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Preliminary study of growth pattern and condition factor of bobo croaker (*Pseudotolithus elongatus*) in obolo area Nigeria

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The preliminary study of the growth pattern and condition factor of Bobo Croaker (*Pseudotolithus elongatus*) in the Obolo Area, Nigeria, was conducted over a six-month period. Samples were collected from the catches of artisanal and local fishers, and the length and weight of the samples were measured *in situ* using appropriate tools. The parameters "a" and "b" of the Length-Weight relationship were estimated using the equation prescribed by Ricker ($W = aL^b$), while the Condition Factor was calculated using Fulton's equation ($K = 100W/L^3$). The combined Length-Weight Relationship (LWR) for both sexes indicated that the values for "a," "b," and R^2 were 0.0166, 2.8176 and 0.9321, respectively. The obtained R^2 values demonstrated a strong linear relationship between the length and weight of the species. The length-weight relationship revealed a negative allometric growth pattern for both males and females. The Condition Factor (K) values ranged from 0.783 to 0.812 with a mean value of 0.827 for males and from 0.809 to 0.892 with a mean value of 0.847 for females. The length-weight relationships and Condition Factor of the study indicated that the species are conducive to various biological activities. However, sustainable management practices that are environmentally friendly should be adopted to protect the aquatic habitat against anthropogenic activities that may adversely affect the species.

Key words: Negative allometry, growth, male, female, correlation.

INTRODUCTION

The Bobo Croaker (*Pseudotolithus elongatus*), commonly referred to as "broke marriage" by the Obolos, belongs to the Scianidae family and is widely distributed in Nigeria, particularly in the Niger Delta Mangrove Region. It is a staple in the diet of the Obolo people, also known as the Andonis, who are an ethnic group in the Niger Delta

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Region of Nigeria (Enemugwem, 1990). The Obolo people inhabit the longest stretch of the Mangroves belt region, which houses the largest oil and gas deposits in the Gulf of Guinea (Enemugwem, 1990).

Pseudotolithus species are primarily marine but are found seasonally in brackish water regions (Akpan, 2013; Akpan et al., 2022; Fischer and Bianchi, 1984). The smaller and younger ones typically prefer shallow waters and migrate to mid-waters when the bottom temperature falls below 18ºC (Olapade and Tarawaille, 2014). These fish species are of economic significance and contribute significantly to the food security of the Obolos and Nigerians in general. They are noted for their omnivorous feeding habits, leaning towards piscivory and benthic feeding (Ajah and Udoh, 2012).

In recent years, oil exploration and pollution have become significant challenges to water resources in the area (Anyanwu et al., 2014; Bassey and Richardo, 2003; Akpan and Etim, 2015). These issues have led to a reduction in water quality, the protection of natural values, and the composition of flora and fauna in the aquatic ecological system (Enemugwem, 2000). To gain a comprehensive understanding of these impacts on the aquatic ecosystem and identify endangered fish species, studies on bio-ecological features are deemed necessary.

A comprehensive understanding of the growth pattern in aquatic species, particularly fish species, is crucial for effective management, as emphasized by Enemugwem (2009). The Condition Factor of fish species has been widely recognized and developed as an index for assessing growth and feeding intensity (Abowei et al., 2008). Various scientists have contributed valuable information on the studied species, including Abowei et al. (2008), Ajah and Udoh (2012) and Isangedighi and Ambrose (2016).

In light of the existing body of knowledge, this present study aims to document the growth pattern and Condition Factor of Pseudotolithus elongatus in the Obolo area, Nigeria. Understanding the growth pattern is essential for estimating biomass and establishing yield through the conversion of one variable to another, a common practice during field studies.

MATERIALS AND METHODS

Study area

The study was conducted at the landing sites of the Iko River Estuary, situated in the geographical setting of the Obolos in the Niger Delta Region. It is positioned within latitude 40°30'N and longitude 70°35'E to 70°40'E, as depicted in Figure 1 (Etesin et al., 2013; Udotong et al., 2008). The estuarine environment is characterized by intertidal mud and sediment. The climate of the area is tropical, marked by two distinct seasons: the dry and wet seasons. The Iko River Estuary holds significant importance in several aspects, serving as breeding sites for diverse biodiversity and facilitating the exploration of mineral resources (Enemugwem, 2009).

Sources of data

Length and weight relationship determination

Monthly samples of *P. elongatus* (Plate 1) were systematically collected at the landing sites of the Iko River Estuary from local fishers. The sampling of landed fishes occurred once a month over a six-month period. Various types of fishing gears were observed to be employed by the fishers during the sampling process. Throughout the sampling duration, the Total Length (TL) of *P. elongatus* samples was measured in situ using a stainless steel measuring board, with measurements recorded to the nearest 0.5 cm. Additionally, the corresponding weight of each sample was measured using an electronic balance scale, with weights recorded to the nearest 0.5 g.

To minimize bias, samples were collected randomly from different points of landing within the river estuary. Monthly measurements were meticulously recorded in a data sheet and subsequently transferred into a data file for further analysis.

Data analysis

The total length (TL) of the collected samples was measured from the tip of the anterior to the caudal fin, while the weight was measured using an electronic scale with measurements recorded to the nearest 0.5 g. Mean ($\bar{x}$) lengths and weights of the classes were employed for data analysis, following an approved format as outlined by Pauly (1983). The relationship between Total Length (TL) and Weight (W) of the fish was expressed through an equation as proposed by Pauly (1983).

$$W = aL^b$$
$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

Where, W = weight of fish (g); L = Total length (TL) of fish (cm); a = constant (intercept); b = slope (change in weight per unit change in length)

The "a" and "b" values were determined through a linear regression analysis of the length and weight measurements of the fish. The length, expressed as Exponent 3, was used as a percentage to calculate the Condition Factor, estimated from the relation as prescribed by Pauly (1983).

$$K = 100\ W/L^3$$

Where, K = Condition Factor, W = Weight of fish (g), L = Length of fish (cm).

RESULTS

The results in Table 1 indicated the size composition of *P. elongatus* in the studied area. The total length (TL) of fish ranged from 13.9 to 26.0 cm (maximum), while the weight is from 27.9 to 153.7 g (maximum).

Table 2 shows the length weight relationship

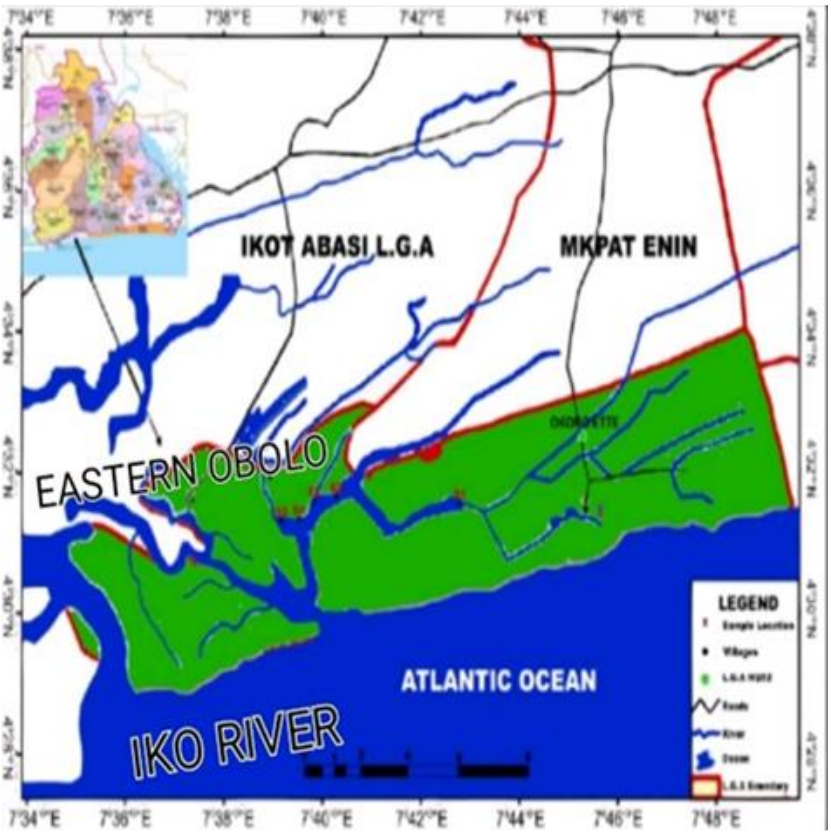

Figure 1. Map of Eastern Obolo, showing the study area.
Source: Wikipedia (2022)

Plate 1. Collected samples of *P. elongates.*

Table 1. Size composition of *P. elongatus* in Iko river estuary.

Months	Female					Male					Over all				
	N	XTL ± Std Err	Range	XW ± std Err	Range	N	XTL± std Err	Range	XW ± std Err	Range	N	XTL ± std Err	Range	XW ± Std Err	Range
Dec.	12	20.75±0.74	15.80-24.40	20.75±0.74	34.10-114.30	18	20.27± 0.55	16.20-25.00	73.38± 5.17	35.00-124.30	30	20.47± 0.43	15.80-25.00	75.73± 3.99	34.10- 124.30
Jan.	14	20.25±0.69	16.60-25.50	74.09±6.97	47.50-130.90	16	19.39±0.34	16.40-21.60	64.86±2.63	45.60-80.50	30	19.79±0.37	16.40-25.50	69.17±3.58	45.60-130.90
Feb.	11	20.00±0.45	15.40-22.50	65.57±4.13	27.90-91.00	19	21.53±0.51	18.20-24.50	81.27±5.83	46.80-117.00	30	20.56±0.36	15.40-24.50	71.33±3.60	27.90-117.00
March	13	21.49±0.78	13.90-26.00	87.39±7.62	40.10-146.80	17	20.37±0.63	16.50-25.80	70.73±7.44	43.70-139.30	30	20.85±0.49	13.90-26.00	77.95±5.48	40.10-146.80
April	12	19.92±0.18	18.70-20.80	63.96±1.57	52.30-70.70	18	20.11±0.29	17.80-22.10	63.68±2.20	46.10-78.30	30	20.03±0.19	17.80-22.10	63.80±1.44	46.10-78.30
May	13	21.51±0.45	18.00-24.60	87.32±7.31	48.80-153.70	16	21.70±0.38	18.00-23.70	89.98±5.79	47.30-134.50	29	21.61±0.28	18.00-24.60	88.74±4.52	47.30-153.70
Total	75					104					179	123.31		446.72	

XTL= Mean Total length, XW= Mean weight, Std Err= Standard error, N= Number of species.

Table 2. Length-weight (LW) relationship parameters of *P. elongates.*

	LW parameter	*P. elongatus*
Male	N	104
	b	2.8765
	a	0.0597
	R^2	0.9188
Female	N	75
	b	2.788
	a	0.0617
	R^2	0.9173
Combined sex	N	179
	b	2.8175
	a	0.0166
	R^2	0.9321

LW= Lenth-Weight, N= Number of species.

parameters of *P. elongatus* in the studied area. The “b” value for the male record was 2.8765, while “a” value was 0.0597 and R^2 value was 0.9188, “b” value for the female was 2.788, while that of “a” value was 0.0617 and R^2 value was 0.9173; for the combined sex the “b” value was estimated as 2.8175 and “a” value was 0.0166, while R^2 value was 0.9321.

Table 3 shows the summary of the K value in

Table 3. Summary of condition factor (K) in males and females of *P. elongatus* from Iko River estuary.

Gender	Minimum	Maximum	Mean
Males	0.783	0.889	0.827
Females	0.809	0.892	0.847

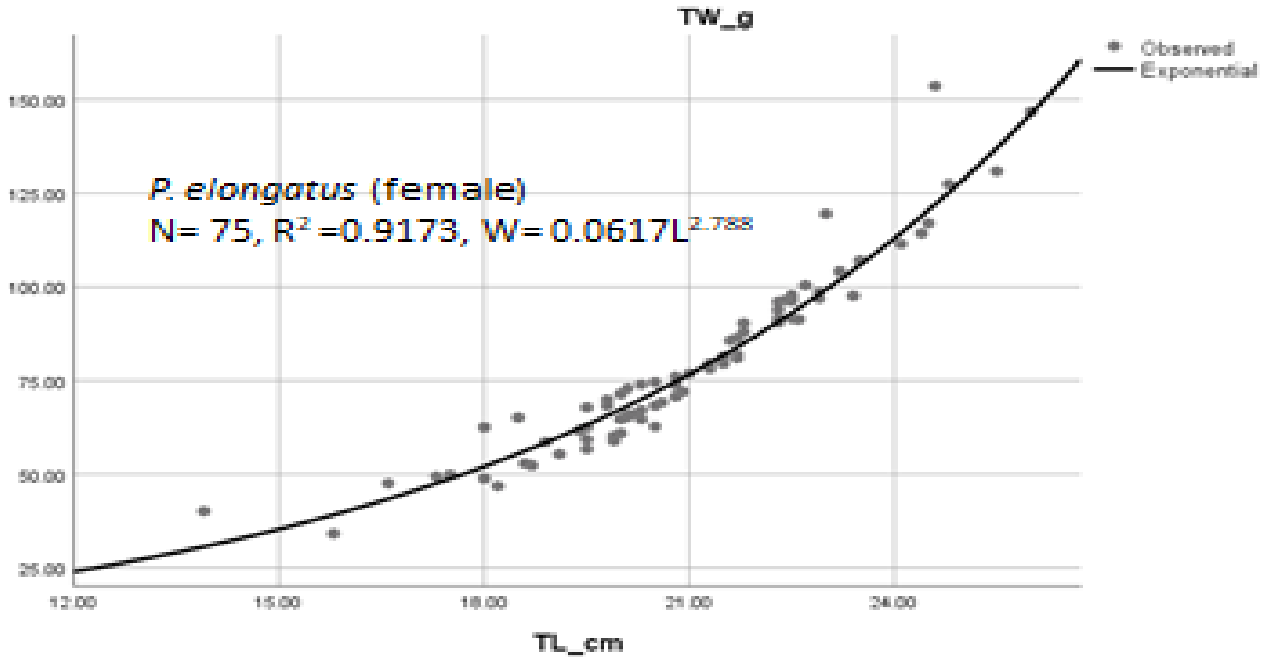

Figure 2. LW graph of female *P. elongatus.*

both males and females of *P. elongatus* from the studied area. The males K value ranged from 0.783 to 0.88 (maximum) with a mean ($\bar{x}$) value of 0.827 while the female K value ranged from 0.809 (minimum) to 0.892 (maximum) with a mean ($\bar{x}$) value of 0.847.

Figures 2 and 3 depict the correlation graphs illustrating the length-weight parameters of male *P. elongatus*, female *P. elongatus*, and the combined sexes.

DISCUSSION

Growth pattern

In this study, the growth pattern of *P. elongatus* in both male and female species exhibited negative allometry (b < 3), as indicated by a t-test departure from 3, which represents the value of isometric growth. Negative allometric growth suggests that the fish species becomes relatively thinner as it grows larger, indicating a trend of reduced size with increasing age (Etesin et al., 2013). Conversely, positive allometric growth (b > 3) would suggest that the fish becomes more robust as it ages (Ekanem et al., 2004).

The R^2 values of 0.9173 and 0.9321 for the male and female sexes, respectively, revealed a strongly linear relationship between the length and weight of the studied fish. Negative allometric growth patterns have been reported in other species, such as 2.92 and 2.97 for *Penaeu notialis* and *P. monodon* (Yakub and Ansa, 2007), 2.84 for female *Clarias gariepinus*, and 2.80 for *P. barbarous* (Udo et al., 2016). The occurrence of absolute isometric growth (b = 3) in the natural setting is rare and situational (Bassey and Richardo, 2013).

Length-weight relationship and condition factor

The parameters of the length-weight relationship provide detailed information on the condition factor and growth

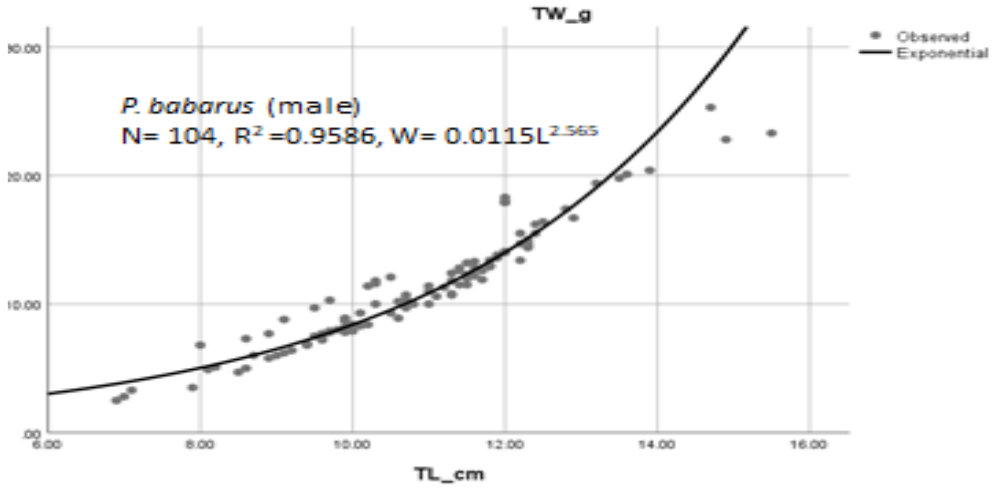

Figure 3. LW graph of male *P. elongates.*

patterns of fish species. The deviation of the b-value depends on the shape and fattiness of the species, although other factors may also play a role, such as food availability, sex, time of season, stages of maturity, and water variables in the aquatic system (Olapade and Tarawaille, 2014; Sarkar et al., 2013; Udo et al., 2016; Ujjania et al., 2012).

The mean condition factor serves as a measure of the suitability of environmental parameters and acts as an index reflecting the interaction between ecological factors (biotic and abiotic) and the physiological conditions of fishes (Olapade and Tarawaille, 2014). In this study, the mean condition factor of *P. elongatus* for males was 0.927, and for females, it was 0.847. This result differs from the Condition Factor range of 0.54 to 1.71 obtained in the same species in Jaja Creek (Isangedighi and Ambrose, 2016). The mean condition factor values obtained from this study suggest that the species were in good condition.

Several factors are known to influence the well-being of fish species, including sorting, sex, stages of maturity, and state of the stomach, data handling, and research errors (Ekanem et al., 2014). Mean condition factor values vary with respect to the season and are significantly influenced by abiotic and biotic conditions (Ajah and Udoh, 2012).

Conclusion

It is a well-established fact that the Condition Factor and Length-weight relationship of fishes are crucial tools for effective management (Olapade and Tarawaille, 2014). The results obtained in this study indicate that the studied species are conducive to positive biological activities. Given that this species is commonly consumed by the Obolos and forms a significant part of the commercially important species in the Niger Delta Region, Nigeria, it is imperative to maintain a record of the length-weight relationships from various habitats around the Niger Delta and other parts of the Obolos for informed management decisions.

Sustainable management practices, including the protection of the environment where the fish inhabit, are essential to safeguard against anthropogenic activities that may have adverse effects on the habitat.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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