

Morphometric characteristics and condition factor of *Chrysichthys nigrodigitatus* (Lacepede, 1803) and *Sarotherodon melanotheron* (Ruppell, 1852) in the Lagos Lagoon

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Abstract

One hundred and fifty (150) specimens of *Sarotherodon melanotheron* and 150 specimens of *Chrysichthys nigrodigitatus* were collected from Better-life Fish Market in Makoko area of Lagos State between June-August 2016 to provide information on the size distribution, length-weight relationship, determine regression equation and coefficient of determination of morphometric parameters and condition factor of the species. Size ranges of 10-22 cm and 15-33 cm were observed in *S. melanotheron* (20-158 g) and *C. nigrodigitatus* (30-279 g) respectively. Length-weight relationship of *S. melanotheron* and *C. nigrodigitatus* were described by the equation $\text{Log } W = -1.107 + 2.4478 \text{ Log } L$ and $\text{Log } W = -1.9287 + 2.8484 \text{ Log } L$ respectively. The b values (growth exponent), 2.4478 and 2.8484 for body weight on total length of *S. melanotheron* and *C. nigrodigitatus* respectively indicate negative allometric growth which implies that the fishes become slenderer as they increase in weight. The least coefficient of determination (r^2), 0.4305 (*S. melanotheron*) and 0.2221 (*C. nigrodigitatus*) were obtained in snout length on total length and pelvic fin length on total length respectively. High values coefficient of determination, obtained indicates a high degree of positive correlation between the different morphometric parameters with the reference length (total length). All mean condition factors (k) calculated for species, size classes and sexes are all above 1 and this reveals that they are all in good conditions and that the environment is suitable for both species with regards to the feeding condition. This study provides some biological information on the condition of the species in the Lagos Lagoon as at the period of the study.

Keywords: Morphometric characteristics; condition factor; *Chrysichthys nigrodigitatus*; *Sarotherodon melanotheron*; Lagos Lagoon.

Accepted: 5 June, 2018.

Introduction

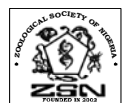
Chrysichthys nigrodigitatus (Family: Bagridae) with a common name 'silver catfish' is a highly valued food fish and is among the dominant fishes of commercial catches as well as culturable fish species from the wild (Ezenwa *et al* 1986). *Sarotherodon melanotheron* is a cichlid which inhabits fresh to brackish water environments (Olaosebikan and Raji, 1998). Knowledge of some quantitative aspects such as length-weight relationship is important in studying fish biology. Length-weight relationships can be used to predict weight from length measurements made in the yield assessment (Pauly, 1993). Other applications of length-weight relationship include the estimation of standing stock biomass and comparison of ontogeny of fish population from different region (Petraakis and Stergiou, 1995). The condition factor which show the degree of well being of the fish in their habitat is expressed by 'coefficient of condition' also known as length-weight factor. 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 regard to the

feeding condition (MacGregoer, 1959). When condition factor value is higher it means that the fish has attained a better condition. The condition factor of fish can be affected by a number of factors such as stress, sex, season, availability of feeds, and other water quality parameters (Khallaf *et al* 2003). This study aimed at providing information on the size distribution, establishing the length-weight relationship, determining the regression equation and coefficient of determination of morphometric parameters and condition factor of *C. nigrodigitatus* and *S. melanotheron* in the Lagos Lagoon. It is hoped that this study will contribute valuable information which is necessary for successful fishery management and aquaculture of *C. nigrodigitatus* and *S. melanotheron*. It will also help to know the state of wellbeing and the growth pattern of *C. nigrodigitatus* and *S. melanotheron* in Lagos Lagoon.

Materials and methods

Study area

The Lagos Lagoon is the largest brackish water body of the Southern Lagoon system in Nigeria (Nwankwo, 2004;



<http://dx.doi.org/10.4314/tzool.v16i1.4>

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Onyema, 2008) with an area of 208 km² (FAO, 1969). The Lagoon lies between Longitudes 3°20' and 3°40'E and Latitudes 6°15' and 6°40'N the estimated area of the main body is 150.56 km² and an average depth of less than two meters (FAO, 1969).

Sampling procedures

Samples of *S. melanotheron* and *C. nigrodigitatus* were collected from the Better-Life Fish Market in Makoko area of Lagos State between June-August, 2016. A total of three hundred (300) specimens (50 *S. melanotheron* and 50 *C. nigrodigitatus* monthly) were collected for the study. Samples were stored immediately in ice chest after collection and transported to Marine Sciences Laboratory, University of Lagos, for analysis. Fish species caught by artisanal fishermen using casts nets (33 mm mesh size), drag nets (25 mm mesh size) and set gill nets (44 mm mesh size) were landed at the market. The fish were examined, sorted and identified using the taxonomic key of Olaosebikan and Raji (1998). The standard length (SL), Total length (TL), Fork length (FL), Eye diameter (ED), Body depth (BD), Dorsal fin length (DFL), Pectoral fin length (PecFL), Pelvic fin length (PelFL), Dorsal spine length (DorSL), Pelvic spine length (PelSL) were measured in centimeter using a measuring board and a ruler while the weight of each fish was also taken in grams (g) using a sensitive balance (Camry EK 5055).

The length-weight relationship was expressed by the equation:

$$\text{Log weight} = \text{Log } a + b \text{ Log length.}$$

Where a and b are regression constants.

The condition factor was calculated using the formula: $k = (100W)/L^3$.

Where k = condition factor, l = standard length (cm) and w = weight (g).

The condition factor was calculated in relation to size and sex.

Results

The morphometric measurements of *S. melanotheron* and *C. nigrodigitatus* are presented in Table 1. *S. melanotheron* and *C. nigrodigitatus* had total length (TL) ranges of 10-22 cm and 15-33 cm respectively with means of 15.87±0.16 cm and 26.21±0.34 cm respectively.

Length range frequency distribution of *S. melanotheron* and *C. nigrodigitatus* are presented in Figures 1 and 2 respectively. The length range of 14.95 cm-16.95 cm led the frequency in *S. melanotheron* with a value of 64 while the length range of 27.95 cm-29.95 cm led the frequency in *C. nigrodigitatus* with a value of 31.

Length-weight relationship of *S. melanotheron* and *C. nigrodigitatus* are presented in Figure 3 and 4 respectively, having equation $\log w = -1.107 + 2.4478 \log l$ and $\log w = -1.9287 + 2.8484 \log l$, respectively.

The regression coefficient 'b' of different variable characters (y) on total length (x) of *S. melanotheron* (Table 2) indicates that the rate of growth in respect to total length is highest in case of body weight ($b = 2.4478$) and lowest in case of snout length ($b = 0.6567$). For *C. nigrodigitatus* (Table 3), the regression coefficient 'b' of different variable characters (y) on total length (x) indicates that the rate of growth in respect to total length is also highest in case of body weight ($b = 2.8484$) and lowest in case of eye diameter ($b = 0.2943$).

The mean condition factor of *S. melanotheron* (Table 4) for male of class group of 13-16.9 cm was 3.56 g/cm³ and for class group of 17-21 cm was 3.1 g/cm³ while for female of class group 14.5-18.4 cm, the mean condition factor was 3.45 g/cm³ and class group of 18.5-22.4 cm was 3.03 g/cm³. The mean condition factor of *C. nigrodigitatus* (Table 5) for male of class group of 21-26.9 cm was 2 g/cm³ and for class group of 27-33 cm was 2 g/cm³ while for female of class group 23.5-28.4 cm, the mean condition factor was 1.34 g/cm³ and class group of 28.5-33.4 cm was 1.64 g/cm³.

Table 1. Morphometric measurements of *Sarotherodon melanotheron* and *Chrysichthys nigrodigitatus*.

Morphometric	<i>S. melanotheron</i>			<i>C. nigrodigitatus</i>		
	N	Min.-Max. (cm)	Mean (cm)	N	Min.-Max. (cm)	Mean (cm)
TL	150	10-22	15.87±0.16	150	15-33	26.21±0.34
SL	150	7.5-17.6	12.57±0.14	150	11.5-28	20.14±0.28
FL	150	NM	-	150	12.6-29.8	21.84±0.29
DFL	150	5.1-12	8.33±0.11	150	3.5-8	6.01±0.07
PecFL	150	2.3-6.9	4.72±0.66	150	2-5.5	4.24±0.05
PelFL	150	2-6.3	3.51±0.05	150	1.5-5	3.50±0.04
BD	150	3-7.5	5.20±0.06	150	2-6	4.45±0.06
ED	150	0.7-1.4	0.99±0.01	150	0.9-1.6	1.10±0.01
PelSL	150	NM	-	150	1-4.6	3.46±0.04
DorSL	150	NM	-	150	2-6.8	4.23±0.06

NM – Not Measured. Min. – Minimum. Max. – Maximum.

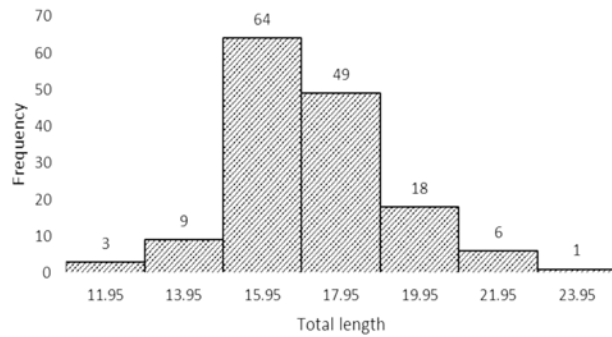


Figure 1. Length frequency distribution of *S. melantheron* from the Lagos Lagoon.

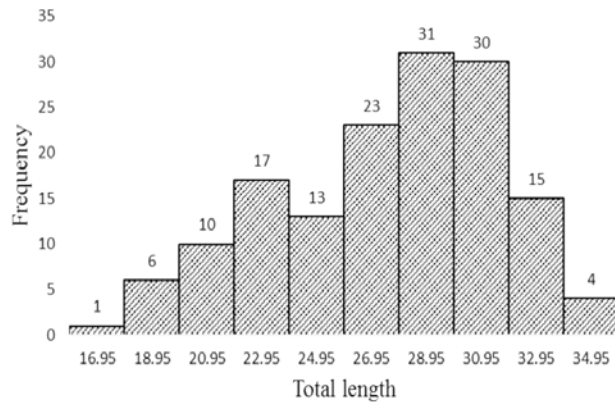


Figure 2. Length frequency distribution of *C. nigrodigitatus* from the Lagos Lagoon.

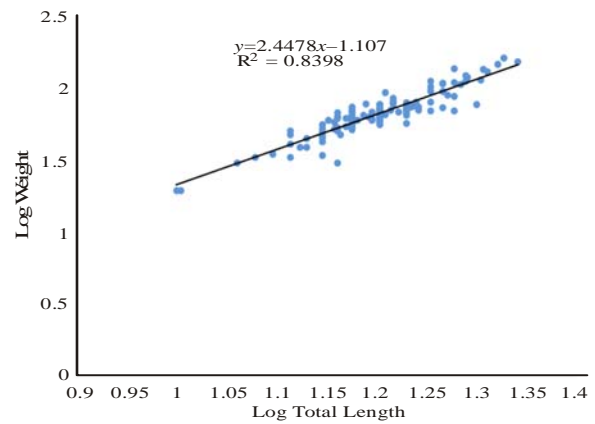


Figure 3. Length-weight relationship of *S. melantheron* from Lagos Lagoon.

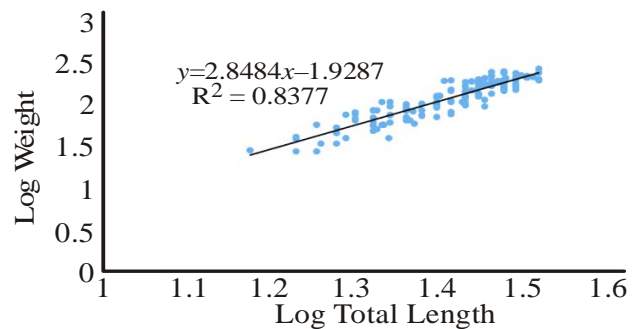


Figure 4. Length-weight relationship of *C. nigrodigitatus* from Lagos Lagoon.

Table 2: Regression equation and coefficient of determination of morphometric parameters of *Sarotherodon melantheron*.

Parameters	Regression Equation	Coefficient of determination (r^2)
Standard Length (Y) on Total Length (X)	$y = -0.1102 + 1.0072x$	0.9143
Head Length (Y) on Total Length (X)	$y = -0.6787 + 1.1169x$	0.8773
Snout Length (Y) on Total Length (X)	$y = -0.5846 + 0.6567x$	0.4305
Body Weight (Y) on Total Length (X)	$y = -1.107 + 2.4478x$	0.8398
Pelvic fin length(Y) on total length(X)	$y = -0.7202 + 1.0507x$	0.5516
Pectoral fin length(Y) on total length (X)	$y = -0.723 + 1.1613x$	0.6593
Dorsal Fin Length (Y) on Total Length (X)	$y = -0.2243 + 0.9519x$	0.7904
Eye Diameter (Y) on Total Length (X)	$y = -0.8288 + 0.6861x$	0.5821
Body Depth (Y) on Total Length (X)	$y = -0.3882 + 0.9185x$	0.6551

Table 3: Regression equation and coefficient of determination of morphometric parameters of *Chrysichthys nigrodigitatus*.

Parameters	Regression Equation	Coefficient of determination (r^2)
Standard Length (Y) on Total Length (X)	$y = -0.1252 + 1.007x$	0.8981
Fork Length (Y) on Total Length (X)	$y = -0.0502 + 0.9792x$	0.9045
Body Weight (Y) on Total Length (X)	$y = -1.9287 + 2.8484x$	0.8377
Pelvic fin length(Y) on total length(X)	$y = -0.0858 + 0.4423x$	0.2221
Pectoral fin length (Y) on total length (X)	$y = -0.1813 + 0.5693x$	0.4517
Pelvic spine length (Y) on total length (X)	$y = -0.3628 + 0.6342x$	0.3649
Dorsal spine length (Y) on total length (X)	$y = -0.264 + 0.6266x$	0.4346
Dorsal Fin Length (Y) on Total Length (X)	$y = -0.2771 + 0.744x$	0.6651
Eye Diameter (Y) on Total Length (X)	$y = -0.3778 + 0.2943x$	0.4146
Body Depth (Y) on Total Length (X)	$y = -0.6897 + 0.9424x$	0.7797

Table 4. Condition factor in relation to size and sex of *Sarotherodon melanotheron*.

Size group (cm)	Frequency	Range of condition factor (g/cm ³)	Mean of condition factor (g/cm ³)
Female			
14.5-18.4	42	2.66-4.46	3.45
18.5-22.4	10	2.11-3.47	3.03
Male			
13-16.9	46	2.73-4.66	3.56
17-21	19	2.61-3.76	3.1
Immature			
10-12.9	5	3.3-4.74	3.86
13-15.9	27	2.63-4.41	3.71
Male and female combined			
13-17.9	93	2.61-4.66	3.48
18-22.9	25	2.11-3.7	3.1

Table 5: Condition factor in relation to size and sex of *Chrysichthys nigrodigitatus*.

Size group (cm)	Frequency	Range of condition factor (g/cm ³)	Mean of condition factor (g/cm ³)
Female			
23.5-28.4	5	0.85-1.63	1.34
28.5-33.4	21	1.22-2.27	1.64
Male			
21-26.9	19	1.09-2.04	2
27-33	46	1.00-2.61	2
Immature			
15-22.9	30	1.24-2.44	1.65
23-30.9	29	2-2.70	1.69
Male and female combined			
21-26.9	23	0.85-2.04	1.54
27-33	68	1.00-2.61	1.61

Discussion

A size range of 10-22 cm was observed in *S. melanotheron* while in *C. nigrodigitatus*, size range of 15-33 cm was observed, showing a range difference from what Lawal *et al* (2010) observed in Epe Lagoon, Nigeria, reporting that the total length of *C. nigrodigitatus* ranged from 11.00 to 30.20 cm between January and July 2008. These size ranges obtained could have been influenced by the mesh sizes of the gears used in catching the fishes and the sampling reveals that samples are not juveniles of breeding grounds.

The *b* values (growth exponent), 2.4478 and 2.8484 for body weight (*y*) on total length (*x*) of *S. melanotheron* and *C. nigrodigitatus* respectively are within the limits (2-4) reported by Tesch (1971) for most fishes and they indicate negative allometric growth which implies that the fishes become slenderer as they increase in weight (Riedel *et al* 2007).

High values coefficient of determination (*r*²) obtained indicate a high degree of positive correlation between the different morphometric parameters with the reference length (total length). The coefficients of determination (*r*²) for length-weight relationship revealed strong

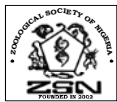
positive correlation between the lengths and weights of *S. melanotheron* and *C. nigrodigitatus* which indicates increase in length with increase in weight. These agreed with earlier studies involving fish species from different water bodies (Fagade and Olaniyan, 1972; Fagade, 1983; Merella *et al* 1997; Ruiz-Ramirez *et al* 1997 and Laleye, 2006). All mean condition factors calculated for species, size classes and sexes are all above 1 and this reveals that they are all in good conditions and that the environment is suitable for both species with regards to the feeding condition (Wade, 1992).

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Citation: Emmanuel, B. E., Akinniyi, O. J. and Inegbedion, E. G.
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<http://dx.doi.org/10.4314/tzool.v16i1.4>



The Zoologist, 16: 21-25 December 2018, ISSN 1596 972X.
Zoological Society of Nigeria.