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Length-weight Relationships and Condition Factor of *Oreochromis niloticus* (Linnaeus) in Oyan Lake, Southwest Nigeria

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Abstract

Oreochromis niloticus in Oyan Lake, Ogun State, Southwest Nigeria was studied for its total length-weight relationships. Condition factor (k) of the fish was also assessed in the study. The analysis in each instance was done based on sexes and combined. It was revealed that the population of O. niloticus comprised mainly adult fish of length group of 17.5 cm. The analysis of length-weight relationship data depicted 'b' value of 2.90 (male), 2.99 (female) and 2.94 for combined sexes. No significant difference ($p>0.05$) in the 'b' values of both sexes. The condition factor of O. niloticus ranged between 1.93 (October) and 2.26 (May) with a mean of 2.09 ±0.1. Sampled fish were observed to be in better condition in the wet season than dry season. Condition factor was significantly higher ($p>0.05$) in the wet season than dry season. Oyan Lake provides good aquatic ecological environment for the growth and development of Oreochromis niloticus.

Key words: *Oyan Lake, Oreochromis niloticus, condition factor, length-weight relationship.*

Introduction

Oyan Lake is one of the most important lake fisheries in the Southwest of Nigeria. It is a man-made lake with water capacity of 270 million m^3. The lake was primarily constructed to supply water for the municipal use, generation of hydro-electric power and dry season irrigation of agricultural crops while fishing was the secondary option. Since its impoundment, fishing activities have been prominent in the lake and has been a major source of fish protein in the region.

The relationship between length and weight of the fish is of great importance in fisheries biology studies in that it is used to convert growth equation in length into equivalent weight (Beyer 1987; Sparre *et al.* 1989; Garcia *et al.* 1989; Haimovici and Velasco 2000). According to Bolger and Connoly (1989), it is used to determine the index of well-being of individual fish. It is used in conjunction with age data to provide information on the stock composition, life span, mortality, age at maturity, growth and production (Bolger and Connoly 1989; King 1996; Diaz *et al.* 2000). The condition factor provides a convenient measure for comparing the weights of fish from different areas or in different seasons (Bagenal 1978).

Jamu and Ayinla (2003) noted that fish yields of most inland waters in Nigeria are on the decline, mainly due to habitat degradation, water issues, (Welcomme 2003) and over-exploitation of fisheries (Offem, *et. al.* 2009). Cichlids were earlier reported to be important fish resources in the aquatic systems of tropical Africa (Fryer and Iles 1974). In waters of the Lake Victoria basin in East Africa, Nile tilapia (*Oreochromis niloticus* L.) was introduced in the 1950s and 1960s. Apart from its natural occurrence in most Nigerian inland waters, it is a valuable frequently cultured fish species, due to its relative ease of culture and rapid reproduction rates. *Oreochromis niloticus* is one of the most economically important fish species in Oyan Lake. Other cichlids in the lake include *Tilapia zilli, Hemichromis fasciatus, Tilapia mariae, Tilapia melanopleura, Tilapia macrocephala, Tilapia manodi* and *Sarotherodon galileaus* (Ikenweiwe *et. al.* 2007). In spite of preponderance of *O.* niloticus among cichlids in the lake, there is paucity of information on its management. Hence, this study was carried out for proper management of the population of *Oreochromis niloticus* in the lake and sustainable fish food production.

Materials and methods

Samples of *O. niloticus* were obtained between May and December, 2010 from the commercial catches landed at the landing sites of the lake. Samples of *O. niloticus* were collected from landing sites located around the lake. Fishing gears used were gillnets, cast nets and local traps. Total length and body depth of individual fish were measured to the nearest 0.1 cm in the field by using measuring board. Fish samples were sexed into male and female. Weight was measured to the nearest 0.1g in the field by using battery operated sensitive electronic balance.

Length-weight relationship was expressed by the equation $W = a*L^b$. Linear transformation was made using natural logarithm as proposed by Zar (1984): $LogW = a + b*LogTL$; where W = weight of the fish (g), a = constant, b = slope and TL = total length (cm). Length-weight parameters 'a' and 'b' for total length-weight and body depth-weight relationships were estimated for males, females and both sexes. The regression equations were obtained by the method of least square regression analysis. Visual inspection of outliers was carried out prior to regression analysis according to Froese (2006). Extreme outliers were excluded in the analysis. Information on months and seasons in which the data were collected was used in the calculation of condition factor. Condition factor (K) of the fish was expressed as $100W/L^3$ according to Le Cren (1951) and Bagenal (1978). The study period comprises of six wet months (May to October) and two dry months (November and December). The mean coefficient of condition was also obtained for each length class using 10cm class interval.

Results

A total of 1688 fish specimens comprising 736 males and 952 females were sampled during the study period. The percentage length frequency composition depicted in Figure 1 shows that length 17.5 cm (47.5%) had highest contribution while 0.5% was the least corresponding to 7.5 cm.

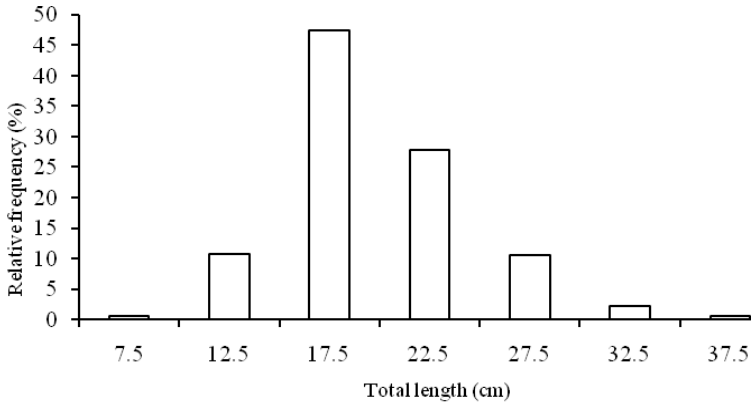

Figure 1. Length frequency distribution of *Oreochromis niloticus* in Oyan Lake, Ogun State, Southwest Nigeria.

Table 1 shows that mean total length in male *O. niloticus* was 20.2 ± 0.18 cm with a range of 11.0 - 39.0 cm and 19.4 ± 0.14 cm ranging from 7.0 to 39.0 cm in female. The mean total length of 20.0 ± 0.11 cm was recorded in combined sexes with a range of 7.0 - 39.0cm. Mean length was significantly higher ($p<0.05$) in male than female. Mean weight of male fish was 212.1 ± 5.8g (17.8 – 1271g) while that of females was 174.1 ± 4.0g (6.0 – 940.0g). In combined sexes, weight ranged from 6.0 to 1271g with an average weight of 190.7 ± 3.4g. The mean weight of male fish is significantly ($p<0.05$) higher than female fish.

Table 1: Length-weight parameters of *Oreochromis niloticus* in Oyan Lake, Ogun State, Southwest Nigeria

			Total length-weight relationship					Body depth-weight relationship				
	n	Mean Wt (g)	Mean TL (cm)	**a**	**b**	**r**	**SE (b)**	Mean BD (cm)	**a**	**b**	**r**	**SE (b)**
Male	736	212.11±5.83	20.17±0.18	-1.56	2.9	0.96	0.03	7.17±0.07	0.03	2.6	0.94	0.03
Female	952	174.14±3.97	19.42±0.14	-1.70	2.99	0.95	0.03	6.79±0.05	0.07	2.54	0.94	0.02
Combined	1688	190.69±3.42	19.98±0.11	-1.60	2.94	0.96	0.22	6.96±0.04	0.05	2.58	0.94	0.02

SE = standard error

Figures 2, 3 and 4 graphically depict the relationship between total length and weight of *O. niloticus* for male, female and both sexes in the lake. The linear logarithmic equations of total length-weight relationships obtained are as follows:

LogW = 2.90*log(TL) – 1.56 (male) …… (i)
LogW = 2.99*log(TL) – 1.70 (female) ……(ii)
LogW = 2.94*log(TL) – 1.60 (combined) …… (iii)

Statistically, the values of 'b' in male (2.90), female (2.99) and both sexes (2.94) were not significantly different ($p>0.05$) from 3. These results suggested that growth of *O. niloticus* in Oyan Lake is isometric.

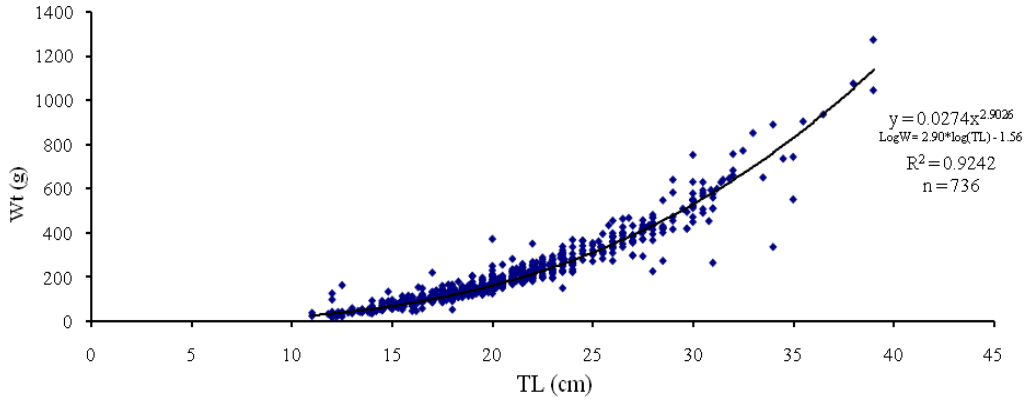

Figure 2: Length-weight relationship of male *O. niloticus* in Oyan Lake, Southwest Nigeria.

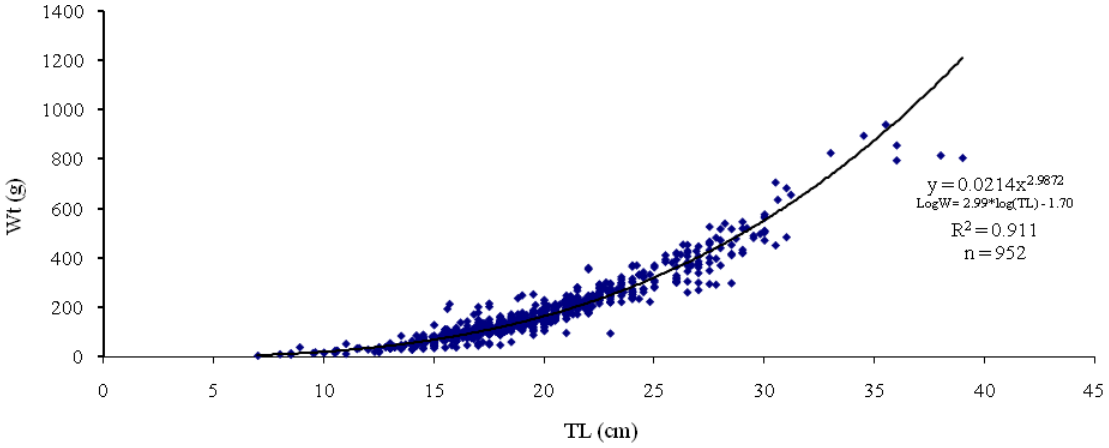

Figure 3: Length-weight relationship of female *O. niloticus* in Oyan Lake, Southwest Nigeria.

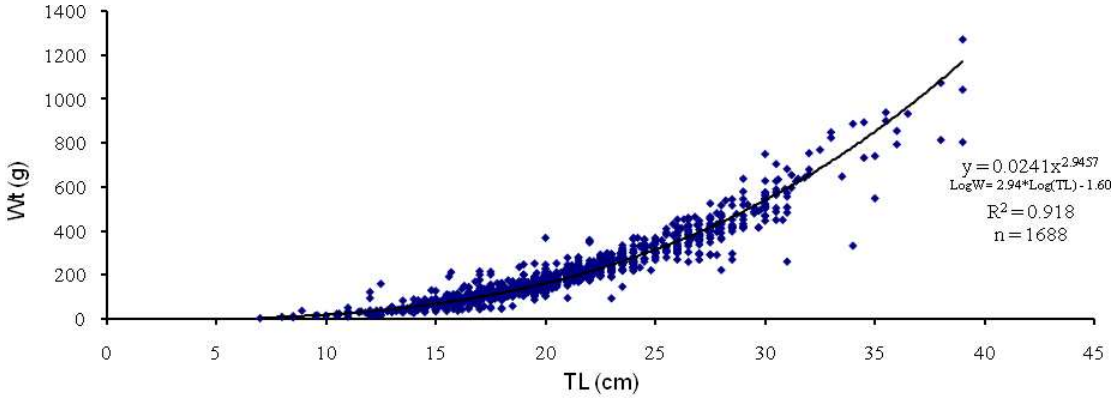

Figure 4: Length-weight relationship of *O. niloticus* (combined) in Oyan Lake, Southwest Nigeria.

Condition factor, an index of well-being of fish, observed in male, female and combined sexes of *O. niloticus* were 2.08, 2.10 and 2.09 respectively. There was no significant difference ($p>0.05$) in condition factor between male and female fish. Highest value (2.29) in condition factor for male was recorded in May while the least (1.85) was observed in December. Female fish attained the highest condition factor (2.22) in May and August; and the least (1.89) was observed in September. In both sexes, the values of condition factor ranged between 2.26 (May) and 1.93 (October). However, gradual decrease in the trend of condition factor was noticed in female during the study period as shown in Figure 5.

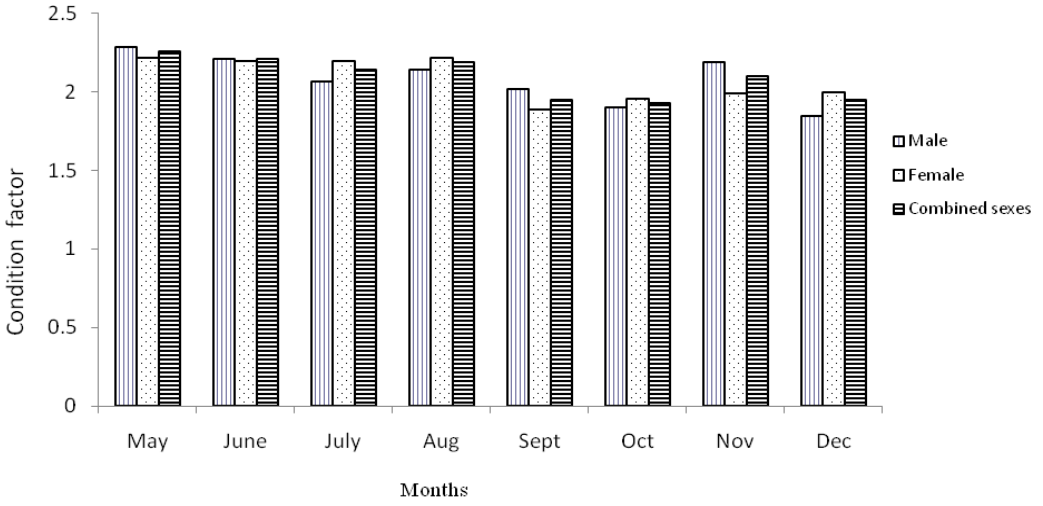

Figure 5: Monthly variation in condition factor of *O. niloticus* in Oyan Lake, Ogun State, Southwest Nigeria.

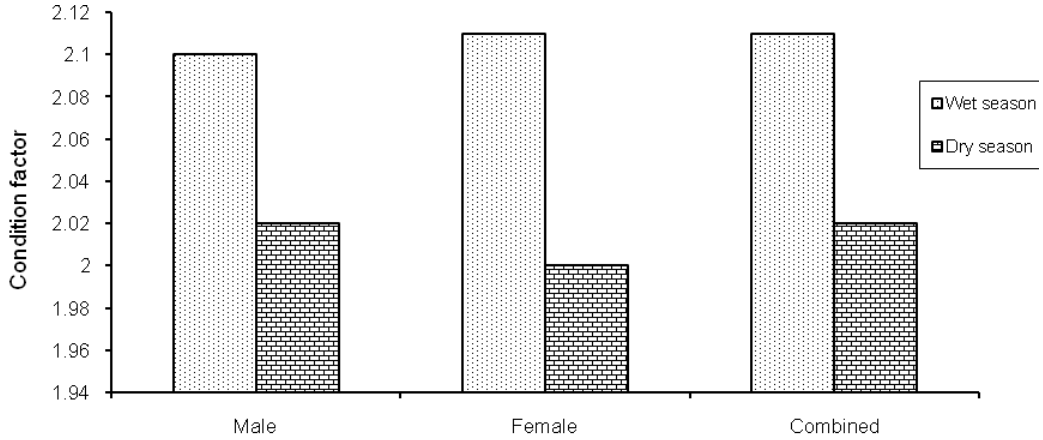

Figure 6: Seasonal variation in condition factor of *Oreochromis niloticus* in Oyan Lake, Southwest Nigeria.

Seasonal variation in condition factor is depicted in Figure 6. The values of condition factor were significantly higher ($p<0.05$) in wet season (2.10, 2.11, 2.11) compared to the dry season (2.02, 2.00, 2.02) in male, female and combined sexes respectively. These show that wet season favours the growth performance of *O. niloticus* in the lake.

Discussion

The high percentage (47.5%) recorded in total length of 17.5 cm indicated that the population of *O. niloticus* in the lake is dominated not only by adults fish but were also in good condition (2.09). The isometric growth of *O. niloticus* in Oyan Lake reported in this study corroborated the result obtained by Ayoade and Ikulala (2007) that carried out similar study on related cichlid species in Eleyele Lake, Southwest Nigeria. They reported 'b' value of 2.80 for *Sarotherodon melanotheron*, 3.34 (*Chromidotilapia guentheri*) and *Hemichromis bimaculatus* (2.14). The relationship between length and weight differs among species of fish according to their inherited body shape, and within a species according to the condition of individuals (Yousuf and Khurshid 2008). Generally, fish population of *O. niloticus* in the lake was observed to be in best condition factor (2.14) at total length 17.5 cm which coincided with highest frequency composition. Condition factor of *O. niloticus* in Oyan Lake was lower than those reported in similar work carried out on other cichlids in man-made lake by Anene (2005); *Chromidotilapia guntheri* (4.58), *Tilapia cabrae* (5.27), *Tilapia mariae* (5.38) and *Tilapia zilli* (4.30). The difference in results could be due to differences in the water quality parameters and natural productivity of the habitats. High condition factor observed in female fish from May to August could be as a result of reproductive status of the fish. High condition factor reported in male, female and both sexes in the wet season could be a result of abundant food available for the fish. At this period, nutrient load in the lake system would have increased due to flooding from upland thereby encouraged high natural production culminating to healthy growth and development. This study showed that population of *Oreochromis niloticus* in Oyan Lake grows isometrically and that they are in better condition in wet season than dry season.

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