

*Original Research Article*

# Length Weight Relationship and Condition Factor of *Heterotisniloticus* in Niger Delta University Teaching and Research Farm

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Abstract

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**Heterotisniloticus** was stocked in the Niger Delta University Teaching and Research farm in September 2015 in an eathernpond of 100m<sup>3</sup>. This study was carried out to understand its well-being in this facility. The length-weight relationship and condition factor was investigated to determine its growth pattern in captivity. A total of 60 fish samples were used in the study comprising 28 males and 32 females. The length-weight measurements were assessed using standard methods. The total length for male ranged from 33-77cm with a mean length of 52.25±1.9cm and weight ranging from 200-4300g with a mean weight of 1221.429±149.4g. The total length of female ranged from 50-73cm with a meanlength of 58.86±1.3cm and weight ranging from 1100-4100g with a mean weight of 1631.25±41.8g. The total length of combined sexes ranged from 33-77cm with a mean length of 55.77±1.2cm and weight ranging from 200-4300g with a mean weight of 1440±101.9g. The males had an intercept (a) value of -1.7441, a slope (b) of 2.785 and a correlation coefficient of (r) of 0.943133. Females had an intercept (a) value of -1.6004, slope (b) of 2.7072 and a correlation coefficient (r) of 0.897441. The combined sexes had an intercept (a) value of -1.7309, slope (b) of 2.7794 and a correlation coefficient (r) of 0.937763. The condition factor (k) for males, females and combined sexes ranged from 1.02-3.01, 1.38-2.56 and 1.02-3.01 respectively with an average of 1.88 for all fish samples. The results indicate a negative allometric (b<3) growth pattern. This study provides the first basic information on length weight relationship and condition factor of *Heterotisniloticus* in captivity from the various ponds and reservoir in the Niger Delta University Teaching and Research Farm.

**Keywords:** Length-weight relationship, condition factor, Niger Delta University Teaching and Research Farm

## INTRODUCTION

Inland tropical water has rich biodiversity which plays significant role in the economy, culture, tradition and food habits of Nigerians. About 316 recorded freshwater bony fish species belonging to 50 families have been reported in Nigeria (Olaosebikan, 2013). Inland water species are the most threatened of all taxa (Ciruna et al., 2004).

Like most countries, fish yields of most Nigerian

waters are generally on the decline (Jamu et al., 2003). The direct drivers of loss and degradation of inland waters are well known and documented and include changes in land use or cover due to vegetation clearance, drainage, and infilling especially connected to expansion of agriculture; the spread of infrastructure, whether for urban, tourism and recreation, aquaculture,

agriculture, or industrial purposes; the introduction and spread of invasive species; hydrologic modification; over harvesting particularly through fishing and hunting; pollution, salinization and eutrophication; and global climate change, which is expected (high certainty) to lead to even further degradation and to exacerbate existing pressures. Estimates of the number of fresh water fishes that will become extinct within the next 20-30 years run as high as 300 species (Stiassny, 1998). This is why conservation is seen as a priority throughout the world.

Due to general environmental degradation, *Heterotisniloticus* has lost an estimated 60% of its previous breeding and nursery habitat in Nigeria (Bake and Sadiku, 2005). *Heterotisniloticus* commonly known as African bony tongue is a long-bodied fish with large scales, long dorsal and anal fins set far back on the body and a rounded caudal fin. Its weight is 3.5 to 5.0 times standard length. It has been reported to reach up to 1m (3.3ft) long and weigh up to 10.3kg (221b) (Froese et al., 2014).

The species is wide spread throughout Africa, where it is native to all the watersheds in Sahelo-Sudanese region, Senegal, and Gambia, as well as parts of eastern Africa. This range includes the basins of the Corubal, Volta, Oueme, Niger, Benoue, and Nile Rivers, as well as those of Lake Chad and Lake Turkana. It has been successfully introduced to Cote d' Ivoire, the Cross River in Nigeria, the Senegal and Nyong Rivers in Cameroon, and the Ogoové River in Gabon, as well as the lower and middle Congo River basin, including Ubangui and Kasai Rivers. It has also been introduced in Madagascar. In some cases, introduction is reported to have had a negative impact on the local ecology (Froese et al., 2014).

*Heterotisniloticus* is of high commercial value for fisheries. Fishing of *H. niloticus* takes place in all African countries where the species occurs (Akinyiet al., 2010). The hardiness of the fish, together with its great growth rate make it a candidate for aquaculture in Africa and it has been transported to a number of countries for this purpose (Froese and Pauly, 2018).

Length-weight relationship is used extensively in fishery research and management (Wang et al., 2012). According to Akinsanya et al. (2007). The emanating need to culture fishes for protein consumption for the rapidly growing population in Nigeria has made it necessary to intensify studies on the length frequency of the African freshwater fishes. Age data, in conjunction with length and weight measurements can give information on stock composition, age at first maturity, life span, mortality growth and production (Kumar et al., 2004).

Thus, the length-weight relationship provides means for finding out the "condition factor" which indicates the "wellbeing of the fish". The relationship permits estimating the weight of a specimen easily when the total length is known, these relationships are useful when rapid

estimation of biomass is necessary (Froese, 1998). The relationship of length-weight estimates condition factor of the fish species and fish biomass through the length frequency (Fishbase, 2013).

The condition factor is an index reflecting interaction between biotic and abiotic factors in the physiological conditions of fishes. In fisheries, the condition factor (k) is used to compare the "condition", i.e. wellbeing of the fish (Sehar and Suleyman, 2012). Factors such as non-availability of food, predation, competition, fishing intensity, change in water physio-chemical parameters, spawning and pollution can influence the wellbeing of fish in the aquatic environment (Abowei, 2009). *Heterotisniloticus* is the only species in the genus *Heterotis* and family Osteoglossidae. The species is widely distributed in tropical rivers and freshwater lakes of Western and Central Africa (Leveque et al., 1990). There are a lot of studies on the feeding relationship length and condition factor of various species in several water bodies (Imiruaye, 2019). But the length-weight relationship and condition factor of *Heterotisniloticus* have not been studied in the fish reservoir of Niger Delta University Teaching and Research Farm, though a study of the length-weight relationship and condition factor of *Heterotisniloticus* had been carried out in the Amassoma flood plain, Niger Delta, Nigeria by Ezekiel and Abowei, 2012. It is imperative to determine the length-weight relationship and condition of wellbeing of the species influenced by different biological and environmental factors, as it provides information about the growth pattern, general health, life history, habitat condition, fish fatness and condition, as well as morphological characteristics of the specie, (Schneider et al., 2000, Froese, 2006) in the research farm. *Heterotisniloticus* had been established in the Teaching and Research farm hence the justification of the study of the well-being of the fish species in culture.

## MATERIALS AND METHOD

The study was conducted at the Niger Delta University Teaching and Research Farm. The Teaching and Research farm (4.58'46.0"N, 6°06'18.1"E) situated in the campus of "Niger Delta University, Wilberforce Island" situated in Amassoma, ((4.9731°N, 6.1090°E), Southern Ijaw Local Government Area of Bayelsa State. The Niger Delta University Teaching and Research farm comprises several diverse ponds (production ponds and nursery ponds) and a reservoir where in *Heterotisniloticus* were stocked for culture. Figure 1

### Sample Collection

Fish species were collected from the reservoir in the Fisheries unit of Niger Delta University Teaching and



**Figure 1.** The geographical location of Niger Delta University Teaching and Research Farm.  
Source: Google (2019).

Research farm with a seine net. The seine net used is 4m in breadth, 14m in length and consist of a cod end which is about 50m in length and 4m in depth with a mesh size of  $1\text{cm}^2$ .

### Length-Weight Relationship (LWR)

The length-weight measurements were taken according to sexes of specimen. The total length was measured from the snout of the fish species to the end of the caudal fin using meter rule. The weight was taken with a weighing balance.

The length-weight relationship of the fish species was determined using the formula:

$W = aL^b$  as used by Ricker (1973).

Where;  $w$  = body weight of fish (g)

$L$  = body length of fish (cm)

$a$  = intercept

$b$  = growth exponent

### Condition Factor (k)

The condition factor ( $k$ ) of the fish species was calculated using the formula;

$K = W \times 100/L^b$  (Pauly, 1984)

Where;

$K$  = condition factor

$L$  = Total fish length (cm)

$W$  = weight of fish (g)

$b$  = Growth exponent derived from length-weight relationship.

### Data Analysis

The data of length and weight was transformed to  $\log_{10}$

and was subjected to Microsoft excel for regression analysis. Pearson's correlation coefficient ( $r$ ) was determined. The slope ( $b$ ) and intercept ( $a$ ) values were obtained from linear regression equation; ( $\log W = \log a + b \log L$ )

### RESULT

A total of 60 fish samples were used in this study, comprising of 28 males and 32 females whose lengths and corresponding weights were measured and recorded. The male length ranged from 33-77cm with a mean $\pm$ S.E of  $52.25 \pm 1.9\text{cm}$ , while the male weights ranged from 200-4300g, with the mean $\pm$ S.E weight of  $1221.429 \pm 149.4\text{g}$ . Notwithstanding, the length of the females ranged from 50-73cm with a mean $\pm$ S.E length of  $58.86 \pm 1.3\text{cm}$ , meanwhile the weight ranged from 1100-4100g with a mean $\pm$ S.E weight of  $1631.25 \pm 41.8\text{g}$ . The length for the combined sexes ranged from 33-77cm with a mean $\pm$ S.E length of  $55.77 \pm 1.2\text{cm}$ . The combined weight ranged from 200-4300g with a mean $\pm$ S.E weight of  $1440 \pm 101.9\text{g}$  as shown in Table 4.1 and 4.2 respectively. The transformed length-weight relationship plots are shown in Fig. 4.1, 4.2 and 4.3 for males, females and combined sexes respectively. The males (Figure 2) had an intercept ( $a$ ) value of -1.7441, a slope ( $b$ ) of 2.785 and a correlation coefficient ( $r$ ) of 0.943133. The females (Figure 3) had an intercept ( $a$ ) value of -1.6004, the slope of 2.7072 and a correlation coefficient of 0.897441. For the combined sexes (Figure 4), the intercept ( $a$ ) had a value of -1.7309, a slope ( $b$ ) of 2.7794 and a correlation coefficient of 0.937763.

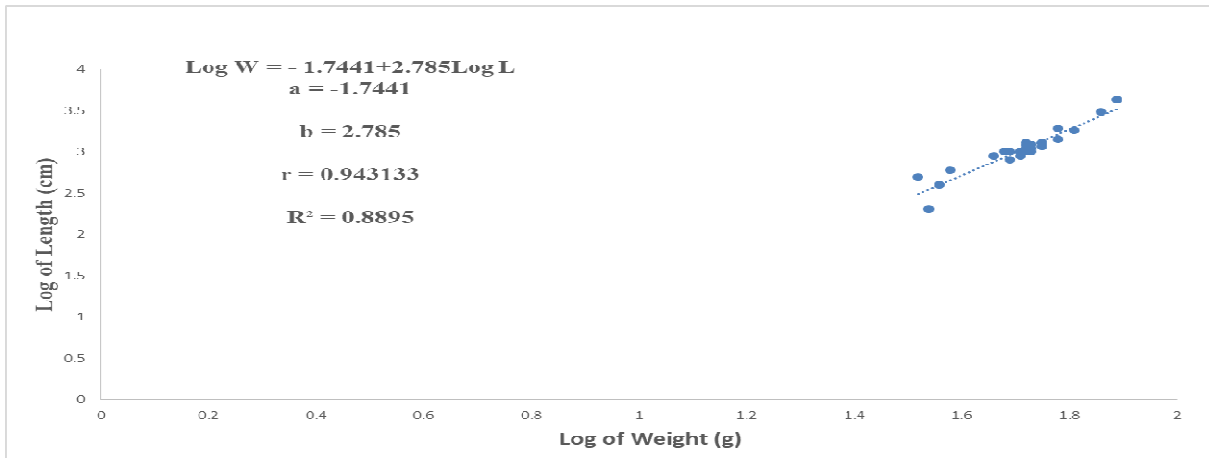
The condition factor ( $K$ ), for males was  $1.88 \pm 0.363$ , ranging from 1.02-3.01, while the females had  $1.88 \pm 0.30$ , ranging from 1.38-2.56, and finally, the combined sexes had  $1.88 \pm 0.331$  ranging from 1.02-3.01.

**Table 1.** The Length measurement of *Heterotisniloticus* sampled in Niger Delta University Teaching and Research Farm

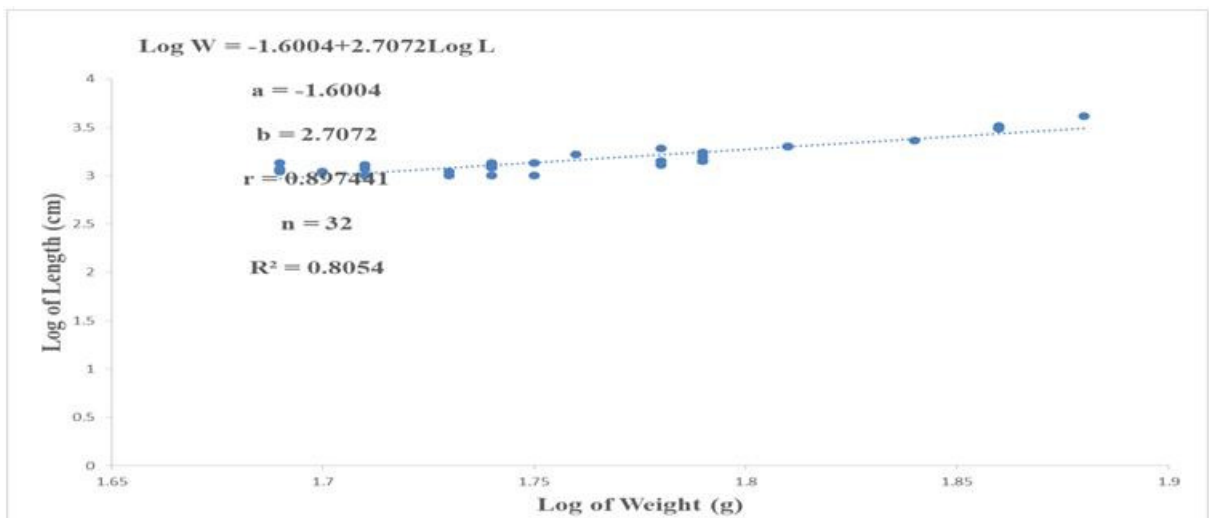
Sex	No. of Specimen	Length (cm)		Mean ± S.E
		Min	Max	
Male	28	33	77	55.25± 1.9
Female	32	50	73	58.86± 1.3
Combined	60	33	77	55.77± 1.2

**Table 2.** The Weight measurement of *Heterotisniloticus* sampled in Niger Delta University Teaching and Research Farm

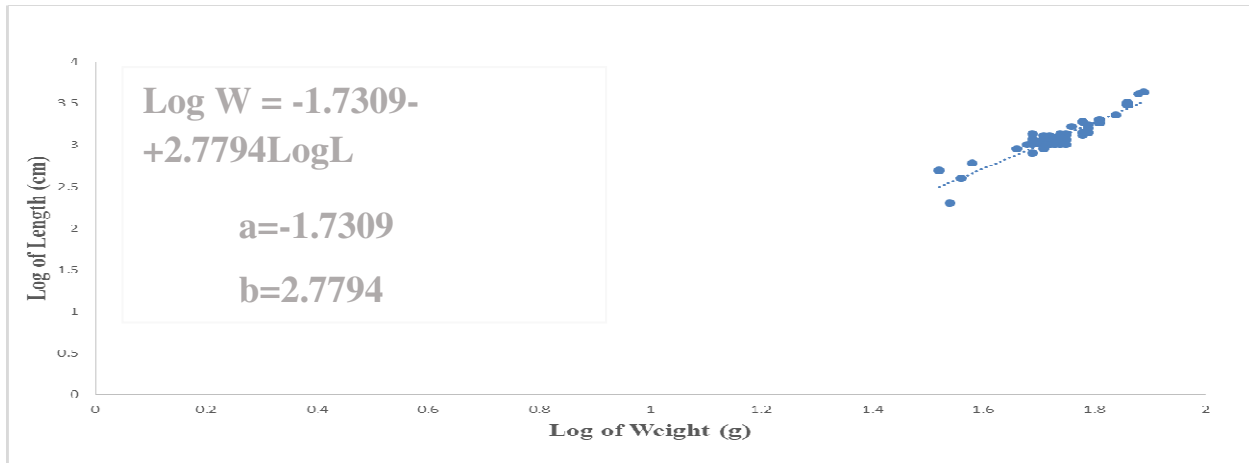
Sex	No. of Specimen	Weight (g)		Mean± S.E
		Min	Max	
Male	28	200	4300	1221.42± 149.4
Female	32	1100	4100	1631.25± 41.8
Combined	60	200g	4300	1440± 101.9



**Figure 2.** The Log Length-Log weight relationship of the males of *Heterotisniloticus*



**Figure 3.** The Log Length-Log weight relationship of the females of *Heterotisniloticus*



**Figure 4.** The Log Length-Log Weight relationship for combined sexes of *Heterotisniloticus*

**Table 3.** The condition factor for males, females and the combined sexes of *Heterotisniloticus* sampled in the Niger Delta University Teaching and Research Farm

Sex	No. of Specimens	Condition Factor (k)		Mean $\pm$ S.D
		Min.	Max	
Male	28	1.02	3.01	1.88 $\pm$ 0.363
Female	32	1.38	2.56	1.88 $\pm$ 0.301
Combined	60	1.02	3.01	1.88 $\pm$ 0.331

## DISCUSSION

The results of the present study on the length weight relationship of *Heterotisniloticus* in the reservoir of the Niger Delta University Teaching and Research Farm showed that growth pattern was negative allometric ( $b < 3$ ) for all the species with the intercept (a) value of -1.7309, a slope (b) of 2.7794 and condition factor 1.88. Fish yield is studied using weight as a measure of size. Length-weight relationship (LWR) and condition factor (K) are important fishery management tools (Uneke 2015; Bagenal and Tesch, 1978). The LWR relationship provides information on the relative wellbeing of fish population, determines whether somatic growth is isometric or allometric (LeCren, 1951).

Condition factor compares the wellbeing of fish with the hypothesis that heavier fish of a given length are in better physiological condition than the less robust in relation to its welfare (LeCren, 1951; Bagenal and Tesch, 1978). According to Adeyemi *et al.*, (2009), a fish is in good condition when  $k \geq 1$ . Earlier reports had suggested that length-weight relationship and condition factor of fish varies due to nutrition (Abobi and Ekau, 2013), condition of life in the aquatic environment (Bashir *et al.*, 1993; Ndiaye *et al.*, 2015) as well as events of life cycle such as metamorphosis, growth and onset of maturity (Le Cren 1951), sex, frequency of spawning and sampling season (Sikokiet al., 1998).

## CONCLUSION

This study provides the first basic information on length weight relationship and condition factor of *Heterotisniloticus* from the reservoir in the Niger Delta University Teaching and Research Farm that will be helpful in similar studies. The fish species exhibited the same growth patterns amongst males and females (negative allometric growth pattern) and the same condition factor. However, more comprehensive studies need to be conducted which would involve the standardization of the sampling sizes, sampling seasons as well as understanding bio-ecology of the fish species before further inferences could be made.

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