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Length - weight relationship and the condition factor of *Tilapia zilli* (Gervais) in Lapai – Agaie Reservoir, Niger state. Nigeria

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Abstract
The length – weight relationship and condition factors of *Tilapia zilli* (Gervais), in Lapai - Agaie Reservoir of Niger state, were studied. One hundred fish samples comprising of 42 males and 58 females were investigated, with the total length ranging from 9.1cm to 16.2cm and the weight ranging from 31g to 172g. The parameters a, b and r of the length –weight relationship were -20.092, 3.268 and 0.756 for male, while the corresponding females values were -8.012, 2.476 and 0.560 respectively. The male species exhibited positive allometric growth while the female growth was negative allometric. The condition factor (K) for the male and female were found to be 2.192 to 2.087 respectively. Male species were in a better condition than the females. Lapai - Agaie reservoir is a good environment for the growth, reproduction and survival of *Tilapia zilli* (Gervais).

Keywords: Allometric growth, environment, fish, reproduction, survival

Introduction

Length and weight are two basic components in the biology of species, at both individual and population level. Length – weight relationship (LWR) is an important factor in fish ecology, the biological study of fishes, and is of paramount importance in fish yield equation and stock assessment. Length- weight relationship as an empirical relationship is useful in the study of natural history of fishes, as it allows prediction of weight of a fish from a given length in yield assessment. According to Beyer (1987), length and weight relationship is a vital tool in fisheries assessment, as it allows estimation of average weight of fish of a given length group, and assessing the relative well- being of fish (Bolger and Coinnolly, 1989).

Tilapia zilli (Gervais) is present in significant larger amount in Lapai - Agaie reservoir, and known to be one of the most important source of protein to man, providing 20-30% of total protein consumed in various countries of the world (El - Sayed, 2006). FDF (2007) revealed that fish contribute about 40% of the animal protein intake of the average Nigeria. According to El – Sayed (2006), in 1960, only two countries in Africa had record of tilapia production, Egypt and Nigeria producing 2,100MT and 1,299MT respectively, while Nigeria produces about 50,000MT in the year 2007 (FDF, 2007). The importance of *Tilapia zilli* as an economically important fish in Africa, and Nigeria in particular cannot be over emphasized, it is known to survive and reproduce under adverse condition (Megbowon, 2011).

Lapai - Agaie reservoir is a man - made fresh water lake, in Lapai local government area of Niger state, in Nigeria, and similar to other in - land water bodies in Nigeria. The reservoir has been undergoing steady exploitation over the years by the artisanal fishermen, whose main objective is to catch fish for commercial purposes.

The objective of the present study is to determine length- weight relationship of *Tilapia zilli* in Lapai - Agaie reservoir, and to ascertain and provide information on the condition factor of the species in the reservoir.

Materials and Methods

Study Area

Agaie - Lapai reservoir is located at longitude 6^{o} 34'E and latitude 9^{o}13'N on River Jatau. River Jatau join River Chanchaga at Ebba, which is one of the major tributaries of River Gbako that drain into River Niger, south of Badegi in Niger State. The reservoir is located near Bakajeba village about 20Km to the North of Lapai, Niger State. The study area is characterized by climatic conditions that prevail in the tropical hinter land climate belt of Nigeria. The annual rainfall ranges between 100 and 150cm, and the relative humidity is about 70% on average (Iloeje, 1976). The area lies within guinea savannah belt of Nigeria. The reservoir supplies the near by communities with domestic drinking water and for other purpose such as irrigation and fishery.

Samples collection

Fish samples of *Tilapia zilli* were obtained from Lapai- Agaie reservoir, Niger State, Nigeria, between March, 2013 to July, 2013. The fishes were purchased randomly from the fishermen at the landing site of the reservoir. The fishermen engaged gill net as their fishing gear. The fishes were transported to the department of biology laboratory of Ibrahim Badamasi Babangida University, Lapai, Niger State, where the laboratory study and analysis was conducted. A total of 100 specimen of *Tilapia zilli* were used in the study.

Total length measurement

Total length of the fish was measured from the top of the snout (with the mouth closed and caudal rays pressed together) to the top of the caudal fin. A measuring board was used and the measurement was made to the nearest centimeter.

Standard length measurement

The standard length was measured from the snout (with the mouth closed) to the hidden base of the median tail fin (point of attachment of the hypural bone), to the nearest centimeter.

Weight

The entire body of the fish was weighed to the nearest gram, using a top loading weighing balance.

Length - weight Relationship

The length- weight relationship was calculated using the formula of Le - Crene (1951):-

$$W = aL^{b}$$

Where,

W = weight in gram
L = standard length in cm
a = constant (intercept)
b = exponent (gradient)

Condition factor of fish

The condition factor `K` was calculated for individual fish for each month, using the Fulton's condition factor `K` (1904):-

$$K = 100\ (W/L^{3})$$

Where,

$K = 100(W/L^{3})$
K = Condition factor
W = weight in grams
L = Standard length (cm)

Results and Discussion

One hundred fish samples consisting of 42 males and 58 females were used for the length – weight relationship study and the condition factor analysis. Total length for the male samples ranged from 9.1 – 16.2 cm and for the females, it ranged between 10.1 – 15.8cm (Table 1). The weight measurement of the males ranged between 31 – 172g, while for the female, it ranged between 31 – 172g (Table 1). The values obtained indicates that the males were significantly larger than the females ($P<0.05$). The b values recorded for the males and females fish samples during the study were 3.268 and 2.476 respectively (Table 2). This revealed that the males show positive allometric growth and the females exhibited negative allometric growth based on Bagenal and Tesch (1978) criteria of 3. Pauly (1983) similarly reported that a slope value greater than 3 indicates allometric growth. The finding of the present study is similar to that of Entsua – Mensah *et. al.,* (1995) that recorded b value of 2.919 for males, while Ofori – Danson *et. al.*, (2002) recorded b value of 3.010 for females, which is contrary to the findings of the study. According to Pauly (1983), estimated b value can be expected to be below 3 (negative allometry), or above 3 (positive allometry). Wotton (1992), also provides a rough idea on this

situation, indicating that allometric growth is negative (b<3), if the fish get relative thinner as it grow, and positive (b>3), if it gets plumber as it grows. The observation of absolute isometric growth (b=3) in nature is occasional (Bagenal, 1978, Bassey and Ricardo, 2003). Thomas *et. al.*, (2003), observed that deviation from isometric growth is often observed as most aquatic organisms change shape as they grow. The exponent (b) value of 2.83 recorded for pooled also indicated negative allometric growth (Table 2). This indicates that Tilapia zillii in the reservoir obeyed the cube law of growth (Le - Cren, 1951), which is not commonly obeyed by most fishes. The findings of the present study is similar to that of Etim (2000),which recorded 2.951 pooled b value, and in contrast to the findings of Fafioye and Oluajo (2005), which recorded b value of 3.042 for the pooled. The differences in the b values could be as a result of the condition of the fish caught during the different seasons, depth of capture, location, length ranges and sample size. According to Pauly and Gayannilo (1997), b values may range from 2.5 to 3.5, which suggest that the result of this study is valid. The mean condition factors obtained for both males and females Tilapia zilli in Lapai – Agaie reservoir were 1.92 and 0.81 respectively, while that of pooled recorded was 1.03. These condition values were not significantly different (P>0.001). The values recorded in the present study, when compared with that obtained by Ekanem (2000) from Cross River (2.04) were low, but higher than 0.79 ± 0.15, which is less than 1.0, reported by Fafioye and Oluajo (2005) from Epe Lagoon. This may be as a result of the differences in the condition of the habitat such as physico-chemical parameters, plant and animal communities (Yem *et. al.*, (2007). The males Tilapia zilli were observed to have better condition factor than the female during the study period. Similar observations were made by Yem *et. al.*, (2007), in which they reported that this may be due to some females being gravid, and hence the decrease in food intake. This agreed with the finding of Wilson and Pitcher (1983), that there was often a rapid fall in female fish condition as they spawn.

Table 1: Size ranges of *Tilapia zilli* from Lapai – Agaie Reservoir, Niger State, Nigeria.

Sex	No.	Length (cm)		Weight (g)	
		Min.	Max.	Min.	Max.
Male	42	9.1	16.2	31	172
Female	58	10.1	15.8	32	172
Pooled	100	9.1	16.2	31	172

Table 2: length – weight relationship parameters and mean condition factor of *Tilapia zilli* from Lapai – Agaie Reservoir, Niger state, Nigeria.

Sex	A	B	r	Condition factor (K)
Male	-20.092	3.268	0.756	2.192
Female	-8.012	2.476	0.560	2.087
Pooled	-12.312	2.862	0.665	2.031

In conclusion, the result of the present study indicates that male *Tilapia zilli* have higher condition factor than the female, and, that both sexes and the pooled exhibited allometric growth. Thus, an indication that Lapai – Agaie Reservoir has good environmental conditions, that support the survival of *Tilapia zilli* in the reservoir. It can also be concluded that the correct interpretation the Length – weight relationship parameters will reveal information that are useful for fishery management. The Length – weight relationship parameters and condition factor of *Tilapia zilli* in Lapai – Agaie reservoir indicates the suitability of the environment for this species. Therefore, for sustainable management of this stock, the environmental status should be maintained.

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