COMPARATIVE STUDIES OF LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF NILE TILAPIA (OREOCHROMIS NILOTICUS LINNAEUS, 1758) FROM RIVERS TARABA AND DONGA

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ABSTRACT

This study compare the length-weight relationship and condition factor of Nile tilapia (Oreochromisniloticus) from rivers Taraba and Donga for a period of three months. Sixty (60) Oreochromisniloticus, 30 from Tella and 30 from Donga each, were purchased from artisanal fishermen in fish market monthly from July 2023 to October 2023. The data obtained from the experiment were subjected to t-test at 95% confidence level (p=0.05) with the aid of IBM SPSS version 25. The result found that the Nile Tilapia from the Donga River had larger bodies and deeper forms compared to those from the river Taraba. The linear regression shows that the parameters regressed at $R^2 = 0.49$ and $R = 0.71$ in river Taraba with p=0.00, indicating that size is more important than age in taxonomy, ecology and physiology. The study revealed that Nile tilapia in Donga River had the hight mean standard length and body weight value. However, it could be suggested that for tilapia farming program the Donga River side should be preferred based on standard length and body weight data obtained from this research.

KEYWORDS

Length-weight relationship, Condition factor, Nile Tilapia, River Taraba&River Donga

1. INTRODUCTION

Aquaculture is the world's fastest growing agricultural and food processing sector, and serves a critical role in developing economies through its value chain linkages in promoting food and nutrition security, rural development, and poverty alleviation [1]. Fish and fisheries are integral part of most societies that make significant contributions to economic, health and social well-being of the society. The products from these fisheries are used in a wide variety of ways, ranging from subsistence use to international trade as highly sought-after and highly-valued items. The value of fish traded internationally is approximately US$204 billion in the year 2020 [2]. Despite the contribution of aquaculture to the nation as a veritable pillar for food and nutrition, its rapid growth is seemingly slowed down by inadequate and poor-quality seed as a result of inbreeding, hybridization of related stock, and poor-quality brood stock.

In Nigeria, Tilapia is an important commercial fish species, distributed in all the rift valley lakes and some other high land lakes and rivers [3; 4]. It contributes more than 50% of the total landings of fish caught per year in Ethiopia [5], and is considered the most edible fish species [6]. The aquatic genetic resources management considers several activities that should be performed in every water body depending on the fish species and nature of the geographic locations.

The effect of environmental changes on the growth of Nile tilapia cannot be over emphasized. This is so as, the achievement of the method of farming tilapia relies on various factors which can be difficult to determine the optimal way under certain conditions. [7] identify various factors in environmental changes that can affect the growth of tilapia to include but not limited to; various feed frequencies, various feeding rate, water quality, water temperature, dissolve oxygen concentration, water pH degree, feed and feeding among other.

Length-weight relationship of fish is an important tool in fishery management and has been frequently used to estimate weight from length. It is known that weight of fish increases as a function of length [8]. LWR data is important for fish stock assessment, especially to estimate fish biomass [9] and for compara- tive growth studies in fisheries management [10]. When the value of regression coefficient (b) equals (3) this indicates isometric growth of fish, and when the value is less than (3) this shows algometric growth [11].

Condition factor serves as an indicator of fatness and general well-being of the fish,based on the assumption that a heavier fish of a given length is in better condition [12]. It represents how fairly deep bodied or robust fishes are [13].

The broad objective of this research work was to determine the length-weight relationship and condition factor of *O. niloticus* bought from Tella and Donga to form a base-line data which can be used for future research development and management of sustainable fisheries.

2. MATERIALS AND METHODS

2.1. Study Area

River Taraba (Tella) is a river in Taraba State, Nigeria, a tributary of the Benue River. The coordinates of River Taraba is between Latitude 8’°34’0”N and the Longitude of 10’°15’0”E. River Taraba takes its source from the high altitude of the Atlantic hills on the Nigeria-Cameroon border in the mid-east part of the state and flows westwards, covering a distance of about 256km before entering the river Benue [14].

Donga is a Local Government Area in Taraba State, Nigeria. Its headquarters is Donga town. The coordinates of Donga River lies between Latitude 7°43’00”N and Longitude 10°03’00”E. It has an area of 3,121 km² and a population of 209,400 people according to 2022 National Population Projection.

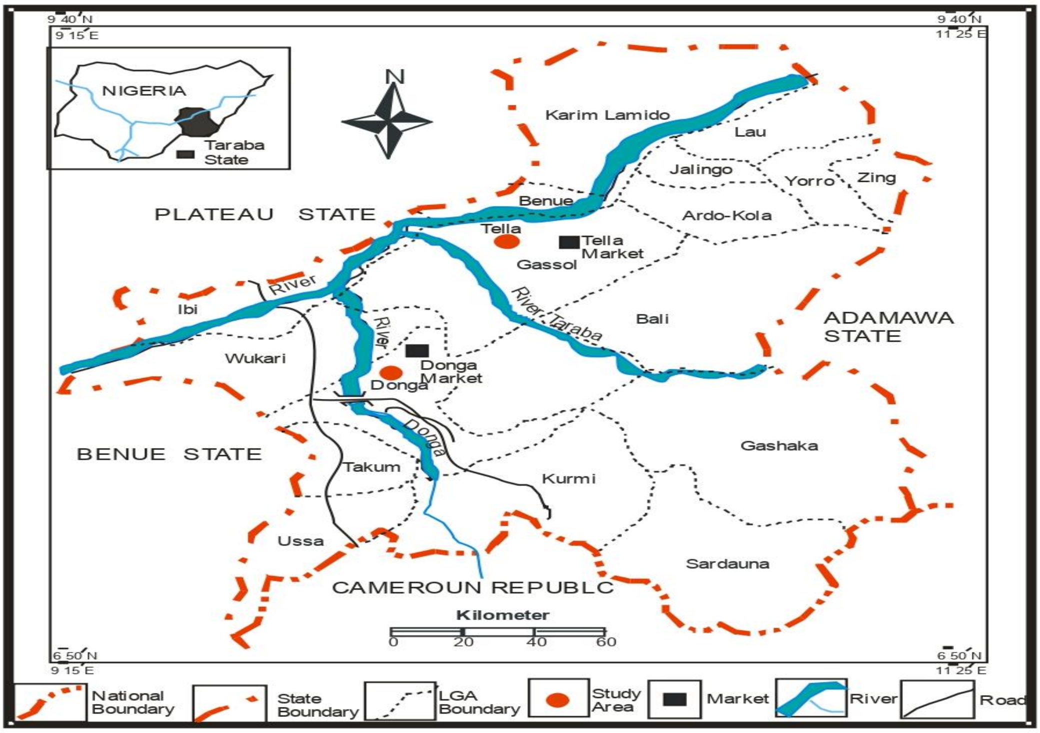

Figure1: Map of Taraba State Showing Tella and Donga Market Areas (Study area)

2.2. Procurement of Experimental Fish Sample

A total of sixty (60) Nile tilapia **(***Oreochromisniloticus***)** 30 each, were purchased from artisanal fishermen at Tella fish market from July 2023 to October 2023 monthly and Dongafish market.This artisanal fishermen at Tella fish market usually obtained their freshly fish product from river Tella (Taraba). Fish sample purchased were transported in ice-box containing ice-block to the Department of Biology Science Laboratory, Federal University Wukari, for determination of length-weight relationship and condition factor. The sample were preserved in a refrigerator throughout the study period to avoid immediate deterioration. Identificationof the fish samples was carried out using Nigeria fresh water fish pictorial key guide [15].

2.3. Method of Data Collection

Eighteen morphometric were measured. The morphometric measurements was taken for all the collected samples and measured to the nearest 0.01cm, with transparent ruler. All morphometric length measurements were taken between identical points along the anterior to the posterior axis of the sample fish whereas body depths was taken perpendicularly between the identified points taken at the first dorsal ray and at the caudal peduncle. The weight of the fish were recorded using sensitive digital weighing scale. The Landmarks measured 18 features in figure 2 shows below.

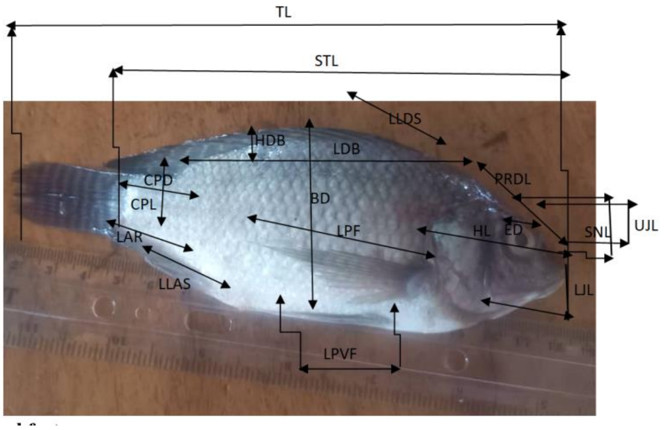

Figure 2: Landmarks showing measured features

2.4. Determination of Length-Weight Relationship

Data on the total body length (L) and body weight (w) were recorded from each fish. The parameters a and b of the length-weight relationship was estimated by logarithmic transformation of the equation:$W = aL^b$

Where W is the body weight (g): L is the standard body length (cm); a is the intercept; and b is the slope. Length-weight relationships was use to provide the condition of fish and determine whether growth is isometric ($b = 3$) or allometric (negative allometric: $b<3$, or positive allometric: $b>3$) [16].

2.5. Determination of Condition Factor (K)

The measured data obtained of body weights (BW) and standard lengths (SL) were used to calculate each fish condition factor (K) using the formula: $K = \frac{BW}{SL^3} * 100$[17].

Where K= Condition factor; BW= body weight; S= standard length in cm.

The mean monthly condition factor of rivers Taraba and Donga fish sample were plotted to illustrate the fluctuations in the relative fish's 'fatness' or 'well-being' during the study period

2.6. Data Analysis

The data obtained from the experiment were subjected to t-test for comparison at 95% level of confidence (p=0.05) with the aid of IBM SPSS version 25. Descriptive statistics was used to calculate minimum, maximum and mean of the species from two rivers Taraba and Donga.The body composition data was analyzed by one-way analysis of variance (ANOVA) at a significance level of p=0.05.

3. RESULTS

3.1. Length-Weight Relationship and Condition Factor

The results of Length-weight relationship analysis at the end of the study are presented in figure 1-8.

3.2. Linear Regression and Condition Factor of *O.niloticus*from Rivers Taraba and Donga

The linear regression and condition factor of *O. niloticus* from Rivers Taraba and Donga shows that the parameters regressed at R^2 = 0.49 and R = 0.71 in river Taraba with p=0.00. The coefficients of regression shows that a = -1.919 and b= 2.9, W was significant descriptor of the regression equation ($p<0.05$) as presented in table 1.

Table 1:Linear Regression and condition factor of *O.niloticus*from Rivers Taraba and Donga

River	A	B	r^2	K	**Growth pattern**
Tella	-1.91	2.93	0.49	1.22	Negatively allometric
Donga	-0.53	1.93	0.62	1.73	Negatively allometric

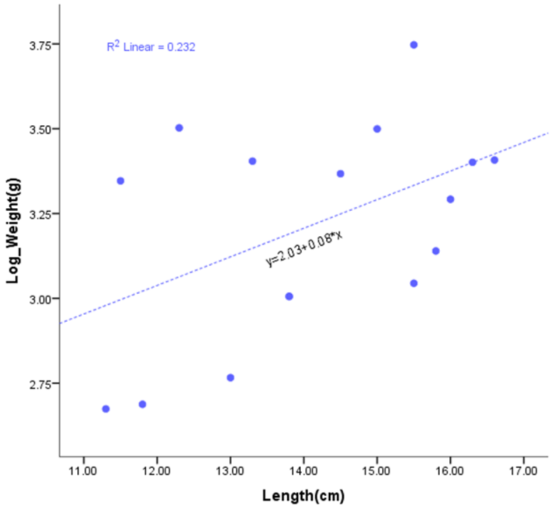

Figure 3: Length-Weight relationship from River Taraba, July 2023

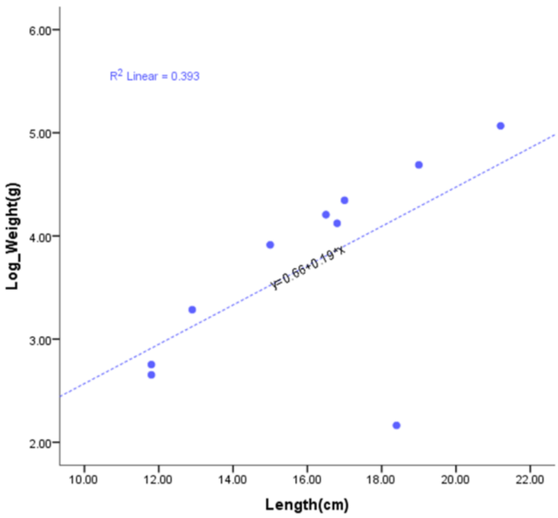

Figure 4: Length-Weight relationship from River Taraba, August 2023

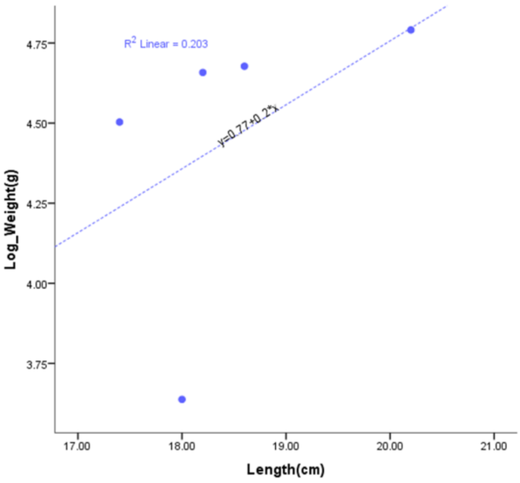

Figure 5: Length-Weight relationship from River Taraba, September 2023

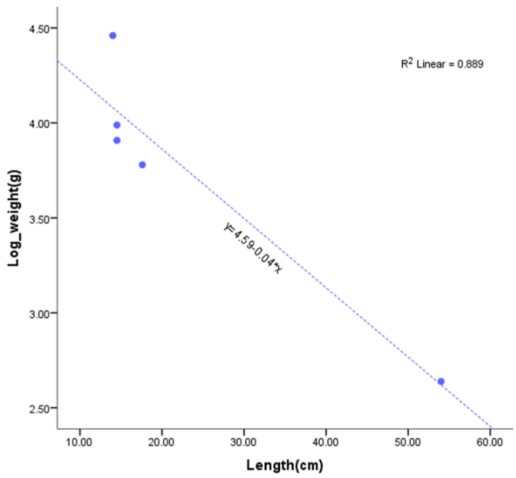

Figure 6: Length-Weight relationship from River Donga, July 2023

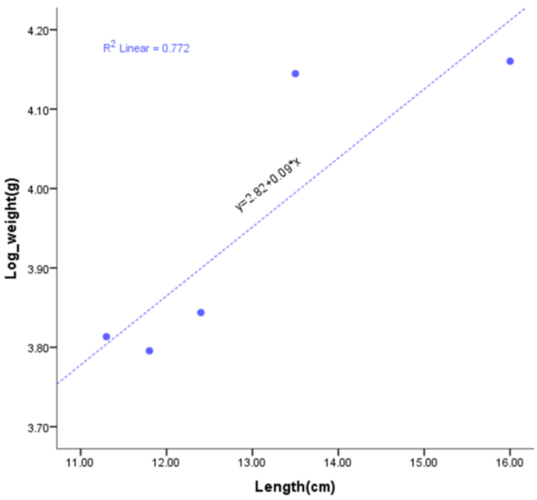

Figure 7: Length-Weight relationship from River Donga, August 2023

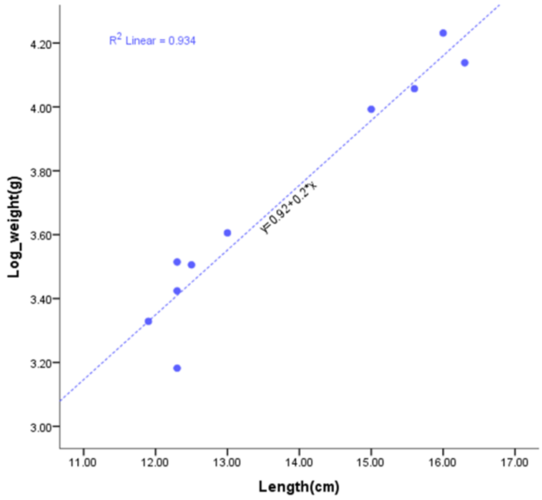

Figure 8: Length-Weight relationship from River Donga, September 2023

4. DISCUSSION

In table 1. The value obtained for the regression coefficient (b) was b=2.93 for river Taraba and b=1.93 from river Donga showing negatively allometric growth pattern of *O. niloticus* from the two rivers. The value disagreed with similar study of [18] who's reported 2.97 to 3.65 in their study. [19] Studied length-weight relationship of O.*niloticus* in three localities in Gebel Aulia Reservoir and reported values of (b) ranging from 2.67- 3.07 for the combined sexes. The value agree with the result obtained in the present study (2.93), suggesting that the local conditions in the study area were suitable for the growth of *O. niloticus.* The highest (1.73) value of "K' was obtained from river Donga while the lowest value (1.22) was recorded in river Taraba. The high value of condition factor recorded for *O. niloticus*reflect that the environment conditions in the study area were favorable for the growth and survival of the fish.

From figure 3. Theresult of length-weight relationship of Nile tilapia (*Oreochromisniloticus*) from rivers Taraba and Donga is somehow similar with the result of [20; 21] whose reported a strong relationship between the body weight and standard length*O.niloticus*. Also, the weight relationship of this study differs from other studies. This study provides insight on the morphological characteristics in relation to the body weight of the fish sample from the two locations for the sustainable management of fishery in Taraba and Nigeria at large. [22; 23] reported that, Nile Tilapia can adjust their body size in response to environmental conditions including food availability and predation pressure. When there is much food sources, Nile Tilapia may developed more deeply set bodies in order to better grab these objects of prey [24]. The populations from River Taraba and Donga differ in their weight-length, which imply that their ecological needs may differ and that they ought to be handled differently. Moreover, more research is required to comprehend the underlying genetic and environmental variables causing these relationship, as this knowledge may be helpful in sustainable fisheries.

5. CONCLUSION

The length-weight relationship and condition factor results obtained from *O. niloticus*of rivers Taraba and Donga in this study indicatenegatively allometric. Previous studies [22; 23] have shown that Nile Tilapia is able to modify their body size in response to environmental factors such as the availability of food and the pressure from predators. Nile Tilapia may have evolved more deeply set bodies to better grasp these prey items when food supplies [24]. The differences in body size, body form and body weight might have occurred as a result of environmental fluctuations. It could be suggested that for Nile tilapia farming program the River Donga side should be preferred based on sizes and biomass.

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