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A COMPARATIVE ASSESSMENT OF ASPECTS OF REPRODUCTIVE BIOLOGY OF TWO FRESHWATER PRAWNS, *Macrobrachium felicinum* (Holthuis, 1949) AND *Atya gabonensis* (Giebel, 1875) IN RIVER BENUE, MAKURDI, NIGERIA

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ABSTRACT

This work was designed to determine and compare sex ratio, fecundity, egg diameter and gonadosomatic index of M. felicinum and A. gabonensis in Lower River Benue from January to December 2016. A total of 295 M. felicinum were sampled with an overall sex ratio of 8.52:1(F:M). The highest sex ratio of female to male (12:1 F:M) was in August while the least was in September (5.00:1 F:M). About 2413 Atya gabonensis were collected with an overall sex ratio of 1:211. F:M Fecundity varied from 230 - 69,782 eggs in M. felicinum and 4,300 - 8,600eggs in A. gabonensis. Stronger correlation was observed between fecundity and total length (r=0.64 in M. felicinum and 0.87 in A. gabonensis). Mean egg diameter of A. gabonensis was 0.46 ± 0.0 mm and that of M. Felicinum was 0.44 ± 0.03. Macrobrachium felicinum showed higher Gonadosomatic Index (0.58 ± 0.041) than A. gabonensis (0.33 ± 0.009). Macrobrachium felicinum appeared to have more reproductive output than A. gabonensis. Both species, A. gabonensis and M. felicinum were recommended as good candidates for culture as their seeds are readily available in the Lower River Benue.

Key words: freshwater prawn, sex ratio, fecundity, gonadosomatic index, egg diameter, Lower River Benue

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INTRODUCTION

Shrimps and prawns are of high economic importance in the provision of food, foreign exchange earnings and employment (FAO, 2008). The presence of prawns in Nigeria's fresh and brackish water has been reported by many authors for e.g. Anetekhai (1986) and Ayoola, *et al*, (2009). Nigeria produces and even exports these fisheries resource but in minimal quantity - about 12,000 tonnes annually (*Zabby et al*., 2010). The global markets for shrimp and prawns are increasing by three percent annually, largely due to increased consumption in the US, Europe and Japan (USTR, 2005). There is need for Nigeria to step up its production to meet the rising demand at local and international demand levels. In order to avoid over exploitation of the natural resources, commercial culture of prawn is the best option. Currently, *Macrobrachium rosenbergii* is the only freshwater prawn used in commercial farming, since its biology and farming technology are well known compared to other species (Valenti, 1990). *Macrobrachium felicinum* and *Atya gabonensis* are among the freshwater prawns reported to occupy the Nigerian main rivers and tributaries (Reed *et. al*., 1967 and Ayoola *et. al*, 2009). Nigeria is lagging behind in prawn culture. The knowledge of reproductive biology of these two species, abundant in our fresh water bodies, is important for evaluation of their potentials for commercial farming, as well as an estimation of the stock size of natural population. The aim of this work was to determine and compare sex ratio fecundity, egg diameter and gonadosomatic index of *M. felicinum* and *A.*

gabonensis in the Lower River Benue, Makurdi, Nigeria.

MATERIALS AND METHODS

The sample area was River Benue in Makurdi, which is located on latitude 7˚ 55' and 7 56' North of equator and longitude 8˚20' and 8˚ 40' East of the Greenwich meridian (Figure 1). River Benue originates from Adamawa hills and flows from the Southern part of Cameroon through Makurdi and Southwards to Lokoja where it forms a confluence with River Niger. At bank full, the River is about 129,000 hectares with as much as 25m difference between high and low water levels.

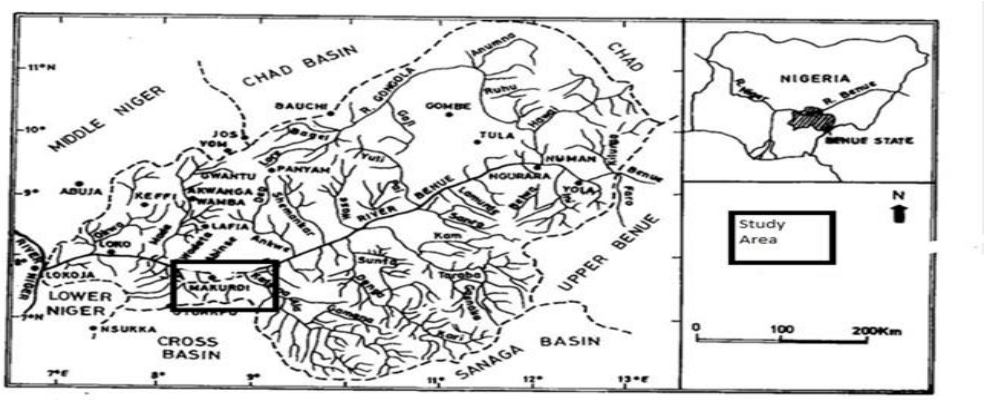

Figure 1: Map of Lower River Benue showing Makurdi, the sampling site. Source: Wikipidia.com (2015)

Prawns were collected with the help of fishermen and transported in iced boxes to the laboratory for further studies. Identification to species level was done by keys of Powell (1982). The sexes were determined with the aid of specific morphological features that were peculiar to male and females of the prawns, such as appendix masculina, reproductive chamber and nubs on the first abdominal segment as demonstrated by Anetekhai (1990). Morphological measurements were done according to a model of Adite *et al*, (2013). Total body weight (g) was taken using a top loading electronic Metler balance (Model 59174). Fecundity was estimated by the gravimetric method of Fernandez *et al*. (1998). Egg diameter was measured to the nearest millimeter using a calibrated eye piece of a binocular microscope. The mean of the diameter of 10 eggs from a female was used as the diameter of individual egg per female.

RESULTS

Sex Distribution

A total of 295 *M. felicinum* was sampled, males were 31 and females were 264 (Table 1). An overall ratio of 8.52: 1(F:M) was observed. The highest number of females to males (F:M of 12:1) was in August and the least sex ratio of female to male was in September (5.00: 1). There was no significant difference ($p>0.001$) in January, February, March and September. About 2413 *A. gabonensis* were sampled, males were 1636 and females were 777 with an overall sex ratio of 1:2.11 (Table 2). There was significant difference ($p<0.001$) in all the months with the highest sex ratio of 1:5.35(F:M) in November and 1:1.59 in April.

Table 1: Sex Distribution of *M. felicinum* (January to September, 2016)

Month	Female	Male	Sex ratio (F:M)	X^2	P-value
January	17	3	5.67:1	0.50	0.480
February	10	1	10.00: 1	1.80	0.180
March	32	3	10.67: 1	0.00	1.000
April	28	3	9.33: 1	4.57	0.033
May	56	7	8.00: 1	9.32	0.002
June	37	4	9.25: 1	7.2	0.007
July	50	6	8.33: 1	9.97	0.002
August	24	2	12.0: 1	8.07	0.005
September	10	2	5.00: 1	1.29	0.257
TOTAL	264	31			

Correlation matrix of morphometric parameters and fecundity

Positive correlation was observed between fecundity and other features measured except with CD in *M. felicinum*. Stronger correlation was observed between Fecundity and total length (r=0.64) in *M. felicinum* and (0.87) in *A. gabonensis* (Tables 4 and 5)

Table 4: Correlation Matrix of Morphometric Parameters and Fecundity of *M. felicinum*

	W	TL	CL	CD	AL
TL	0.29				
CL	0.26	0.81			
CD	0.03	-0.15	-0.15		
AL	0.23	0.48	0.54	-0.11	
Fecundity	0.42	0.64	0.57	-0.00	0.14

Keys: W=Weight; TL = Total length; CL = Carapace length; CD = Carapace diameter; AL = Abdomen length

Egg Diameter

There was a significant difference (P<0.05) between the egg size of *A. gabonensis* and *M. Felicinum* (Table 6). *Atya gabonensis* had larger eggs (0.46 ± 0.01 mm) than *M. Felicinum* (0.44 ± 0.03).

Table 5. Correlation Matrix of Morphometric Parameters and Fecundity of *A.*

Species	Mean	Minimum	Maximum
M. felicinum	15,133 ± 1222	230	69,782
A. gabonensis	6,450 ± 2150	4,300	8,600

Keys: W=Weight; TL = Total length; CL = Carapace length; CD = Carapace diameter; AL = Abdomen length

Table 6: Mean Egg Diameter of *A. gabonensis* and *M. Felicinum*

Parameter	Mean	Minimum	Maximum	N
A. gabonensis	0.46 ± 0.01^{a}	0.2	0.6	210
M. Felicinum	0.44 ± 0.03^{b}	0.2	0.6	100

Mean in the same column with different superscript differ significantly (P<0.05).

Gonadosomatic Index of *Atya gabonensis* and *Macrobrachium felicinum*

There were significant differences between both the Gonadosomatic Index (GSI) of the two species. *Macrobrachium felicinium* showed higher GSI (0.58 ± 0.041) than *Atya gabonensis* (0.33 ± 0.009)

Table 7: Gonadosomatic Index of *A. gabonensis* and *M. felicinum*

Species	Mean	Minimum	Maximum
Atya gabonensis	0.33 ± 0.009^{b}	0.06	0.97
Macrobrachium felicinum	0.58 ± 0.041^{a}	0.03	2.46

Mean in the same column with different superscript differ significantly (P<0.05).

DISCUSSION

Atya gabonensis Males appear to be more in number than females while M. felicinum has more females than males. Ukagwu and Deekae (2016) reported similar observation of more females *M. felicinum* than males with the sex ratio of 1:2 (M: F) in Akor River, Ibere Ikwuano, Abia State. Similarly, a sex ratio of 1:2 (M: F) was established in *M. vollenhovenii* by Ukagwu and Deekae (2016); George and Rao (1967) in respect of *Penaeus. indicus*, *Metapenaeus dobsoni*, *Machrobrancium affinis* and *Parapenaeopsis stylifera*. These observations contradict the reports of (Menon, 1957 and Marioghae, 1982) in which the sex ratio was the same. In this study area, it is likely that more females of *M. felicinum* are prone or vulnerable to catch in nature than the males which migrate into deeper waters soon after spawning. According to Tawari-Fufeyin *et al*. (2005), sex ratios may not always be static, as they vary from season to season or from year to year within the same population.

Fecundity ranged from 4,300 - 8,600 and 230 - 69,782 for *A. gabonensis* and *M. felicinum* respectively. *Macrobrachium felicinum* seems to be more fecund than *A. gabonensis*. Fecundity of *A. gabonensis* is higher than the 950-27,700 reported by Obande *et al.* (2009). *Macrobrachium felicinum* had lower fecundity than that observed by New and Singholka (1982) (100,000 - 700, 000); but within the range reported by Rao (1998) (20,000 and 70,000) for *M. rosenbergii*. Ribeiro *et al*. (2012) reported about 7,200 per clutch for *M. amazonicum*. The result of fecundity of both species in this study is higher than that recorded for other members of the genus *Macrobrachium* by Coelho *et. al*. (1982); Ovie, (1986); Marioghae, (1987); Ribeiro *et. al*. (2012); Da Silva *et al*. (2004). The Fecundity/total length relationships show an increase in number of eggs with increasing female size; a similar situation was also observed by Albertoni *et al*. (2002) in *M. acanthurus*, Hart *et al.* (2003) in *M. felicinum* and Deekae and Abowei (2010) in *M. macrobrachion*. The increase of fecundity with body size seems to be a rule that is applicable to many crustaceans (Udo and Ekpe, 1991; Llodra *et al*. 2000).

Atya gabonensis had larger eggs than *M. felicinum*. Egg size has been shown to be an accurate measure of energetic investment both within and between caridean species (Clarke, 1993a). Large eggs in several invertebrate groups have been shown to produce larger, more competent larvae (Clarke, 1993a). Mashiko (1985) showed larger *Palaemon paucidens* eggs hatched into larger larvae, which survived longer and developed further under starvation conditions than smaller larvae. Thus, large eggs are likely to be more successful when food resources are limiting for larvae. The higher value of GSI of *M. felicinum* indicates more reproductive output than *A. gabonensis* in Makurdi.

CONCLUSION

Though both species proved to be good candidates for aquaculture due to availability of their seeds, relatively high fecundity and good reproductive output, *M. felicinum* was more fecund and had more reproductive output but smaller eggs.

REFERENCES

Albertoni, E., Palma-Silva, C. and Esteves, F. (2002). Fecundity of *Macrobrachium acanthurus* Eiegmann, 1836 (Decapoda: Palaemonidae) in a Tropical Coastal Lagoon Subjected to Human Impacts (Mace, Brazil). *Acta Limnologica Braziliensia*, 14(1): 71-80.

Adite, A., Abou, Y., Sossoukpe, E., Gbaguidi, M.H.A.G. and Fiogbé, E.D. (2013). Meristic and Morphological Characterization of the Freshwater Prawn, *Macrobrachium macrobrachion* (Herklots, 1851) from the Mono River-Coastal Lagoon System, Southern Benin (West Africa): Implications for Species Conservation. *International Journal of Biodiversity and Conservation*, **5**(11): 704-714.doi: 10.5897/IJBC2013.0622.

Anetekhai, M.A. (1986). Aspects of the bioecology of the African River prawn *(Macrobrachium vollenhovenii*) in Asejire Lake, Ph.D. Thesis submitted to University of Ibadan, pp. 225.

Coelho, P. A., Ramos-Porto, M., Barreto, A. V. and Costa, V. E. (1982b). Crescimento em viveiro de cultivo do camarão canela Macrobrachium amazonicum (Decapoda, Palaemonidae). *Revista Brasileira de Zoologia*. **1**(1): 45-49.

Da Silva, R. R., Sampaio, C. M. S. and Santos, J. A. (2004). Fecundity and Fertility of *Macrobrachium amazonicum* (Crustacea, Palaemonidae). *Brazillian Journal of Biology*, **64**(3A): 489-500.

Deekae S.N., J.F. Abowei. (2010). The Fecundity of *Macrobrachium macrobrachion* (Herklots, 1851) from Luubara Creek, Ogoni Land, Niger Delta, Nigeria. *International Journal of Animal and Veterinary Advances*, **2**(4): 148–154.

Hart, A.I., Ansa E. J. and Sekibo, I. (2003). Sex Ratio, Sexual Dimorphism and Fecundity in Pond Reared Niger River Prawn, *Macrobrachium felicinurn* (Ilolthuis, 1949). *The Zoologist*, **2**(l): 56-61.

FAO (2008) Fishstat Plus (v. **2.32**) issued 11.03.2008. FAO, Rome

Fernandez–Palacios, H.Q., Robaina, M.L. and Valencia, A. (1998). Combined Effect

of Dietry a–tocopherol and n–3 HUFA on Eggs Equality of Gilthead Sea Bream Brood Stock (*Sparus aurata*). *Aquaculture*, **161**:475–476.

George, M. J. and Rao, P. V. (1967). Distribution of Sex Ratios of Penaeid Prawns in the Trawl Fishery off Cochin. Proceedings on Symposium on Crustacea. *Journal of Marine Biology Association India*,**11**: 698– 700.

Llodra, E.R., P.A., Tyler, J.T. Copley. (2000). Reproductive biology of three caridean shrimp, *Rimicaris exoculata*, *Chorocaris chace*i and *Mirocaris fortunate* (Caridea: Decapoda), from Hydrothermal vents. *Journal of Marine Biological Association* UK, **80**: 473–484.

Marioghae, I.E. (1982). Notes on the biology and distribution of *M. vollenhovenii*, *M. macrobrachion* in the Lagos Lagoon. *Revue de Zoologie Africaines*, **96**(3): 493 - 508

. Marioghae, I.E. (1987). An appraisal of the cultivability of Nigerian palaemonid prawns. ARAC/87/WP/4. UNDP/FAO/NIOMR Lagos. Working Paper, pp: 12.

New, M. B. and Singholka, S. (1982). Freshwater prawn farming: Manual for the culture of Macrobrachium rosenbergii. FAO- Fisheries Technical Paper No., 225, 1982, 116.

Menon, M.K.(1957). Contribution on the biology of penaeid prawn of the south west coast of India. Sex ratio and movements. *Indian Journal of Fish*, **4** (1): 62–74.

Obaje, N. G. (2009). Geology and Mineral Resources of Nigeria, London: Springer Dordrecht Heidelberg, Pp5-14.

Ovie, S.O. (1986). The fecundity of *Macrobrachium macrobrachion* (Herklots, 1851) and the effect of salinity and food on the development of its larvae. M. Tech. Thesis, Aquaculture, Rivers State, University of Science and Tech/African. Regional. Aquaculture Centre, Port Harcourt Nigeria, pp: 54.

Powell, C. B. (1982). Fresh and brackish water prawns of economic importance in Niger Delta. In proceedings of 2nd Conference of Fisheries Society of Nigeria, Calabar, 22-24 Jan 1982, pp 254-285.

Rao, K.J. (1998). Emerging technology on the seed production of *Macrobrachium rosenbergii*: In Current and Emerging Trends in Aquaculture [Thomas, R.C. (ed.)]. New Delhi: Daya Publishing House, pp. 164-169.

Reed,W..(1967).Fisheries of Northern Nigeria. Ministry of Agriculture of Northern Nigeria.157pp.

Ribeiro, K., Franceschini-Vicentini, I.B., Papa, L.P., New, M.B. and Valenti, W.C. (2012). Effect of polyunsaturated fatty acids on the fecundity of the Amazon River prawn *Macrobrachium amazonicum* (Heller, 1862). *Aquaculture Research***, 43**(12): 1756-1763.

Tawari–Fufeyin, P., Ekaye, S.A. and Ogigirigi, U. (2005). Contribution to the biology of *Chrysichthys nigrodigitatus* (1803) in Ikpoba River, Benin City. Nigeria. *Journal of Agriculture, Forestry and Fisheries*, **6**(1): 19–23.

Udo, P. J. and Ekpe, E. D. (1991). Fecundity in the African river prawn *Macrobrachium vollenhovenii* (HERKLOTS, 1857) from natural habitats. *Journal of Aquaculture in the Tropics*, **6**: 173–177.

Ukagwu, J. I. and Deekae, S. (2016). Sex population structure of *Macrobrachium felicinum* and *Macrobrachium vollenhovenii* in the Akor river, Ibere Ikwuano, Abia State

Zabbey, N., Erondu, E. S. and Hart, A. I. (2010). Nigeria and the prospect of shrimp farming: critical issues. Livestock Research for Rural Development. Volume **22**, Article #198. Retrieved January 17, 2016, from http://www.lrrd.org/lrrd22/11/zabb22198.htm