MORPHOMETRIC AND MERISTIC CHARACTERIZATION OF *Macrobrachium vollenhovenii* in OGUN RIVER, ABEOKUTA, NIGERIA

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ABSTRACT
This study was carried out in River Ogun, Abeokuta, Nigeria from February to December, 2014. Samples of Macrobrachium vollenhovenii used in the investigation were collected monthly from artisanal fishermen. The samples were preserved with ice and transported to the laboratory. Weight, total length, carapace length, length of cephalothorax, eye diameter, length of right and left antenna were measured. Others were length of right and left chela, length of uropods, length of rostrum, length of telson, dorsal and ventral rostral spines. Total length and weight of M. vollenhovenii ranged from 8.0 – 18.2 cm (mean = 14.81 ± 0.28 cm) and 6.1 – 105.0 g (mean = 36.48 ± 1.16 g). Though, right chela and antenna were longer than the left, no significant difference (p>0.05) was detected. Negative correlations were observed between length of right chela-eye diameter (-0.11), and length of left chela-eye diameter (-0.04). However, highest correlation (0.96) was detected between total length and weight while the least positive correlation (0.03) exists between eye diameter and length of uropod. Derived b-value of length-weight equation was 3.30, which was not significantly different (p>0.05) from 3. This study provides information on the characterization of M. vollenhovenii which can be used as taxonomic tool for its identification.
Keywords: freshwater, length - weight relationship, prawn, phenotypic

INTRODUCTION
Nigeria is blessed with adequate fisheries resources, which have contributed immensely to the growth and development of the country. Freshwater prawn of the genus Macrobrachium are decapods crustaceans belonging to the family Palaemonidae and are important for commercial fisheries and aquaculture (Bello-Olusoji *et al*., 2006). Culturable freshwater prawns belong to the Macrobrachium, which was reported as the largest genus of the family Palaemonidae (Soundarapandian, 2008). About 200 Macrobrachium species have been identified (Jayachandran, 2001) all of which lived in freshwater at least for part of their life (Davassi, 2011). These prawns are distributed throughout the tropical countries of the world (Bello-Olusoji *et al*., 2006). They inhabit inland freshwater areas such as rivers, streams and lakes including estuarine areas (New, 2002; Davassi, 2011). In the genus Macrobrachium, only two members *M. vollenhovenii* and *M. macrobrachion* were considered for aquaculture (Marioghae, 1987 and Willfuhr-Nast *et al.*, 1993). Among the two prawns, *M. vollenhovenii* is the largest of the local palaemonid prawns (Marioghae, 1987).

Marioghae (1990) stated that *Macrobrachium vollenhovenii* lives and breeds successfully in freshwater and brackish water systems. Marioghae (1987) and Jimoh *et al.* (2005), attributed the aquaculture potential of *M. vollenhovenii* to its wide distribution in freshwater, attainment of large size, disease resistance, high market value and good taste. The authors also added that until adequate hatchery system is developed for the production of their seeds, the young prawn may still have to be sourced from the wild. *M. vollenhovenii* is highly priced and a foremost relished shellfish produce of Ogun River, Southwest Nigeria. Marioghae (1987) opined that many fishermen and consumers cannot differentiate between the prawns. Therefore, this study was carried out to provide information on morphometric and meristic characters for identification of *M. vollenhovenii* among other *Macrobrachium* species and to investigate the correlations that exist between the measured phenotypic variables.

MATERIALS AND METHODS
Description of the study area
Ogun State is a state in the south western region of Nigeria. It has boundary with Lagos State and Atlantic Ocean to the South, Oyo and Osun States to the North, Ondo State to the East and the Republic of Benin to the West. River Ogun is one of the main rivers in the south western part of Nigeria with a total area of 2.24 x 10^6 m^2 and a fairly large flow of about 393 m^3 sec^{-1} during the west season (Oketola *et. al.*, 2006). It is located on 3° 28´ E and 8° 41´ N from its source in Oyo State and located on 3° 28´ E and 6° 35´ N in Lagos where it enters the Lagos lagoon (Ayoade *et. al*., 2007) as shown in Fig. 1. The major tributaries of Ogun River are the Ofiki, Oyan and Opeki Rivers. The rainy season (April – October) and dry season (November – March) are the two major seasons in Ogun River basin. Mean

annual rainfall ranges from 900 mm in the north to 2000 mm towards the south. The vegetation zones that are identifiable on the watershed are the high forest vegetation in the north and central part and the swamp/mangrove forests that cover the southern flood plains as it enters the lagoon (Oketola *et al.*, 2006).

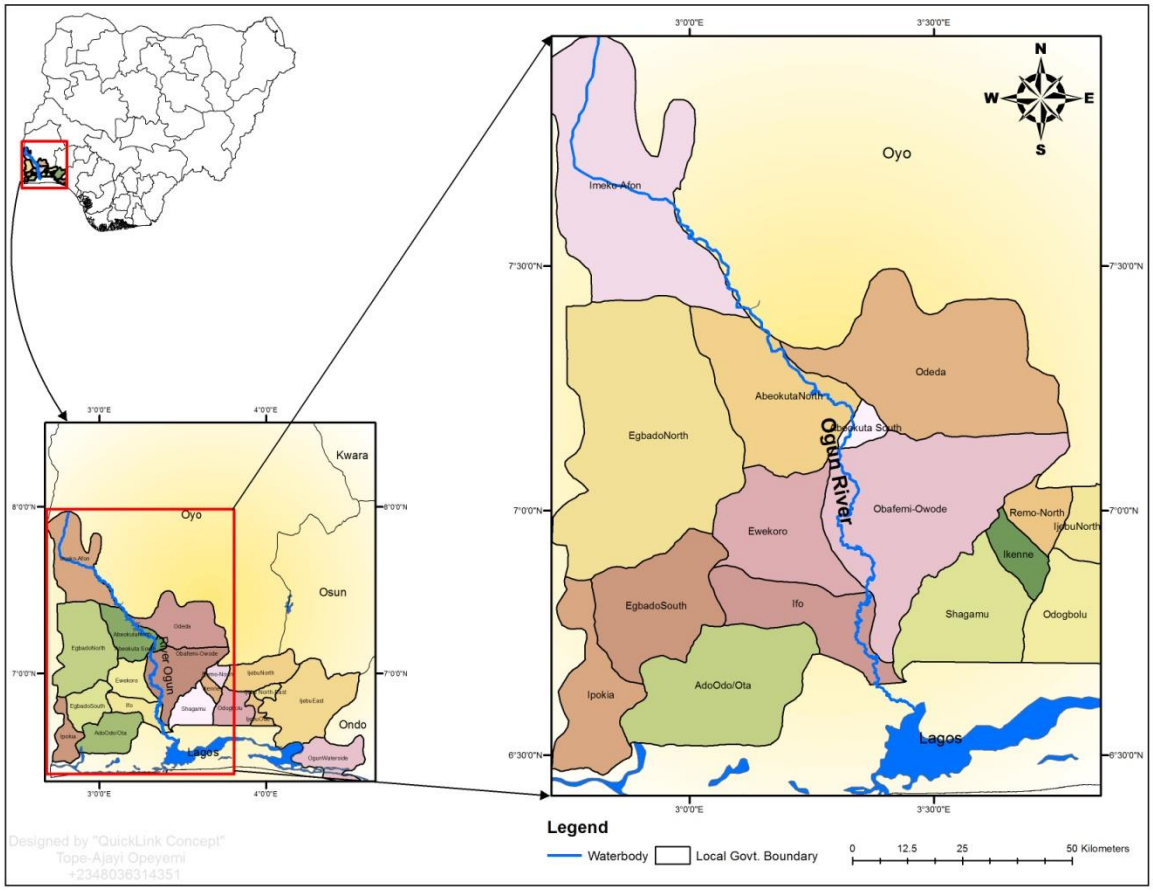

Fig. 1: Map of the study area

Collection of sample

The study was carried out from February to December, 2014 in the Ogun River, Abeokuta. Specimens of *M. vollenhovenii* were collected on monthly basis from the artisanal fishermen operation in the middle basin of Ogun River. The prawns were caught with assorted traps. The species of *M. vollenhovenii* were kept in ice chest and taken to the laboratory for examination. Measuring board was used to measure the total length (TOL) length of left arm (LLA), length of right arm (LRA), length of right antenna (LRT) and length of left antenna (LLT) to nearest 0.1 cm. Digital vernier calliper was used to measure rostral length (ROL), carapace length (CAL), eye diameter (EYD), length of telson (LOT), length of uropod (LOU), length of right chela (LRC), length of left chela (LLC), and length of cephalothorax (LCE) and later converted to cm. The weight (WGT) of the prawn was measured with an electronic scale (Camry - model: EHA251) to the nearest 0.1 g. Number of dorsal rostral spine (DRS) and ventral rostral spine (VRS) were the only meristic characters that were investigated.

Statistical analysis

Descriptive and inferential statistics were used for the analysis. Correlation analysis was performed to reveal the relationship between the measured variables. Total length/weight relationship was expressed by the equation $W = a*L^b$. Linear

transformation was made using natural logarithm as proposed by Zar (1984): LogWGT = a + b*Log TOL ; where WGT = weight of the prawn (g), a = constant, b = slope and TOL = total length (cm). Scatter diagram was used to detect the outliers which were removed before the data was subjected to least-square regression analysis (Froese, 2006). Regression co-efficient (slope = b) from the linear regression analysis was tested for significance from 3 (isomerism) using Student's T-test at 5% level of significance.

RESULTS

A total of 253 *M. vollenhovenii* were collected from Ogun River, Abeokuta from February to December, 2014. Table 1 shows the results of descriptive analysis of *M. vollenhovenii* from Ogun River. The mean total length was 14.8 ± 0.28 cm, ranging from 8.0 cm to 18.2 cm. The body weight was between 6.1 g and 105.0 g with a mean of 36.48 ± 1.16 g as shown in Table 1. Number of dorsal and ventral rostral spines ranged from 10 to 16 and 2 to 5 respectively. Table 2 shows the correlation matrix of morphometric characters. Very high positive correlation was observed between WGT and TOL (0.96), LLC and LRC (0.92), LCE and LOR (0.89), LCE and LOC (0.89), and WGT and LOC (0.87). The results of linear regression of length-weight relationship analysis are depicted in Table 2. The linear relationship observed between the total length and weight was $\text{Log WGT} = 3.30 * \text{Log (TOL)} - 2.14$. This growth pattern suggested positive allometric growth of *M. vollenhovenii* in Ogun River. The slope (3.3) which is the b-value is not significantly different ($p > 0.05$) from 3 the value of isometric growth. Correlation co-efficient of 0.98 obtained revealed that strong relationship exist between the total length and weight of *M. vollenhovenii* with corresponding co-efficient of determination (R^2) of 0.96.

Table 1: Mean of morphometric and meristic characters of *Macrobrachium vollenhovenii* from Ogun River, Abeokuta, Southwest Nigeria

Character	Acronym	Minimum	Maximum	Mean ± S.E
Length of rostrum (cm)	LOR	1.8	4.7	3.02 ± 0.03
Length of carapace (cm)	LOC	2.5	6.3	4.2 0± 0.05
Eye diameter (cm)	EYD	0.3	0.5	0.38 ± 0.003
Length of telson (cm)	LOT	1.1	2.6	1.54 ± 0.01
Length of Uropod (cm)	LOU	1.2	2.8	1.80 ± 0.02
Length of right chela (cm)	LRC	1.5	10.5	3.30 ± 0.13
Length of left chela (cm)	LLC	1.8	8.8	3.29 ± 0.14
Length of cephalothorax (cm)	LCE	3.1	9.1	5.92 ± 0.07
Total length (cm)	TOL	8.0	18.2	14.81 ± 0.28
Weight (g)	WGT	6.1	105.0	36.48 ± 1.16
Length of right arm (cm)	LRA	5.3	19.0	11.25 ± 0.48
Length of left arm (cm)	LLA	6.2	17.4	11.52 ± 0.70
Length of right antenna (cm)	LRT	11.1	28.8	16.16 ± 0.35
Length of left antenna (cm)	LLT	1.4	29.8	15.86 ± 0.35
Number of dorsal rostral spines	DRS	10	16	13 ± 0.07
Number of ventral rostral spines	VRS	2	5	4 ± 0.07

Table 2: Correlation matrix of morphometric characters of *Macrobrachium vollenhovenii* from Ogun River, Abeokuta, Ogun State, Nigeria

	LOR	LOC	EYD	LOT	LOU	LRC	LLC	LCE	TOL	WGT	LRA	LLA	LRT	LLT
LOR	1													
LOC	0.79	1												
EYD	0.22	0.35	1											
LOT	0.59	0.70	0.20	1										
LOU	0.66	0.74	0.03	0.74	1									
LRC	0.64	0.63	-0.11	0.61	0.86	1								
LLC	0.66	0.69	-0.04	0.63	0.89	0.92	1							
LCE	0.89	0.89	0.25	0.73	0.79	0.70	0.77	1						
TOL	0.41	0.46	0.27	0.36	0.18	0.12	0.16*	0.49	1					
WGT	0.72	0.87	0.27	0.66	0.72	0.67	0.71	0.84	0.96	1				
LRA	0.25	0.30	0.15	0.22	0.22	0.63	0.51	0.36	0.14	0.28	1			
LLA	0.30	0.34	0.09	0.28	0.35	0.34	0.38	0.33	0.17*	0.39	0.33	1		
LRT	0.47	0.54	0.25	0.42	0.42	0.39	0.39	0.53	0.36	0.51	0.51	0.24	1	
LLT	0.31	0.32	0.04	0.20	0.25	0.19*	0.30	0.36	0.25	0.36	0.27	0.17*	0.24	1

* Correlation is significant at 0.05 level.

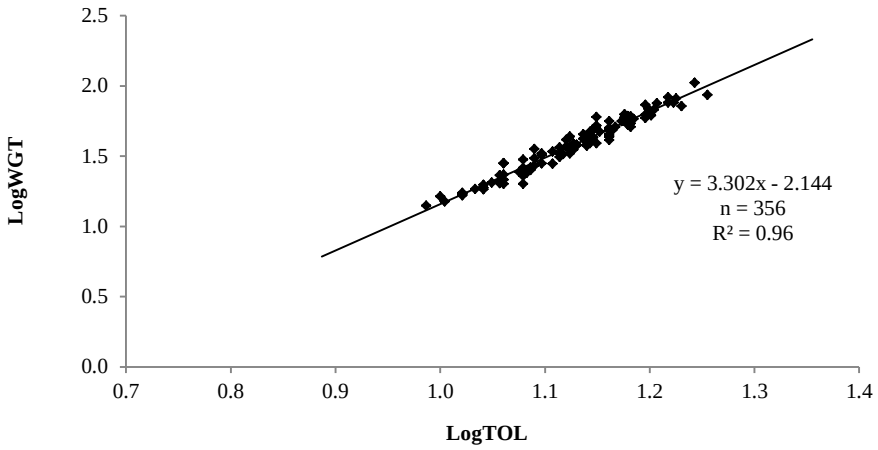

Fig. 2: Length-weight relationship of *Macrobrachium vollenhovenii* from Ogun River, Abeokuta, Southwest Nigeria

DISCUSSION

Ogun River, Abeokuta in South West Nigeria supports major artisanal fishery that have been sustained for several years. The prawn is the only commercially important shellfish in Ogun River. Of the shellfishes, the decapods crustacean, the *M. vollenhovenii* occur seasonally in this river especially during on-set of rainy season. More so, it has sustained the local fishery and served as source of income for the fishermen and fisherfolks as it is highly priced. It is also serves as source of protein in the diet of the people. The occurrence of *M. vollenhovenii* in Ogun River is seasonal. Similar reports on seasonal occurrence of *Macrobrachium*

species have been documented by Marioghae (1990) in Lagos Lagoon and Anetekhai (2002) for *M. vollenhovenii* in Asejire Lake. According to USAID 2002, the main fishing season of *Macrobrachium* species in Nigeria is May - October while Marioghae (1990) reported a breeding season of April - October for *Macrobrachium* species in Nigeria waters. Thus, the fishing season coincides with the period of intensive spawning and according to Enin (1997), a likely consequence of this coincides between the spawning and fishing seasons is the exposure of spawning population to intense exploitation with severe consequence for the spawning adults, the eggs, larvae and stock size.

Jimoh *et al.* (2012) reported mean total length of 8.06 cm in Badagry Creek while Holthuis (1980) and Marioghae (1987) documented 18.9 cm and 18.2 cm as the maximum length observed in brackish environment respectively. Higher mean total length observed in this study might be due to the difference in environment. It can be deduced that freshwater environment is preferred environment for *M. vollenhovenii* for good growth. It was observed that the result of mean weight was higher than that previously reported. Mean body weight reported by Jimoh *et al*., 2012 were 6.29 g and 4.7 g for *M. vollenhovenii* and *M. macrobrachion* respectively.

The correlation between total length and body weight was found to be positively high and significant ($p < 0.05$). Meye and Arimoro (2005) also recorded a positive correlation between total length and body weight for males of *M. dux*. Anetekhai (1997) reported lower mean body weight for male *M. vollenhovenii*.

Among morphological characters, rostrum length and rostral spines are the main useful taxonomic characters that distinguished prawn species (Naiyanetr, 2001; Murphy and Austin, 2005). In the study, the range of dorsal and ventral rostral spines was 10 – 16 and 2 – 5 respectively. However, 6 – 14 (dorsal) and 3 – 8 spines (ventral) were reported by Jimoh *et al.* (2012). Similar observations were made by Anetekhai (1997) for *M. macrobrachion* in the Badagry Creek, Southwest Nigeria. Previous work carried out on *M. macrobrachion* documented a range of 7 – 15 (dorsal), 3 -10 ventral spines, rostral length (1.80 cm) and carapace length of 1.74 cm (Jimoh *et al.,* 2012).

The minimum and maximum total lengths of prawn observed in the study were higher compared with those reported in New Calabar River by Marioghae (1987) and Rutherford, (1971) for *M. vollenhovenii*; and *M. acanthaarus* and *M. olferis* by Klaus and Gloria (1998). *M. vollenhovenii* in Ogun River exhibited positive allometric growth. Similar value (3.11) was reported by Jimoh *et al.* (2012) for *M. vollenhovenii* and 2.58 (*M. macrobrachion*) in Badagry Creek. Lawal-Are and Apapa, 2014 reported b-value of 2.92 for *Penaeus monodon* in Niger Delta area. Lawal-Are and Owolabi (2012) documented b-values of 2.59 and 2.69 (*M. vollenhovenii*) and 2.87 and 2.41 (*M. macrobrachion*) in Lekki and Lagos lagoons respectively, which were negative allometric growth.

CONCLUSION

The size of *M. vollenhovenii*, length and weight, from Ogun River is higher than that reported from brackish environment. It can be deduced that salinity, which makes the difference, is an important factor that influence the development of the meristic and morphometric characters of *M. vollenhovenii*. This study shows that *M. vollenhovenii* perform better in Ogun River than previous works carried out in brackish water environment; hence its fishery should be developed. Since environmental factors can influence the phenotypic characters of this species, there is need for molecular characterization of this prawn species for proper identification.

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