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Length-weight Relationship and Condition factor of *Chrysichythys nigrodigitatus* and *Schilbe mystus* in Erelu Lake, Oyo State, Nigeria

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Abstract

The study on length-weight relationship and condition factor of *Chrysichythys nigrodigitatus* and *Schilbe mystus* from Erelu Lake, Oyo was conducted monthly for Twenty-one months (July, 2013-March, 2015). A total of One thousand one hundred and seventy-nine (1179) fish samples composed of Six hundred and twenty-eight (628) *C. nigrodigitatus* and Five hundred and fifty-one (551) *S. mystus* were collected using gill nets. The specimens were preserved in ice-packed box and taken to laboratory for length - weight measurement. The length-weight relationship was estimated using the linear regression model $W=aL^b$ and condition factor, (k) determined using the equation $K= 100.W/L^3$. The result revealed preponderance of females (301 and 382) over males (250 and 246) for *S. mystus* and *C. nigrodigitatus* respectively in the population. Negative allometric growth was recorded for both species and sexes. The values of (b) ranged from 1.76 to 2.56 for *C. nigrodigitatus* and 2.20 to 2.95 for *S. mystus*. Also, the condition factor were varied between 0.199 and 2.053 for *C. nigrodigitatus* and 0.172 -2.417 for *S. mystus* but female *C. nigrodigitatus* and *S. mystus* have higher k value than their male counterpart indicating better state of well-being when compared to the males. A further investigation on the bionomics of fishes in this lake is advocated to substantiate the results of this study.

Keywords: Growth pattern; Allometric growth; Bionomic; Reservoir

Introduction

The freshwater Nile silver schilbeid catfish, *Schilbe mystus*, (Order: Siluriformes, Family: Schilbeidae) and the freshwater Bagrid catfish, *Chrysichthys nigrodigitatus*, (Order: Siluriformes, Family: Claroteidae) constituted one of the most dominant fish species in Nigeria inland waters. These carnivorous species are good quality food fish of white and very tasty flesh serving as delicacy for many low income earners [1], especially in riverine communities. In addition, they are important both in ecological and economical terms, playing salient role in determining the dynamics and structure of aquatic ecosystem [2]. According to Akinsanya [3], the emanating need to culture fishes for protein consumption for the teeming rapidly growing populations in the developing countries have made it necessary to intensify studies on the length frequency of the African freshwater fishes. It is equally necessary to study the length-weight relationship (LWR) of these species in order to provide and increase the knowledge of the stock available.

The LWR is one of the standard methods that yield valid biological information. It establishes the mathematical relationship between the two variables, length and weight, so that unknown variable can be readily computed from the known variable. Also, it shows the variations from the expected weight, for the known length groups, this is in turn reflects its fatness, general wellbeing, gonad development and suitability of environment of the fish [4]. The condition factor (CF) is an index reflecting interactions between biotic and abiotic factor in the physiological condition of fishes. It shows the welfare of the population during the various stages of the life cycle [5].

The importance of LWR and CF of fishes has inspired a large number of works in Southwestern Nigerian lakes and reservoirs [6-10]. The most notable contribution on *Chrysichthys nigrodigitatus* and *Schilbe mystus* were that of Olagbemide [11], Dada and Araoye [12], Taiwo and Aransiola [13]. However, no information is available on the LWR and CF of *Schilbe mystus* and *Chrysichthys nigrodigitatus* in Erelu Lake. Therefore, the present study was undertaken to elucidate the pattern of growth and general well-being of these fish species in this reservoir. Since LWR and condition factor is a perfect indicator to assess the welfare of fish, the study will provide information for successful development, production and sustainable management of the subject species.

Materials and Methods

Study area

The study area (Figure 1) is Erelu reservoir, Oyo West Local Government, Oyo State, Nigeria. The dam was built in 1961 by the then Western region government to supply portable water to Oyo and its environs. It also provides nursery and breeding grounds for a large variety of fish species and as such gave room for fishing activities. It is located on latitude $07^053' - 07^054'N$ and longitude $03^053' - 03'55'E$. Erelu dam was built on Awon River along Oyo/Iseyin axis and fed by the following tributaries: Isuwin, Oroki, Ogbagba, Oloro, Elesin, Awon and Abata. It has a catchment and impoundment area of about 243.36 km and 3158600 m^2 respectively, with maximum depth of about 5.1 m. The dam is about 6.4 km from the heart of Oyo town.

Sample collection

Samples of *Chrysichthys nigrodigitatus* and *Schilbe mystus* were obtained on a monthly basis for Twenty-one months (July 2013-March 2015) using gill-nets of mesh sizes 38.1, 50.8, 63.5, 76.2, 88.9, 101.6 and 127.0 mm. Each net was 30 m long and 3 m deep. The nets were set simultaneously at the shore, surface and bottom at 1900 hours and fish retrieved the following morning between 0700 and 0900 hours.

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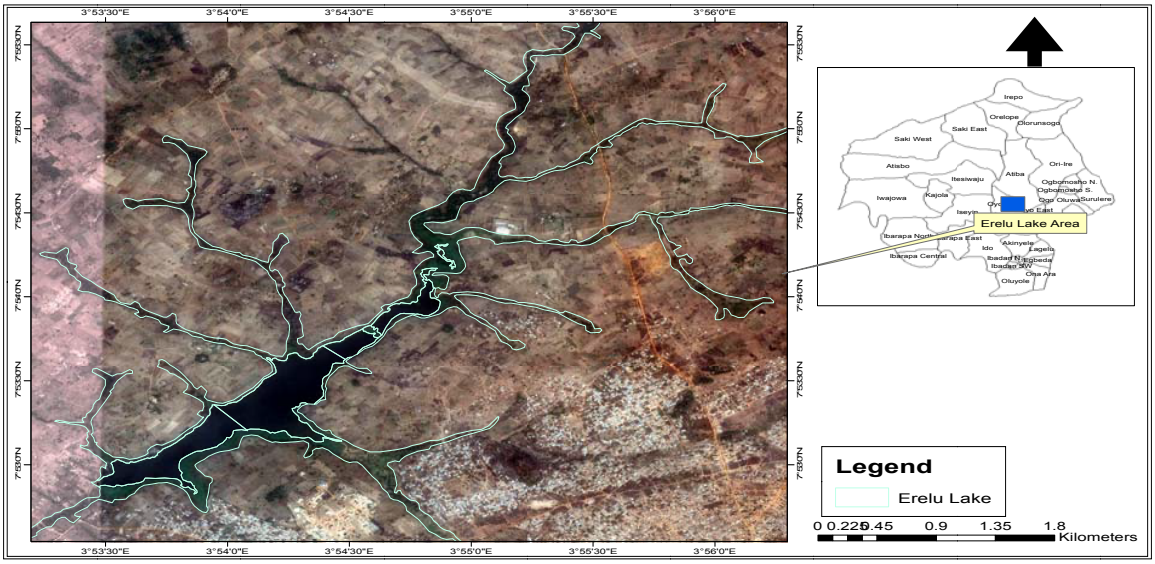

Figure 1: Map of Erelu Lake.

Sample species	Sex		
	Male	Female	Combined sexes
Chrysichthys nigrodigitatus	246	382	628
Schilbe mystus	250	301	551

Table 1: Sample size of *C. nigrodigitatus* and *S. mystus* collected from Erelu Lake.

The specimens collected were immediately transported in ice block to the laboratory for length (cm) and weight (g) measurement using the method described by Adetayo and Kusemiju.

Estimation of length - weight relationship and condition factor

The relationship between the length (L) and weight (W) of fish was calculated using Le Cren [4] equation: $W = aL^b$; where W= weight (g), L= length of fish (cm), a and b = regression coefficient and slope respectively. The logarithm-transformed data will give the linear regression equation: Log W = log a + b log L

Condition Factor (K) was estimated by the relationship $K = \frac{W X 100}{L3}$

Where K = condition factor, L = Total length (cm), W = Weight of fish (g)

All the statistical analyses were considered at significance level of 5% ($p<0.05$). The Statistical Package for Social Sciences (SPSS, version 17) and Microsoft Office Excel software were deployed in this study.

Results and Discussion

A total of One thousand one hundred and seventy-nine (1179) fish samples composed of Six hundred and twenty-eight (628) *C. nigrodigitatus* and Five hundred and fifty-one (551) *S. mystus* were collected during the study period. The sample size and growth parameters for the two species were computed separately for male, female and combined sexes as shown in Table 1, Figures 2 and 3.

This result revealed preponderance of females over males in the population sampled. The male to female ratio was significantly different

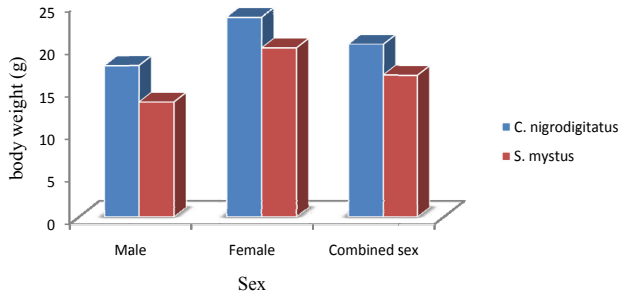

Figure 2: Mean body weight of *C. nigrodigitatus* and *S. mystus* sampled during the study period.

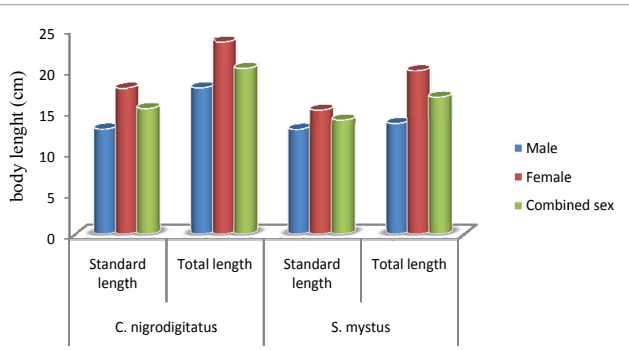

Figure 3: Mean body length of *C. nigrodigitatus* and *S. mystus* collected for the study.

($p<0.05$) from the expected ratio of 1:1. This was also experienced for *S. mystus* in Erinle Lake by Komolafe and Arawomo [14]. Similarly, Fafioye and Oluajo [15] reported preponderance of female in the population of *C. nigrodigitatus* from Epe lagoon.

The length of *S. mystus* sampled ranged from 8.50 cm-31.50 cm (SL) while the weight ranged from 15.3 g-483.2 g. The largest male fish weighed 301.7 g, while the largest female fish weighed 483.2 g. Also for

C. nigrodigitatus, the least standard length was 11.7 cm (18.9 g BW) in male while the largest was 33.6 cm TL (528.9 g BW) in female. These results showed that females were longer and heavier than males for both species. This is in agreement with Le Cren (1951) who reported that females are heavier than males of the same length probably because of difference in fatness and gonadal development.

The log length - log weight relationship for these species is as shown in Figures 4 and 5. From the regression analysis of standard length and weight of the two sampled species (Table 2), the values of intercept ranged from 0.1048 - 0.1414 in *C. nigrodigitatus* while log "a" value for *S. mystus* was varied between 0.1492 and 0.3480 respectively. The values of (b) of the length- weight relation were ranged from 1.76 to 2.56 for *C. nigrodigitatus* and 2.20 to 2.95 for *S. mystus*. T- test conducted showed significant difference between the values of 'b' obtained and the expected value of isometric growth i.e., 3 ($p<0.05$). Therefore, the growth pattern in both sexes of *C. nigrodigitatus* and *S. mystus* in Erelu reservoir are said to be negatively allometric. The correlation

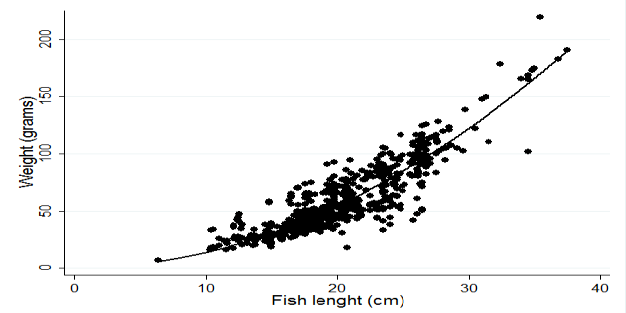

Figure 4: Length-weight relationship of (Combined sexes) *Chryschythy snigrogiditatus* of Erelu Lake.

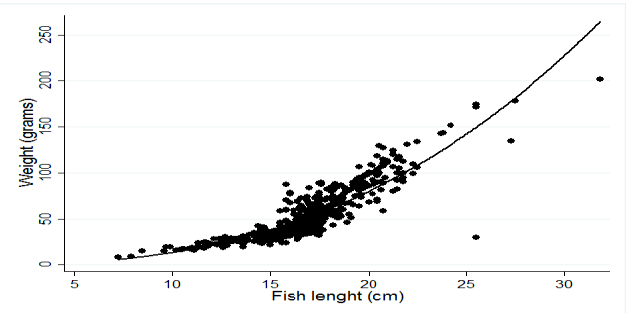

Figure 5: Length-weight relationship of (Combined sexes) *Schilbemystus* of Erelu Lake.

Species	Sex	a	b	r^2	MSE
C. nigrodigitatus	M	0.1383	1.7620	0.8845	12.1365
	F	0. 1048	2.5671	0.9766	13.0527
	CS	0.1414	1.9880	0.9578	13.6836
S. mystus	M	0. 1492	2.9581	0.9226	13.2100
	F	0.1928	2.2054	0.9391	12.9452
	CS	0.3480	2.5813	0.9517	13.1436

M: Male; F: Female; CS: Combined Sex; A: Intercept; B: Slope; R2: Coefficient of Determination; MSE: Mean Standard Error

Table 2: Regression Coefficient for Length-weight relationship of *C. nigrodigitatus* and *S. mystus.*

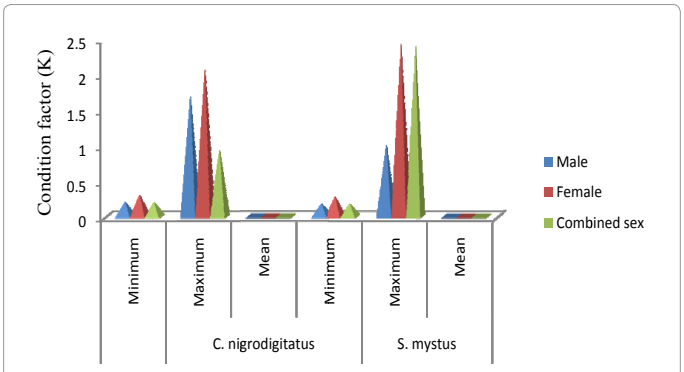

Figure 6: Condition factor of *C. nigrodigitatus* and *S. mystus*in Erelu Lake.

coefficients (r) of the fishes which ranged between 0.8845 and 0.9766 indicated high degree of positive correlation between their standard lengths and body weights. This implies that the body weights of the fishes increased with increase in body length, but the rate of increase in weight is less than the rate of increase in length. Offem [16], reported similar negative allometric (2.6) growth pattern in *C. nigrodigitatus* in the Cross River inland wetland. Negative allometric growth has also been reported for *S. mystus* from Ologe Lagoon, Lagos [17]. However, unlike the results in this study, positive allometric growth patterns were reported for *C. nigrodigitatus* in Amassoma River flood plains [18], Epe Lagoon [15] and Asejire dam [19].

The condition factor (k) values obtained for males, females and combined sexes of *C. nigrodigitatus* and *S. mystus a*re presented in Figure 6. The (k) values were highest in females of *S. mystus* (2.417) and *C. nigrodigitatus* (2.053); the values were least in male (0.172) and combined sex (0.180) of *S. mystus*. The mean condition factor for both species (combined sexes) was 0.736 ± 0.335 (*C. nigrodigitatus)* and 1.071 ± 0.256 (*S. mystus*). The males and females revealed significant differences in the value of 'k' in *C. nigrodigitatus* and *S. mystus*.

This result implies that females do better in terms of fatness and robustness in Erelu lake. Also, there is an indication showing that *S. mystus* enjoyed a better environmental condition in Erelu lake more than *C. nigrodigitatus.* Similar to these observations, Lawal [20] and Kumolu-Johnson and Ndimele [17] have also reported significant differences in k-factor between sexes of *C. nigrodigitatus* and *S. mystus*. Condition factor has also been closely linked with reproductive cycle for fishes in other water bodies [21,22].

Conclusion

This preliminary study revealed that *C. nigrodigitatus* and *S. mystus* from Erelu lake, Oyo, Nigeria exhibited negative allometric growth pattern. The correlation coefficients of the length-weight relationships indicated high degree of positive correlation. The condition factor showed that *C. nigrodigitatus* and *S. mystus* were in good physiological state of wellbeing in the dam. Further investigations of the bionomics of the fishes of this dam are advocated to complement the results of this study.

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