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Length -Weight / Girth Relationship and Condition Factor of the Periwinkle *Tympanotonus fuscatus*, (Cerithidae: Gastropoda) of the Cross River, Nigeria

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ABSTRACT
Morphometric parameters as well as the condition factor of the periwinkle; *Tympanotonus fuscatus* were investigated in 1,500 specimens obtained at Esuk Nsidung, Calabar from fishermen who fished the Cross River estuary, Nigeria. The length-weight, girth-length and weight-girth relationships were positively correlated. The calculated "b" for length-weight relationship was 2.05 which was significant < 3($t=1.05$, $df = 2, 55$, $P<0.02$) while those calculated for weight-girth and length–girth relationships were 0.30 and 0.67 respectively. This species is not overexploited in the South East of Nigeria. Condition factor estimated for the specimen was 0.28. The implications of these results in relation to the fisheries of the species in the Cross River estuary are discussed.

Keywords: Morphology, condition factor, *Tympanotonus fuscatus*, Cross River

1. Introduction
The length-weight relationship (LWR) and its accompanying parameters are inevitable tools in the practical assessment of stocks of aquatic species (fin and shell fishes). Quantitative comparison of shell fishes necessary for managerial purposes necessitates different morphometric measurements for population estimates. Estimation of the length-weight relationships of organisms are essential among other reasons; for assessing the relative well-being of fish and other species/population [5] and for inter and intra-species morphological comparisons [19]. This also allow for the estimation of the average weight of the fish of a given length group by establishing a mathematical relationship between the two [4]. Pauly [19] and Nwosu *et al* [20] listed several stock assessment situations when LWR may be needed to include; the conversion of length of individual fish to weight, estimating the mean weight of the fish of a given length class, conversion of growth equation for length into a growth equation for weight and morphological comparisons between populations of the same species or between species. Available literature on LWR's concentrates more on fin-fishes than shell-fishes especially in West Africa and on the bivalve mollusk than the gastropods in other parts of the world. Nair and Nair [17] revealed a larger deviation in height with greater depth in the brackish water oyster (*Crassostrea madrasensis*) of the Cochin Harbor (India); variation in height did not also result in corresponding variations in depth with increased height.
The formula; $y = bx\ k$, where `y´ is a linear measurement of weight of a part and `x´ that of the whole while `b´ and "k" are constants, has been used to describe differential growth in a number of forms including mollusks, crustaceans, insects and mammals. When `K´ equals unity, the part bears a constant relation to the whole, and its proportion is unchanged with increasing size; this is "isogonic growth". Positive and negative heterogony is when `K´ is greater or less than unity and the part increases or decreases relatively with increased size of the whole. The magnitudes of the constants are influenced by the parts and the organism investigated while `b´ in addition is dependent on the unit of measure.

This general formula has also been utilized to describe accurately the length-weight relationship in several forms, especially fishes and mollusks.

Despite the high economic importance of shell fishes in Nigerian fishery, a dearth of information remains prevalent in parameters of length-weight relationship. In the crustacean *Macrobrachium macrobrachion*, length-weight relationship is a significant relationship, and an indication that the weight growth departs significantly from the expected isometry resulting in allometry [9, 2].

Regression between weight and linear measurements of shell in *Crassostrea madrasensis* showed exponential relationship [18].

Most bivalves are commercially important shell fishes in many countries e.g. Nigeria [22, 6]. *Tympanotonus fuscatus* is a delicacy similar to the bivalves in importance in West Africa and it is highly cherished in soup in the South-Eastern states of Nigeria. This organism has been under excessive exploitation for several years. It is suspected that the species is probably over-exploited. This study is carried out in Nigeria to achieve the following objectives; provide growth data for the species giving indication on it relative well-being in its environment; contribute morphometric data on the species and ascertain the state of its exploitation in the environment.

2. Materials and Methods

The periwinkles for this study were bought from traders at Esuk Nsidung, Calabar. Esuk Nsidung is located within latitude 40º45¹ N to 50º15¹ N and longitude 80º15¹ E to 80º30¹E on the Cross River channel. These traders bought their wares wholesale at Ikang from fishermen and retail them at this beach market in Calabar. All size categories of the 1,500 samples of the periwinkle were randomly collected on a daily basis in January 2008 from this market.

In the laboratory, measurement of shell lengths, girth sizes and weights were made. The shell length was considered to be the distance between the anterior and posterior ends of the shell measured to the nearest 0.1 cm; body weight was measured to the nearest 0.01 gm with an electronic balance. The girth of the shell was measured to the nearest 0.1mm. with a venier caliper. Sexes were not determined.

Statistical analysis was done using linear regression and log transformed data of the total length, body weight and girth size of specimen. The condition factor `K´ was calculated with the following formula [23].

$$K = \frac{Wx\ 100}{L^3}$$

Where,

`K´ is equal to the condition factor, ´W´ the body weight and `L` the total length of the specimen.

3. Results

The total lengths and weights of *T. fuscatus* of the Cross River ranged between 1.80 cm/0.57 gm) to 5.20 cm/7.81 gm for the juveniles and adults categories respectively. Adults size range between 2.10–5.2 cm and the juveniles with a total length range of 1.80–2.00 cm. The longer the specimens the heavier it became giving a positive relationship (Fig.1).With this, a regression coefficient of 0.86 was calculated for *T. fuscatus* of the Cross River, Nigeria. In a similar manner, the girth size changed positively as the weights and total lengths of specimen also changed giving a positive correlation coefficient of 0.78 and 0.73 respectively. The condition factor of *T. fuscatus* of the Cross River is 0.28

4. Discussion

In this study, the smallest *T. fuscatus* measured 1.80 cm total length or 0.52 gm (body weight) and the largest measured 5.2 cm total length or 7.81gm body weight. The final total lengths of species are one of the criteria in assessing the exploitation level of that organism in its environment. The total length reported for *T. fuscatus* of this study range from 1.8 cm. to 5.2 cm. and is similar to what was reported earlier on the species [8] implying that the species is still underexploited in the Cross River ,Nigeria

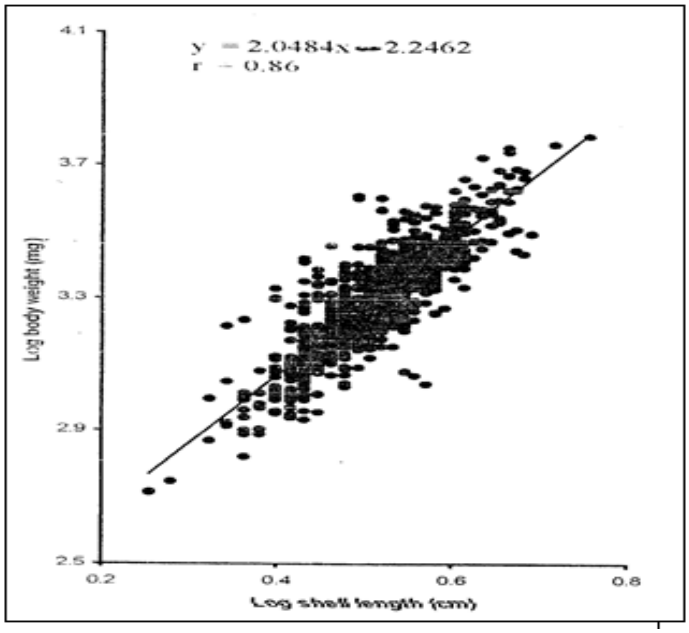

Fig 1: The relationship between the hell length and body weight of *T. fuscatus* of the Cross River, Nigeria

Length-weight relationship which is a measure of the weight-growth of most fin fishes, shellfishes and other invertebrates tend to show "isometry" when the 'b' value has been determined to be equal to 3.0 while "allometric" situations reports b<or> 3 [3] When the 'b' value is less than 3.0 or greater than 3.0 they are said to be either "negative allometry" or "positive allometry" [3]. In this study the 'b' value of 2.05 is less than the isometric value and probably show a negative allometry indicating that in *T. fuscatus* the larger the species the smaller their organs. Torres [21] reported a value of b<3 in a multi- species study of LWR's.

In this study the relationship between total length and body weight of *T. fuscatus* showed a positive correlation .This means that there was a general corresponding and proportionate increase in weight with increases in total length of the species. In this study too, we observe that specimens with similar total lengths tend to exhibit the same body weights. This has a lot to do with the condition factor of the species. Condition factor of species describe the well-being, corpulence and fatness of the organism. This definition was used by Etim and Taege [10] to describe the condition of *Egeria radiata* of the Cross River at Itu. The condition factor of 0.28 calculated for this animal is different from the expected Fulton's condition of 1.13 already published and reported by Etim and Taege [10]. The plausible reason for this low condition factor in *T. fuscatus* can be accounted for by reasons of differences in terms of species of study, their origin and other factors known to influence parameter of organisms originating from different places. It can as well be related to food scarcity/ starvation or even reproduction. These factors are known to influence growth data and could lead to low physiological conditions in species.

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