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LENGTH-WEIGHT RELATIONSHIP OF PALAEMONID AND PENAEID SHRIMPS OF THE CROSS RIVER ESTUARY, SE NIGERIA

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ABSTRACT

The length-weight relationships of the form $W=aL^b$ was derived for three species of *Macrobrachium*, namely: *M. macrobrachion*, *M. vollenhovenii* and *M. equidens* by sexes, as well as for *Palaemon maculatus* and *Penaeus notialis*. The b-values for *M. macrobrachion* were 3.496 (both sexes), 3.535 (males) and 3.386 (females), while b-values for *M. vollenhovenii* were 3.389 (both sexes), 3.483 (males) and 3.329 (females). Similarly, the b exponent for *M. equidens* were 3.322 (both sexes), 3.186 (males) and 3.333 (females). The b-values for *P. maculatus* and *P. notialis* were 3.205 and 2.863 respectively. A t-test ($p<0.05$) of the exponents revealed a departure from isometry, indicative of changes in body forms as these shrimps attained maturity. However, while the palaemonid species showed positive allometry, the penaeid species showed a negative allometric growth.

KEYWORDS: Length-weight, shrimps, estuary, Nigeria

INTRODUCTION

The Cross River Estuary is located in the South-East of Nigeria and lies approximately between latitudes 4^0 and 8^0N and longitudes $7^0$30' and 10^0E. In this estuary, these *Macrobrachium* species sustain a year-round fishery in the artisanal *Macrobrachium* fishery. The *Macrobrachium* fishery of the Cross River Estuary includes other palaemonids and penaeid species (Nwosu, 2000).

Length-weight relationships (LWR) are essential, among other reasons, for assessing the relative well-being of fish populations (Bolger and Connolly, 1989), for inter- and intra-specific morphological comparisons (Pauly, 1993), and for estimation of biomass in stock assessment (Martin-Smith, 1996). Length-weight relationships of fishes also allow the estimation of the average weight of the fish of a given length group by establishing a mathematical relation between the two (Beyer, 1987). Length-weight relationship can also be used in setting yield equations (Beverton and Holt, 1957). However, it has been reported that LWR could vary for species, sexes, seasons, age and reproductive time (Weatherley and Gill, 1987). The presented results were to establish intersexual and interspecific variations in the LWR of three *Macrobrachium* species as well as *Palaemon* and *Penaeus* in the Cross River Estuary, Nigeria.

MATERIALS AND METHODS

Shrimp specimens for this study were collected at a major commercial landing site (Akpan's beach) on the coast of Calabar. Samples were taken at random from the three gears exploiting the fishery (beach seine, pushnet and trap) weekly from January 1997 to June 1998. Each sample was sorted into species and sexes. Total length (TL mm) was measured to the nearest 0.1mm from tip of rostrum to tip of telson. Weight of shrimps was measured to the nearest 0.1g with an electronic balance after draining excess water. Parameters of the length-weight relationships a and b of the equation $W = aL^b$ were obtained from the log-transformed length and weights using the formula

$$\ln W = \ln a + b \ln L \quad \ldots\ldots\ldots\ldots 1)$$

where ln W and ln L are log-transformed weights and lengths respectively, a and b are exponents or (parameters) of the relationship.

T-test for departure from isometry was carried out using the formula in Pauly (1984) thus:

$$\hat{t} = \text{s.d.}(x)/\text{s.d.}(y) \times ((b-3)/\sqrt{1-r^2}) X \sqrt{n-2} \quad \ldots\ldots 2)$$

where s.d. (x) and s.d. (y) are standard deviations for ln total length and ln individual weight, respectively, b is the slope; r^2 is the coefficient of determination and n is the number of individuals used in the computation.

RESULTS AND DISCUSSION

Table 1 is a summary of the results. The exponent b of the species fall within the acceptable range of values of b according to Carlander (1969). He demonstrated that values of $b<2.5$ or $b>3.5$ are either based on very small range of sizes and/or that such values are likely to be erroneous. The values of b in this study, are therefore confirmed to be reliable, and could serve for further comparisons with other shrimp populations or species, and/or applied in studies of population dynamics and conditions of the species. For instance, Enin (1994) obtained a b-value of 3.28 for *M. macrobrachion*, similar to b-value of 3.28 obtained for *Macrobrachium carcinus* by Valenti *et al.* (1994). The preceding results for the palaemonid species agree with Enin (1994) and Valenti *et al.* (1994) whose reports for *M. macrobrachion* and *M. carcinus* showed positive allometry. T-test for departure from isometry showed a significant difference from 3 ($P<0.05$) for both sexes combined or separated. This shows that growth is positively allometric, with the individual shrimp getting plumpier as the shrimp grows bigger. Also, regressions of *M. macrobrachion*, *M. vollenhovenii* and *M. equidens* were significantly different for different sexes (F-test, $p<0.05$). This shows the existence of inter-specific and inter-sexual variations in length-weight growth of these species. This result agrees with Weatherley and Gill (1987) that LWR could vary for species sexes, seasons and age. Mathews and Samuel (1990) reported negative allometric relationships for *Penaeus semisulcatus* (2.746) and *Metapenaeus affinis* (2.971). This finding agrees with the result for *P. notialis* in this study and deviated from Pauly (1982) isometric result obtained for *P. setiferus* (3.075) and *Metapenaeus dobsoni* (3.0). Thus, the penaeid species in this study grows slimmer as it attains maturity. This further confirms the existence of inter-specific variations in length-weight growth of shrimp species. While the palaemonid shrimps were positively allometric, the only penaeid species in the study area showed negative allometry. The results in this study can be applied in stock assessment studies for these shrimps.

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Table 1: Length-weight relationships of the form $W = aL^b$ of three species of *Macrobrachium* caught during 1997-1998 from the Cross River Estuary, Nigeria.

Species	Sex	a(x10^{-6})	b	R	n	Length Max	Length Min	Weight (g) Max	Weight (g) Min
M. macrobrachion	Both	1.27	3.496	0.974	22.383	124	22	11.5	0.1
" "	M	1.03	3.535	0.978	7,273	124	22	11.5	0.1
" "	F	2.04	3.386	0.969	13,216	104	22	9.8	0.1
M. vollenhorenii	Both	2.63	3.389	0.992	2,562	190	25	102.5	0.2
" "	M	1.82	3.483	0.993	1,071	190	25	102.5	0.2
" "	F	3.35	3.329	0.990	1,359	159	25	69.9	0.2
M. equidens	Both	2.92	3.322	0.974	1,034	102	22	9.4	0.1
" "	M	4.58	3.186	0.971	365	102	22	9.4	0.1
" "	F	2.91	3.333	0.976	591	98	22	8.7	0.1
Palaemon maculatus	Both	2.24	3.205	0.632	138	55	25	0.8	0.1
Penaeus notialis	Both	12.6	2.863	0.937	295	123	41	14.6	0.3

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