MORPHOMETRIC PARAMETERS OF RED BELLY TILAPIA (*Tilapia zillii*) IN EGBE DAM, GBONYI LOCAL GOVERNMENT, EKITI STATE NIGERIA.

A PROJECT SUBMITTED

BY

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EKITI STATE.

NOVEMBER, 2017.

DEDICATION

I dedicated this work to my lovely parents in the Lord, Mr and Mrs Lawrence Feyisola Afolabi.

DECLARATION

I declare that this work was done by me under the supervision of Prof P.A Araoye.

18th November, 2017
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AFOLABI ABIOLA VICTOR

FAQ/11/0029

CERTIFICATION

This is to certify that this work was authorized and has been approved for its contribution to knowledge and literary presentation.

27/02/18

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Date

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ABSTRACT

A total number of 60 Tilapia *zillii* specimens were collected from Egbe dam Gbonyin local government in Ekiti West for 25 days. Morphometric measurements taken in the laboratory include total length, standard length, body weight, body depth, dorsal fin length, caudal peduncle length, head length, fork length, and pre-dorsal fin length. Total number of 34 female *Tilapia zillii* were collected as 26 number of male *Tilapia zillii* were collected from the study area. The maximum total length obtained from fish samples is 17.9cm while the minimum length obtained is 13.1cm respectively. Also, the maximum weight obtained is 106.5g while the minimum weight is 39.2gThe b-value which indicate allometric growth pattern for male *Tilapia zillii* is 2.57 and for female is 2.57. Similarly, the b-value for combined sex is 2.42. The condition factor (k) for male Tilapia *zillii* is 2.10 and the female has a value of 2.16 while 2.14 was recorded for the combined sex respectively. The study shows clearly that there was high correction between male *Tilapia zillii* (r=0.330) and the female(r=0.325). Also, for the combined sex there was weak correction within combined sex(r=0.336).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

CHAPTER ONE

1.0 INTRODUCTION

Length and weight data are useful standard outputs of fish sampling programs Morato *et al.* (2001). In fish, size is generally more biologically relevant than age, mainly because ecological variability in size has important implication for diverse aspects of fisheries science and population dynamics Erzini (2005) length weight regression have been used frequently to estimate weight from length because direct weight measurement can be time consuming in the field Sinovoic *et al.* (2004). The estimation of population size of a fish stock for the purpose of its rational exploitation often requires knowledge of individual body WLR in the population Dulcic and Kraljevic (2007). Weight length relationship (WLR) have several applications namely on fish biology, physiology ecology and fisheries assessment. In biological studies, weight length relationship enables seasonal variation in fish growth to be followed and the calculation of condition indexes. Weight length relationship gives us life history and morphological comparison between difference fish population from different fish species or between difference fish population from different habitat Colves *et al.* (2010), Santos *et al.* (2012). According to Abdorahaman *et al*, (2004), the length weight relationship is particularly important in parameterizing yield equation and in estimation of stock size. The parameter b of the LWR (W=alb) also known as allometric coefficient, has an important biological meaning, indicating the rate of weight gain relative to growth in length. Marked variability in estimates of b is usually observed among different population of the same species, or within the same population at different time.

Marked variability in estimates of b is usually observed among different population of the same species or within the same population at different times. On the other hand, sampling related factors or calculation method may often account for the sign difference in estimate by King (2005).

Length weight relationship give information on condition and growth pattern of fish. Mendes *et al*; (2004).The regression coefficient (b) for isometric growth is 3 and values greater or less than 3 indicate positive and negative allometric growth respectively. Therefore, obtaining accurate LWR parameter estimates is an important factor in the assessment of fish stocks. Length weight relationship are useful in fishery management for both applied and basic use to;

(I) Estimate weight from length observation

(II) Calculate production and biomass of fish population

(III) Provide important information in fisheries management for comparative growth studies (Moutopoulos and Stergiou, 2002)

In fisheries science, the condition factor is used in order to compare the condition fatness or well being of fish condition factor studies take into consideration the health and general well being of a fish as related to its environment, hence it represent how fairly deep bodied or robust fishes and it is based on the hypothesis that heavier fish of a particular length are in better physiological condition. Condition factor have been successful at explaining variation in reproductive behavior and success (Barber, 2002, Kendah and Okuda, 2002). Fulton's condition factor k, represent the mass of an individual relative to its body length. K assumes isometric growth in which mass scales to the cube of length (Bryan and Cargilell, 2004). According to Lizoma *et al.* (2002) the study of the condition factor is thus important for understanding the life cycle of fish species and contributes to adequate management of these species and therefore to the maintenance of equilibrium in the ecosystem. Therefore, the morphometric parameters and condition factor of *Tilapia zillii* being studied to provide baseline parameters for management studies, to bridge the information lacking about the species and to study the status of the population of Tilapia *zillii* in Egbe dam.

1.1 AIM OF THE STUDY

To determine the morphometric parameters of Tilapia *zillii* (Red belly tilapia) in Egbe dam.

Also, to determine the relationship between length and weight of Tilapia *zillii* in the study area.

1.2 OBJECTIVE OF THE STUDY

I. To determine the growth pattern of *Tilapia zillii* in the study area

II. To determine length weight relationship

III. To determine the condition factor

CHAPTER TWO

2.0 LITERATURE REVIEW

Red belly tilapia is a species of fish that has been introduced globally mainly for aquaculture purpose or as a food fish. Native to Africa and southwest Asia, it is a highly successful species, capable of outcompeting both native and non-native species for food, habitat and spawning sites. It's ability to easily switch food source allow for population to continue to grow in the absence of a depleted food sources allow for population to continue to grow in the absence of a depleted food source(e.g Macrophytes in North Carolina). Red belly tilapia may also compete with centrachid fishes (sun fish) for nesting site, and through aggressive interactions it may alter the composition of fish communities. It is a voracious herbivores and may negatively impart plant density, decreasing abundance and altering the composition of native plants. This can then negatively affect native organisms that depend on such plants for spawning protection or foraging (spateru 2008)

Taxonomic Tree

Domain: Eukaryota

Kingdom: Metazoa

Subphylum: Vertebrata

Class: Actinopterygii

Order: Perciformes

Family: Cichlidae

Genus: Tilapia

Species: Tilapia *zillii*

2.1 DESCRIPTION

Non breeding individual are dark olive on top and light olive to yellow brown on the sides often with an alloctrous blue sheen. The chest is pinwish and lips are bright green. Breeding individuals are shiny dark green on the tip and sides, red and black on the throat, belly and have obvious vertical bends on the sides. Six to seven dark vertical bars cross two horizontal stripes on the body and caudal peduncle. Fins are olivaceaus. They are covered in yellow spots with the dorsal and anal fins displaying an outline of a thin orange band caudal fins are often grey with pale dots covering the entire fin. Red belly tilapia usually weigh 300g and can be up to 40cm in length with a total of 13-16 dorsal spines. Adults show a black spot outlined in yellow red belly tilapia individuals that are from 2-14cm(SL) have entirely yellow to grey caudal fin with no dots, developing a greyish caudal fin with dots with increasing size(Williams and Bonner, 2008; Froese and Pauls 2014)

2.1.1 Distribution

Its native range includes tropical and subtropical Africa and southwest Asia (Froese and Pauly 2014).

Its non native distribution includes Antigua and Barbada, Eritica, Ethiopa, Guam, Iran, Japan, Madasgascar, Mauritius, Mexico, New Caledonia, Philippines, Saudi Arabia, Russia, Syria, Taiwan, Tanzania, Turkey, UK, USA, Austrialia, Fiji Hawali and Thailand (Froese and pauly, 2014).

2.1.2 HISTORY OF INTRODUCTION AND SPREAD

Red belly tilapia was introduced to most locations by state agencies, private companies Universities or government based institutions mainly for control of aquatic plants, mosquitoes, chrimomid midges or forage or food fish or for aquaculture evaluation (Grabowoki *et al*; 1984; Courtenay and Robins, 1989). From the 1980s it was often introduced as an aquaculture species, typically formed in cages in open bodies of water. This has resulted in fish escapes when cages were damaged due to environment forcing such as storms, human actions or Horricanes. Documented cases of red belly tilapia introductions are usually reported because of both release and escape (Issa, 2014).

2.1.3 LIFE CYCLE STAGES

Spawning of *Tilapia zillii* takes 1 to 2hrs while hatching of the eggs takes between 48 and 74 hours. Fry form school which is protected by both parents. I month after spawning T. *zillii* can spawn again. In its native range, *Tilapia zillii* can breed throughout the year. Maturity is reached at about age 2, growing to 170mm in year 1 and 315mm in year 2. Longetivity of Tilapia *zillii* is around 6 years (Williams, 2008; GSMF 2005).

2.1.4 USES OF TILAPIA *ZILLII*

Tilapia zillii is used for aquaculture, commercial aquarium trade, a weed control agent, and as a recreational fishery for many countries throughout the world (FishBase, 2008). In a study investigating the feeding preferences of T. *zillii* among four species of aquatic plants, it was determined that *Charasp* and *Najas* marina could be controlled by *Tilapia. zillii* in small lakes and ponds (Saeed, 1986).

2.1.5 HABITAT DESCRIPTION

Tilapia zillii generally prefer shallow, vegetated areas in a tropical climate but will live over sand, mud, or rock; tolerating a range of pH between six to nine. While temperature between 20 to 32 degrees Celsius are optimal for Tilapia *zillii*, it can tolerate temperature between 11 to 36 degrees Celsius, becoming lethargic and vulnerable to predators and disease below 16 degrees Celsius. Mostly occurring in freshwater, Tilapia *zillii* are often found in brackish water and has occasionally been reported to be found in marine waters; tolerating salinity levels up to 29-45ppt9 (Costa Pierce, 2003; FishBase, 2008; GSMFC, 2005).

2.1.6 REPRODUCTION

Tilapia zillii are dioecious and begin courtship and mate selection in waters at or above 20 degrees Celsius. Both parents may help in nest building constructing nesting depressions 20 to 25 cm in width and 5 to 8cm in depth, often in bottoms with sand or pebbles and ample vegetation. Eggs are green, sticky, 1-2mm in diameter, and have been found in waters ranging in temperature of 20 to 28^0C. The adhesive eggs are laid directly on the substrate within the excarvated nest. Males fertilize the eggs externally. Females have been reported to lay between 1000 and 6000 eggs at one time. Both parents fan water over the eggs with their fins and pick debris and dead eggs from the nesting depression. Nest complexity can be variable, often with simple nests and limited parenting at exposed sites and complex nests with brooding chambers in sheltered areas. Tilapia *zillii* is not a mouth brooder (FishBase, 2008; Williams, 2008; GSMFC, 2005).

2.1.7 NUTRITION

Tilapia zillii are omnivorous with juveniles being more carnivorous, consuming a number of different zoobenthos. Adults are especially herbivorous, consuming mainly aquatic plants. In a study of feeding habits of *Tilapia zillii* within Lake Kinneret (Israel), the main source of food was Chironomida pupae (Diptera) in the spring and winter and zooplankton in the summer and autumn with algae supplementing the diet throughout the year (Spataru, 1978; Williams, 2008; GSMFC 2005)

2.1.8 ECOLOGY

Tilapia zillii (Red belly tilapia) is primarily herbivorous with aquatic macrohytes, algae and diatoms generally comprising 80% of its diet and the remainder including aquatic insects and crustaceans and fish eggs proportion of diet from animal sources is generally size related with larger fish consuming more animal based food items(Khallof 1987). Red belly tilapia is highly tolerant to saline solution, with survival and growth occurring in salinity up to 40% and reproduction occurring through 29%. This specie is a substrate spawners with fishes forming monogamous pairs and exhibiting bi parental guarding behavior. Net represent small saucer shaped depression in the substrate but show some variation a morphology due to environmental conditions (Bruton Auphen 1992). Breeding season is dependent on climate with warm temperature stable equatorial population.

2.1.9 GENERAL IMPACTS

Adult *Tilapia zillii* are considered to be voracious herbivores, often decreasing plant density and changing the composition of native plants which can threaten many native aquatic organisms that depend on such plants for forage, protection, or spawning (Spatarau, 1978 and GSMFC, 2005).

2.3 PHYSIOCHEMICAL PARAMETERS OF WATER

2.3.1 Temperature

Tilapia zillii is considered a relatively stenothermal species with a temperature ranged of 14 to 33^{0}C (Philippart and Ruwet, 1982). At high temperatures mortality is sporadic, and the species poorly supports sharp changes in temperature. A 25 % mortality occurred when the temperature fell abruptly from 18 to 8 C and the fish were left at this low temperature for 3 hrs (Malard and Philippart, 1981).

2. 3.2 Oxygen

Using a sealed respirometer, (Wokoma 1986) estimated the lower lethal dissolved Oxygen concentration for all sizes of *Tilapia zillii* to be between 0.1 to 0.2 mg/l. The fish goes into an anaerobic stage before death occurs. Oxygen consumption varies with the size of the fish, with smaller individuals (0.5 to 0.7 g) consuming 625 to 446 mg/ kg/hr depending on the ambient dissolved oxygen concentration. Larger individuals (7.5 g and above) consume about 90 to 100 mg/kg/hr (Wokoma, 1986).

2.3.3 pH

Tilapia zillii shows a remarkable resistance to low pH values The lower lethal range is between 3.0 and 3.3 (50 % mortality in 7 days) with fish surviving 7 days at pH 3.4 (Wokoma, 1986). In ponds constructed in acid sulfate soils, *Tilapia guineensis* grows and reproduced at pH values ranging from 3.5 to 5.2. Some acclimatization is necessary. A direct transfer of 250 mg fry from pH values of 7 to 8 to a pond with a pH value of 3.7 caused 100% mortality in 24 hours.

2.3.4 Salinity tolerance

Tilapia zillii is a true euryhaline species; growing and reproducing in salinities of 0 to 35 ppt. The optimum salinity range has not been studied. In certain situations *Tilapia zillii* the predominant tilapia species in fresh water (eg. Lake Anyama; Aghien Lagoon, Cote d' Ivoire). In the Niger Delta, there are three main tilapia species (*Sarotherodon melanotheron, Tilapia zillii, Tilapia. Mariae)*. In low salinities (5 to 10 ppt) *Tilapia guineensis* is by far the predominant species, but in the middle salinity ranges (10 to 15 ppt), the ratio of *Tilapia zillii* to *Sarotherodon melanotheron* is roughly 1: 1 and no *Tilapia mariae* are present. In higher salinities, *Tilapia zillii* again predominates with a ratio of *Tilapia zillii* to *Sarotherodon melanotheron* of 2 : 1.

CHAPTER THREE

3.0 MATERIALS AND METHOD

3.1 DESCRIPTION OF STUDY AREA

This research was carried out in Egbe dam in Ado Ekiti which is the capital of Ekiti state. Egbe reservoir is situated across Egbe River, which is located in the suburb of Egbe Ekiti in Gbonyin local government area of Ekiti state in western Nigeria. The reservoir take its source from kwara state and runs through Ekiti to Ondo State and eventually empty into the popular Osse river in Ondo State. The reservoir lies between latitudes 7^036N and 7^039 North and longitude 5^032 E and 5^035 East of the equator. The entire length of the reservoir is 26.5 acres and the depth is 64m. The reservoir is located on undulating plane, surrounded by highland from which runoffs also feed the reservoir during raining season. The reservoir is underlain by metamorphic rocks. Some physical and chemical condition of the river has been investigated in the previous studies.

3.2 COLLECTION OF FISH SAMPLES

Fish samples used in this study were collected from the landing sites of the artisanal fishermen in month of June. During this period of study 15 fishes were collected in each of the week respectively, making a total of 60 fishes over the study period.

3.3 FISH IDENTIFICATION

Fish collected from the landing sites of the fishermen were sorted into various species and counted. Identification was done both in the field and in the laboratory using fish identification guides of (Reed *et al*; 1967; Babatunde and Raji, 1986; Idodo-Umeh 2003).

3. 4 TRANSPORTATION OF SAMPLE

The catches were sorted into species on the field and collected into 50 litres of gallon and transported to the laboratory where they were preserved in 10% formalin for further examination. Size range of the sample examination. Size range of the sample examined covered both small and large fishes.

3.5 MATERIALS

Electrical weighing balance

Metre rule

Bowls

Flat board

3.6 PROCEDURE

The length weight measurement data were stratified to ensure that all the size ranges were accounted for in the data.

Fish length was determined using a measurement board to the nearest Centimeter. The weight of the fish was taken using the electric weighing balance to the nearest gram(g), both standard length(SL), total length, body depth (Bd), body weight (bw), dorsal fin length, fork length, caudal peduncle length, head length, pre dorsal length were measured to the nearest Centimeter.

3.7 ANALYSIS OF DATA

Correlation and Regression were used to analyze significance of the variation of the relationship between the length and weight of the fish. Also, Anova table was used to analyze different data gotten from the laboratory.

CHAPTER FOUR

RESULT

4.1 Length-Weight Relationship

The length-weight relationships of *Tilapia zillii* species sampled from Egbe River are presented in Table 1. The 95% confidence interval values of the exponent 'b' in the relationship for the male fish was 2.57 and 2.10 for the female fish while the value was 2.42 for combined sex (M+F) respectively. Analysis of both the males and females separately and combined showed that the species exhibited allometric growth pattern. Their 'b' values were less than 3. There was strong correlation between the length and the weight of all the sexes.

Condition factor (K)

The mean condition factors (K) of the species studied are shown in Table 2. There were differences in the condition factors for the males and females as well as combined sexes of *Tilapia zillii* sampled from Egbe River. As shown in the Table, the condition factor for the species recorded was between 2.10 and 2.16. The males had a value of 2.10 and the female had a value of 2.16 while value of 2.14 was recorded by the combined sex respectively.

Table 1. Length-weight relationship of *Tilapia zillii* from Egbe River

Sex	N	a	B	R	Sig. of r	Patter
M	26	28.76	2.57	0.330	0.01	**Allometric**
F	34	42.49	2.10	0.325	0.01	**Allometric**
M+F	60	34.72	2.42	0.336	0.01	**Allometric**

Table 2. Mean condition factor (K) of *Tilapia zillii* from Egbe River

Sex	N	Mean K	Mean TL(cm)	Mean W(g)	STD	SE
M	26	2.10	14.67	66.48	1.50	**0.29**
F	34	2.16	15.08	74.18	2.13	**0.36**
M+F	60	2.14	14.90	70.84	1.88	**0.24**

TL=Total Length, **W**=Weight, **STD**=Standard Deviation

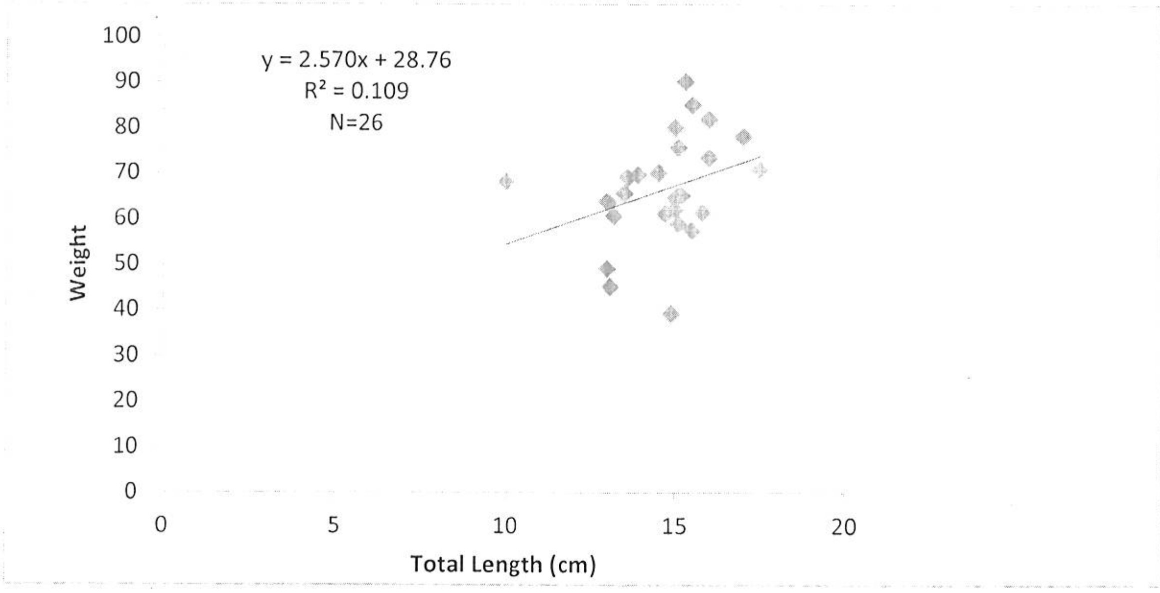

Figure 1. Length weight relationship of male *Tilapia zillii*

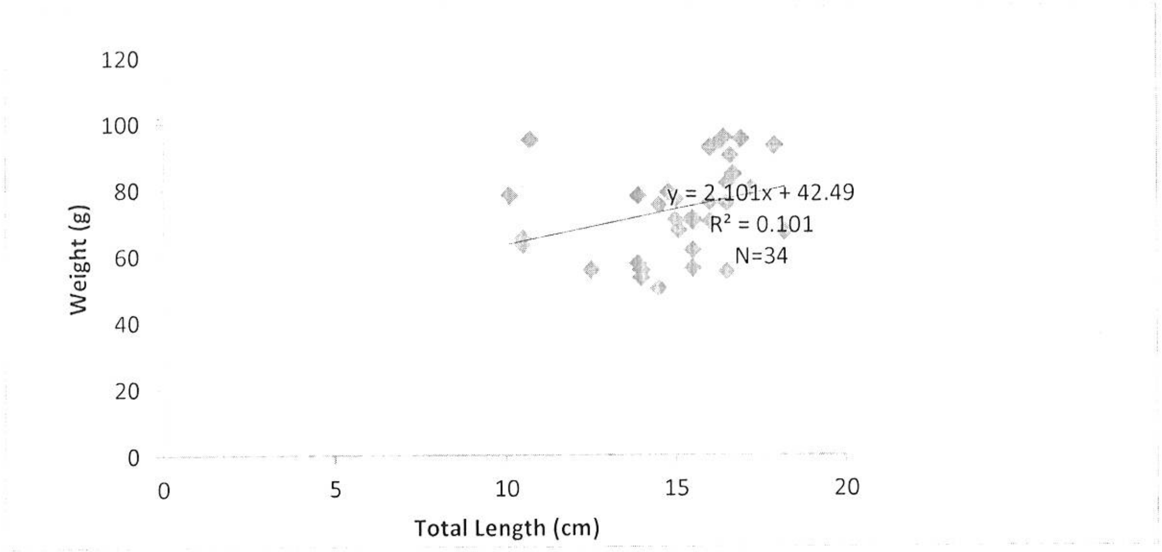

Figure 2. Length weight relationship of female *Tilapia zillii*

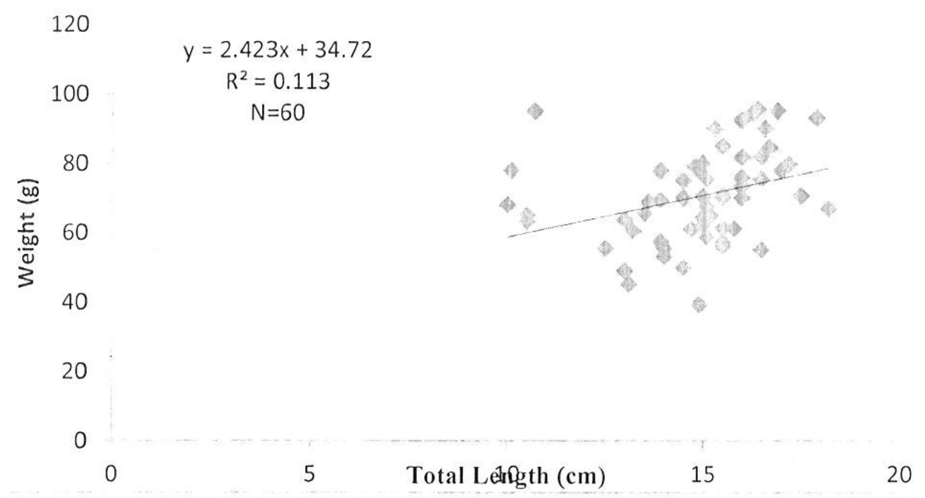

Figure 3. Length weight relationship of combined sex of *Tilapia zillii*

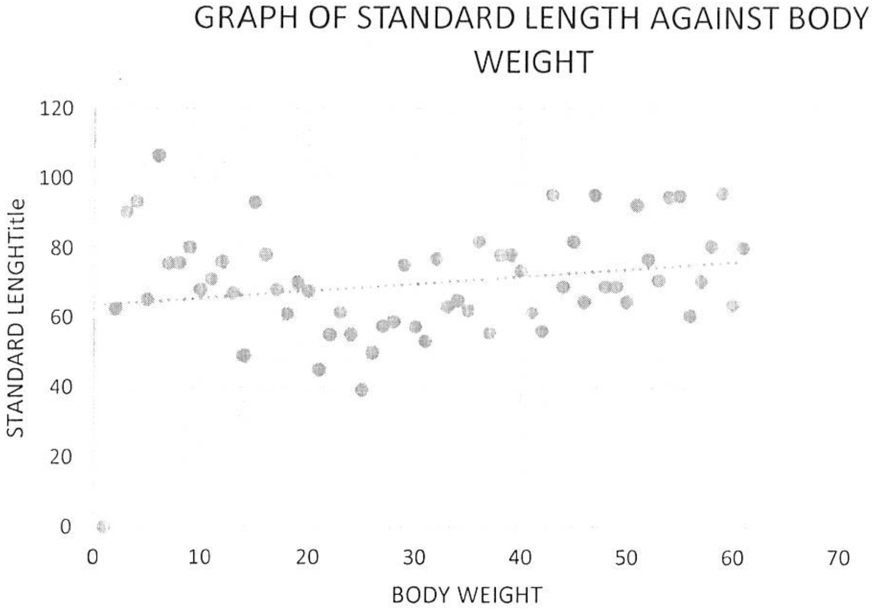

Figure 4. Graph of standard length against body weight.

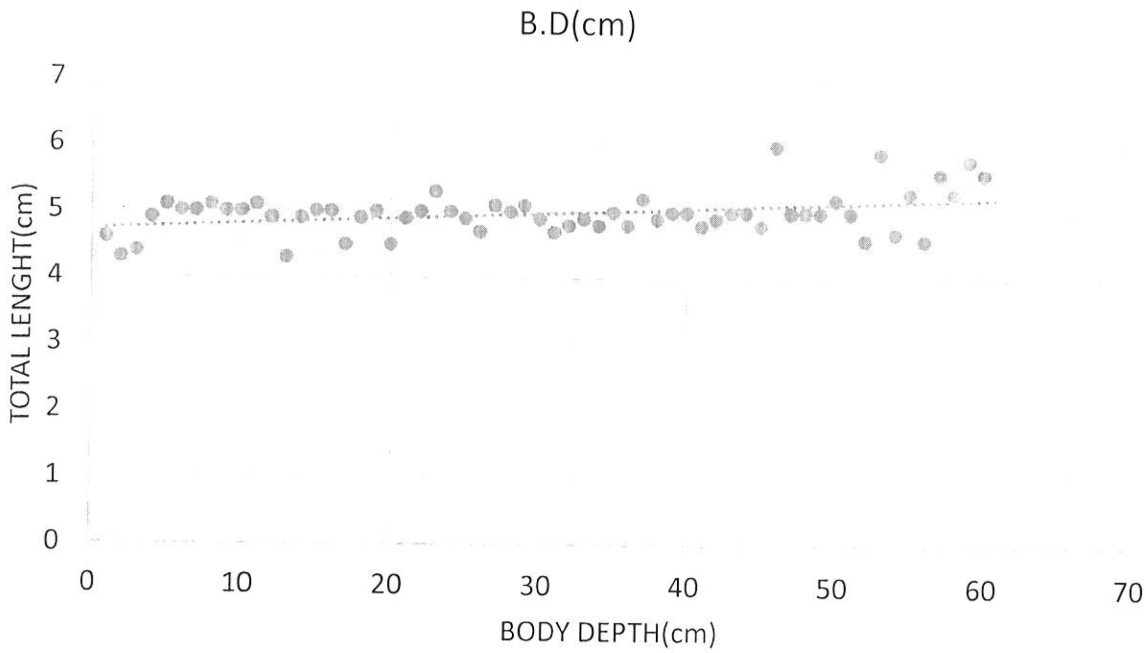

Figure 5. Graph of total length against body depth.

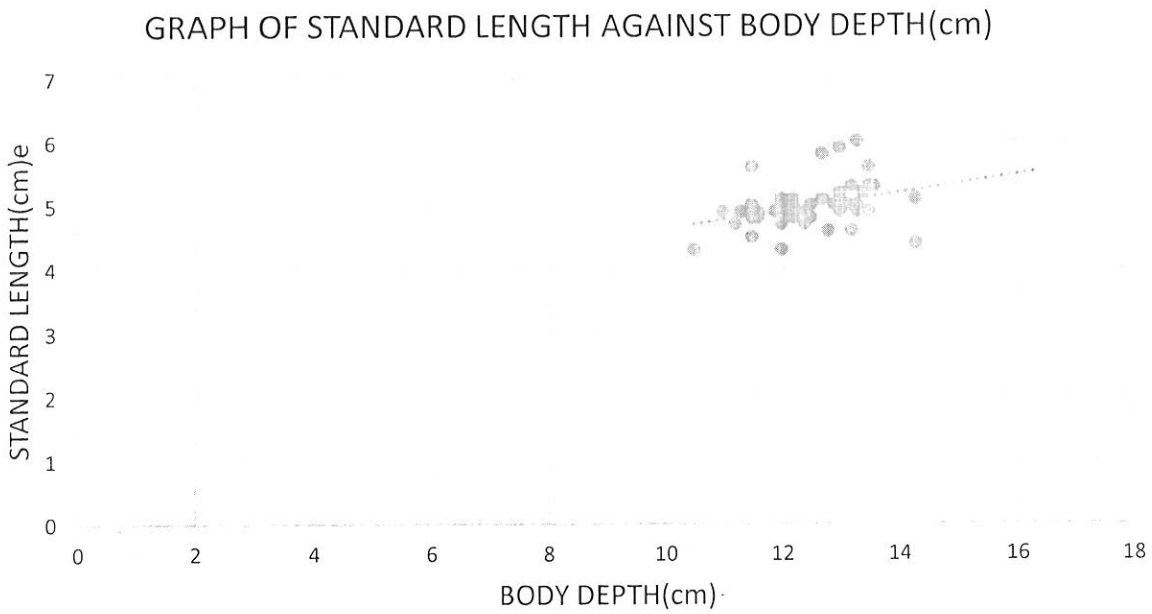

Figure 6. Graph of standard length against body depth.

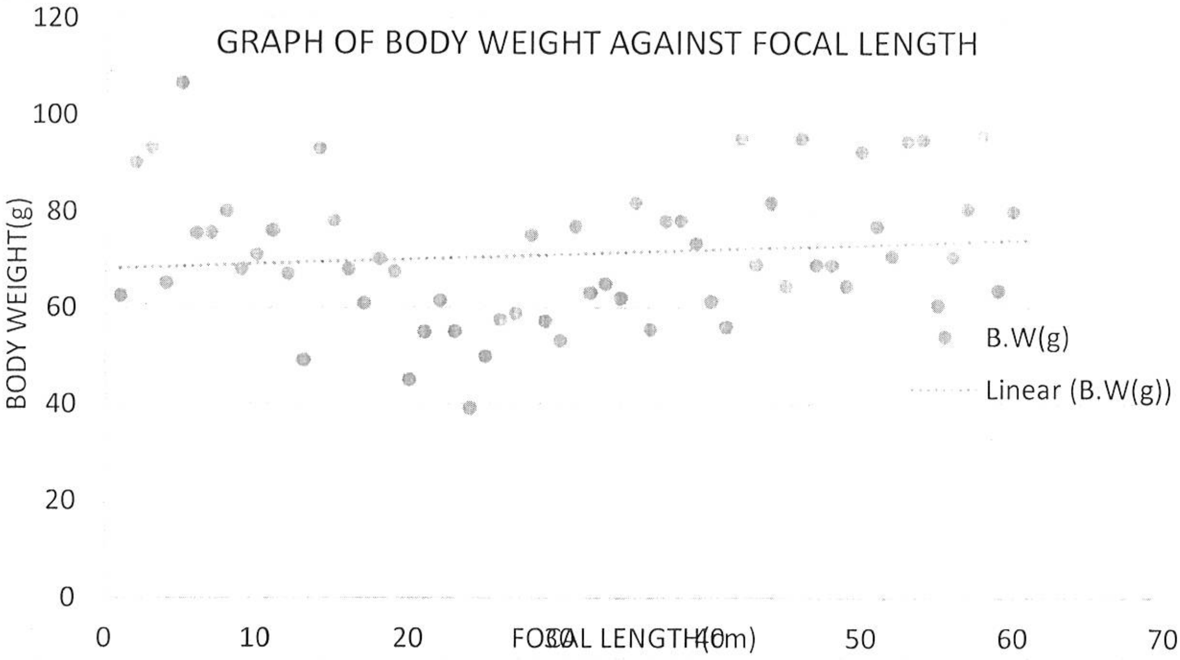

Figure 7. Graph of body weight against focal length.

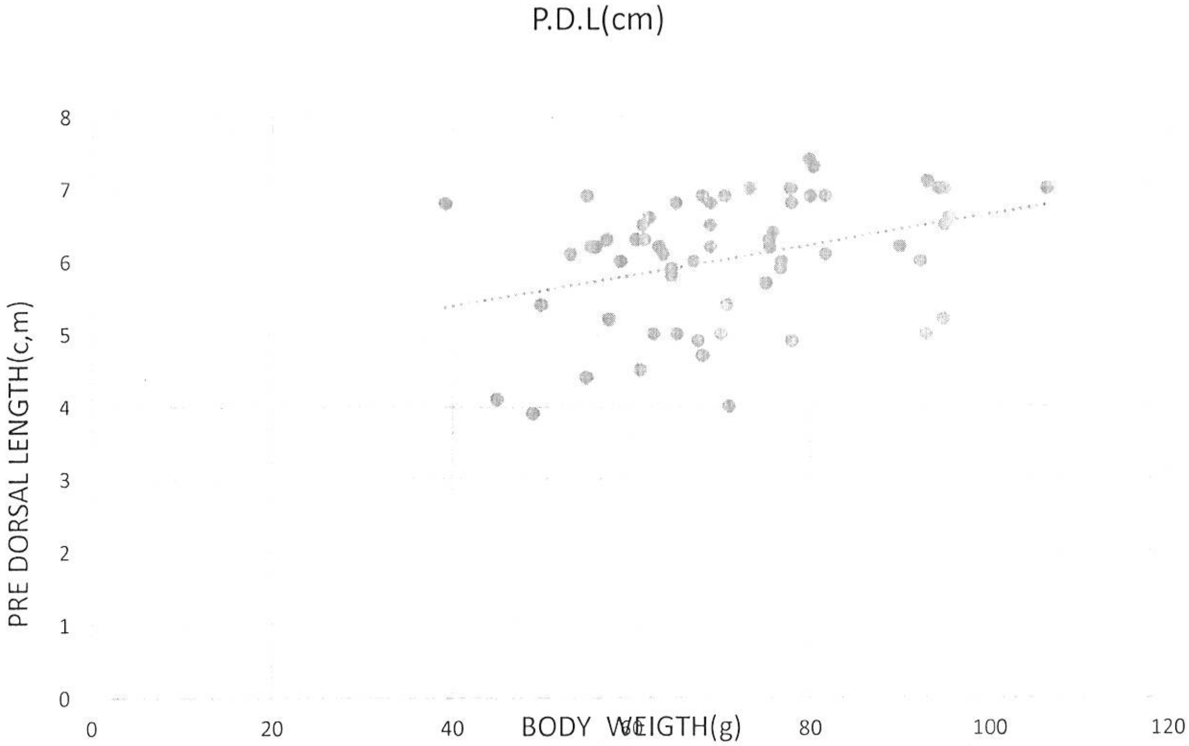

Figure 8. Graph of pre dorsal length against body weight.

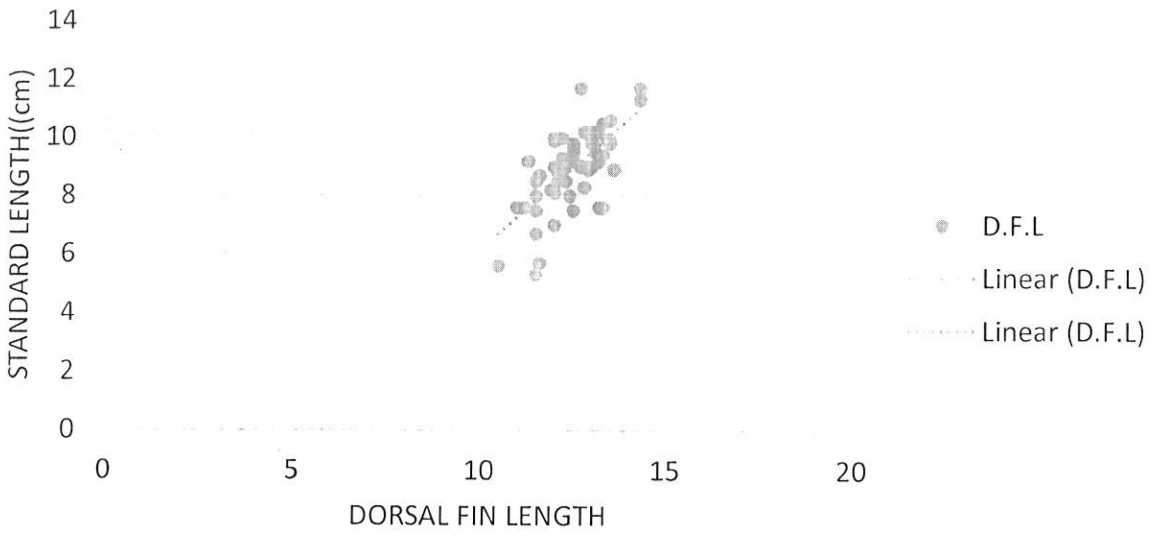

Figure 9. Graph of standard length against dorsal fin length.

CHAPTER FIVE

DISCUSSION

The effective management of any fishery requires considerable knowledge of population parameters such as length-weight relationship (Dan-Kishiya, 2013). This relationship is very important in fisheries biology because it allow estimation of average weight of the fish of a given length group (Beyer, 1987), assess the well-being of individuals and to determine possible differences between separate unit stocks of the same species (King, 2007). The relationship is also important in fisheries management for comparative growth studies (Moutopoulos and Stergiou, 2002). Also (Pauly 1993) stated that length-weight relationship (LWR) provides valuable information on the habitat where the fish lives while Kulbicki *et al.* (2005) stressed the importance of LWR in modeling aquatic ecosystems. The b values in length- weight relationships determine the growth pattern of the fish species.

When b is equal to 3 or close to 3, growth in the fish is said to be isometric i.e. fish becomes more robust with increasing length (Bagenal and Tesch, 1978).

Similarly when b is far less or greater than 3, growth in the fish is allometric i.e. the fish becomes thinner with increase in length (King, 1996). The result of the present study showed that the growth of *Tilapia zillii* sampled from Egbe River was allometric. This means that the fishes do not grow symmetrically (Tesh, 1968) or the fish becomes thinner with increase in length (King, 1996). Similar works have been documented from different Inland water bodies in Nigeria. Among them are the findings of Christina *et al.*, (2016) in length-weight relationship and condition factor of freshwater fish *Tilapia mossambica* from River Thamirabarani and Abowei and Hart (2009) who investigated some morphometric parameters of 10 fin fish species of Lower Nun River in Niger Delta. Ibrahim *et al.* (2009) also observed allometric growth pattern of fish species in Kontagora Reservoir while Ude *et al.* (2011) made similar observation in an evaluation of length- weight relationship of fish species of Ebonyi River in Ebonyi State. The Red belly (*Tilapia zillii*) from Egbe River in the present study had b values of 2.57 for male, 2.10 for female and 2.42 for combined sex. These values were similar with the findings of Imam *et al.* (2010) with a recorded range of between 1.4 and 2.50 in Wasai Reservoir in Kano. Values of 2.7-3.0 were recorded for *O. urolepis* in fresh water floodplain lakes in Ruwe ponds (Mgaya *et al.*, 2005), whilst 2.7 and 3.2 were observed in *Tilapia zillii* for wet and dry seasons respectively (Haruna, 2006). Dan-kishiya (2013) also recorded similar values for *Barbus occidentalis* and *Barilius loati* where the b- value range was between 1.9 and 2.3 and this value was also in agreement with the findings of Ibrahim *et al.* (2012) from Kontagora Reservoir in Niger state with a maximum b-value of 2.8 for Cyprinids. However the b-values recorded for *Tilapia zillii* in the present study are within the range of 2 - 4 recommended as appropriate for fresh water fishes and an ideal fish maintain the shape (Anani and Nanos, 2016; Golam and Al-Misned 2013).

5.1 Condition factor (K)

The relationship of length-weight can be use in the estimation of condition factor (K) of fish species (Dan-Kishiya, 2013). In fisheries science, the condition factor is used in order to compare the condition, fatness or wellbeing of fish (Ahmed *et al.*, 2011). It is based on the hypothesis that heavier fish of a particular length are in a better physiological condition (Bagenal and Tesch, 1978). Ndimele *et al.*, 2010 reported that condition factor is a useful index for monitoring of feeding intensity, age and growth rates in fish. It is strongly influence by both biotic and abiotic environmental conditions and can be use as an index to assess the status of the aquatic ecosystem in which fish live (Anene, 2005). The condition factors (K) of 2.10, 2.16 and 2.14 were obtained for *Tilapia zillii* from Egbe River for male, female and combined sex respectively. The value of the condition factor (K) in the present study was similar to what was obtained in other tropical water bodies. Dan-Kishiya (2013) recorded a value of 2.02, 1.96 and 2.00 for male, female and combined sex respectively for *Tilapia zillii* from a tropical water supply reservoir in Abuja. Also Kumolu-Johnson and Ndimele (2011) obtained a K-value of between 0.91 and 8.46 from Ologe Lagoon in Lagos. But Ibrahim *et al.* (2012) recorded a mean K-value of 1.98 ± 0.35 in Kontagora Reservoir in Niger State. While in sudan Ahmed *et al.* (2011) recorded a K-value range of 0.506 and 3.415. The mean K-values of species sampled had their value greater than 1 which was an indication that the fish species were doing well in the River. Condition factor higher than 1.0 suggests good fish health condition and indicates an isometric growth, which is desirable in fish farming (Ayode, 2011).

5.2 CONCLUSION

Different range sizes of *Tilapia zillii* were captured for correct identification, transportation, preservation and measurement. Morphometric measurement were taken in *Tilapia zillii* in other to know the variability between two or more fish. In addition, measurement were taken to know the relationship between two parameters (e.g. Total length & Body weight, Total Length and Body depth. Condition factor was determined to know how well being the status of the fish in a particular aquatic ecosystem.

Finally, as the total length of the fish increases the weight of the fish also increases. As the standard length increases the body weight also increases.

5.3 RECOMMENDATION

Proper management practices should be put into Consideration for the purpose of ensuring Sustainability of fish species stock and also prevent them from being endangered.

I recommend the use of different mess size of net to capture fish from the wild for the purpose of reducing over exploitation of species stock. (Smaller fish should be harvested and the bigger one should be left for natural breeding purpose.

Since *Tilapia zillii* is highly prolific in nature, excessive feeding which can be prone to more production of ammonia (NH_3) that is very toxic to the fish population should not be given to the fish.

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APPENDIX

TABLE OF MORPHOMETRIC PARAMETERS OF *TILAPIA ZILLII* IN EGBE DAM

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	TL[b]	.	Enter

a. Dependent Variable: BW

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.336[a]	.113	.098	12.85475

a. Predictors: (Constant), TL

b. Dependent Variable: BW

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1223.024	1	1223.024	7.401	.009[b]
	Residual	9584.184	58	165.245		
	Total	10807.207	59			

T.L	S.L	B.W	B.D	D.F.L	H.L(cm)	SEX	C.P.L(cm	F.L	P.D.L(cm)	Condition factor(K)
15.3	13.2	62.5	4.6	9.2	3.0	M	1.6	14.0	5.0	2.71
16.6	12.0	90.1	4.3	10.0	4.2	F	2.6	14.5	6.2	5.21
17.9	14.3	93.2	4.4	11.3	5.1	F	3.0	15.3	7.1	3.19
15.5	12.1	65.1	4.9	8.5	3.0	F	2.0	13.9	5.0	3.80
17.5	14.3	106.5	5.1	11.7	5.0	F	2.2	16.0	7.0	3.64
16.5	12.5	75.5	5.0	9.7	4.3	F	2.0	14.1	6.3	3.86
15.1	12.0	75.6	5.0	9.0	4.2	M	1.8	14.0	6.2	4.38
15.0	13.0	80.1	5.1	9.8	4.9	M	2.1	14.2	6.9	3.64
15.0	12.1	68.0	5.0	8.8	4.7	M	1.7	13.9	6.9	3.84
15.5	12.5	71.0	5.0	9.5	2.0	F	1.5	14.9	4.0	3.64
16.0	12.7	76.0	5.1	9.0	4.4	F	1.8	14.1	6.4	3.71
15.2	12.3	67.0	4.9	8.5	4.0	F	1.3	14.0	6.0	3.60
13.0	10.5	49.0	4.3	5.6	1.9	M	1.1	11.5	3.9	4.23
17.1	13.5	93.0	4.9	9.8	3.0	F	2.0	15.1	5.0	3.78
16.1	13.3	78.0	5.0	9.4	2.9	F	1.8	14.9	4.9	3.32
15.2	12.9	68.0	5.0	9.0	2.7	M	1.4	14.2	4.7	3.17
14.7	11.5	61.0	4.5	8.0	2.5	M	1.3	14.0	4.5	4.01
16.0	13.0	70.1	4.9	9.0	3.0	F	2.1	14.5	5.0	3.19
15.1	12.9	67.5	5.0	8.9	2.9	F	2.0	14.3	4.9	3.14
13.1	11.5	45.0	4.5	5.3	2.1	M	1.5	12.5	4.1	3.52
14.5	11.6	55.0	4.9	5.7	2.4	M	1.9	14.0	4.4	3.52
15.5	12.5	61.5	5.0	9.2	4.3	F	3.0	14.7	6.3	3.15

16.5	13.5	55.1	5.3	10.6	3.9	F	2.0	15.8	6.9	2.23
14.9	11.5	39.2	5.0	8.5	3.8	M	1.8	14.0	6.8	2.57
14.5	11.9	49.9	4.9	8.2	3.4	F	1.5	13.5	5.4	2.96
13.9	11.2	57.5	4.7	7.6	3.2	F	1.4	13.0	5.2	4.09
15.1	12.0	58.8	5.1	9.0	4.0	M	2.0	14.0	6.0	3.42
14.5	11.5	75.1	5.0	7.5	3.7	F	1.5	13.8	5.7	4.94
15.5	12.2	57.3	5.1	8.9	4.0	M	1.6	14.7	6.3	3.15
14.0	11.3	53.2	4.9	9.2	4.1	F	1.2	13.2	6.1	3.68
14.8	12.0	76.9	4.7	8.1	4.0	F	1.5	13.5	6.0	4.45
16.5	12.5	63.1	4.8	9.8	4.2	F	2.0	14.1	6.2	3.23
15.1	12.3	65.0	4.9	9.1	4.8	M	1.8	14.0	6.8	3.49
15.0	11.6	62.0	4.8	8.7	4.6	M	1.5	13.8	6.6	3.97
16.5	13.0	81.8	5.0	9.9	4.9	F	2.0	15.0	6.9	3.72
14.0	11.5	55.5	4.8	7.5	4.0	F	1.2	14.0	6.2	3.64
17.0	13.4	77.9	5.2	10.0	5.0	M	2.0	15.2	7.0	3.23
13.9	11.0	78.0	4.9	7.6	4.0	F	1.0	13.0	6.8	5.86
16,0	13.0	73.3	5.0	9.9	5.0	M	2.0	15.2	7.0	3.34
15.8	12.5	61.3	5.0	7.5	4.0	F	1.5	13.0	6.5	3.14
15.5	12.2	56.0	4.8	10.0	4.2	F	1.2	12.7	6.2	3.09
15.0	13.3	95.1	4.9	7.6	4.5	M	2.0	11.9	6.5	4.04

a. Dependent Variable: BW

16.0	12.0	68.9	5.0	9.9	4.2	F	1.9	12.6	6.8	3.99
15.0	13.1	81.8	5.0	9.5	4.5	M	1.4	12.0	6.1	3.64
14.5	12.2	64.5	4.8	9.3	3.9	F	1.0	11.4	5.8	3.55
16.9	13.3	95.1	6.0	10.5	5.0	F	2.0	16.0	7.0	4.04
13.6	12.0	68.9	5.0	7.0	4.2	M	1.5	13.6	6.2	3.99
16.0	13.1	68.9	5.0	10.2	4.5	M	1.8	15.5	6.5	3.06
15.0	12.2	64.5	5.0	8.8	3.9	M	1.6	14.2	5.9	3.55
16.0	13.0	92.4	5.2	9.8	4.0	F	1.5	15.0	6.0	4.21
15.0	12.1	76.8	5.0	9.0	3.9	F	1.3	14.0	5.9	4.34
14.5	12.8	70.7	4.6	8.3	3.4	M	1.2	13.9	5.4	3.37
16.3	13.0	94.5	5.9	10.2	5.0	F	1.9	15.8	7.0	4.30
13.1	12.4	94.9	4.7	8.0	3.2	M	1.7	15.0	5.2	4.97
14.5	13.2	60.5	5.3	7.6	4.3	F	1.9	16.8	6.3	2.63
15.5	12.8	70.5	4.6	10.2	4.9	F	2.2	17.4	6.9	3.36
16.5	11.5	80.5	5.6	6.7	5.3	F	3.0	18.5	7.3	5.29

14.9	13.6	95.6	5.3	8.9	4.6	M	1.9	15.5	6.6	3.80
14.5	12.7	63.6	5.8	11.7	4.8	M	1.7	15.0	6.1	3.10
T.L	S.L	B.W	B.D	D.F.L	H.L(cm)	SEX	C.P.L(cm	F.L	P.D.L(cm)	Condition factor(K)
15.3	13.2	62.5	4.6	9.2	3.0	M	1.6	14.0	5.0	2.71
16.6	12.0	90.1	4.3	10.0	4.2	F	2.6	14.5	6.2	5.21
17.9	14.3	93.2	4.4	11.3	5.1	F	3.0	15.3	7.1	3.19
15.5	12.1	65.1	4.9	8.5	3.0	F	2.0	13.9	5.0	3.80
17.5	14.3	106.5	5.1	11.7	5.0	F	2.2	16.0	7.0	3.64
16.5	12.5	75.5	5.0	9.7	4.3	F	2.0	14.1	6.3	3.86
15.1	12.0	75.6	5.0	9.0	4.2	M	1.8	14.0	6.2	4.38
15.0	13.0	80.1	5.1	9.8	4.9	M	2.1	14.2	6.9	3.64
15.0	12.1	68.0	5.0	8.8	4.7	M	1.7	13.9	6.9	3.84
15.5	12.5	71.0	5.0	9.5	2.0	F	1.5	14.9	4.0	3.64
16.0	12.7	76.0	5.1	9.0	4.4	F	1.8	14.1	6.4	3.71
15.2	12.3	67.0	4.9	8.5	4.0	F	1.3	14.0	6.0	3.60
13.0	10.5	49.0	4.3	5.6	1.9	M	1.1	11.5	3.9	4.23
17.1	13.5	93.0	4.9	9.8	3.0	F	2.0	15.1	5.0	3.78
16.1	13.3	78.0	5.0	9.4	2.9	F	1.8	14.9	4.9	3.32
15.2	12.9	68.0	5.0	9.0	2.7	M	1.4	14.2	4.7	3.17
14.7	11.5	61.0	4.5	8.0	2.5	M	1.3	14.0	4.5	4.01

16.0	13.0	70.1	4.9	9.0	3.0	F	2.1	14.5	5.0	3.19
15.1	12.9	67.5	5.0	8.9	2.9	F	2.0	14.3	4.9	3.14
13.1	11.5	45.0	4.5	5.3	2.1	M	1.5	12.5	4.1	3.52
14.5	11.6	55.0	4.9	5.7	2.4	M	1.9	14.0	4.4	3.52
15.5	12.5	61.5	5.0	9.2	4.3	F	3.0	14.7	6.3	3.15
16.5	13.5	55.1	5.3	10.6	3.9	F	2.0	15.8	6.9	2.23
14.9	11.5	39.2	5.0	8.5	3.8	M	1.8	14.0	6.8	2.57
14.5	11.9	49.9	4.9	8.2	3.4	F	1.5	13.5	5.4	2.96
13.9	11.2	57.5	4.7	7.6	3.2	F	1.4	13.0	5.2	4.09
15.1	12.0	58.8	5.1	9.0	4.0	M	2.0	14.0	6.0	3.42
14.5	11.5	75.1	5.0	7.5	3.7	F	1.5	13.8	5.7	4.94
15.5	12.2	57.3	5.1	8.9	4.0	M	1.6	14.7	6.3	3.15
14.0	11.3	53.2	4.9	9.2	4.1	F	1.2	13.2	6.1	3.68
14.8	12.0	76.9	4.7	8.1	4.0	F	1.5	13.5	6.0	4.45
16.5	12.5	63.1	4.8	9.8	4.2	F	2.0	14.1	6.2	3.23
15.1	12.3	65.0	4.9	9.1	4.8	M	1.8	14.0	6.8	3.49
15.0	11.6	62.0	4.8	8.7	4.6	M	1.5	13.8	6.6	3.97
16.5	13.0	81.8	5.0	9.9	4.9	F	2.0	15.0	6.9	3.72
14.0	11.5	55.5	4.8	7.5	4.0	F	1.2	14.0	6.2	3.64
17.0	13.4	77.9	5.2	10.0	5.0	M	2.0	15.2	7.0	3.23
13.9	11.0	78.0	4.9	7.6	4.0	F	1.0	13.0	6.8	5.86
16,0	13.0	73.3	5.0	9.9	5.0	M	2.0	15.2	7.0	3.34

15.8	12.5	61.3	5.0	7.5	4.0	F	1.5	13.0	6.5	3.14
15.5	12.2	56.0	4.8	10.0	4.2	F	1.2	12.7	6.2	3.09
15.0	13.3	95.1	4.9	7.6	4.5	M	2.0	11.9	6.5	4.04
16.0	12.0	68.9	5.0	9.9	4.2	F	1.9	12.6	6.8	3.99
15.0	13.1	81.8	5.0	9.5	4.5	M	1.4	12.0	6.1	3.64
14.5	12.2	64.5	4.8	9.3	3.9	F	1.0	11.4	5.8	3.55
16.9	13.3	95.1	6.0	10.5	5.0	F	2.0	16.0	7.0	4.04
13.6	12.0	68.9	5.0	7.0	4.2	M	1.5	13.6	6.2	3.99
16.0	13.1	68.9	5.0	10.2	4.5	M	1.8	15.5	6.5	3.06
15.0	12.2	64.5	5.0	8.8	3.9	M	1.6	14.2	5.9	3.55
16.0	13.0	92.4	5.2	9.8	4.0	F	1.5	15.0	6.0	4.21
15.0	12.1	76.8	5.0	9.0	3.9	F	1.3	14.0	5.9	4.34
14.5	12.8	70.7	4.6	8.3	3.4	M	1.2	13.9	5.4	3.37
16.3	13.0	94.5	5.9	10.2	5.0	F	1.9	15.8	7.0	4.30
13.1	12.4	94.9	4.7	8.0	3.2	M	1.7	15.0	5.2	4.97

14.5	13.2	60.5	5.3	7.6	4.3	F	1.9	16.8	6.3	2.63
15.5	12.8	70.5	4.6	10.2	4.9	F	2.2	17.4	6.9	3.36
16.5	11.5	80.5	5.6	6.7	5.3	F	3.0	18.5	7.3	5.29
14.9	13.6	95.6	5.3	8.9	4.6	M	1.9	15.5	6.6	3.80
14.5	12.7	63.6	5.8	11.7	4.8	M	1.7	15.0	6.1	3.10

b. Predictors: (Constant), TL

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.724	13.380		2.595	.012
	TL	2.424	.891	.336	2.721	.009

a. Dependent Variable: BW

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	58.9624	78.8381	70.8433	4.55293	60
Residual	-31.63929	34.24094	.00000	12.74534	60
Std. Predicted Value	-2.610	1.756	.000	1.000	60
Std. Residual	-2.461	2.664	.000	.991	60

a. Dependent Variable: BW

ANOVA

				Sum of Squares	Df	Mean Square	F	Sig.
TL	Between Groups	(Combined)		2.398	1	2.398	.676	.414
		Linear Term	Unweighted	2.398	1	2.398	.676	.414
			Weighted	2.398	1	2.398	.676	.414
	Within Groups			205.772	58	3.548		
	Total			208.170	59			
BW	Between Groups	(Combined)		871.692	1	871.692	5.089	.028
		Linear Term	Unweighted	871.692	1	871.692	5.089	.028
			Weighted	871.692	1	871.692	5.089	.028
	Within Groups			9935.515	58	171.302		

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
TL	Male	26	14.6731	1.50188	.29454	14.0665	15.2797	10.00	17.50
	Female	34	15.0765	2.12760	.36488	14.3341	15.8188	10.10	18.20
	Total	60	14.9017	1.87838	.24250	14.4164	15.3869	10.00	18.20
BW	Male	26	66.4846	11.68475	2.29157	61.7650	71.2042	39.20	90.10
	Female	34	74.1765	14.05852	2.41102	69.2712	79.0817	49.90	95.60
	Total	60	70.8433	13.53414	1.74725	67.3471	74.3396	39.20	95.60

Regression

		TL	BW
TL	Pearson Correlation	1	.336**
	Sig. (2-tailed)		.009
	N	60	60
BW	Pearson Correlation	.336**	1
	Sig. (2-tailed)	.009	
	N	60	60

**. Correlation is significant at the 0.01 level (2-tailed).

Plate 1: **Morphometric (Specimens Length) measurement**

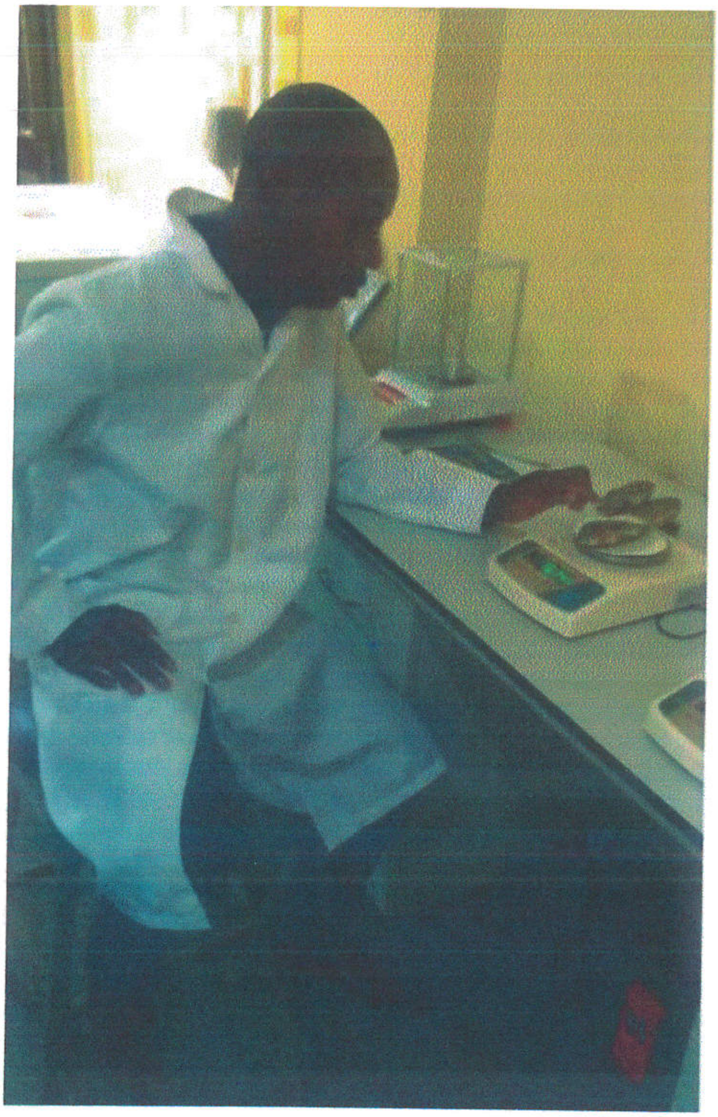

Plate 2: **Morphometric (Specimens Weight) measurement**