Length –weight relationship and condition factor of long neck croaker –*Pseudotolithus typus* (Bleeker, 1863) from Lagos Lagoon, Nigeria

**Keywords:** length-weight relationship, condition factor, Lagos lagoon, *Pseudotolithus typus*

1. **Introduction**

*Pseudotolithus typus* is found along the coast of West Africa from Senegal to Angola. The Sciaenids constitute a large and varied family of fishes related to snappers but differs in that the spinous dorsal fin is short and the adipose tissue is much longer than the anal fin, which has only one or two spines. *P. typus* possess long head and body, a compressed body with the top of the head slightly concave, supra-lateral eyes and large mouth with lower jaw projecting. *P. typus* is among the top commercially fish species that is widely consumed locally by Nigerians because of its abundances on the local market [1].

Length-weight relationship (LWR) is of great importance in fishery assessments [2]. Length and weight measurements in conjunction with age data can give information on the fish stock, age maturity, life span, mortality, growth and reproduction [3].

Length-weight relationship of fish is widely recognized as an important tool in fisheries science especially in ecology population dynamic and stock management [4]. For this reason, 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 [5]. This relationships provides information on growth patterns and growth of the fish. During their development, fish are known to pass through stages in their life history which are defined by different length-weight relationships [6].

In fisheries science however, the condition factor (K) is used to compare the “condition”, i.e., fatness or wellbeing of fish [1]. It is based on the hypothesis that heavier fish of a particular length are in a better physiological condition.
It is also a useful index for monitoring feeding intensity, age, and growth rates in fish [9].

2. Materials and Methods

2.1 Study Area

Lagos State lies between longitude 3°21'24"E and latitude 6°35'8"N. It is located at the South-Western of Nigeria. Lagos State consists of twenty local governments. Ikeja currently serves as an administrative seat of the State and of a local government. The study area is Makoko, located in Lagos Mainland Local Government Area of Lagos State. Makoko is one of the many water and shoreline settlements in Lagos State. Makoko is a shanty settlement located in the centre of Lagos city, along the banks of the Lagos lagoon. Makoko lies within the south-eastern part of Lagos metropolis. It is bounded on the North by Iwaya and University of Lagos; at the West, by Ebute-Meta; South, by the Third mainland Bridge; and East by the Lagos lagoon [9].

2.2 Fish samples collection

Samples of *Pseudotolithus typus* were randomly obtained from September 2018 to February, 2019 from fishermen catches at Makoko landing point. The fish collection was done monthly for six consecutive months. A total of 93 specimens were collected and transported in ice-packed box to the wet laboratory of the Department of Biological Oceanography, Nigerian Institute for Oceanography and Marine Research (NIOMR) for further examination. These specimens were usually collected during early hour of morning. The sampling methods were season stratified. Seasonal stratification covered wet (September - November) and dry (December – February) seasons.

2.3 Laboratory Procedure

The nomenclature of the fish samples taken to the laboratory for this study conformed to Schneider (1990). The fish specimens were treated individually to determine their biometric data. The fish specimens were treated individually to determine their biometric data. In the Laboratory, Total length and Standard length of each fish sample was measured to the nearest 0.1cm while the weight of each specimen was measured to the nearest 0.1gram with a piece of clean hand towel.

The total length of the fish was measured from tip of the mouth to the caudal peduncle. Meanwhile, fish weight was taken into a data sheet for data analysis.

2.4 Growth Parameters

The total length of the fish was measured from tip of the anterior part of the mouth to the caudal fin while standard length was measured from tip of the mouth to the caudal peduncle. Meanwhile, fish weight was taken after blot drying with a piece of clean hand towel.

Total length (TL), Standard length (SL) for individual specimen was measured using measuring board the nearest 0.1cm while the weight of each specimen was measured to the nearest 0.1gram with the use of an electronic weighing balance (Camry model EK5350 of 5kg capacity).

2.5 Determination of Length- Weight Relationship

Length-weight relationship was determined by linear relationship technique to see if there is a correlation between the length and weight of the fish using the formula described by [11] as follows:

\[ W = aL^b \]  

The above equation (i) and data were transformed in to logarithms before the calculations were made. Therefore equation (ii) becomes:

\[ \log W = \log a + b \log L \]  

Where:

- \( W \) = Weight of the fish in grams (g)
- \( L \) = Standard length of the fish in centimeters (cm)
- \( a \) = the regression constant which is also the intercept
- \( b \) = an exponent (slope)

2.6 Condition Factor (K)

The condition factor which is a measure of the relative wellbeing of the fish was estimated using the Fulton’s coefficient formula [13]:

\[ K = \frac{100W}{L^3} \]

Where:

- \( K \) = Condition factor
- \( L \) = Standard length in centimetre
- \( W \) = Body weight in grams

2.7 Statistical Analysis

Data obtained from the study were subjected to descriptive statistics (mean and standard deviation) and presented in graphs, pie chart and bar chart. Data were subjected to one way analysis of variance (ANOVA) and significant differences accepted at \( P<0.05 \) using statistical package (SPSS version 14). Relationship between variables (Length and Weight) was analysed using regression.

3. Results

3.1 Growth Parameters and Characterization of Fish Species

The range and mean values of weight and total length of *Pseudotolithus typus* from Lagos lagoon are presented in Table 1. Maximum weight was recorded in September with a mean value of 200.01±46.28g while the minimum weight in December with a mean of 118.78±42.98g. The minimum total length was 16cm with a mean of 21.01±3.52 recorded in February, while the maximum total was 36cm with a mean of 27.01±3.62 recorded in November. The weight of *Pseudotolithus typus* sampled ranges from 129g – 261g (September), 122g – 222.5g (October), 78g – 223g (November), 50g – 195g (December), 37g – 200g (January) and 69.00g – 213.00g (February). Monthly variation the monthly sampled fishermen catches of *Pseudotolithus typus* is shown in Figure1. The highest mean body weight was recorded in September (200.01g) while the lowest mean body weight was obtained in January (89.11g). Table 1 shows total length range from 25cm-32cm, 24.50cm – 32cm, 21cm – 36cm, 20cm – 29cm, 18 – 31cm and 16cm – 26cm for September, October, November, December, January and February, respectively. The highest mean total length was noted in September (29.04cm) while the lowest mean total length (23.81) was recorded in January.
Table 1: Monthly variation in weight and total length of *Pseudotolithus typus* from Makoko, Lagos lagoon, Nigeria.

| Month    | Weight (g) Mean± SD | Min. | Max. | Total Length (cm) Mean ±SD | Min. | Max. |
|----------|---------------------|------|------|----------------------------|------|------|
| September| 200.01±46.28        | 129.00 | 261.00 | 29.04±2.62                  | 23.00 | 32.00 |
| October  | 164.38±32.02        | 122.20 | 222.34 | 29.31±2.17                  | 24.50 | 32.00 |
| November | 160.63±42.98        | 78.00  | 223.00 | 27.01±3.620                 | 21.00 | 36.00 |
| December | 118.78±42.12        | 50.00  | 195.00 | 24.80±2.99                  | 20.00 | 29.00 |
| January  | 89.11±38.91         | 37.00  | 200.00 | 23.81±3.48                  | 18.00 | 31.00 |
| February | 116.00±36.90        | 69.00  | 213.00 | 24.83±3.48                  | 18.00 | 30.00 |

The standard length of *Pseudotolithus typus* ranges from 20cm-29cm, 20cm-26.50cm, 17cm-33cm, 15cm-25cm, 15cm-27cm and 15.50-26.40cm for September, October, November, December, January and February, respectively. The monthly variation in mean standard length of *Pseudotolithus typus* is shown in Figure 2. The highest mean standard length of 33cm was recorded in November while the lowest mean standard length (15cm) was recorded in December.

Table 2 shows the relationship between the natural Log of body weight and the natural Log of total length of *Pseudotolithus typus* for the month of September. The growth exponent ‘b’ is 2.43, the intercept ‘a’ is 2.91 while the coefficient of determination R^2 is 0.827. The value of the coefficient of determination shows a high degree of correlation between the weight and standard length of *Pseudotolithus typus* in September.

The relationship between the natural Log of body weight and the natural Log of total length of *Pseudotolithus typus* for the month of September has a growth exponent ‘b’ of 2.91, the intercept ‘a’ is 3.70 while the coefficient of determination ‘R^2’ is 0.82. The value of the coefficient of determination shows a high degree of correlation between the weight and standard length of *Pseudotolithus typus* in January.

The relationship between the natural Log of body weight and the natural Log of total length of *Pseudotolithus typus* for the month of November has a growth exponent ‘b’ of 2.17, the intercept ‘a’ is 2.37 while the coefficient of determination ‘R^2’ is 0.38.

The range and mean monthly condition factor (K) values is presented in Table 3. Maximum condition factor obtained for *Pseudotolithus typus* was 0.91 in September with a mean of 0.81±0.09 while the minimum condition of 0.65 was recorded in October with a mean of 0.81±0.09. Condition factor of *Pseudotolithus typus* range was 0.60-0.91, 0.65-0.99, 0.47-1.11, 0.58-1.03, 0.44-0.82, 0.37-1.44 for September to February respectively. Table 4 shows mean overall condition factor of *Pseudotolithus typus* samples collected. A mean condition factor of 0.81 was recorded with a standard deviation of ± 0.92.

Table 2: Relationship between weight and total length of *Pseudotolithus typus* from Makoko, Lagos lagoon, Nigeria

| Month    | Intercept (a) | Growth exponent (b) | Coefficient of determination (R^2) |
|----------|---------------|---------------------|-----------------------------------|
| September| 2.91          | 2.43                | 0.83                              |
| October  | 2.09          | 2.17                | 0.77                              |
| November | 1.26          | 1.92                | 0.74                              |
| December | 7.13          | 3.69                | 0.87                              |
| January  | 3.79          | 2.59                | 0.82                              |
| February | 0.64          | 1.27                | 0.38                              |

Fig 1: Monthly sampled fishermen catches for *Pseudotolithus typus* in Makoko

Fig 2: Monthly mean Standard length of *Pseudotolithus typus* samples
4. Discussion

4.1 Length and Weight Relationship of Pseudotolithus typus

A length-weight relationship (LWR) provides information on growth patterns and growth of animals. During their development, fish are known to pass through stages in their life history which are defined by different length-weight relationships. In this study, growth of Pseudotolithus typus samples from Lagos lagoon showed negative allometry. It was observed that if fish must maintain its shape as it grows, their b-values must be equal to 3, but there is no existing theory that says the b-value must be negatively or positively allometric. Allometric growth is negative (b<3) if the fish gets relatively thinner as it grows bigger (growth in age with reduction in size) and positive (b>3) if it gets plumper as it increases in age. It was reported that various factors, including seasons, environmental parameters, the presence of food, feeding ratio, habitat, sex and physiological conditions of fish may be responsible for differences in the observed b value. The strong relationship between length and weight in the coefficient of determination (R²) values agrees with previous studies on different fish species from various water bodies.

Table 3: Monthly condition factor of Pseudotolithus typus samples

| Month       | Condition factor K |
|-------------|--------------------|
|             | Mean±SD | Min. | Max. |
| September   | 0.81±0.09 | 0.60 | 0.91 |
| October     | 0.81±0.09 | 0.65 | 0.99 |
| November    | 0.82±0.15 | 0.47 | 1.11 |
| December    | 0.75±0.12 | 0.58 | 1.03 |
| January     | 0.64±0.12 | 0.44 | 0.82 |
| February    | 0.79±0.26 | 0.37 | 1.44 |

Table 4: Overall condition factor of Pseudotolithus typus from Makoko, Lagos Lagoon, Nigeria

| Month           | Condition factor K |
|-----------------|--------------------|
|                 | Mean±SD | Min. | Max. |
| September-February | 0.81±0.92 | 0.65 | 0.99 |

5. Conclusion and Recommendation

The growth pattern of Pseudotolithus typus in Lagos lagoon indicated allometric growth. Varied condition factor (K) value was obtained and this shows that the well-being of this species depends on season.

6. References

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