, females and the combined sexes. A total of 1650 specimens comprising of 978 males and 672 females was collected during the period. Size composition of collected samples showed that the population was dominated by juveniles and medium size fishes, with fewer larger specimens. The length weight relationships established for the population of *C laticeps* studied were; log w= 3.13 logl-1.89 (l= standard length), log w= 3.15 logl-1.86 and log w= 3.14 log l-1.88 for males, females and combined sexes, respectively. Mean Condition Factor values for the different size categories ranged from 1.77 – 2.49 for males, 1.76- 2.64 for females and 1.76- 2.51 for combined sexes. The K values obtained for the sampled fish population indicate good condition for the population of *Clarotes laticeps* studied. This is an indication of well-being and health status of the population. In addition, the size composition of the population showed that it has potential for growth.

Keywords: condition factor, *Clarotes laticeps,* size distribution, lower, River Niger.

1. Introduction

The length-weight is an important piece of information in studying the natural history of fishes. Apart from allowing predictions of weight from length in yield assessment [1], it is used in the estimation of stock size [2]. The length-weight relationships is an indication of the condition factor and the general well-being of the fish [3], and could also be used for comparing the population of the same species from different environment [4]. It varies depending on the condition of life and environment, and this variation indicates the suitability of the environment of the fish [5].

Data on length-weight relationships of tropical fish species is therefore, vital to the estimation of standing crop, as well as the exploitation rate of the fish for the sustainable management of the fishery. Such management effort is very necessary in the light of over exploitation of wild stock as a result of increasing demand for fish, and the use of obnoxious fishing methods which further compounds the problem of depleting wild fish stock.

Clarotes laticeps offers an attractive profile for scientific investigation as a commercial fish species in the River Niger. It constitutes a significant portion of the total fish catch of the artisanal fishermen who exploit the River Niger for their socio- economic needs [6]. The significance of this could be appreciated against the background of the numerous consumers who rely greatly on the supply from this source to meet their daily fish protein requirements. It is therefore, imperative that the conservation of the fish could ensure the availability of the fish. This would substantially improve the socioeconomic well-being of the fishermen who ply their trade daily on the Niger, while at the same time satisfying the nutritional needs of the inhabitants of the area.

Inspite of the importance *C. laticeps* as a commercial fish species of the River Niger, information on aspects of its biology with respect to the river is very scanty. The current study was executed to provide vital information on the fish condition or “well-being”, length

–weight relationship in the fish population, as well as the size distribution. Such information is needed for effective management of the fish in the River Niger system, thereby ensuring sustainability.

In the lower Niger, commercial and industrial activities are quite rife. Such activities include large scale farming along the banks of the river, oil exploration and the damming of the river and, recently the federal government concluded plans to dredge the River Niger. The consequences of these activities could lead to further serious impacts on the population and the size composition of the fish in the river. Also, these activities could result in the gradual destruction of their breeding and feeding sites. Thus, a sharp decline in fish production is envisaged, supporting the fear of the eventual extinction of these species [7], as recruitment from the wild may no longer be sustainable. Therefore, the conservation of these freshwater fish species is very necessary in order to meet the economic and biological needs of the people, especially the artisanal fishermen who depend solely on the fishery resources of the River Niger for their livelihood

2. Materials and Methods

2.1 Fish sampling

Fish samples used for the study were collected for three years between January, 2010 and December, 2012 from the lower reaches of the River Niger, between Illushin in Edo State and Niger Bridgehead, Asaba, Delta State, Nigeria (Figure 1).

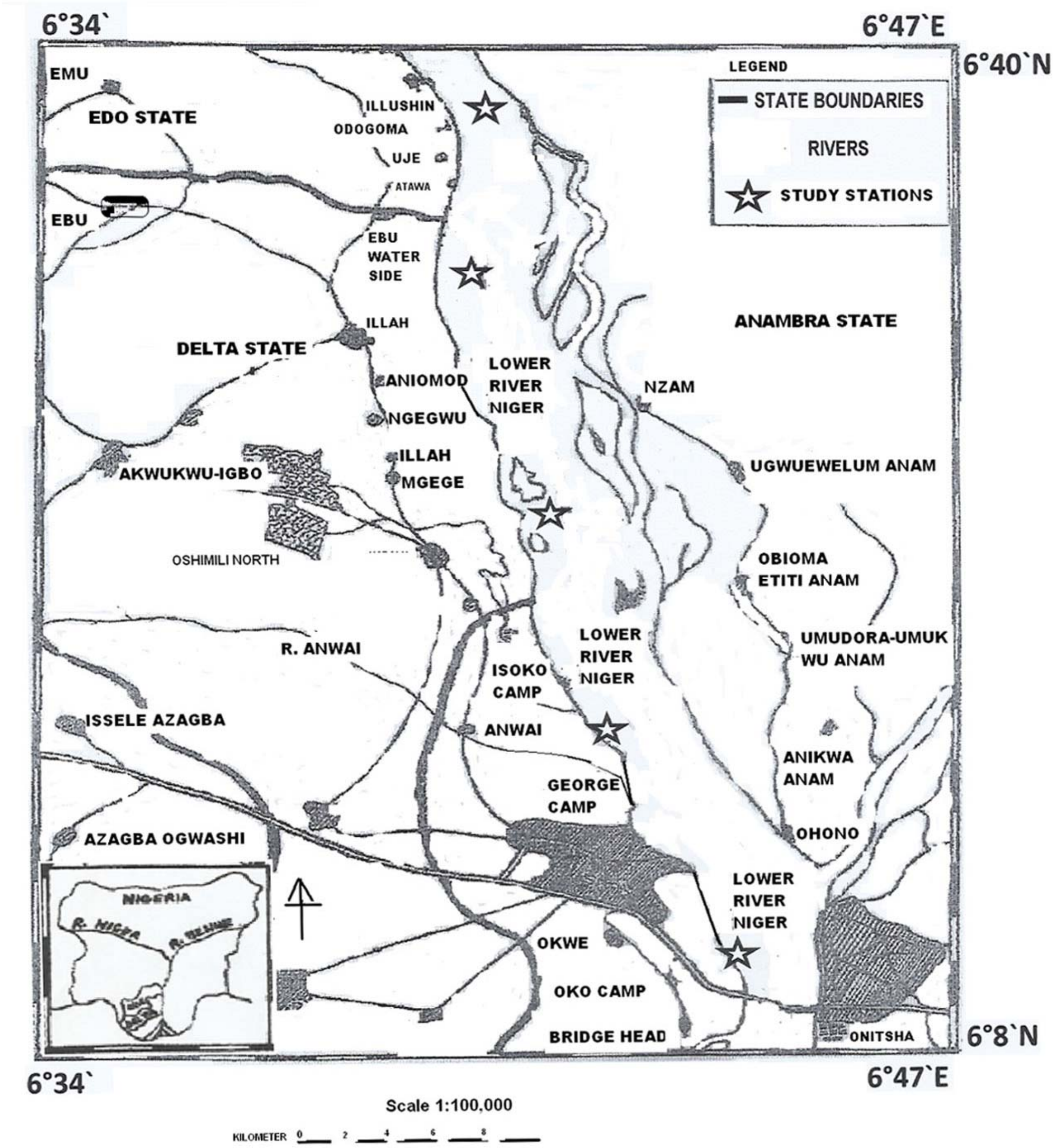

Fig 1: Map showing the study area

Fish sampling was done twice a month, usually from 7 am in the morning to 11 am, with the aid of gill nets, longlines and local 'mari' traps. In the laboratory, the fish were sorted according to the stations where they were caught and the sex of sample determined. The standard length of each specimen was taken to the nearest 0.1 cm with the aid of a measuring board, while the wet weight of each fish sample was determined to the nearest 0.1 g by using Larks torsion balance.

2.2 Length- weight relationship
Length – Weight relationship of fish samples was determined using the equation:

$$W = a1^b \quad \ldots\ldots\ldots\ldots\ldots\ldots.. [8]$$

Where W = Weight in grams, L = Standard length of the fish in centimeters, and the values 'a' and 'b' estimated using the least square method [9] by the logarithmic transformation, using the expression

$$\text{Log } W = \log_a + b \log 1 \text{ (Standard length\}}$$

2.3 Condition factor
The condition factor (K) of each fish was calculated from the relationship.

$$K = \frac{W \times 100}{L^b} \quad \ldots\ldots\ldots\ldots\ldots.. [10]$$

Where W = body weight (gm)
L = length (standard length) in cm.
b = growth exponent assumed to be 3.

2.4 Statistical analysis
Relationship between length and weight was determined by multiple regression analysis.

3. Results
A total of one thousand, six hundred and fifty fish samples was collected during the sampling exercise, comprising of 978 males and 672 females.

3.1 Size frequency and condition factor distribution in males
The length frequency, weight and condition factor distribution of male *C. laticeps* sampled are presented in Table 1. The highest number of male fish caught was 271 and this was recorded in the 32.5 – 37.4 cm, standard length category. This category had a mean weight of 937.8 g. This was followed by the class range 12.5 – 17.4 cm which had a total of 123 individuals and a mean weight of 63.0 grams. The least number of male *C. laticeps* caught occurred in the 57.5 – 62.4 cm standard length category, with only 4 individual with a mean weight of 4,900 g, while only 5 individuals with a mean weight of 5,100 g, was recorded in the largest length category of 62.5-67.4 cm.

The least mean condition factor value was recorded in the smallest size category of 7.5-12.4 cm, standard length, with a mean K of 1.77 and a range of 1.28-2.27. The highest value occurred in 47.5-52.4 cm category, with a recorded mean K of 2.49 (1.96-2.67). The least K recorded for an individual male sample was 0.50. This occurred in the 27.4-32.4, cm standard length category, while the highest was 3.35 recorded in the 32.5-37.4 cm category.

Table 1: Length, weight and condition factor distribution of sampled male *C. laticeps* in the Lower Niger River

Class Interval (SL, cm)	No	Mean, SL (Standard length) Cm	Mean Weight (g)	Mean K (Condition factor)
7.5 – 12.4	106	10.4	19.5	1.77 (1.28–2.27)**
12.5 – 17.4	123	15.1	63.0	1.77 (1.16 – 2.03)
17.5 – 22.4	121	19.5	176.7	2.29 (1.42 – 2.8)
22.5 – 27.4	24	25.0	355.0	2.17 (1.30 – 3.28)
27.5 – 32.4	136	30.0	538.0	2.00 (0.50 – 3.00)
32.5 – 37.4	271	35.5	937.8	2.09 (1.37 – 3.35)
37.5 – 42.4	86	39.4	1352.2	2.20 (1.46 – 2.65)
42.5 – 47.4	39	46.0	2,225.5	2.26 (0.55 – 2.75)
47.5 – 52.4	42	47.8	2718.9	2.49 (1.96 – 2.67)
52.5 – 57.4	21	56.2	3351.4	1.87 (0.55 – 2.10)
57.5 – 62.4	4	61.0	4,900.0	2.16 (2.14 – 2.16)
62.5 – 67.4	5	65.5	5,100.0	1.81 (1.77 – 1.89

**Range of condition Factor (k)

3.2 Size frequency and condition factor distribution in females
Table 2 provides the length frequency, weight and condition factor (K) distribution in the females. The greatest number of females sampled (119) were found in the class range of (32.5 – 37.4cm) with a mean weight of 942.6 g. This was followed by the class range 27.5 – 32.4 cm which had a total of 108 female individuals and a mean weight of 586.3 g. Only 7 individuals were sampled in the 47.5 – 52.4 cm category, representing the least frequency in the size distribution of the females. Relatively fewer females were caught at the lower size categories. For instance in class 7.5 – 12.4 cm, which is the smallest size category, only 58 females were sampled, while the next higher size group (12.5 – 17.4 cm) recorded 59 female samples.

The smallest female size category, 7.5-12.4 cm gave the least mean K of 1.76, with K values ranging from 1.20 to 2.35. The highest mean K value of 2.54 was recorded in the 22.5-27.4 cm standard length group, with individual K values ranging between 1.39 and 3.04.

Table 2: Length, weight and condition factor distribution of sampled female *C. laticeps* in the lower Niger River

Class Interval (SL, cm)	No	Mean, SL (cm)	Mean Weight (g)	Mean K (condition factor)
7.5 – 12.4	58	10.6	21.1	1.76 (1.20 – 2.35)**
12.5 – 17.4	59	15.1	77.5	2.23 (1.45 – 2.67)
17.5 – 22.4	99	20.6	225.3	2.50 (1.19 – 3.51)
22.5 – 27.4	62	25.7	453.0	2.64 (1.39 – 3.04)
27.5 – 32.4	108	29.2	586.3	2.35 (1.67 – 3.02)
32.5 – 37.4	119	34.54	942.6	2.27 (0.70 – 3.55)
37.5 – 42.4	109	39.2	1403.8	2.33 (0.5 – 3.60)
42.5 – 47.4	51	44.2	2051.0	2.37 (1.86 – 2.83)
47.5 – 52.4	7	48.6	2432.9	2.12 (1.22 – 2.67)

**Range of condition factor (k)

3.3 Size frequency and condition factor distribution in the combined sexes

The length frequency and weight distribution of the combined sexes are presented in Table 3.

In the combined fish samples, the 32.5 – 37.4 cm standard length group had the largest number caught with a total of 309 samples and a mean weight of 939.4 g. The least number of 4 fish samples was recorded in the 57.5 – 62.4 cm size group, with a mean weight of 4,610 g. Generally, the distribution shows a steady increase in number from smaller size groups, with peaks at the size groups 27.5 – 32.4 cm and 32.5 -37.4 cm. Fewer samples were progressively recorded as fish size increases.

The smallest size category (7.5-12.4 cm) had a mean K value of 1.76, representing the least, while the 22.5-27.4 cm size category gave the highest mean K value of 3.04. The K values for female samples were generally higher than those of the males.

Table 3: Length, weight and condition factor distribution of sampled combined sexes of *C. laticeps* in the lower Niger River

Class Interval (SL, cm)	No	Mean, SL (cm)	Mean Weight (g)	Mean K (condition factor)
7.5 – 12.4	164	10.5	20.3	1.76 (1.2 – 3.27)**
12.5 – 17.4	182	15.1	67.7	1.92 (1.54 – 2.67)
17.5 – 22.4	220	20.0	198.0	2.36 (1.62 – 2.85)
22.5 – 27.4	86	25.5	425.7	2.51 (1.31 – 3.04)
27.5 – 32.4	244	29.7	560.0	2.35 (1.2 – 3.02)
32.5 – 37.4	390	35.2	939.3	2.14 (0.6 – 3.0)
37.5 – 42.4	194	39.3	1380.4	2.26 (0.5 – 3.60)
42.5 – 47.4	91	44.9	2110.5	2.31 (0.54 – 2.83)
47.5 – 52.4	49	47.9	2677.7	2.43 (1.22 – 2.67)
52.5 – 57.4	(21)	57.0	3599.2	1.93 (0.58 – 2.16)
57.5 – 62.4	4	61.0	4610.0	2.16 (2.14 – 2.16)
62.5 – 67.4	5	65.5	5100.0	1.81 (1.77 – 1.89)

**Range of condition factor (k)

3.4 Length –weight relationship of *C. laticeps*

The length-weight relationship in males, females and the combined sexes are presented in Figures 2, 3, and 4 respectively.

The regression of the log of the weight on the log of standard length of samples of male *C. laticeps* is shown in Figure 2 The relationship between standard length and weight is represented by the equation LogWt = 3.13 logSL – 1.89. In the female samples this relationship is presented as LogWt = 3.15 Log SL-1.86, where Wt is the weight of the fish in grams and SL is the standard length (in cm) as shown in Figure 3. This relationship is however expressed as LogWt = 3.14 LogSL – 1.88, in the combined sexes (Fig. 4).

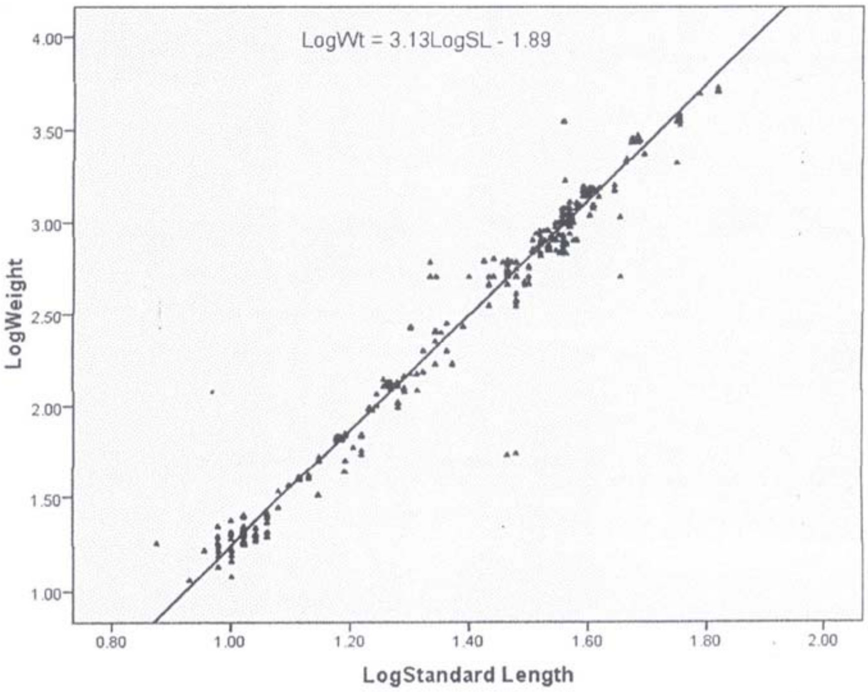

Fig 2: Regression of Log of the Weight on the Log of Standard Length samples of Male *C. laticeps* caught in the Lower River Niger.

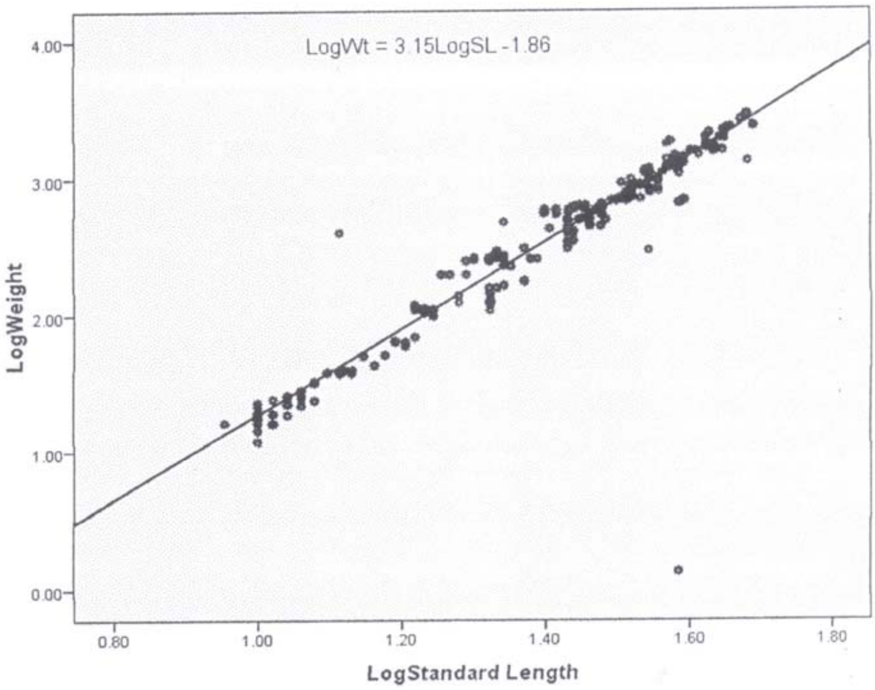

Fig 3: Regression of Log of the Weight on the Log of Standard Length of Female *C. laticeps* Sampled in the Lower Niger.

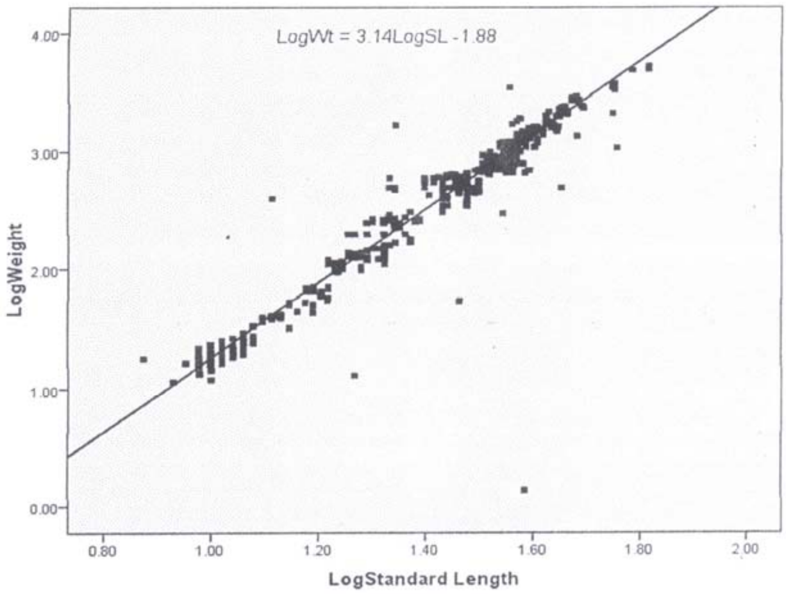

Fig 4: Regression of Log of the Weight on the Log of Standard Length of the combined sexes *C. laticeps* Sampled in the Lower Niger.

4. Discussion

4.1 Length-weight relationship

The determination of the length weight relationship of the fish studied was considered to be of major interest, since apart from predicting the average weight of the fish at a given length [11], it is equally employed in assessing the well-being of the fish population in a given water body [12] as well as providing very important information about a population by describing the structural characteristics within the population [13]. It also helps in the prediction of potential yield and the determination of size at capture to obtain optimum yield, as these parameters are a function of the weight of the fish [14].

The length-weight data generated in this study yielded different length- weight relationship for the males, females and the combined sexes. Computed regression equation established the relationship Log wt =3.131 Log SL-1.89 for the males, while Log wt=3.15log SL-1.86, represented the length weight-relationship in females. In the combined sexes, the length-weight was derived as, Log wt=3.14 Log SL-1.88. These relationships show great differences, compared with those established for another population of *C. laticeps* from the freshwater reaches of the lower Nun River [15]. In that study, the length-weight relationship for a combined sample (male and female) of *C. laticeps* was given as,

$$\log wt = 2.88 \log l + 0.158. \ (l = \text{total length}).$$

Population variations that occur in different localities have been differentiated on the basis of length-weight data. The “b” values obtained for the population of *C. laticeps* in the lower River Niger whether determined using standard length or total length were found to be within the range of 2.5-5.3 established for tropical fishes [16]. Assessment of the growth pattern of *C. laticeps* in the locality studied indicated isometric growth for the fish population. This observation agrees with the isometric growth reported previously in a population of *C. laticeps*, in the fresh water reaches of the lower River Nun [15]. However, the “b” values, in absolute terms, were different. Differences in locality could have accounted for this. Also, isometric growth pattern has been reported in *Chrysichthys auratus*, a close relative of *C. laticeps* from the southern part of the Nile River. However, variability in the growth pattern within the same species has been reported in a population of *Chrysichthysnigrodigitatus,* from three locations of study [18]. The study indicated isometric growth for one of the three locations of study, while reporting allometric growth for the fish samples collected from the other two locations. Following from the above observation it is quite possible to encounter such variability in the growth pattern of *C. laticeps* studied elsewhere.

The largest specimen of *C. laticeps* collected in this study measured 65.5 cm, in standard length and 78 cm (total length). Previous studies established an Lmax value of 59.1 cm (TL) for the population of *C. laticeps* in the lower River Nun [15], in contrast to the Lmax of 100 cm (TL) reported for the same fish species in the River Niger [19]. The relatively small Lmax value of *C. laticeps* reported in the Lower Nun River could possibly suggest, that the population of *C. laticeps* in that river, were of smaller sizes than those in the River Niger.

4.2 Condition factor

The ranges of condition factor obtained in this study were generally high compared to those obtained for the same fish in the lower Nun River in a study [15]. In that study the mean condition factor obtained from combined male and female sexes was 0.96, in contrast to 2.16 obtained in this study. The use of standard length in the computation of condition factor in this study, as against total length used by the workers in the lower reaches of the Nun River, could possibly account for the differences in the values recorded in the two locations. However, condition factor values from the Niger Delta for some catfishes have been generally low. A range of 0.77 – 0.81 was reported for *Chrysichthys filamentosus* in Oguta lake [20]. Also, a range of 0.49-1.8 was recorded in a similar population in Andoni River [21].

The wide variation in the condition factor that occur among fishes have been attributed to factors such as location, season and food availability [22, 23, 24]. Condition factor in *Distichodus* species was observed to be higher during the wet seasons and lower during the dry season, as reported in a study [25]. Such differences associated with seasons were observed in this study with higher wet season and lower dry season values. The higher wet season condition factor value was associated with increased food availability, occasioned by flood; and gonadal development associated generally with fish during the flood season. While the low dry season values were adduced to physiological stress due to changes in physical and chemical condition of the habitat, and reduced availability of food [25]. In a population of *C. nigrodigitatus* investigated in the Cross River [24], it was reported that smaller size specimens had higher condition index than bigger ones. This was attributed to smaller fishes being more efficient at finding food than the bigger ones. The results obtained in this study did not confirm this observation, as the condition factor distribution among the samples of *C. laticeps* collected in this study did not show a higher condition factor in the smaller specimens, compared to those of the bigger sizes.

5. Conclusion

The size composition of samples indicated that the population of *C laticeps* studied had a higher proportion of juveniles and maturing medium size groups, with fewer representation in the larger and more mature group. Although few specimens were recorded in the bigger categories of samples collected, it could be suggested that recruitment of new individuals would not however, be grossly affected, as the bulk of the sampled population comprised more of the maturing individuals that could sustain the population of *C laticeps* in the area. Thus, the size distribution of the population studied indicates a population which has potential for growth.

The condition factor values (K) obtained for the fish population showed that the population was in good condition, an indication of the well-being and healthy status of the population. It is equally an indication of the ability of study environment's ability to sustain the population of *C laticeps*.

6. References

1. Pauly D. Editorial Fishbyte section: Nage. The ICLARM Quarterly 1993; 16(2):2-26
2. Maity DS, Chanda S, Akhand AA, Hazra SC. Length weight relationship of four commercially important marine fishes of Northern Bay of Bengal, West Bengal, India, 2012.
3. Diaz IS, Garcia RA, Acero CB, Naras G. Length-weight relationship of demersal fish from the upper continental slope off Columbia. The ICLARM Quarterly 2000; 23(2):23-25.
4. Renjin PK, Bijoy NS. Length-weight relationship, condition factor and morphometry of gold spot mullet Liza parsis from Cochin estuary. Indian Journal of Geo-Marine Sciences 2011; 40(4):567-571.
5. Lagler KF. Length-weight relationship and condition factor of common minnow, *Esomus clauricus* from different fresh water environments Zoological Journal of the Limnological Society 1956; 62(4):349-354.
6. Holden M, Reed W. West African Freshwater Fishes. Longmans Ltd London, 1972, 33.
7. Stiassny M. The medium is the message: Fresh water biodiversity in Peril in Craft J and F. Gifo (eds): Biodiversity science and policy, Columbia University Press, 1998, 53-71.
8. Pauly D. Length-converted catch curves. A powerful tool for fisheries research in the tropics. ICLARM, Fishbyte 1984; 2(3):9-10.
9. Ricker WE. Linear regression in fisheries research. Journal of Fisheries Research Board of Canada 1973; 30: 409-434.
10. Bannister JVC. The length–weight relationship, condition factor, gut content in the dolphin fish, *Coryphaena Hippurus* (L). Mediterranean Journal of Fish Biology 1976; 9:335-338.
11. Beyer, J.E. (1987). On length-weight relationships computing the mean weight of the fish of a given length class Fish byte 1987; 5(1):11-13.
12. Bolger T, Connoly PL. The selection of suitable indices for the measurement and analysis of fish condition. Journal of fish biology 1989; 34:171-182.
13. LeCren ED. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). Journal of Animal Ecology 1951; 20:201-219.
14. Barros SE, Mosa SG, Regidor HA, Suhring SS. Relaciones longitude-peso em peces del embalse cabra corral, Salta, Argentina. *Boletin de la sociedad de biologia de concepcion* 2001; 72:25-30.
15. Abowei JFN, Davies AO. Some Population parameters of Clarotes laticeps (Ruppel, 1929) from the freshwater reaches of the lower Num River, Niger Delta, Nigeria. American Journal of Scientific Research 2009; 2:15-19.
16. Bagenal TB, Tesch FW. Age and Growth. In Bagenal, T. B. (ed) methods of assessment of fish production in fresh water Oxford, Blackwell Scientific Publications, 1978, 101-136.
17. Shenouda TS, Fatten FA, Mahmoud MR, Ray MM. A detail Study on age and growth for *Chrysichthy auratus* and *Chrysichthys rueppelli* from the southernmost part of the River Nile (Egypt). Journal of the Egyptian-German Society 1994; 200(1412):73-101.
18. Offem BO, Ayotunde EO, Ikpi GU. Dynamics of the reproductive biology of the *Heterobranchus longifilis* Val; Pisces: (1840) in the wetland of cross River, Nigeria. Research Journal of Fisheries and Hydrobiology 2008; 3(1):22-31.
19. Reed W, Burchard J, Hopson AJ, Jonness J, Yaro I. Fish and fisheries of Northern Nigeria. Ministry of Agriculture, Kaduna 1967; 226.
20. Ajayi O. Biological studies on the family Bagridae in lake Kainji Nigeria. University of Ife, Ile-Ife, Nigeria. M. Phil. Thesis 1972, 115.
21. Nwadiaro CS, Okorie PU. Some aspects of the reproductive biology of *Chrysichthys filamentosus*, Boulenger, 1912 (Siluroidei) Bagridae in Oguta lake, Imo State, Nigeria. Revolutionary Zoology of Africa 1912; 9:233-241.
22. Mgbenka BO, Eyo JE. Aspects of the biology of *Clarias gariepinus* in Anambra River Basin 2. Maturation and condition Factor. Journal Science and Agricultural Technology 1992; 2(1):52-55.
23. Ikomi RB. Studies on the growth pattern, feeding habits and reproductive characteristics of the Mormyrid, *Brienomyrus longionalis* (Boulenger, 1901) in the upper Warri river, Nigeria. Fisheries Research 1996; 26:187-198.
24. Ekanem SB. Some reproductive aspects of *Chrysichthys nigrodigitatus* (lacepede) from cross River, Nigeria. Naga, ICLARM 2000, 2, 2.
25. Nwani CD. Length weight relationship and condition factor of Distichodus species of the Anambra River. Animal Research International 2006; 3(2):461-465.