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## Sex population structure of *Macrobrachium felicinum* and *Macrobrachium vollenhovenii* in the Akor river, Ibere Ikwuano, Abia State

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### Abstract

Akor River Ibere was sampled for 24 months during September 2012 – October 2014 using the Area density method. The river was delineated into three stations for sampling purposes namely Station A, B and C. Station A is located at Obuoro, Station B is located at Elemaga while Station C is located at Itunta where the prawns were all collected from. In the three stations, females predominated over the male with overall prawn species of 4,859 individuals out of which 3302 were females and 1551 were males giving a ratio of 1:2.07. A total number of 1,239 *Macrobrachium felicinum* were caught out of which 370 individuals were males and 869 individuals were females giving a ratio of 1:2 which was significantly different ( $p < 0.05$ ) from expected ratio of 1:1, 3,620 *Macrobrachium vollenhovenii* samples were caught in the three stations out of which 1,187 were males and 2,433 were females giving a ratio of 1:2 which showed no significant difference ( $p > 0.05$ ) though a ratio of 1:1 is expected. There were significant differences in number of shrimps caught between seasons ( $p < 0.05$ ). There were two peaks of abundance of male shrimps. The first peak was in July - Aug 2013, the highest numbers of females were obtained in September 2013, the peak of the rainy season while another peak occurred in July and September 2014. The presence of both sexes of *Macrobrachium* in Akor River suggests that there is possibility of prawn larval production for aquaculture practice.

**Keywords:** Akor River, *Macrobrachium felicinum*, *Macrobrachium vollenhovenii*, Sex ratio

### 1. Introduction

The freshwater prawn belonging to genus *Macrobrachium* of the crustacean sub family *Palaemonidae* include more than 60% of the prawn species, they are highly esteemed as nutritive proteinaceous food, bearing a varying market price for larger forms from 60-120g and have average adult weight of 50g and a total length of 200mm. They are extensively distributed in freshwater and estuaries of the world (Kutty *et al.*, 2000) [12]. In the last few years, the freshwater prawn farming has already become a major contributor to global aquaculture, in terms of quality and value (New, 2000) [18]. According to FAO report (2000) cited by Valenti (2002) [27], world production of freshwater prawn during 1990 to 2000 increased from 21,000 to 185,000 tons per year, which corresponds to an increase of about 500%. The freshwater prawn culturing is simpler than salt water prawns.

In freshwater rivers and creeks in the Niger Delta of Nigeria, *Macrobrachium* fishery predominates. Three species namely, *Macrobrachium felicinum* (Niger River prawn), *Macrobrachium vollenhovenii* (African River Prawn) and *Macrobrachium macrobrachion* (Brackish river prawn) dominate the catches of this subsector (Powell, 1983) and cited by Ukagwu *et al.*, (2015) [26]. *Macrobrachium vollenhovenii* is endemic to the eastern Atlantic, with viable fishery in most of the countries in the West African sub-region. Gabche and Hockey (1995) [8] have reported its growth and mortality in Cameroon, while Bello-Olusoji and Somers (1997) [4] have studied its distribution in Western Nigeria.

Biology and fishery of prawn have attracted considerable attention of biologists and fish farmers recently due to their great economic importance but there exists scanty information pertaining to taxonomy and diversity of prawn. (Gulland, 1982)

Furthermore, anthropogenic activities in a river such as swimming, washing, dredging, lumbering and fishing have been known to cause some ecological changes in aquatic habitats, Akor river is not an exception.

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The Sex population structure estimation is indicating the abundance of any sex at a particular time (Bahuguna, 2013) [3]. It is generally considered that in a healthy population, the sex ratio should be 1:1. It is important to derive means of ensuring a proportional prawn fishing of both sexes. A basic knowledge of sex population structure estimation of prawn farming is essential in the management practices of aquaculture. Other factors include physico-chemical parameters, vulnerability of females to their predators and other ecological hazards which possibly change the sex composition in streams and rivers. A lot of work has been done on the sex population structure and other aspects of *Macrobrachium* species. (Marioghae, 1982) [16], Powell (1982) [21], Dobriyal *et al*, 2004 [6] (Nwosu and Wolfi, 2006) [20], Deekae, (2009), (Bahuguna, 2013) [3]. In Akor River Ibere, Ukagwu (2015) [26] have discovered the occurrence of *Macrobrachium* species and this study is in continuation with some other studies and it is reporting on the sex population structure of *Macrobrachium felicinum* and *Macrobrachium vollenhovenii*.

**1.1 Sampling stations**

Ibere is in Ikwuano Local government area between latitudes 05.34829°N and Longitude 007°.34468' E with elevation of 77m. The Ibere region which is located in the northern part of Ikwuano LGA (Fig. 1) is a mountainous region. The soil is either completely clayey or else is clay-loam. The dry season topo map of Ibere shows one river: Inyang itu (Akor). Consequently, surface run-offs flowing into numerous valleys and channels occurring in the region transform Ibere into a region of innumerable anatomizing watercourses all linked up into one giant complex river network (Chude and Chukwu, 2012) [5]. Three fixed stations were sampled from October 2012 to September 2014 in Akor river in Ibere. The river derived its source from the Ozuitem hills known as “Mgbele Akor” and empties itself at the Qua Iboe river in Akwa Ibom state. Three fixed stations were sampled. The stations are Obuoro (Latitude 05.44829°N and Longitude 007°.64468' E with elevation of 77m) Station A, Elemaga (Latitude 05°.46678°N and Longitude 007°.63078'E with elevation of 60m) Station B and Itunta (05°.44183°N and longitudes 007°.61908'E with elevation of 57m station C where the river cuts across. Obuoro was labeled Station A; Elemaga was labeled Sampling Point B while Itunta was labeled Station C (Map 1). The Akor River in Ikwuano with the source in Bende has a gentle slope from its banks, that permits the

inflow of surface run-off and organic matter derived from the surrounding vegetation. These in turn contribute to the allochthonous input of the river. The substratum is made up of a deep layer of clay and an ad-mixture of silt and decomposing organic matter.

**2. Materials and Methods**

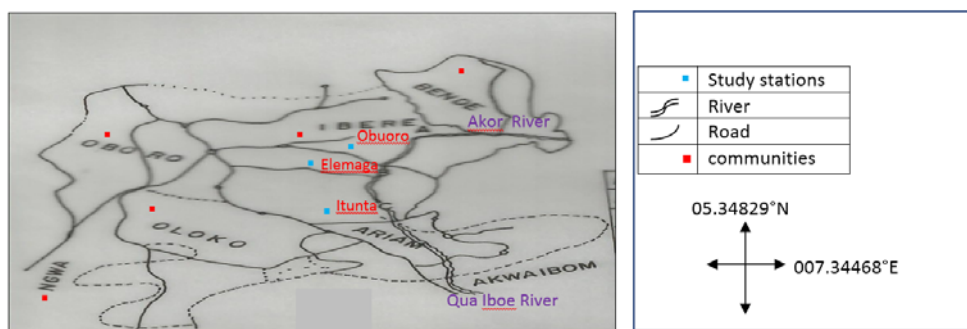
**2.1 Sampling method**

The area density method was employed for the population studies. For the purpose of sampling, Akor River was delineated into three sections designed as station A, B and C. the sampling programme spanned for twenty-four months (October 2012 to Sept 2014) with the assistance of the artisanal fishers at the three different sampling points with the use of basket traps made of bamboo and has cone shape as described by Solarin *et al.*, (2003) [25]. Sampling was conducted fortnightly between 7.30hrs and 12.30hrs and on sampling days.

For each station two fishermen were engaged and three traps were used. At each station the fishermen set the three sets of traps against the water current among aquatic macrophytes and left them overnight. The traps were retrieved the following day after about twelve hours corresponding to another low tide. The prawns collected at each station were sorted into male and female). Other species recovered from the trap were, *Tilapia guineensis* and *Sarotherodon melanotheron*. The shrimp samples were then preserved in 4% formaldehyde and transported to the laboratory. Species were identified using the identification key suggested by Powell (1983) [22]

**2.2 Sex determination and structure**

The prawns were sorted out after capture and identified using Holthius (1980) [10] and Powell (1983) [22]. The total length and weight of the prawn was recorded in fresh condition. The sexes of the shrimps were determined based on morphological characteristics as stated by New and Singholka (1982) [19] and Sagua (1980). Male shrimps possess appendix masculina on the second pleopod while females have none. Females were broader than the males. A total number of 4,859 individuals were recorded, 1557 males and 3302 females. The sex-ratio was calculated for the entire period of study (dry and wet season) and its significance was tested by Chi-square test ( $X^2$ )  $X^2 = O-E^2/E$  where  $X^2$  is chi-square, O is observed and E is expected value.



**Fig 1:** Map showing the study stations

**3. Results and Discussion**

During the period of study the two species recorded were *Macrobrachium felicinum* and *Macrobrachium vollenhovenii* showed differences in sex population structure (Table 1). At

station A, 241 individuals of *Macrobrachium felicinum* females were caught representing 63.3% of the total catch and 122 individual males representing 33.3% of the total catches which showed significant difference ( $p < 0.05$ ) and a ratio of

2:1.02. 712 individual females *Macrobrachium vollenhovenii* representing 68.1% of the total catch and 332 male individual species representing 31.8% of the catches were recorded at the same station which was significantly different ( $p < 0.05$ ) and had a ratio of 2:1.04. At Station B, 294 individual females of *Macrobrachium felicinum* were recorded representing 64.7% of the total catch, 160 individual males of *Macrobrachium felicinum* were recorded representing 35.25 of the total catch and they showed no significant difference ( $p > 0.05$ ) and had a ratio of 1:1.08. 831 females *Macrobrachium vollenhovenii* were recorded in the same station constituting 67.2% of the total catch, 404 male individuals of the same species was recorded in the same station constituting 32.7% and was significantly different ( $p < 0.05$ ), it had a ratio of 2:1.08. At station C, 304 female individuals of *Macrobrachium felicinum* were recorded constituting 72% of the total catch, 118 male individuals constituting 38.81% which showed significant difference ( $p < 0.05$ ) and had a ratio of 2:1.04. 890 female individuals of *Macrobrachium vollenhovenii* were recorded representing 69.47% of the catches, 451 male individual species were recorded representing 35.2% of the catches which showed significant difference ( $p < 0.05$ ) and a ratio of 1 male :2 females. Generally, in the three stations, a total number of 1,239 *Macrobrachium felicinum* samples were collected out of which 370 individuals were males and 869 individuals were females giving a ratio of 1:2 which was significantly different ( $p < 0.05$ ) from expected ratio of 1:1, At total number of 3,620 *Macrobrachium vollenhovenii* samples were collected in the three stations out of which 1,187 were males and 2,433 were females giving a ratio of 1:2 (Table 2 & 3) which showed no significant difference ( $p > 0.05$ ) though a ratio of 1:1 is expected. There were significant differences in number of shrimps caught between seasons ( $p < 0.05$ ). Also, there were two peaks of abundance of male shrimps. The first peak was in July - Aug 2013, the highest numbers of females were obtained in September 2013, the peak of the rainy season while another peak occurred in July and September 2014.

Knowledge of sex population status estimation has its own

significance. It will give immense help in detecting differential prawn fishing in different periods of the year and the various size groups (Bahuguna, 2013) [3]. Thus we can get information about the abundance of the sex ratio at a breeding time, month, seasons and throughout the year. Holcik *et al.*, (1988) [9] have stated that the expected composition of males to females is 1:1. In this study the highest number of female population was observed in the month of September and the lowest number of male population was estimated in the month of January. Mejia-Ortiz *et al.*, (2001) [17] have noticed a sex ratio of 7:3 males per females in *Macrobrachium acanthurus*, *Macrobrachium hetreochirus* exhibited a sex ratio of 1:3 males per females and in *Macrobrachium carcinus*, a sex ratio of 1:3 females per male was recorded. Anturus and Oshire (2004) have found a ratio of 1:0.94 between males and females for *Macrobrachion potuna* in the coast of Rio De Janiero, Brazil. The male population based sex ratio was 1:1 (Mantel and Dudgeon, 2005) [14]. The proportion between males and females in the studied population was of 1:1.6 (Sampaio *et al.*, 2007) [24]. These reports are in contrast with the findings of this study where female prawns dominated over the male prawns. Mantellato and Barbosa (2005) [15] have observed opposite for *Macrobrachium brasiliense* collected in Serra Azul Sao Paulo that the female predominated over the males in a proportion of 1:2.6. *Macrobrachium potiuna*. Artunes and Oshiro (2004) have found a ratio of 1:1 between males and females for *Macrobrachium potiuna* in the coast of Rio de Janiero, Brazil. Arimoyo and Meye (2007) have observed male to female ratio of 1:1.2 in *Macrobrachium dux* in the River Orogodo, Niger Delta

Nigeria. A similar ratio has been reported by Inyang (1981) [11] for *Macrobrachium felicinum*, and *Macrobrachium vollenhovenii* and *Macrobrachium macrobrachiom* by (Marioghae, 1982) [16]. Lawal-Are and Owolabi (2012) [13] have reported a sex ratio of 1:3.02 for *Macrobrachium macrobrachion* dominated by females and ratio of 1:3.34 for *Macrobrachium vollenhovenii* dominated by females in the Lekki Lagoon Lagos Nigeria which supports the findings of this study.

**Table 1:** The sex population structure of the *Macrobrachium* species recorded at the different study stations during the period of study.

Months	Station A				Station B				Station C			
	Mff Mfm	X <sup>2</sup>	Mvf Mvm	X <sup>2</sup>	Mff Mfm	X <sup>2</sup>	Mvf Mvm	X <sup>2</sup>	Mff Mfm	X <sup>2</sup>	Mvf Mvm	X <sup>2</sup>
Oct 12	0 0	P<0.05	20 8	P<0.05	0 0	P>0.05	24 12	P<0.05	0 0	P<0.05	18 17	P<0.05
Nov 12	0 0		23 7		0 0		25 14		0 0		33 16	
Dec 12	0 0		19 8		0 0		23 15		0 0		36 15	
Jan 13	0 0		10 7		0 0		26 14		0 0		34 15	
Feb 13	0 0		23 11		6 2		31 14		4 1		32 14	
Mar 13	6 0		20 12		10 6		34 21		6 2		36 18	
Apr 13	10 2		28 18		13 2		39 19		11 5		43 20	
May 13	15 5		35 12		15 5		40 22		15 8		45 18	
Jun 13	18 6		32 14		18 4		39 24		20 6		45 20	
Jul 13	20 10		35 19		20 9		42 25		22 11		43 24	
Aug 13	19 17		32 22		26 19		40 17		25 10		48 22	
Sep 13	23 8		38 14		26 20		41 18		28 16		46 27	
Oct 13	4 7		30 13		19 18		43 19		16 12		49 28	
Nov 13	2 0		24 7		12 3		32 9		9 2		44 19	
Dec 13	0 0		20 7		4 9		30 6		4 3		36 12	
Jan 14	3 1		13 8		4 2		30 8		10 0		30 14	
Feb 14	0 0		17 7		0 0		31 7		6 3		32 8	
Mar 14	0 0		18 20		0 0		34 9		0 0		28 19	
Apr 14	11 5		45 18		11 5		45 20		13 2		30 19	
May 14	15 8		45 20		15 8		45 18		15 5		39 22	

Jun 14	20 6		43 24		20 6		43 20		18 4		40 24
Jul 14	22 16		48 7		22 16		48 24		30 9		39 25
Aug 14	25 15		46 22		25 15		20 22		26 9		42 17
Sep 14	28 16		48 37		28 16		26 27		26 10		40 18
Total	241 122		712 332		294 160		831 404		304 118		890 451

\*Mff= *Macrobrachium felicinum* females  
Mfm=*Macrobrachium felicinum* males  
Mvf = *Macrobrachium vollenhovenii* females  
Mvm= *Macrobrachium vollenhovenii* males

**Table 2:** Contingency table on the sex population structure of *Macrobrachium felicinum* at the study stations

Sex	Station A	Station B	Station C	Total
Male	122	160	118	370
Female	241	294	304	869
Total	363	454	422	1239

O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E	X <sup>2</sup> Cal	X <sup>2</sup> tab
92	108.4	-16.4	268.96	2.48	54.63	5.991
160	135.58	24.42	585.64	4.32		
118	126.02	-8.02	64.32	0.51		
271	254.59	16.41	269.29	1.06		
294	318.42	-24.42	596.34	277.92		
304	295.98	8.02	64.32	-231.66		

P<0.05

**Table 3:** Contingency table on the sex population structure of *Macrobrachium vollenhovenii* at the study stations

Sex	Station A	Station B	Station C	Total
Male	332	404	451	1187
Female	712	831	890	2433
Total	1044	1235	1341	3620

O	E	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E	X <sup>2</sup> cal	X <sup>2</sup> tab
332	342.32	-10.2	104.04	0.30	0.883	5.991
404	404.96	-0.92	0.9216	0.0023		
451	439.71	11.29	127.46	0.029		
712	701.67	10.33	106.71	0.15		
831	830.04	0.6	0.36	0.0004		
890	901.29	-11.29	126.78	0.14		

p>0.05

**4. Conclusion**

From the study the sex ratio was determined using the chi-square, *Macrobrachium felicinum* spp had a sex ratio of 1 male: 2 females which showed significant difference (p<0.05) with the females were higher in number, *Macrobrachium vollenhovenii* spp had a sex ratio of 1male :2 females and was not significant at (p>0.05) though females were also higher in number and revealed that the females dominated the river which indicates that both sexes are available in the river and can be exploited for prawn larval production for aquaculture practices.

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