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Length-Weight Relationship of *Tilapia zillii* Fish Species Collected from Egbe Reservoir, Ekiti State, Southwest Nigeria

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Abstract

Sustainable exploitation is vital to biodiversity conservation, employment and food security. *Tilapia zillii (Coptodon zillii)* is an important species in the fishery of Egbe reservoir, Ekiti State, Southwest Nigeria. To enhance its sustainable management, a study of its length and weight distribution and the length-weight relationship was carried out. Fish samples were collected from the catch of artisanal fishermen operating in the reservoir. Mean fish length and weight were 23.7 cm and 260.7 g, respectively. Catch lengths were higher than length at maturity recorded for the fish. The sex ratio was 1.00:1.38 in favor of males. The condition factor was 1.93, 1.94 and 1.91 for both sexes, female and male, respectively. While the b values were 3.196, 2.692 and 3.682 for both sexes, females and males, respectively. The results showed sexual dimorphism in the growth pattern of the fish in the water body. The current exploitation level as revealed from the catch lengths indicate that *Tilapia zillii* fish species is not under threat in the water body. It is therefore capable of contributing to gainful employment and animal protein security in its environment.

SCAN ME

Introduction

Tilapia is an aquaculture fish globally cultured in not less than 85 countries, especially in Asia and the Middle East [1]. The tilapines thrive in a wide range of habitats with reference to temperature and salinity [2]. They are seemingly riverine fishes living in marginal waters and flood-plain pools, but they have also adapted to lacustrine conditions [3]. Thus, they currently live in various ecological water systems, including slow-moving rivers and their flood-plain pools and swamps, small shallow lakes, large deep lakes, impounded water bodies, isolated crater lakes, soda lakes, thermal springs and brackish-water lakes [4]. One of the common species of Tilapia is *Tilapia zillii*, the name was recently changed to *Coptodon zillii* by Dunz and Schliewen [5]. This species has been reported to survive and function normally in water bodies with salinity ranging between 10% and 30% [6]. A length-weight relationship is an important tool in fish biology, physiology, ecology, fisheries assessment and fish conservation [7]. Knowledge of the length-weight relationship plays a huge role in the prediction of the weight of fish from length measurements made in yield assessment [8] and this assists greatly in establishing sustainable exploitation and management of fish populations [9]. The condition factor derived from the length-weight data is used to assess the well-being of fish [10] and also infer certain facts about food supply, timing and duration of breeding of fish of the same species in different populations [11].

Reservoirs are natural or artificial lakes that contribute significantly to the fish supply in many countries, especially those in the tropics. Jackson and Marmulla [12] reported that tropical and sub-tropical reservoirs are more productive than temperate reservoirs. Also, the contribution of reservoirs to Nigeria's domestic fish production has been described as immense [13,14]. Several studied reported length-weight relationships of some fish species across several Nigerian reservoirs [15-17], but very little information exists on the length-weight relationship of *Coptodon zillii* in Egbe reservoir, Ekiti State. Egbe reservoir has been reported to have *Coptodon zillii* as one of its most abundant species and has the enviable potential for fisheries exploitation because of its high total fish abundance [18]. These facts, therefore, necessitate a study to examine the length-weight relationship of *Coptodon zillii* in Egbe reservoir with a view to determining the exploitation status of the fish and the suitability of the reservoir for the continued survival of the fish as well as for proffering appropriate management strategy for the fish and the reservoir.

Materials and methods

Egbe reservoir is located across the Egbe River in the suburb of Egbe Ekiti in the Gbonyin Local Government area of Ekiti State in Nigeria. The reservoir takes its source from Kwara State and runs through Ekiti to Ondo State, and eventually empties into the popular Osse river in Ondo-State. The reservoir lies between latitudes 7036N and 7039' North and longitude 5032' E and 5035' East of the equator. The entire length of the reservoir is 26.5 acres and the depth is 64 m. A total of one hundred (100) pieces of *Tilapia zillii* specimens (42 females and 58 males) were collected from artisanal fishermen operating on the reservoir between the months of August and October 2018. The fish were transported to the laboratory of the Department of Animal and Environmental Biology Adekunle Ajasin University, Akungba-Akoko, Ondo State. In the laboratory, identified was performed as described in previous reports [19, 20]. Fish were cleaned, blotted and weighed with a top-loading digital balance (Metler) to the nearest 'g' and measured to the nearest 'cm' with a 60 cm fish measuring board. Sex was determined through gonad as well as secondary sexual characters. Length and weight frequency distribution chat were obtained using a class interval of '3 cm' and '50 g' for length and weight, respectively. Body and length weights were log-transformed and the least square regression analysis of the independent (length) and dependent (bodyweight) variables was carried out and presented graphically in scatter plots. The relationship between length (L) and weight (W) of fish was expressed by the following equation [21]:

$$W = {}_aL^b \quad \text{Eq. 1}$$

Where W= weight of fish (g), L= total length of fish (cm) 'a'= intercept and 'b= slope.

The 'a' and 'b' values were obtained from a log-transformed linear regression of the length and weight of fish. The correlation (r^2) which shows the association between the length and weight was computed from the linear regression:

$$\text{Log}W = \log a + b \log L \quad \text{Eq. 2}$$

Where a = intercept, on y-axis b = an exponent between 2 and 4, W = weight of fish (g) and L= total length of fish (cm) [22].

The condition factor (K) was determined from the following equation [23]:

$K=100W/L^3$ Eq. 3

Where W= weight of fish (g) and L= length of fish (cm).

Results

Length frequency distribution showed that the class interval 22.1-24.0 cm had the highest numbers (49) of fish and class interval 26.1-28.0 cm was least represented (9) in the catch (Fig. 1). For weight distribution, the modal class interval was 200.1-250.0 g and the least class interval was 350.1-400.0 g (Fig. 2). The sex ratio for the sample was 1:1.38 in favor of males.

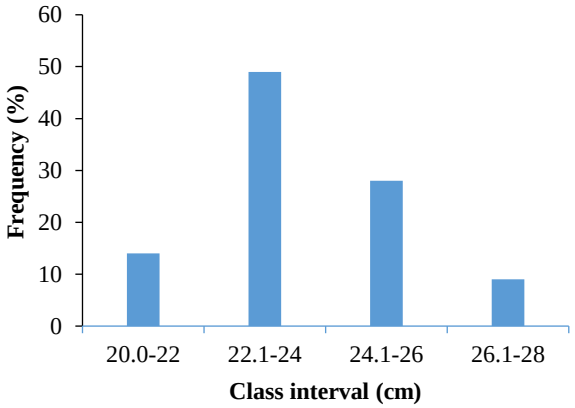

Fig.1 Length -frequency distribution for *Tilapia zillii* (both sexes) from Egbe reservoir Ekiti State, Southwest Nigeria.

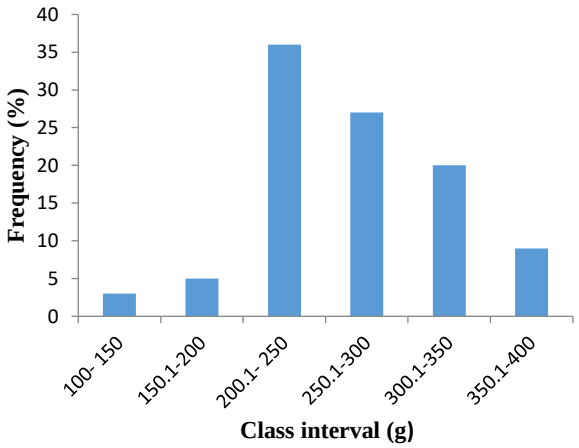

Fig. 2 Weight distribution of *Tilapia zillii* (both sexes) from Egbe reservoir, Ekiti State, Southwest Nigeria.

The results of the length and weight of both sexes of the fish ranged from 20.9 cm to 27.0 cm with a mean of 23.8 cm and 102.1 g to 395.6 g with a mean of 260.7 g, respectively. For the different sexes of the fish, the male's length was between 21.4 cm and 27.0 cm with a mean of 23.9 cm, while the weight ranged from 102.1 g to 395 g and had a mean of 263.7 g. The total length for females ranged from 20.9 cm to 26.9 cm with mean length of 23.6 cm, while the weights varied between 107.7 g to 357.0 g with a mean of 256.8 g. The condition factor, which is a reflection of the fish adaptability to its environment ranged from 0.95 to 2.90 and a mean of 1.93 was obtained for both sexes. For the different sexes, it ranged from 1.15 to 2.24 with a mean of 1.94 and 0.95 to 2.90 with a mean of 1.91 for females and males, respectively. The regression plot of the length-weight relationship for the fish showed that the 'b' value for the species in the water body is 3.20 for both sexes and 2.69 and 3.68 for females and males, respectively (Fig. 3 - Fig. 5). The values showed that there might be sexual dimorphism in the fish growth pattern with the females displaying negative allometric growth patterns.

Discussion

Catch distribution showed diverse lengths and weights thus indicating the varieties of gear employed by the fishermen. However, the fish does not appear threatened because the minimum catch length was higher than a length at maturity recorded for the fish (female: 8.7 cm; male: 9.7 cm) [24]. The length-weight relationship values for males, females and combined sexes of *Tilapia zillii* showed that the males have a positive allometric growth with b value of 3.68, while the females had a b value of 2.69 indicating a negative allometric growth pattern. The b value of the females was much lower than that of the males but not below the benchmark of 2.5 as suggested by Sachidanandamurthy and Yajurvedi [25] to indicate sub-normal fish growth in a particular environment. The combined b value of 3.2 obtained also falls within the range of 2.5 – 3.5 for tropical fish species as suggested by Gayannilo and Pauly [26]. Compared to our study, previously, some researchers reported similar [27-29], while some reported lower b values for fish [14, 30, 31]. This variability is to be expected when comparing the length-weight relationship between single species in different populations and habitat, according to Uneke [31] and could have occurred because of the difference in environmental factors

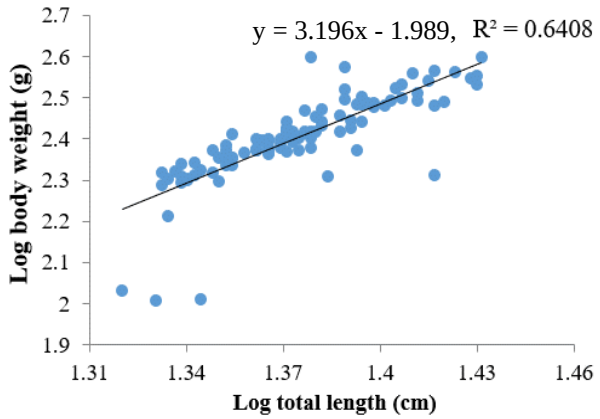

Fig. 3 Length-weight. the relationship for *Tilapia zillii* (both sexes) from Egbe reservoir Ekiti State, Southwest Nigeria.

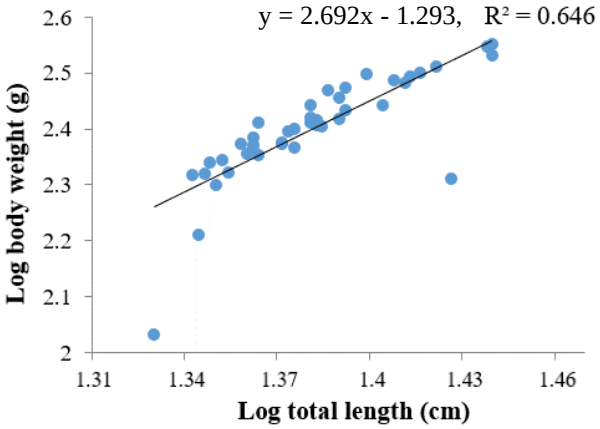

Fig. 4 Length-weight relationship for *Tilapia zillii* (female) from Egbe reservoir Ekiti State, Southwest Nigeria.

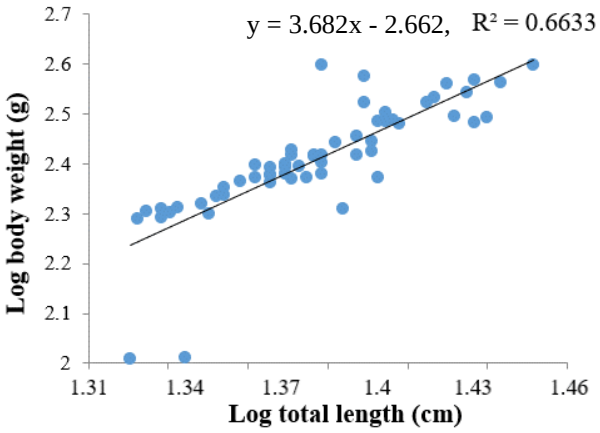

Fig. 5 Length-weight relationship for *Tilapia zillii* (male) from Egbe reservoir Ekiti State, Southwest Nigeria.

such as temperature, food supply, spawning conditions and other factors such as sex, age, fishing time and area and fishing vessels [32] and other environmental conditions unique to the Egbe reservoir. The condition factor showed that the population of *Tilapia zillii* in the Egbe reservoir is in good condition with values of 1.91, 1.94 and 1.93 for males, females and both sexes, respectively. The higher mean condition factor recorded for the females could have resulted due to the period of sampling, which took place between August and November. This corroborates the work of Uneke [31] who reported that females had a higher condition factor in the months of September and November, while El-Sayed et al. [24] reported females to have a higher condition factor in August. With reproduction having a marked effect on condition factor of fish, the variance in condition factors for both sexes of *Tilapia zillii* in each habitat may be due to differences in rainfall patterns and thus shows differences in the onset of their reproduction.

Conclusions

The data obtained in this study clearly showed that the fish are not in danger or under threat in the water body of the Egbe reservoir, Ekiti State, Southwest Nigeria. Therefore, it can be interpreted that fish are capable of contributing to gainful employment and animal protein security in their environment.

Conflict of interest

The authors have no conflict of interest.

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