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**Research Paper**

# MORPHOMETRIC CHARACTERISTICS AND MERISTIC TRAITS OF *Tilapia zillii* FROM THREE MAJOR DAMS OF A SOUTHWESTERN STATE, NIGERIA

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## ABSTRACT

*Tilapia zillii was* examined in three major dams in Ekiti State, Nigeria (Ureje dam, Ado, Egbe dam and Ero dam) for their morphometric characteristics and meristic traits. The results showed that the average body weight of the fish sampled were 145.86±50.06g in Ado, 30.19±9.35g in Egbe and 40.58±52.30g in Ero dam. Average total lengths were 21.29±3.20cm, 12.32±1.74cm and 11.24±1.56cm for Ado, Egbe and Ero dam respectively. The relationship between average weight and length of *T. zillii* showed that Y=15.202X-179.33 ($R^2$=0.7181), Y=4.40049±-24.075 ($R^2$=0.6708) and Y=2.6676X10.596 ($R^2$=0.0063) for Ado, Egbe and Ero dam respectively. The results on headlength, total length, body weight and standard length and pre-pelvic distance are significantly different at 95% among the *T.zillii* of the three dams. There was no significant difference in the meristic traits of the *T. zillii* of the three dams. The population size of *T.zillii* in the three dams was just too small compared to other species of fish hence the need to assess the stock of fish in these dams critically for the encouragement of proper fishing activities in these dams

**KEYWORDS**: *Tilapia zillii*, Morphometric Characteristics, Meristic traits, Dam, Nigeria

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## INTRODUCTION

Tilapia of the family *Cichlidae*, is an African freshwater fish with over 100 species. Culturing of tilapia boosts the source of fish protein in many countries of the world and the consumption of tilapia in both the developing and industrialized countries has increased tremendously. There has been an increasing interest in tilapia culture and it has been transplanted and stocked into waters of most countries of the World (Balarin and Hatton, 1979, Eknath *et.al*., 1993). *T. zillii* was among the species of *Cichliidae* caught in the three water reservoirs in Ekiti State, Nigeria, *T. zillii* has many attributes that make it suitable for culture. Among these are its general hardiness, high tolerance to adverse environmental conditions and overcrowding, its ability to withstand low oxygen and a wide range of salinity concentrations and resistance to diseases. Tilapia is able to survive and grow on a wide range of natural and artificial feeds, converts food efficiently, grows relatively fast, has a high yield potential and is accepted by a wide range of consumers. Furthermore, tilapia can be grown in a variety of culture systems ranging from simple systems with little infrastructure to more intensive and complex systems (Ridha, 2006). Based on the attributes mentioned above, there is need to assess their population among the fish diversity of these dams for proper monitoring and of the growth and development. This can be done through morphometric characteristics of the fish.

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Morphometric and meristic studies of animals are part of the vigorous tools for measuring descreteness of the same species (Naeem and Salam, 2005). Morphometric studies of animals are not only essential to understand the taxonomy but also the health of species involved (including reproduction) in an environment. These traits reveal the inter relations between the various body parameters like length, weight, fecundity etc. Meristic traits are the countable structures occurring in series (such as myomeres, vertebrate, fin rays etc.) in fish. These characters are among those most commonly used for differentiation of species populations (Sedaghat *et al*, 2012). since morphometric characterization of fish is not only essential to the understanding of the classification of fish but also, the health of the species involved; the shape and structures are unique to the species and the variations in its features are related to the habit and habitat among the fish species.

This study was therefore designed to assess the population of *T. zillii* collected from Water works in Ado-Ekiti, Egbe-Ekiti and Ero reservoirs through their morphometric characteristics and meristic traits.

## MATERIALS AND METHODS

STUDY SITES

*Tilapia zillii* samples were collected from three major dams in Ekiti State, Nigeria. The Dams are Ado-Ekiti waterworks reservoir, Egbe reservoir in Egbe –Ekiti, Ero reservoir in Ikun-Ekiti. Ado- Ekiti water works reservoir was constructed by damming the Ureje river in Ado-Ekiti in 1958 for the supply of water for domestic uses and production of fish for Ado-Ekiti community and the environs (Agbeyo, 1976). At full capacity, the reservoir contains about 47million gallons of water (Ebisemiju, 1993). It is situated on an undulating plane of an average height of about 440m above sea level and surrounded by highlands. The dam lies between latitude $70^{o}$ $37^{I}$ north and longitude $5^{o}$ $13^{I}$ east of the equator.

Egbe water reservoir originated from Kwara State, Nigeria and flows from the north to the south through Ode –Ekiti to Egbe-Ekiti. It was built in 1975 by damming the Osse river at Egbe- Ekiti. The dam was commissioned in 1989. It covers an area of 26.5 hectares with the depth of about 64m. The reservoir is located at an undulating plane surrounded by highlands from which run-offs also feed the reservoir during raining seasons. The capacity of the reservoir is about 144million cubic meters. The location of this reservoir is on latitude $7^{o}$ $36^{I}$ North and longitude $5^{o}36^{I}$ east of the equator.

Ero water reservoir is a tropical reservoir situated at Ikun- Ekiti. It is an earth filled embankment with a length of 662m and an impoundment area of 4.5km. It was commissioned in 1985.The water level is about 504m containing about 2009 million cubic meter. It lies between latitudes $7^{o}15^{I}$ - $8^{o}5^{I}$ and longitudes $4^{o}45^{I}$ -$5^{o}45^{I}$

### COLLECTIONS AND IDENTIFICATION OF FISH SPECIMEN

*Tilapia zillii* were selected from the samples of *Cichliidae* collected from the three water reservoirs bi-weekly from August to December, 2012. The fish samples were collected with the aid of cast netting of 3.5mm mesh size. The samples were transported to the Post graduate laboratory of Zoology Department, Ekiti State University, Ado- Ekiti for the practical. The *Cichliidae* samples were sorted into different samples. The *T. zillii* was identified using the standard key by Olaosebikan and Raji, (1998).

### MORPHOMETRIC AND MERISTIC FEATURES

Head diameter (HD); the width between the anterior tip of the fish and the posterior bony edge. Total length (TL); distance between the anterior tip of the fish and the most posterior tip of the caudal fin. Body weight (BW); the measure of the total body mass. Standard length (SL) was determined using a ruler, by measuring the length from the tip of the mouth to the beginning of the tail. Dorsal fin length (DFL), Pelvic fin length (PCFL) Genital papillae (GPL), Pectoral fin length (PEFL), Pectoral spine length (PESL), Anal fin length (AFL), Pre pectoral distance (PPCD), Pre pelvic distance (PPLD), Pre anal distance (PAD), Head length (HL), Snout length (SNL), Body depth at anus (BDA), Caudal peduncle (CPD), Caudal fin ray (CFR), Dorsal fin ray (DFR), Pectoral fin ray (PECF), Pelvic fin ray (PELF), Anal fin ray (AFR), Eye diameter (ED)

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**LENGTH-WEIGHT RELATIONSHIP**

This relationship was determined following Le Cren (1951) in which Length-weight was expressed as $W = aL^b$,

Where W = Weight in gramme (g), L = length in centimetre (cm), a= a constant being the initial growth index, and b = growth coefficient. Constant 'a' represents the point at which the regression line intercepts the y-axis and 'b' the slope of the regression line.

**DATA ANALYSIS**

Data on mean weight,standard length, total length and other morphometric parameters were analysed by using Students' T-test

**RESULTS**

All the *T. zillii* specimens' morphometric characteristics and meristic traits are shown in table1. The table shows the Fvalues, probability and the mean values of morphometric characteristics of *T. zillii* from Ado, Egbe and Ero dams of Ekiti State, Nigeria.

The mean body weight values of the fish ranged from 40.58±52.3g in Ero reservoir to 145.86±50.06g in Ado reservoir. The mean body weights of the *T. zillii from* the three dams are significantly different from each other (Probability ≤ 0.05%). The mean total length of the fish species from the three dams ranged from 11.24±1.56cm in Ero to 21.29± 3.20 cm in Ado. The values of the total length of the fish of the three dams are significantly different from each other (Probability ≤ 0.05%). The data on Head diameter (HD), standard length (SL) and pre-pelvic distance (PPLD) are significantly different among the three dams. Whereas, the data on dorsal fin length (DFL), pelvic fin length (PCFL), pectoral fin length (PEFL), pectoral spine length (PESL), Anal fin length (AFL), pre-pectoral fin distance (PPCD), pre-anal distance (PAD), head length (HL), snout length (SNL), body depth at anus (BDA) and caudal peduncle depth (CPD) are not significantly from each other among the three dams.

Fig. 1, 2 and 3 show the relationship of the average body weight and total length of *T. zillii* collected from Ado, Egbe and Ero reservoir respectively. The correlation values are Y= 15.202X-179.3 ($R^2$= 0.7181), Y=4.40049X-24.075 ($R^2$=0.6708) and Y= 2.6676X+10.596 ($R^2$= 0.0063) for Ado, Egbe and Ero reservoir respectively.

**DISCUSSION**

The *Cichlids* along with some families of fish such as *Castosmids* and *Characids* are characterized with extremely large variations in their body shapes (McCune, 1981). It was reported that high morphological diversity exists among as well as within tribes of *Cichlids* in most of African lakes. Variation in body form has important fitness consequences in fish both in cultured and the wild species (Gatz, 1998, Gulliet *et al*2003). Morphological differentiation between fish populations in different localities/ habitats may not be related to genetic differentiation alone but by the inclusion of the environmental factors or their interactions (Kara *et. al, 2*011). Morphological variability of fish was reported to be an important adaptive strategy for populations experiencing inconsistent environmental conditions (Stearn, 1989 and Scheiner, 1993). Genetic differences and reproductive isolation between populations may lead to local adaptation, which is reflected in morphology, behaviour, physiology and life history traits (Pakkasmaa and Piironen, 2001). Environmental factors on the other hand, can produce phenotypic plasticity, which is the capacity of a genotype to produce different phenotypes in different environmental conditions (Scheiner, 1993). Variability of environment could be explained by the variation of abiotic components such as physico-chemical parameters by water habitat substrate types and biotic components like competition and predation, which serve as selective pressures. Most of the abiotic components in an environment are determined by geographical location such as altitudinal and latitudinal position where the species inhabit. It has been reported that altitudinal variation could indirectly affects the morphology of a species. Elevation variation has been shown to be correlated with body sizes (Alkinson and Sibbly, 1997, Jin *et.al,* 2007) and the head sizes (Liao *et.al,* 2006). In this study, significant variation occurred in the body weight (BW), total length (TL), head diameter (HD) among the *Tilapia*

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*zillii* collected in these the three reservoirs. The cause(s) of the variation of morphometric characters in the species may be as a result of the environmental variations of their habitat and other hidden factors. The body shape of *Clarias* and *Tilapia* and other families of fish have been reported to be modified by temperature fluctuations (Beacham, 1990). Other factors reported to have influence on the shape modification of fish are food or feeding (Day *et.al*, 1994, Day and Mcphail, 1996). Food types were observed to affect the body weight of Crucian carp (*Carassius carassius)* (Bronmark and Miner, 1992). Also, the induced defenses in the presence of predators or good food conditions lead to a deep body shape in the species (Bronmark and Petterson, 1994, Holopainen *et.al.*, 1997)
The meristic traits recorded in this work are fairly constant. These agreed with the findings of Reed *et.al*.(1967) and Holden and Reed, (1972) that fin rays of the *Tilapiini* do not vary much. The meristic traits are fixed in the early embryonic life of individual fish and remain unchanged thereafter under stable environmental factors. Meristic characters are determined by the respond of animals to short time environmental factor variations during embryonic development. These could result in wide variations among members of the same and even different year classes of a single stock of fish (Lindsey, 1988). In contrast, morphometric characters varied according to the changing environmental conditions of the habitat throughout their life and the phenotypic plasticity have been shown in many freshwater fish species (Haider and Jonsson, 1993, Peres-Neto and Magnan, 2004.

In this study, the population size of *Tilapia zillii* recorded in these three dams are too small compared to what some Authors have reported on the species in the dams. The reduction in the abundance of the *T.zillii in* these reservoirs may be as a result of some inherent factors such as over- exploitation, predation pressure etc. The fish sample collected in Ero reservoir for example is at variance to the population size Oso *et.al*, (2013) reported on this same species. They were able to collect eighty-one (81) individuals between April and December 2009. The results obtained on this may not be true status of the fish population in the three reservoirs. Hence there is need to determine factor(s) responsible for the scanty population size of this species in the three reservoirs for the sustainability of aquacultural practices in Ekiti State, Nigeria.

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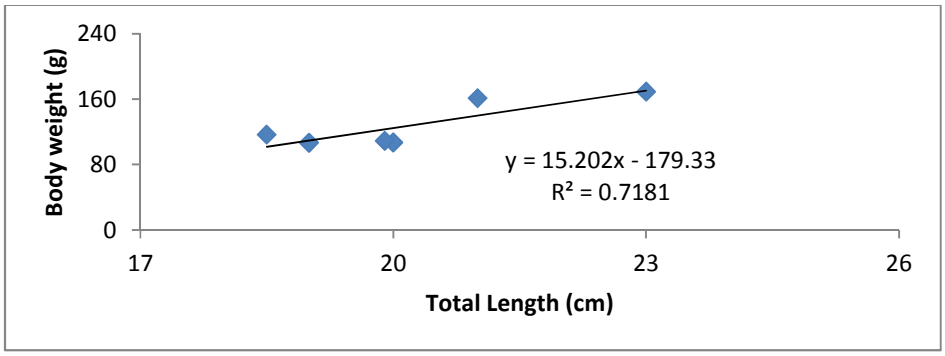


**FIG. 1**: The relationship between the body weight (g) and total length (cm) of *Tilapia zillii* from Ado-Ekiti dam

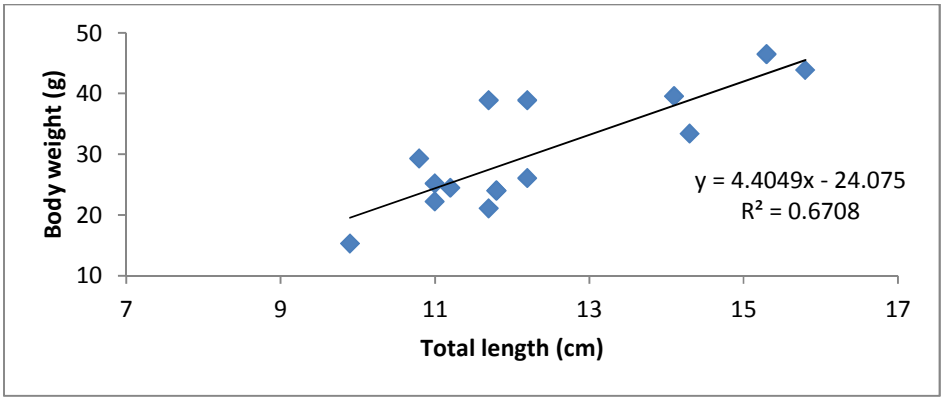


**Fig. 2:** The relationship between the body weight (g) and total length (cm) of *Tilapia zillii* from Egbe – Ekiti dam

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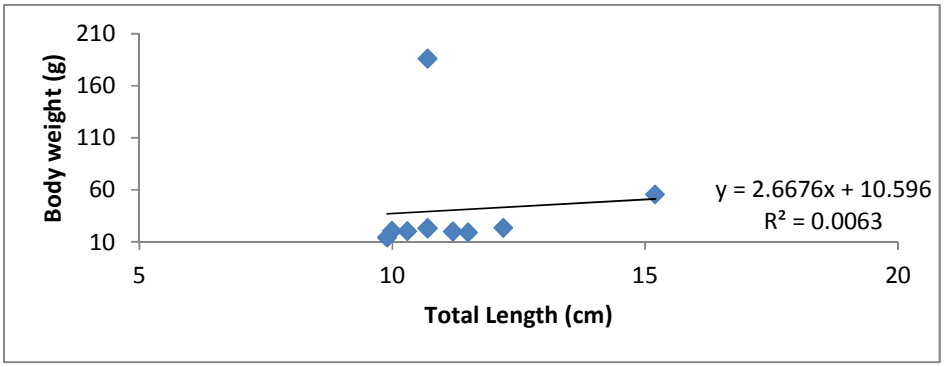


**Fig. 3:** The relationship between the body weight (g) and total length (cm) of *Tilapia zillii* from Ero dam

**Table1:** The F-values, probability and the mean values of the morphometric characteristics and meristic traits of the *Tilapia zillii* from three main dams (Ado, Egbe and Ero) of Ekiti State, Nigeria

| **Characteristics** | **F-Values** | **P-Values** | **ADO** | **EGBE** | **ERO** |
|---|---|---|---|---|---|
| | | | MEAN±SD | MEAN±SD | MEAN±SD |
| Head diameter (HD) | 31.96 | 5.92E-08 | 5.74±0.89$^{a}$ | 3.47±0.77$^{b}$ | 2.59±0.56$^{c}$ |
| Total length (TL) | 62.53 | 4.7E-11 | 21.29±3.20$^{a}$ | 12.32± 1.74$^{b}$ | 11.24±1.56$^{c}$ |
| Body weight (BW) | 20.19 | 3.73E-06 | 145.86±50.06$^{a}$ | 30.19±9.35 | 40.58±52.3$^{b}$ |
| Standard length (SL) | 47.99 | 8.99E-10 | | 10.09±1.61$^{b}$ | 8.78±0.75$^{c}$ |
| Dorsal fin length (DFL) | 60.10 | 7.38E-11 | 16.82±3.22$^{a}$ | 6.11±0.99$^{b}$ | 5.72±0.99$^{b}$ |
| Pelvic fin length (PCFL) | 44.35 | 2.09E-09 | 11.10±2.24$^{a}$ | 2.79±0.54$^{b}$ | 2.35±0.37$^{b}$ |
| Genital papillae (GPL) | 9.16 | 0.00087 | 5.07±0.98$^{a}$ | 0.35±0.05$^{a}$ | 0.37±0.09$^{a}$ |
| Pectoral fin length (PEFL) | 0.60 | 0.55468 | 0.46±0.21$^{a}$ | 3.64±4.83$^{b}$ | 2.84±0.44$^{b}$ |
| Pectoral spine length (PESL) | 9.96 | 0.00054 | 5.06±1.39$^{a}$ | 1.53±0.51$^{a}$ | 2.00±0.41$^{b}$ |
| Anal fin length (AFL) | 50.24 | 5.45E-10 | 3.00±1.65$^{a}$ | 2.55±0.49$^{b}$ | 2.25±0.49$^{b}$ |
| Prepectoral distance (PPCD) | 11.77 | 0.00020 | 5.11±0.92$^{a}$ | 4.63±1.17$^{a}$ | 3.29±0.54$^{b}$ |
| Pre pelvic fin distance (PPLD) | 67.04 | 2.11E-11 | 5.85±1.13$^{a}$ | 3.98±0.58$^{b}$ | 6.80±0.76$^{a}$ |
| Pre anal distance (PAD) | 42.82 | 3.04E-09 | 6.83±1.30$^{a}$ | 7.70±0.75$^{b}$ | 3.94±0.52$^{c}$ |
| Head length (HL) | 38.27 | 9.78E-09 | 11.95±2.29$^{a}$ | 3.19±0.59$^{b}$ | 2.75±0.39$^{b}$ |
| Snout length (SNL) | 37.33 | 1.26E-08 | 5.06±0.64$^{a}$ | 1.41±0.57$^{b}$ | 1.75±0.50$^{b}$ |
| Body depth at anus (BDA) | 427.12 | 1.05E-21 | 3.04±1.32$^{a}$ | 1.55±0.78$^{b}$ | 1.66±0.16$^{b}$ |
| Caudal peduncle depth (CPD) | 28.71 | 1.65E-21 | 2.94±0.78$^{a}$ | 2.29±0.46$^{b}$ | 2.24±0.29$^{b}$ |
| Caudal fin ray (CFR) | 12.16 | 0.00016 | 3.70±0.86$^{a}$ | 18.13±1.25$^{a}$ | 15.90±0.88$^{a}$ |
| Dorsal fin ray (DFR) | 7.75 | 0.00209 | 17.81±1.80$^{a}$ | 28.93±2.87$^{a}$ | 25.10±2.02$^{a}$ |
| Pectoral fin ray PECF) | 5.14 | 0.01252 | 27.74±1.16$^{a}$ | 12.73±0.70$^{a}$ | 12.00±0.00$^{a}$ |
| Pelvic fin ray (PELF) | NS | NS | 12.78±0.64$^{a}$ | 6.00±0.00$^{a}$ | 6.00±0.00$^{a}$ |
| Anal fin ray (AFR) | NS | NS | 6.00±0.00$^{a}$ | 12.60±0.63$^{a}$ | 11.90±0.57$^{a}$ |
| Eye diameter (ED) | NS | NS | 11.83±0.75$^{a}$ | 1.10±0.23$^{a}$ | 1.35±0.32$^{a}$ |
| | | | 1.18±0.21$^{a}$ | | |

Mean values in the same column with the same superscripts are not significantly different from each other (P≤0.05)

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