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Length-Weight Relationship and Condition Factor of Two Species of *Tilapia* and One Species of *Mormyrops* from a Tropical Dam in a Southwestern State, Nigeria

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Abstract

The length-weight relationship and condition factor of *Tilapia zillii, Oreochromis niloticus* and *Mormyrops anguilodes* from Itapaji dam, Ekiti State Nigeria were examined in this study. A total of 150 Cichlidae which made up of 130 *T. zillii* (65 females and 48 males) and twenty-four *O.niloticus* (11females and 13 males) and 13 *M. anguilodes* (11 females and 2 males) procured directly from the Fishermen were examined for this research. The parameters 'a' and 'b' were determined from the linear regression of the log of length and weight of the fish when transformed into the growth equation, $W= aL^b$. The values of 'b' for the fish species ranged from -1.16 to 10.12 and the result showed that Cichlidae had negative allometric growth while the Mormyrops showed positive allometric growth. The condition factor 'K' value for females and males of *O.niloticus* were closer to the recommended range of 2.9 to 4.8 reported as suitable for matured freshwater species in the tropics while the 'K' value of other two species were greater than 1 except in the female *M. anguilodes* .The difference in the 'K' values may be caused by the variation in weight of individual fish species sampled as well as environmental factors to which they are exposed in the dam.

Keywords: Length-Weight relationship; Condition Factor; Tilapia; Mormyrops; Itapaji Dam

Introduction

Fish are aquatic organisms consist of gill bearing cranium but lack limbs with digits, they are cold-blooded animals. They are of great importance for the Nigeria aquaculture industry and its production is gradually increasing. Fish like other hunting activities has been a major source of food for human race and has put an end to the unsavoury outbreak of anaemia, kwashiorkor etc. Cichlidae genera include *Oreochromis, Sarotherodon and Tilapia*. They add values to the life of fish farmers and commercial fishery of inland waters of most countries of the world. They are tolerance to a variety of habitats and omnivore nature of their feeding habit confers them an

important element of fish farming which demands mode of their life and ecological requirements [1]. Mormyrops species are well distributed in swamps, lakes and rivers of most Nigerian fresh water bodies. Mormyridae include Hyperopisus, Mormyrus, Petrocephalus, Mormyrops, Marcusenius and Gnathonemus. The family Mormyridae is highly variable in shape of their head. Their common characteristics include upward pointing of pectoral fin, narrow gill openings and their eyes are small and weak and covered by a thin layer of skin. This species has always been consumed for their oily and tasty flesh according to Achionye-Nzeh, Babatunde and Aminu, Nzeh and Lawal [2-4].

FAO reported that Nigeria is one of the largest importers of fish in the developing world, importing about 600,000 metric tonnes annually [5]. To solve this short-fall in fish supply, Nigeria must be fully involved in proper aquacultural management. Scientifically sound management of fish resources relies on the basic knowledge on the biology of the species, including information on population structure, such information influences the development of the management strategies and strategies for conserving biodiversity [6]. Morphological characters such as morphometrics and meristics have been commonly used to identify stocks of fish [7,8]. Virtually, nothing is known about the morphological population structure of Cichlidae and Mormyridae species from Itapaji dam, Ekiti State, Nigeria. It is vitally important to obtain detailed knowledge on the population structure of these commercially exploited species and to apply knowledge to the management of the fisheries in the dam. This research work was therefore designed to compare the length-weight relationship and condition factor of *Oreochromis niloticus, Tilapia zillii and Mormyrops anguiloides* collected from Itapaji Dam, Ekiti State, Nigeria.

Materials and Methods

The Study Area

The samples were collected from Itapaji dam. The dam was constructed in 1975 for the supply of water for domestic use and production of fish for Ikole Local Government Area of Ekiti State and the environs. It is entirely within the tropics. It is located between latitude 7^0 53^1N and longitude $5^0.5^1 30^{11}$ E of the Equator. The dam has the capacity of 5,175m^3/day. The surface area is 115.2Km. It's length is 400m and the height is 24m. Its neighbours are Kwara State to the North, Kogi State to the North East, Ekiti East to the East, Gboyin Local Government in the South and Oye Local Government in the West.

Sample Collections and Identificaton

Tilapia species (*Oreochromis niloticus and Tilapia zillii)* and *Mormyrops* species. (*Mormyrops anguiloides*) were collected directly from the local fish farmers. The fish were collected by set and catch net usually set overnight. The samples collected were transported to the laboratory immediately for the experiment. The *O. niloticus, T. zillii* and *M. anguiloides* were identified using the standard key by Olaosebikan and Raji (1998)[9].

Experimental Procedure

The fish samples bought directly from the Fishermen were transported immediately to the Post graduate laboratory of Zoology and Environmental Biology Department, Ekiti State University, Ado- Ekiti for the practicals. The fish samples were sorted into different samples and sexes and labelled properly.

Data Collection

The data on growth pattern of the species were collected through length – weight relationship by using the equation below,

$W = aL^b$

Where W= weight of fish in grammes (g)

L = Total length of fish in Centimeters (cm)

a = intercept of the regression

b = Regression coefficient (slope) (Pauly, 1983) [10].

The "a" and "b" values were obtained from the linear regression of the logarithm of length and weight of fish. When b is equal to three (3), isomeric pattern of growth occurs but when b is not equal to 3, allometric pattern of growth occurs which may be positive if greater than 3 or negative if less than 3. The correlation coefficient (r^2) that shows the degree of association between the length and the weight was computed from linear regression analysis.

$R = r^2$

The mean weight and length of the experimental fish were used to estimate condition factor using equation below:

$$K = \frac{100W}{L^3}$$

Where K-The Condition Factor

W= Weight in grams (g)

L= Total length of fish in centimeters (cm)

Results

A total number of one hundred and fifty (150) *Tilapia* species consisted of one hundred and thirteen of *Tilapia zillii* (65 females and 48males) and twenty-four of *Oreochromis niloticus* (11 females and 13 males) and *Mormyrops anguiloides* (11 females and 2 males) were collected for this work.

Table1 shows the ranges and mean values of the total length and body weight of famales and males of the three species of fish collected from Itapaji water reservoir, Ekiti State Nigeria. Among the males, *Mormyrops anguiloides* had highest mean length with 30.05cm while the *T. zillii,* and *O. niloticus* had 16.59 and 16.68 respectively. The results on length among females followed the same format of the results on males. Both males and females of *M. anguiloides* outweighed others. The males had the mean weight of 172.0g while the female had 145.12g. The males and females of *O. niloticus* followed with 84.7 and 85.11g respectively.

Fish species	Total Length Body Weight Sex Range Mean Range Mean
Tilapia zillii	Female 14.1-19.3 16.54 39.5-108.0 77.81 Male 14.0-19.1 16.59 43.4- 97.2 67.47
Oreochromis niloticus	Female 15.5-18.1 16.64 61.9-98.5 85.11 Male 14.0-17.8 16.68 66.6-105.0 84.70
Mormyrops anguiloides	Female 24.4-39.5 27.48 97.7-182.3 145.12 Male 28.0-32.1 30.05 151.9-193.4 172.00

Table 1: The ranges and mean values of the total length and body weight of the three fish species collected from Itapaji Dam, Ekiti State, Nigeria.

Table2 shows the condition factor and length-weight relationship of the males and females of the three species of fish sampled from Itapaji dam. The mean condition factor ranged from 0.75 in the females of *M. anguiloides* to 1.75 in the females of *T. zillii.* The length- weight relationship of the females and males shows that the 'b' value ranged from -1.16 in the males of *O. niloticus* to 10.12 in the males of *M. anguiloides.* The correlation coefficient "r" ranged from 0.09 in the males of *O. niloticus* to 0.64 in the females of *M. anguiloides.*

Fish species	No K-factor Regression Regression equation coefficient Sex sampled a b r^2 r
Tilapia zillii	Female 65 1.75 80.10 0.09 0.016 0.13 Male 48 1.63 37.36 1.81 0.016 0.13
Oreochromis niloticus	Female 11 2.25 60.68 1.46 0.021 0.15 Male 13 2.19 104.07 -1.16 0.007 0.09
Mormyrops anguiloides	Female 11 0.75 -80.24 8.20 0.408 0.64 Male 02 1.27 -131.51 10.12 1 1

Table 2: Length-Weight relationship and condition factor of the three species collected from Itapaji Dam, Ekiti State, Nigeria.

Discussion

Among the three species of fish sampled for this work, *Mormyrops anguiloides* had the least sample size. The possible reason for the low number of the species may be due to over exploitation by the local fish farmers thereby makes the species a threatened one. The results further showed that the *Tilapia zillii* was a dominant species in the reservoir which was followed closely by *O. niloticus* during the collection periods.

The result of length- weight regression analysis in this work showed that both the males and females fish exhibited allometric growth. The values of "b" showed that both males and females of *T. zillii* and *.O.niloticus* exhibited negative allometric growth while the female and male of *M. anguilodes* exhibited positive allometric growth pattern. This means that *T. zillii* and *O. niloticus* become thinner or slender with increase in their length as it was reported by King, and Riedel, et al. while *M. anguiloides* becomes stocky or robust as its length increases [11,12]. The results obtained in this work were similar to what was documented on fishes of some Nigerian inland waterbodies. Notable among these Authors are Sangu et al. and Offem, et al. [13,14]. They reported 35.9% and 24% of their samples respectively exhibited negative allometrics. Dan-Kishiya (2013) reported that all the five fish species collected from a water supply reservoir in Abuja had negative allometric growth while Oso and Iwalaye reported three out of their four collections from Ero dam in Ekiti State, Nigeria had negative allometric [15,16] . The number of sample of *Mormyrops* species collected for this work was very low, in contrast to the result of Offem et al. in which the species was one of the dominant species collected from the flood plain river of Calabar, Nigeria[14]. The possible

reason for the number available may be due to over exploitation of the samples by the fish farmers.

The b values reported for *T. zillii* and *O. niloticus* males and females in this research work had were 1.81, 0.91 and -1.16, 1.14 respectively. The values were similar to 1.4 and 2.3 reported on Wasai river, Kano samples by Imam et al. but in variance to the range of 4.73 to 15.59 recorded for *T.zillii, Sarotherodon melanotheron, T. guinesis,T. mariae* and *O. niloticus* from Badagry creek, Lagos by Akintade, et al. [17,18].

The 'b' values of females and males of *M. anguiloides* 8.20 and 10.12 showed that they exhibited positive allometry growth. The results were similar to 6.82 reported for *Bathygobius soporator* by Akintade et al. 18]. The reasons for differences in the fish growth patterns, may be due to availability of food, the season of the collection, poor environmental conditions, competition along the food chains.

The effective management of fishery resources requires considerable knowledge of population parameters such as length-weight relationship. The relationship is essentially important in fishery biology for it allows estimation of average weight of fish from a given length grou, assess the well-being of individuals and to determine the possible differences between separate unit stocks of the same species [19,20]. This relationship is also important in fisheries management for comparative growth studies [21]. The length- weight relationship provides valuable information on the habitat where the fish lives, and also in aquatic ecosystems modelling [22,23].

Condition factor (K) is described as a morphometric index needed to evaluate physiological status of fish based on the fact that those individuals of a given length which have a higher mass are in a better condition.

The relationship of length –weight can be used in the estimation of condition factor (K) of fish species. The condition factor obtained in this study ranged from 0.75 in the female *M. anguiloides* to 2.25 in the female *O. niloticus* which were varied from what some Authors reported, for example Oso and Iwalaye, reported 0.99455 to 4.3457 for four fish species from Ero dam, Ekiti State, Ajani reported range of 0.45 to 2.25 for five tropical fish of a coastal lake in Lagos Nigeria, Nwadiaro and Okorie reported the condition factor ranged from 0.49 to 1.48 in Oguta lake, Kumolu-Johnson and Ndimele reported the K value of the range of 0.91 to 8.46 for twenty-one fish species from Ologe lagoon, Lagos, while Abowei and Hart also reported K value of 1.10 for *Cyloglossus senegalensis* in Nikoro river. Ajani and Wale reported that "K" value less than 1 implied that the fish are not in good condition within their habitat while values greater than 1 implied that the fish are in good condition of physiological state within their habitat [24-28]. The "K" values obtained in this study were greater than 1except in the *M. anguiloides* on which 0.75 was reported. Based on our findings, it could be said that all the fish samples are in good condition of well-being except the female of *M. anguiloides* in Itapaji dam, Nigeria. It was observed that the 'K'-values obtained in this work were lower than the range of 2.9 to 4.8 recommended as suitable for matured freshwater fish by Bagenal and Tesch [29]. The variation in values may be attributed to variations in variations in weight and stage of maturity. Other factors which might have contributed to the variations may include stress, season, availability of feeds, mutagens from human interference, and other water quality parameters.

Conclusion

The results obtained on the *T. zillii and O, niloticus* showed that they exhibited negative allometric growth while the *M. anguiloides* exhibited positive allometric growth. Also, the K values obtained revealed that the fish samples were in good condition of well-being except the females of *M. anguiloides*. Results also showed that the population of *M, anguiloides* is being threatened. Various factors may have contributed to variations recorded among the fish species hence; there may be need for proper examination of the water quality parameters and other factors affecting the Itapaji dam to establish the suitability of the reservoir for fish breeding.

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