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Length-Weight Relationship and Condition Factor of *Macrobrachium macrobrachion* in the Lagos-Lekki Lagoon System, Nigeria

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Abstract: Length-weight relationship and condition factor of 24 months samples of *Macrobrachium macrobrachion* Herlots, 1851, from the Lagos-Lekki lagoon system were estimated. The parameters a and b of the length-weight relationship were -4.98 and 2.95 for male, while the corresponding female values were -4.76 and 2.82. The species exhibited negative allometric growth. The condition factor k was 1.09 and 0.98 for male and female, respectively. The implication of the estimated LWR parameters to the assessment of *M. macrobrachion* stock in the Lagos-Lekki lagoon system was highlighted.

Key words: Length-weight relationship, condition factor, *Macrobrachium macrobrachion*, lagoon

INTRODUCTION

Macrobrachium macrobrachion Herklots, 1851 (Brackish River Prawn) is an important species in the artisanal shrimp fisheries in coastal lagoons, estuaries and mangrove creeks in Nigeria. *Macrobrachium* sp. occur throughout the West African region. Holthuis (1951) listed at least ten members of the genus from West Africa. Marioghae (1982, 1990) in investigating the fishery, distribution and salinity tolerance of *M. macrobrachion* and *M. vollenhovenii* in Lagos lagoon reported that *M. macrobrachion* constituted about 60% of all shrimp landed and about 83% of all *Macrobrachium* sp. catch.

In fisheries research, length-weight relationships are important for the estimation of weights where only length data are available and as an index of the condition factor of the fish (Pauly, 1993; Petrakis and Stregiou, 1995; Goncalves *et al*., 1967; Haimovici and Velasco, 2000). Basic information such as knowledge on parameters that relate weight to length of fish is scanty, even though it is of great importance in studies on fisheries biology (Vazzoler, 1996) and on the evaluation of fish stocks (Entsua-Mensah *et al*., 1995). Among its most frequent uses, Pauly (1993) notes the importance of Length-Weight Relationships (LWR) in the calculation of the fish's average weight at a certain length class and the conversion of an equation of growth in length into an equation of growth in weight, besides morphological comparisons between populations of the same species.

Arslan *et al*. (2004) stated that it is usually easier to measure length than weight and weight can be predicted later on using the length-weight relationship. Furthermore, standing crop biomass can be estimated (Morey *et al*., 2003) and seasonal variations in fish growth can be tracked in this way (Ritcher *et al*., 2000).

The mathematical parameters of the relationship between the length and weight of fish furnish further information on the weight variation of individuals in relation to their length (condition factor, k). This factor estimates the general well-being of the individual and is frequently used in three cases:

- Comparison of two or more co-specific populations living in similar or different conditions of food, density or climate.
- Determination of period and duration of gonadal maturation.
- Observation of increase or decrease in feeding activity or population changes, possibly due to modifications in food resources.

The condition factor often referred to as K factor provides information on well being of a fish and is usually influenced by age of fish, sex, season, maturity stages etc. Fish specimens of a given length, exhibiting higher weight are said to be in better condition (Anyanwu *et al*., 2007).

This study is aimed at estimating the length-weight relationship and condition factor of *M. macrobrachion*

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in the Lagos-Lekki lagoon system, thus providing information required for the assessment of this stock in this coastal lagoon system.

MATERIALS AND METHODS

Samples of *M. macrobrachion* were collected on a monthly basis for 2 years (May 2002-April 2004) from 18 stations on the Lagos-Lekki lagoon system, longitude 3°22.5'-4° 13' E and latitude 6°24'-6°38'N (Fig. 1).

The biometric measurements of the specimen were made with Vernier callipers. The measurements taken were Total Length (TL), from the orbital notch to the tip of the telson, Carapace Length (CL), from the orbital notch to the posterior edge of the carapace. These measurements were made to the nearest centimetre (cm), as described by FAO species identification sheets for fishery purposes (Fischer *et al*., 1981). The specimens were also weighed using EK1 200 A model electronic top loading weighing balance and specimen were weighed to the nearest milligram (0.1 g). The weights taken were Total Weight (TW) and Carapace Weight (CW).

The Length-Weight Relationship (LWR) was estimated using the Eq.

$$W = aL^b \quad (1)$$

Where,

W = Weight.
L = Total length.
a = Regression constant.
b = Regression coefficient.

The values of constant a and b were estimated from log transformation values of length and weight i.e.,

$$\log W = \log a + b \log L \quad (2)$$

The analysis was carried out using Microsoft Excel.

Fulton's condition factor (Pauly, 1984; Wooton, 1992) was also calculated using the means of total length and weight of the shrimp. The equation is as follows:

$$CF = \frac{\bar{W} \times 1000}{\bar{TL}^3} \quad (3)$$

Where,

$\bar{W}$ = Mean weight (g).
$\bar{TL}$ = Mean total length (cm).

The correlation coefficient (r) was also estimated to determine the degree of linear relationship between the length and weight of samples.

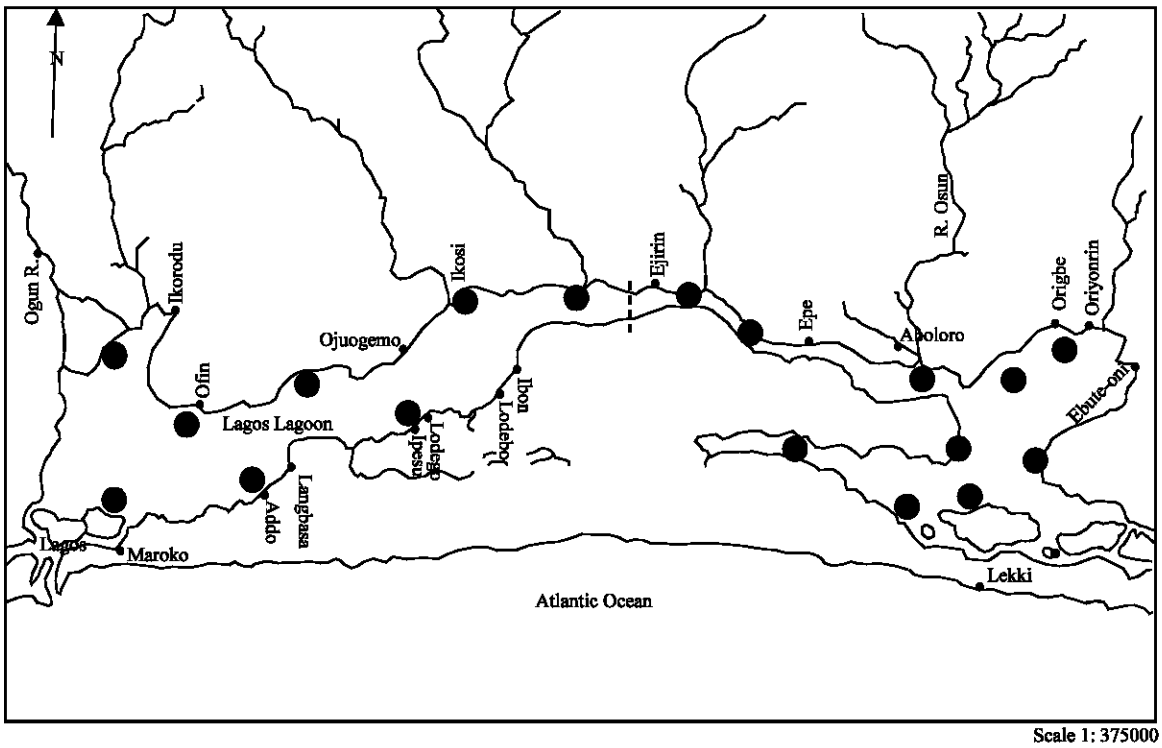

Fig. 1: Study area (Lagos-Lekki lagoon system) with sampling sites

RESULTS AND DISCUSSION

The length-weight relationship obtained for the 2 sexes of *M. macrobrachion* and is shown in Table 1. The value of a = -4.76 and b = 2.82 for female *M. macrobrachion* showed that the female of the species growth is not isometry as the t-test for departure from 3 which is the value of isometric growth showed significant difference. There is linear relationship however between the length and weight as indicated by the high r of 0.99. The condition factor that is a measure of the suitability of the environmental factor for growth of the species is 0.98. For the male, the a value was -4.98, while the b was 2.94, male growth also departs from isometry as the t-test was significant. The r value of 0.98, revealed a strong linear relationship between length and weight. The condition factor for the male was 1.09.

Figure 2-5 are the plots of the raw data and the logarithmic transformation of the length-weight relationship for this species.

Length-Weight Relationship (LWR) data are important for fish stock assessment. A characteristic of length-weight relationship in fishes and invertebrates is that the value of the exponent (b) is 3 when growth is isometric (without changing shape). If b value is different from 3, growth is said to be allometric (fish changes shape as it grows larger). Allometric growth may be negative (b<3) or positive (b>3). Decrying the general lack of adequate theory to guide research and to formulate testable hypothesis on LWR of fish and aquatic invertebrate, Pauly (1993) stated that there is no theory that tells us in which case estimated b value can be expected to be below 3 (negative allometry) or above 3 (positive allometry). However, Wootton (1992) provides

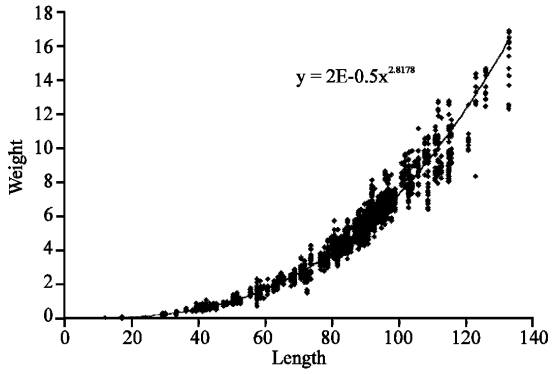

Fig. 2: Length-weight relationship for female *M. macrobrachion*

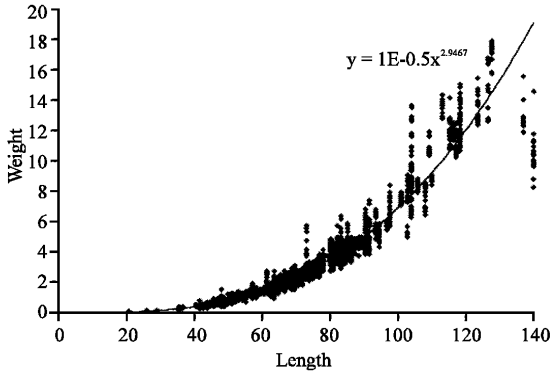

Fig. 4: Length-weight relationship for male *M. macrobrachion*

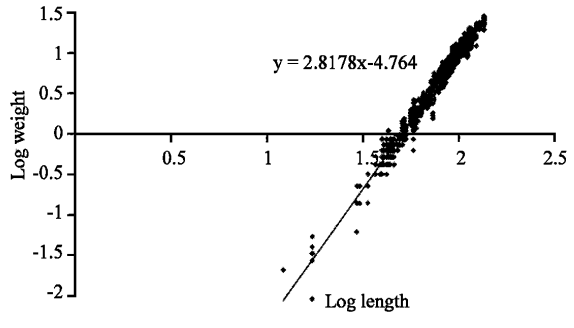

Fig. 3: Log length-weight relationship for female *M. macrobrachion*

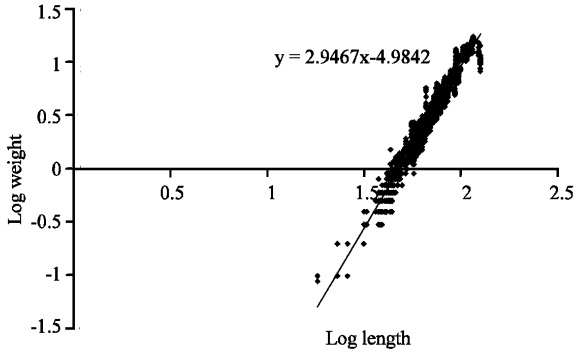

Fig. 5: Log length-weight relationship for male *M. acrobrachion*

Table 1: Length-weight relationship parameters and condition factor for *M. macrobrachion*

							Length (cm)			Weight (g)		
Species	Sex	N	a	b	r	CF	Min.	Max.	Mean	Min	Max.	Mean
M. macrobrachion	Female	8097	-4.76397	2.817795	0.988477	0.98	3	13	8	0.02	16.8	5.02
M. macrobrachion	Male	4071	-4.98425	2.946706	0.984557	1.09	3	13	7	0.09	17.6	3.75

a rough idea on this situation, indicating that allometric growth is negative (b<3) if the fish gets relatively thinner as it grows larger and positive (b>3) if it gets plumber as it grows. Thus some indication of the condition of fish population can be obtained from the length-weight equation.

The b values of both sexes of *M. macrobrachion* exhibited allometric growth. Allometric growth was also observed in *M. macrobrachion* from the Cross River estuary according to Enin (1994). The condition factor an indicator of the environmental suitability for the resource, estimated for female (0.98) and male (1.09) for *M. macrobrachion* was close to the result obtained (1.19) for this species by Enin (1994). Bendito-Cecilio *et al.* (1997) stated that the allometric growth exhibited in 52 fish species analysed proved the indispensability of allometric condition factor in Itaipu Reservoir, Parana, Brazil. According to Braga (1986), in the case of such species with allometric growth, CF does not vary with fish length.

CONCLUSION

The correct interpretation of the parameters resulting from length-weight relationship will disclose information that is useful for fisheries management. *M. macrobrachion* length-weight relationship parameters and condition factor in the Lagos-Lekki lagoon system revealed the suitability of the environment for this species, thus for sustainable management of this stock, the environmental status should be maintained.

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