The Zoologist Vol. 5: 47-53(2007)

LENGTH-WEIGHT RELATIONSHIPS OF THE PINK SHRIMP PENAEUS NOTIALIS AND GIANT TIGER SHRIMP P. MONODON OF BUGUMA CREEK IN THE NIGER DELTA, NIGERIA

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Abstract
Two hundred indigenous pink shrimps, Penaeus notialis and 19 exotic giant tiger Shrimps, P. monodon from Buguma Creek were caught in brackish water tidal ponds of the Nigerian Institute for Oceanography and Marine Research, Buguma in April, May and June 2005. The length-weight relationship of both species indicated allometric pattern of growth. Regression coefficient values (b) computed were 2.92 and 2.97 for P. notialis and P.monodon respectively, although the values are not significantly different from 3 (Isometric growth) ($P>0.05$). In terms of biomass, P. monodon significantly outweighed P. notialis ($P<0.05$), having mean individual weight of 13.37 + 8.86g as compared to P. notialis with a mean weight of 2.82 + 2.12g. However, P. notialis indicated a better condition factor (K) than P. monodon. Computed K values were 0.876 + 0.119 and 0.803+0.45 for P notialis and P. monodon respectively, although not significantly different ($P>0.05$).

Key words: Penaeus notialis, P. monodon, brackish water. Length weight Relationship, condition factor.

Introduction

The pink shrimp, P. notialis constitutes the dominant penaeid shrimp caught in both inshore artisanal fishing and offshore industrial trawling in Nigeria. Its distribution in both brackish and marine waters spreads across the entire coastal wetlands of Nigeria and other parts of west Africa (Deekae and Ayinla, 1995; Ogbonna, 2001; Abowei et al., 2006). It constitutes a significant shell fish catch of the coastal fishing communities in the Niger Delta (Ajana, 1996) and has a thriving market in all major towns of Nigerian coastal states (Deekae and Ayinla, 1995). Ogbonna (2001) reported P. notialis as the dominant species of 10,807 mt. shrimp catch of Nigeria in 1997 whose major proportion was exported to Europe.

The giant tiger shrimp, P. mondon is the world's most valued shrimp species and indigenous to southeast Asia. Although aquaculture has become the major source of its supply all over the world (FAO, 1999; Yap, 2003), significant catch of the shrimp from the wild still exists in some of its native countries (Rahman, 2001). Meanwhile, the species has started appearing in the Nigerian shrimp catches in recent times, which indicates invasion of the west African coastal waters by the species.

Unlike P. monodon whose 80.6% of the total world production is accounted for by aquaculture (FAO, 1999) supply of P. notialis still depends mainly on capture from the wild especially in Nigeria and other parts of West Africa. The need thus arises for continuous stock assessment and yield potential evaluation of the shrimps of Nigerian coastal waters in order to ensure sustainable exploitation of the resources.

Evaluation of length-weight relationship provides an essential tool for stock and yield potential assessment of aquatic fauna. It is useful in estimating standing stock biomasses and densities of various species in a locality (Gonzalez-Gandara et al., 2003; Thomas et al., 2003). Also length-weight relationship is related to metabolism in each species and the environment in which it lives (Claro and Garica-Arteaga, 1994). Therefore, it could be used to calculate the condition factor, a vital tool for assessing the well being of a species population in different localities (Bolger and Conolly, 1989; Patrakis ad Stergion, 1995).

This study was aimed at determining the relationship between length and weight of the indigenous pink shrimp, P. notialis and exotic giant tiger shrimp, P. monodon of Buguma Creek, captured in the brackish water periods at Buguma in the Niger Delta, one of the Nigerian coastal communities where capture fishery is a major activity.

Materials And Methods

Sampling Station

The brackish water fish farm station of the Nigerian Institute for Oceanography and Marine Research at Buguma, Niger delta Nigeria was the sampling station. The farm, one of the oldest in Nigeria (Deekae and Ayinla, 1995) is located on long $6^{0}51^{1}$E and 4^{0} 35^{1}N (Fig 1). The area is characterized by mangrove Vegetation with *mainly Rhizophora, Avicennia, Laguncularia, and Acrostichum*(Deek and Ayinla, 1995). The soil at the farm is peaty consisting of mangrove remains know as Chikok" and 50% clay (Dublin-Green and Ojounuga, 1988).

The farm consists of fifteen earthen ponds whose sizes range from 0.4ha to 1ha, which are used for fish and shrimp research. The ponds receive water by tidal flow from Buguma Creek through a main channel connected to the creek. (Fig. 2, 3) Water flows into the creek from New calabar river during each of the diel tidal regimes that characterize the area. The salinity of the creek water during sample collection period ranged from 14-19% while PH varied from 6.27 to7.73.

Sample Collection

Tidal water, which brings in the shrimps from the creek, was allowed to flow in during high tide by opening the main channel sluice gate. The water together with the shrimps was allowed to fill two unstocked 0.4ha ponds. The boards at the ponds gates were arranged in such a way that 0.6-1.0m depth of water was retained in the ponds. The ponds were filled and partially drained with each tidal change. Trapped shrimps were collected after two weeks following complete draining of the ponds with screen meshes at the gates to prevent the shrimps from escaping. Collection was done by seining in the drainage basins of the ponds after which P. notialis and monodon were sorted out of the entire catch and counted. Samples were collected monthly from April to June 2005.

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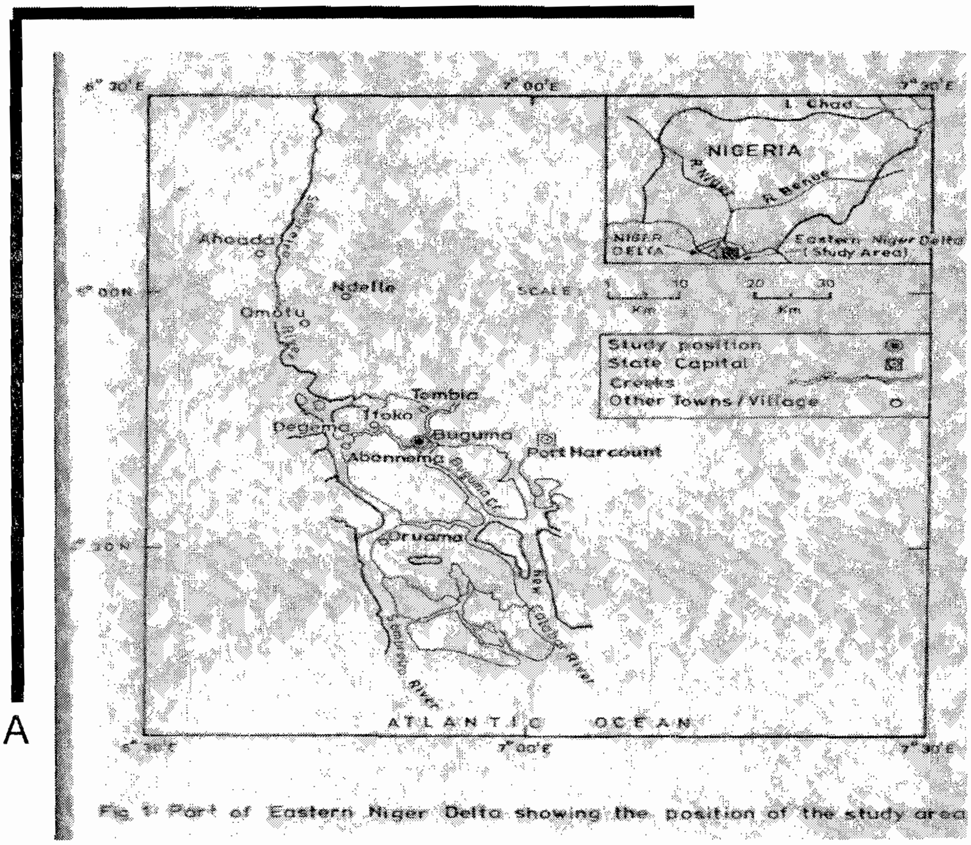

Fig. 1: Eastern Niger Delta showing the position of study area

Morphometric measurement

The total length (TL) of each shrimp was measured from the tip of the rostrum to the tip of the telson to the nearest 0.01mm using a pair of vernier calipers. The weight of each shrimp was taken and recorded to the nearest 0.1g, using "OHAUS" digital Top loading weighing balance, model 71160415.\

Data Analysis

For each species, the entire three months samples data were pooled together. The mean Total length and weight as well as the standard deviations were calculated for each species. Using the pooled data, the length-weight pairs were fist plotted under FAO Fish Stock Assessment Tool (FISAT) data Analysis programme to Identify and delete obvious outliers (Gayanio et al 1996). The length-weight relationship parameters, a, b, rand r^2 were computed using regression analysis of the same programme. The FISAT programme allows for logarithmic transformation of W=a/b (Thomas et al, 2003) into Log W= log a + b log L where W=weight of the shrimp in gram, L=length of the shrimp in mm, a =

proportionality constant and b = regression coefficient.

According to Gayanio et al., (1996), a sample size of minimum of ten in number is valid for length-weight relationship analysis under the FISAT programme. The body conditions factors (k) of each shrimp was determined using the equation of Worthington and Ricardo (Fagade and Olaniyan 1972):

$$K = \frac{\text{Weight}}{(\text{Total length})^3}$$

The mean K as well as standard deviation was determined for each species.

The data were subjected to unpaired t-test at 95% confidence level to determine the significance of differences in computed values between the two species as contained in Ogbeibu (2005)

Results

Total numbers of 200 P. notialis and 19 P. monodon specimens were collected during the study period (Table 1). Total length of P. notialis ranged from 22.70 to 108.60mm with a mean value of 64.49 +17.57mm whereas P. monodon total length ranged between 74.45 to 173.50mm with a mean value of 113.71mm + 5.48mm. The body weight of P. notialis ranged from 0.10g and 8.90g, with a mean value of 2.82+2.129 while that of P. monodon ranged between 4.20g and 39.40g with a mean value of 13.37 + 8.86g (Table 1). The body weight of P. monodon was significantly higher than that of P. notialis ($p<0.05$).

Figures 3 and 4 present the plotted length-weight relationships for P. notialis and P. monodon respectively. The overall length-weight relationship of P. notialis was log W =2.92logL-log4.913, while that of P. monodon was logW=2.97 logL-log5.032 (Table1). The b values, 2.92 for P. notialis and 2.97 for P. monodon were Not significantly different from 3 ($p>0.05$).

The mean condition factor (K) for P. notialis was 0.876+0.119, while that of P. monodon was 0.803+0.113 (Table1). The K values for both species were neither significantly different from each other nor significantly different from 1 ($p>0.05$).

Discussion

The marked difference in the total numbers of P. notialis and P. monodon caught during the study period can be explained by the fact that the former has been a common penaeid shrimp of coastal water of Nigeria and other parts of West Africa (Obakin. 1972; Bayagbona et al., 1979; Deekae and Ayinla, 1995; Abowei et al., 2006) where the latter's occurrence is more recent.

The observed significantly higher body weight of P. monodon than that of P. notialis is attributed to its ability to grow bigger and at a faster rate than other penaeid shrimps and its hardy nature, being able to withstand and tolerate a wide range of salinity despite the optimal level of 10-25% (New and Rabanal, 1985). Good and impressive growth of P. monodon has been reported in fresh water lake of the Philippines (Pantatisco, 1979); rivers irrigation channels and ground water of Thailand (Raghunath et al., 1997); and under above 40% salinity condition in Saudi Arabia (Yap, 2003).

The regression coefficient (b) of 2.92 and 2.97 for P. notialis and p monodon respectively indicates allometric growth of both species. According to Thomas et al. (2003), regression coefficient of 3 of an ideal fish or other aquatic fauna is indicative of maintenance of dimensional equality as the organism grows (isometric growth). B value of less than 3 shows that as the organism

Table 1: Length-weight Relationship and related statistics of *P. notialis* and *P. monodon* of the Buguma brackish water creek, Niger Delta, Southern Nigeria (April – June 2005)

Species	Samples size	Total Length (mm) Weight (g)				Regression Parameters				Condition factor (k)	
		Range	Mean	Range	Mean	a	b	r	r^2	Range	Mean
P notialis	200	22.70-108.60	64.49±2.12	0.10-8.90	2.82±2.12	-4.913	2.917	0.991	0.982	0.582-1.564	0.87±0.119
P monodon	19	74.45-173.50	113.71 ± 5.48	4.20-39.40	13.37±8.86	-5.032	2.967	0.979	0.959	0.642-1.094	0.80±0.113

$\text{Log w} = 2.92 \log L - \log 4.913$

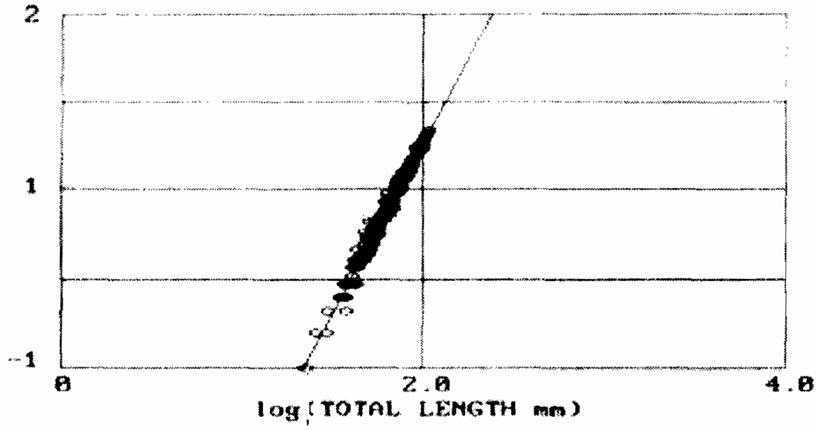

Fig.3: Length – Weight Relationship of *P. notialis*

$\text{Log w} = 2.97 \log L - \text{Log } 5.032$

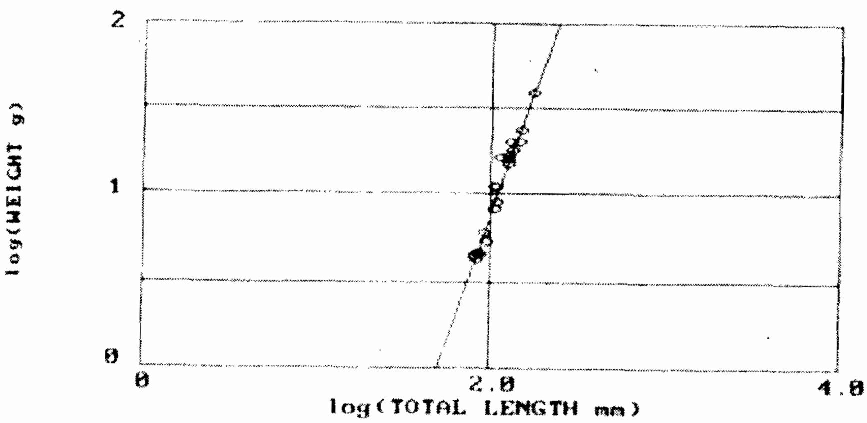

Fig.4: Length – Weight Relationship of *P. monodon*

increases in length, it becomes more slender (negative growth) while value of greater than 3 denotes positive allometric growth, a situation whereby the organism becomes more stout as it increases in length.

Meanwhile, an observation of absolute isometric growth (b=3) in nature is occasional (Baganal, 1978; Bassey and Ricardo, 2003). Deviation from isometric growth is often observed as most aquatic organisms change shape as they grow (Thomas et al., 2003). The direction and degree of deviation of b is largely influenced by the Productivity of the immediate environment of the organism. Highly Productive zones tend to promote positive allometric growth while low productive ones such as deep-sea zone enhance negative allometric growth (Philip and Mathew, 1996; Prasad, 2001; Thomas et al., 2003). Prasad (2001) recorded higher b value (3.223) for *P. monodon* semi-intensively reared in Kerala, the region with the highest productivity in India than those reared in other regions. Thomas et al. (2003) also reported a trend of negative allometric growth with increase with depth exhibited by species of fish of continental slope beyond 250m depths along the west coast of India.

The estimated b values for *P. notialis* and *P. monodon* in this study, 2.92 and 2.97 respectively tend to indicate negative allometric growth of both species but not significantly different from 3, (isometric growth). This suggests the relatively productive nature of the brackish water of Buguma creek. Similar negative allometric growth has been recorded for some other aquatic fauna species in the Niger Delta. These include b value of 2.92 for *Nematopalaemon hastatus* (Enin, 1994) and 2.38 for snake head, *Channa Channa* of the fresh water swamps (Alfred-Ockiya, 2000). However, Enin (1994) reported positive allometric growth of *Macrobrachium macrobrachion* (b=3.28) of Cross River estuary while Bassey and Richard (2003) reported b values of 3.072 and 3.209 for male and female of *Aphiosemion gardneri* respectively in Mfangmfang pond in Uyo, Niger delta, Nigeria.

The observed condition factor (K) for *P. notialis* and *P. monodon* in this study, 0.876 and 0.803 respectively ($P > 0.05$) suggests the ecological suitability of the brackish water of Buguma creek to be co-inhabited by indigenous pink shrimp, *p. notialis* and exotic giant tiger shrimp *P. monodon*

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