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Population growth of three freshwater prawns (*Macrobrachium* spp.) in Lower Ogun River, Southwest Nigeria

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ABSTRACT

Growth parameters of the populations of three freshwater prawns: *Macrobrachium vollenhovenii*, *M. macrobrachion* and *M. felicinum* in the Lower Ogun River were determined. For each population, length-frequency data for twenty-four month period (January 2006-December 2007) were analysed to determine the growth parameters, using routines in FAO-ICLARM Stock Assessment Tools (FISAT II). Estimates from FISAT indicated steady growth of the three populations. *M. vollenhovenii* had mean maximum length (L_{max}), asymptotic length ($L\infty$), performance index (ø') and growth coefficient (K) of 187.00 mm ± 5.66, 215.10 mm ± 16.27, 3.98 ± 0.04 and 0.2 ± 0.04 respectively. Mean values for L_{max}, $L\infty$, ø' and K for *M. macrobrachion* were 86.00 mm ± 1.00, 100.26 mm ± 12.20, 0.59 ± 0.16 and 3.76 ± 0.01 respectively, while 76.45 ± 3.25, 69.00 mm ± 1.00, 1.33 ± 0.67 and 3.87 ± 0.19 were the respective mean values of the growth parameters for *M. felicinum*. The suitability of the *Macrobrachium* species for aquaculture based on the estimated growth parameters is discussed.

Keywords: Lower Ogun River, Asymptotic length, Maximum length, Growth performance index, Growth coefficient.

INTRODUCTION

Freshwater prawns (of the genus *Macrobrachium*) constitute a group of economically important macroinvertebrate fauna. They support tremendous artisanal and capture prawn fisheries activities both in the coastal and inland water bodies in Nigeria and other tropical and subtropical countries (Abowei et al., 2006; Abohweyere 2008; Abohweyere et al., 2008).

Study of growth is an important aspect of stock assessment, which is very crucial for sustainable exploitation and management of aquatic macrofauna resources. Growth parameters, especially determined through the use of length frequency distribution data give account of the state of populations of aquatic macrofauna in the tropical region (Ansa and Sikoki, 2006). Moreover, apart from being the major inputs into stock prediction models, growth parameters also indicate the suitability of aquatic macrofauna species for aquaculture (Abowei et al., 2006; Ansa and Sikoki, 2006; Francis and Sikoki, 2006).

Although, stock assessment studies of some species of *Macrobrachium* and some other shellfishes in Nigerian water bodies have been carried out using length frequency data such as Enin (1995), Ansa and Sikoki (2006), Nwosu and Wolfi (2006), Abohweyere (2008), and Abohweyere et al. (2008), on a general note there is a dearth of information on the stock assessment of shrimps and prawns in Nigeria and other tropical nations (Abowei et al., 2006). Meanwhile, Gayanilo et al. (2005) advocated the use of length-frequency distribution data for the assessment of tropical shellfish stocks.

Therefore, this paper reports on the growth parameters of three species of

Macrobrachium: *M. vollenhovenii*, *M. macrobrachion* and *M. felicinum* in the Lower Ogun River, Southwest Nigeria where the prawns are often harvested by artisan fishers. Apart from serving as useful tools for sustainable and effective management of the resources, the findings in this study will also reveal the suitability of the prawns for aquaculture.

MATERIALS AND METHODS

Study area

The study was carried out in Ishasi area of lower course of Ogun River. The entire study area lies on Longitude 3^o 16'E and Latitude of between 6^o 37'N and 6^o 39'N (Figure 1). The area has a tropical rainforest climatic condition with rainy season from April through November and dry season from December through March. The mid-channel of Lower Ogun River is more or less devoid of higher macrophytes, while the vegetation towards the bank ranged from floating higher plants such as duckweed (*Lemna* spp.), water lettuce (*Pistia*) and water hyacinth (*Echhiornia crassipes*) and rooted plants such as Elephant grass (*Pennisetum*), Giant star grass (*Cynodon*) and Bamboo (*Bambusa*).

Artisanal fishing activities both for finfish and freshwater prawns, *Marobrachium* were the major human activities observed in the study area. Perturbations are kept to the barest minimum within the study area probably due to the fact that the neighbouring community depends on the river for source of water for domestic use.

Sample collection

Samples of *Macrobrachium* prawns were collected from three stations (stations 1, 2 and 3) with 200 m intervals (Figure 1) on monthly basis.

At each station prawns were collected from both left and right sides of the river bank using a scooping gear made of 0.5 m diameter circular mosquitoe net bag as described by Udolisa and Solarin (1979) and Marioghae (1990). Identification of various species of *Macrobrachium* prawns collected was done using diagnostic features described by Powell (1983) and Marioghae (1982).

Total length (TL) of every prawn specimen was measured orbital notch to the tip of the telson (Abohweyere et al., 2008) to the nearest 0.01 mm using Vernier callipers. The TL values were used to generate monthly length-frequency data for each of the three *Macrobrachium* prawns of each station.

Data analysis

For each of the three *Macrobrachium* species, data from the three stations were pooled to generate length-frequency data for each of the years 2006 and 2007.

The length-frequency data were analysed to determine the growth parameters of each *Macrobrachium* species using routines in a computer software programme, FAO-ICLARM Stock Assessment Tools (FISAT II), (Gayanilo et al., 2005).

Asymptotic length ($L\infty$) for each year was estimated through Powell-Wetherall plot (Powell, 1979; Wetherall, 1986). $L\infty$ was seeded into ELEFAN I routine to scan for the best growth coefficient (K) value (Ansa and Sikoki, 2006). The growth performance index (ø) was determined using $L\infty$ and K values as follows:

$Ø' = 2 \log L\infty + \log K$ (Abohweyere, 2008)

Maximum length (L_{max}) was obtained by direct observation

Mean and standard deviation values for $L\infty$, ø', K, and L_{max} of each *Macrobrachium* species were estimated.

RESULTS AND DISCUSSION

Mean maximum lengths (L_{max}) of 187.00±5.66 mm, 86.00±1.00 mm and 69.00±1.00 mm were respectively recorded for *M. vollenhovenii*, *M. macrobrachion* and *M. felicinum* while the Powell-Wetherall plot gave mean asymptotic lengths ($L\infty$) of 215.10±16.27 mm, 100.26±12.20 mm and 76.45±3.25 mm for the prawns respectively (Table 1). The variations within the L_{max} and $L\infty$ for the three species are indicative to differences in maximum attainable size of various species of *Macrobrachium*. Marioghae (1990) recorded similar variations in the maximum attainable size for the three species in Lagos Lagoon. Also, Willfuhr-Nast et al. (1993) that cited *M. vollenhovenii* as the main targeted prawn species in the West African tropical water bodies attributed it to its much larger attainable size than others. The L_{max} values for *M. vollenhovenii* and *M. macrobrachion*, which decreased from 2006

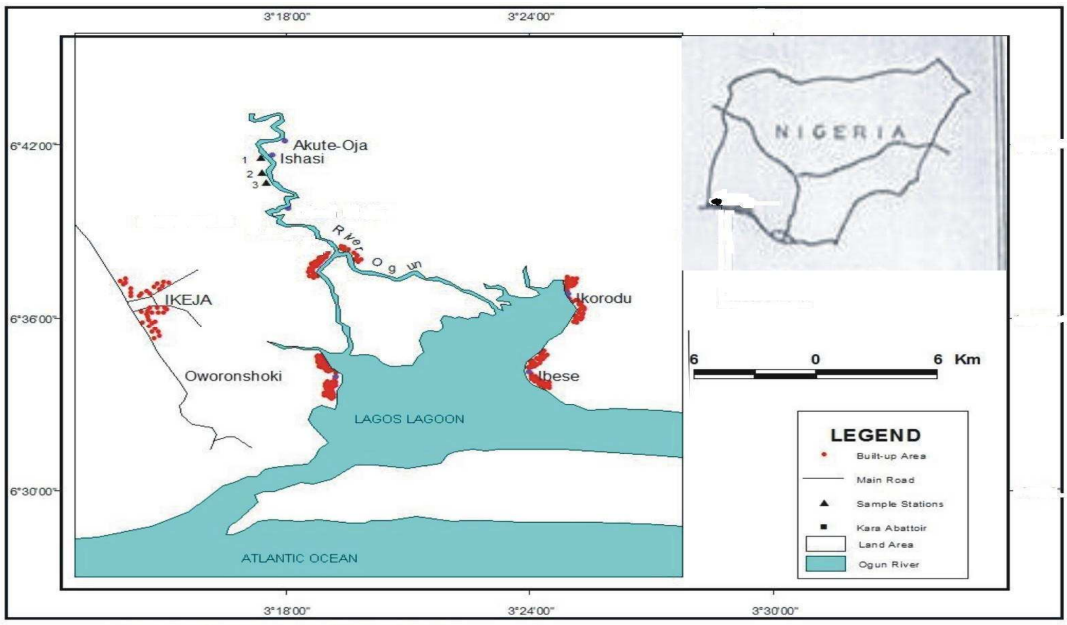

Figure 1: Map showing location of Lower Ogun River (study area) in Nigeria and the designated sampling stations.

to 2007 (Table 1), could be as a result of removal of large individuals from the environment probably due to fishing (Ansa and Sikoki, 2006).

The mean L∞ for *M. vollenhovenii* is higher than 164 mm, 180 mm and 188.10 mm respectively recorded for the species by Gabche and Hockey (1995) from Lobe River, Cameroon, Etim and Sankare (1998) from Fahe Reservoir, Cote'divore and Abowheyere et al. (2008) from Lagos-Lekki Lagoon, but comparable to 213 mm obtained by Nwosu and Wolfi (2006) for the species from Cross River Estuary, southern Nigeria. The asymptotic length, L∞ also known as length at infinity, is a major parameter in evaluating the status of the population of aquatic macrofauna (Abowheyere, 2008). Thus, the relatively high L∞ recorded for *M. vollenhovenii* in this study is indicative to a better status of the population of the species in the current study area than those studied by the earlier workers. This could be as a result of differences in geographical locations and prevailing ecological conditions of the areas.

Growth performance index (ø') values for the three species did not fluctuate much from 2006 to 2007 (Table 1) and indicated a steady growth of the prawns. Mean values of ø' for *M. vollenhovenii*, *M. macrobrachion* and *M. felicinum* were 3.98 ± 0.04, 3.76 ± 0.01 and 3.87 ± 0.19 respectively (Table 1). These values are higher than 2.50 and 2.3 reported for *M. vollenhovenii* and *M. macrobrachion* respectively in Lagos-Lekki Lagoon by Abowheyere (2008) and Abowheyere et al. (2008) as well 2.48 recorded by Enin (1995) for *M. macrobrachion* in Cross River Estuary. The relatively high ø values recorded in this study indicates that Lower Ogun River supports a more steady growth of *Macrobrachium* populations than the areas studied by the earlier workers.

Mean growth coefficient (K) values of 0.2 ± 0.04, 0.59 ± 0.16 and 1.33 ± 0.67 were recorded for *M. vollenhovenii*, *M. macrobrachion* and *M. felicinum* respectively (Table 1). Higher K value (0.55) was however

Table 1: Growth parameters of three species of freshwater prawn (*Macrobrachium*) in Lower Ogun River

Species	**2006**				**2007**				**Mean values And Standard deviations**			
	L_{max} (mm)	**L∞** (mm)	**K**	**ø'**	**L_{max}** (mm)	**L∞** (mm)	**K**	**ø'**	**L_{max}** (mm)	**L∞** (mm)	**K**	**ø'**
M. vollenhovenii	191.00	226.60	0.18	3.95	183.00	203.59	0.24	4.01	187.00 ± 5.66	215.10 ± 16.27	0.2 ± 0.04	3.98 ± 0.04
M. macrobrachion	87.00	108.88	0.47	3.75	85.00	91.63	0.70	3.70	86.00 ± 1.00	100.26 ± 12.20	0.59 ± 0.2	3.76 ± 0.01
M. felicinum	68.00	78.74	0.86	3.73	70.00	74.15	1.80	4.00	69.00 ± 1.00	76.45 ± 3.25	1.33 ± 0.7	3.87 ± 0.19

L_{max} = Maximum Length
L∞ = Asymptotic Length
K = Growth Coefficient
ø' = Growth Performance Index

reported for *M. vollenhovenii* in Lagos-Lekki Lagoon by Abowheyere et al. (2008). The relatively low K value of *M. vollenhovenii* in this study could be as a result of the presence of large length classes as indicated by the relatively high maximum and asymptotic lengths. The decline in K as maximum and asymptotic lengths increase indicates that the growth rate of the prawns decreases with increase in size and age. This agrees with the findings of Ansa and Sikoki (2006) within the populations of benthic bivalves in the Andoni Flat, Niger Delta and Abowheyere (2008) within the populations of *Macrobrachium* prawns of Lagos-Lekki Lagoon.

The findings in this study, especially the relatively high maximum attainable size recoded for *M. vollenhovenii* as well as the steady growth of the three *Macrobrachium* species indicate that the environmental conditions in the Lower Ogun River favour growth and development of the prawns. In this regard, it is recommended that the prawns be developed for large-scale aquaculture production. Post-larvae or juveniles of the prawn can be grown either in cages, pens (in the Lower Ogun River) or ponds (within the river vicinity). Growth of the prawns could be enhanced with proper and adequate supplemental feeding. The aquaculture production of the freshwater prawn will undoubtedly reduce pressure on capture fisheries and thereby ensure conservation of the resources and biodiversity.

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