

Aspects of the Biology of the Gabon Shrimp *Atya gabonensis*, Giebel 1875 in the Cross River, Nigeria

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Abstract: *Atya gabonensis* Giebel (Atyidae) is a freshwater shrimp endemic to West Africa. In the Cross River system, it inhabits the rocky bottom characteristic of the central to northern section of the Cross River. Its reproductive biology and feeding habits were studied from January to June 2006. The onset of spawning was indicated in March by the prevalence of soft-bodied specimens in catch samples. Fecundity of berried females varied with size and month. With a size range of 6.5-11 cm, fecundity varied from 850-12,220 eggs/female during the study period. The stomach content analysis revealed dominance of detritus, indicating that the species could have filtered organic particles from water column and/or near the usually rocky bottom. Conserving the natural habitats of this species, as well as exploring its aquaculture and aquarium potentials are imperative for the improved food-protein intake of the local communities in particular.

Key words: *Atya gabonensis*, freshwater shrimp, biology, communities, Cross River, Nigeria

INTRODUCTION

Atya gabonensis (Atyidae) is one of the freshwater shrimp species endemic to West Africa. First reported on Gabon, the species is now known to inhabit freshwater rivers and streams of rocky or non-rocky bottom type from Senegal to Gabon (Powell, 1982). It has been given several common names such as African Fan Shrimp, African Filter Shrimp, African Giant Shrimp, Vampire Shrimp, Blue Rhino Shrimp, Gabon Shrimp and Cameroon Fan Shrimp.

Within the central to northern sections of the Cross River, a separate seasonal fishery exists for the species, lasting from December to about June/July each year, depending on the onset and intensity of the rainy season. In Northern Nigeria, Reed (1967) reported that the species is harvested in small scale, while in the west of Nigeria (e.g., River Osse), Powell (1982) also noted that the species is caught with bamboo poles and artificial shelters. Obande and Kusemiju investigated the food and feeding of this species in Lower River Benue while Okayi and Iorkyaa (2004) studied its length-weight relationship in Mu River, Makurdi, Nigeria.

Studies on other members of the genus include the mating behaviour of *A. innocous* (Felgenhauer and Abele, 1982) and some aspects of reproduction of *A. margaritacea* in Pacific Mexico (Martinez-Mayen and Roman-Contreras, 2000). Powell (1982) included another species of this genus *Atya africana* for the study area but

his finding has yet to be confirmed. The present study is a contribution on feeding and some aspects of reproductive biology of the species in the Cross River system, Nigeria.

MATERIALS AND METHODS

The study area: Data for this study were collected at Itigidi situated by coast of central Cross River (Fig. 1). The Cross River has its origin from the Cameroon mountains, initially flowing westward into Nigeria then turning southward and emptying into the Atlantic, a distance of over 600 km. The central to northern segment of this river is characterized mainly by rocky bottom, different from the southerly section which is essentially muddy.

Collection and analysis of samples

Stomach content: A total of 343 stomachs collected from *A. gabonensis* at the study site (Fig. 1) from January to June 2006. The specimens were caught by artisanal fishermen who dive to the river bed, dipping hands in rock crevices, holes and around objects. These fishers rarely used bamboo traps or similar method for harvesting of the species. Specimens were transported to the lab in a cooler filled with ice bags to reduce posthumous digestion. Stomach content analysis was carried out following the frequency of occurrence method described by Hyslop (1980). Contents of cut stomachs

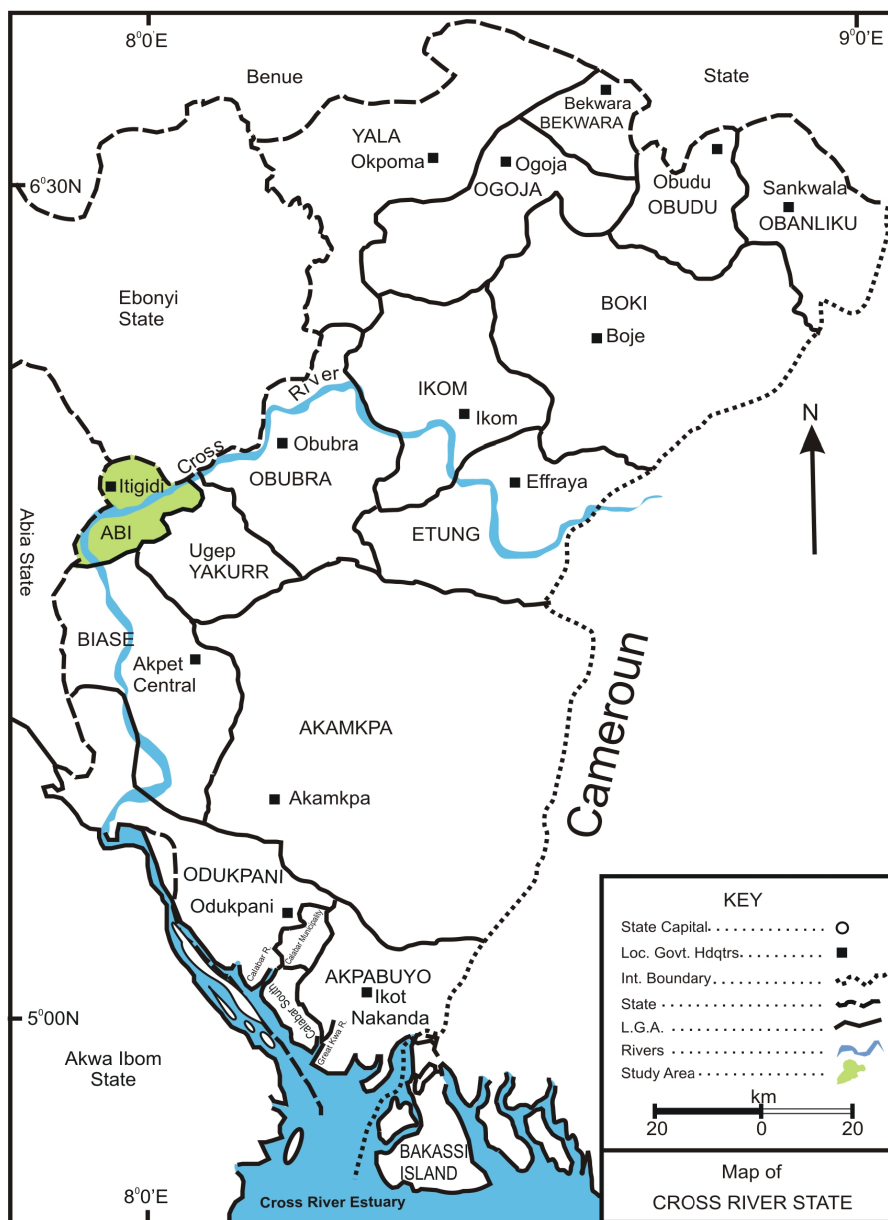


Fig. 1: Map of Cross River State showing the sampling site (Itigidi-shaded area)

were emptied into a petri-dish and examined using a contrast microscope (Model BM 62B) at $\times 10$ magnification. Samples were collected monthly for 6 months.

Fecundity estimation: Berried females were not observed in samples until April. This was preceded by occurrence of soft-bodied specimens in March samples. Sampling continued until June when diving method preferred by the local fishermen was considered dangerous as a result of rise in water levels of the Cross

River during rainy seasons. At the laboratory, eggs of each berried female were extracted onto an absorbent paper, weighed and placed in sampling bottles containing 4% formalin. Sub-samples of preserved eggs were counted using hand/magnifying lens (Bagenal and Braum, 1978). Three sub-samples were taken from each specimen and a mean was computed. Total number of eggs borne by each shrimp was then obtained by multiplying the average number of eggs by the weight of the egg mass from that specimen.

RESULTS AND DISCUSSION

Stomach contents analysis: The stomach contents of *A. gabonensis* with size range of 6.5-14 cm (total length) examined in this study constituted of detritus and mud throughout. Whereas, specimens ranging in size from 6.5-11.5 cm had only detritus, larger specimens of 12-14 cm had detritus and mud. No other food item was identified. Of the 343 stomachs examined, 12 (or 3.5%) were empty. Table 1 shows the result of the gut content analysis for different size groups.

Fecundity estimation: A total of 147 egg-carrying females were sampled from April to June 2006. While 18 (of 48) or 37.5% were sampled in April, 93 (of 112) or 83.04% and 36 (of 65) or 55.38% were sampled in May and June, respectively (Fig. 2). Figure 3 shows the relative importance of berried females during the sampling months. Peak of reproductive activity was in May. No berried female was observed in samples from January to March. However, 8 (of 25) or 32% sampled in March were soft-bodied.

Number of eggs (or fecundity) per unit specimen sampled varied with size of the specimen. Within a size range of 6.5-11 cm, fecundity range was 850-12,220. Table 2 shows the size range and corresponding number of eggs estimated. Felgenhauer and Abele (1982)

Table 1: Size groups and food items collected from *A. gabonensis* in the Cross River

Total length (cm)	Body weight (g)	Gut weight (g)	Food items
6.5	8.1	1.2	Detritus
7.0	12.1	1.9	-
7.5	12.0	1.6	-
8.0	16.4	2.6	-
8.5	21.2	5.3	-
9.0	24.5	3.4	-
9.5	31.8	4.6	-
10.0	36.7	4.4	-
10.5	30.3	6.7	-
11.0	50.0	5.8	-
11.5	51.5	6.6	-
12.0	58.7	7.2	Detritus and mud
12.5	58.0	6.2	-
13.0	66.0	9.1	-
13.5	52.1	9.3	-
14.0	60.3	9.0	-

Table 2: Relationship between size (total length in cm) and number of eggs in *A. gabonensis* females

Size range (TL cm)	Body weight (g)	Estimated number of eggs
6.5	8.8	850
7.0	12.9	3,818
7.5	11.0	2,767
8.5	18.0	4,298
9.0	22.3	5,146
9.5	30.1	9,889
10.0	32.2	10,296
11.0	41.3	12,220

observed that reproduction in *Atya margaritacea* was continuous based on the presence of ovigerous females in samples throughout the year. This observation contrasts from the situation of *A. gabonensis* in the present study where no ovigerous female was found in samples until April. However, their report of maximum reproductive period during the rainy season (June to October) is similar to findings in the present study. Peak of reproductive activity fell within the rainy season month of May. This result is however could not be conclusive since sampling was terminated in June when it became unsafe for the divers due to rise in water levels as the rainy season in the area intensified. It is considered probable that maximum reproductive period could lie within any of the other rainy season months not sampled. Besides the rise in water levels of the Cross River, heavier rains associated with this period is usually accompanied by massive runoff and flooding of rivers which decreased visibility and made fishing by the diving method difficult. Although, no berried female was encountered in samples

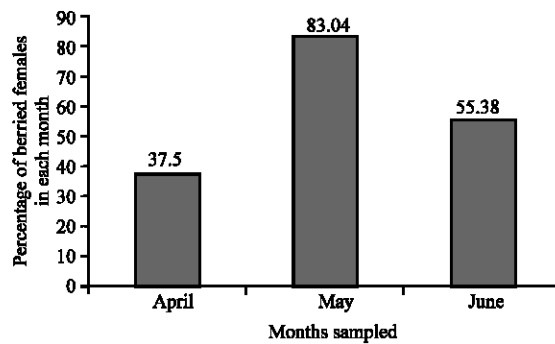


Fig. 2: Percentage of berried females in each monthly sample

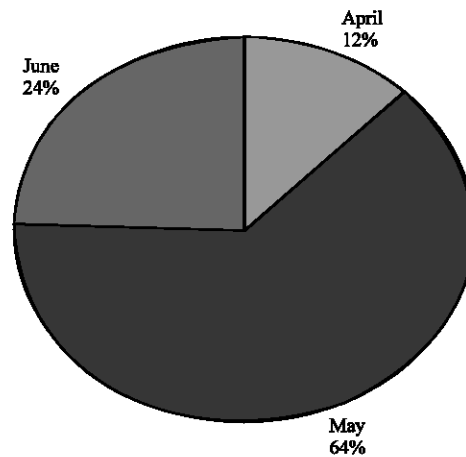


Fig. 3: Relative importance of berried females of *A. gabonensis* for each sampling month

until April, the occurrence of soft-bodied specimens in the preceding month (March) was considered as consistent with pre-reproduction moulting associated female shrimps. Most atyids are known to filter water column and also scrap substrate for food, an exception though is *A. abelei* from the Pacific slope of Panama which feeds by passive filtration only (Felgenhauer and Martin, 1983). Generally, prawns are said to be omnivorous, consuming anything from algae, aquatic insects and their larvae, mollusks, crustaceans and fish to detritus and mud (Kurian and Sebastian, 1982; New, 1990; Adetayo and Kusemiju, 1994; Khan *et al.*, 2001; Job and Nyong, 2004; Job, 2006).

The reports of these researchers indicated that most prawns/shrimps consume detritus at some stage in their life cycle. In fact, Obande and Kusemiju reported the occurrence of detritus in 79.1% of stomachs examined in *A. gabonensis* from the Benue River, algae and detritus forming the most important food items. However, only detritus and mud particles were observed in the present study. The possible explanation for the occurrence of only detritus and mud could be the fact that food preference for most species changes with season (availability) and size (suitability). Larger specimens (12-14 cm TL) consumed detritus and mud while in medium sized specimens (6.5-11.5 cm TL), only detritus was observed in stomachs examined. Environmental conditions of this habitat resulting in the abundance or scarcity of one food item or another could be responsible. However, this result is still open to further investigations.

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REFERENCES

- Adetayo, J.A. and K. Kusemiju, 1994. Some aspects of the biology of the pink shrimp, *Penaeus notialis* (Perez-Farfante), in the Lagos Lagoon, Nigeria. J. Sci. Res. Dev., 1: 80-84.
- Bagenal, T.B. and E. Braum, 1978. Eggs and Early Life History. In: Methods for Assessment of Fish Production in Fresh Water, Bagenal, T.B. (Ed.). Blackwell Scientific Publications, Oxford, pp: 165-201.
- Felgenhauer, B.E. and L.G. Abele, 1982. Aspects of mating behavior in the tropical freshwater shrimp *Atya innocous* (herbst). Biotropica, 14: 296-300.
- Felgenhauer, B.E. and J.W. Martin, 1983. *Atya abelei*, a new atyid shrimp (Crustacea, Decapoda, Atyidae) from the Pacific slope of Panama. Proc. Biol. Soc. Washington, 96: 333-338.
- Hyslop, E.J., 1980. Stomach content analysis-A review of methods and their application. J. Fish. Biol., 17: 411-429.
- Job, B.E. and E.A. Nyong, 2004. Diet composition and condition factor of the African River Prawn *Macrobrachium vollenhovenii* (Herklots, 1857) (Crustacea, Decapoda, Palaemonidae) of the Cross River Estuary, Nigeria. Afr. J. Fish. Aquacult., 4: 9-17.
- Job, B.E., 2006. Food, feeding ecology and condition index of Brackish River Prawn *Macrobrachium macrobrachion* (Herklots, 1851) (Crustacea, Decapoda, Palaemonidae) of the Cross River Estuary, South-Eastern Nigeria. Proceedings of the 21st Annual Conference of the Fisheries Society of Nigeria, Nov. 13-17, Calabar, Nigeria, pp: 137-143.
- Khan, R.A., N. Aravindan and A. Kalavat, 2001. Distribution of two post-larvae species of commercial prawns (*Fenneropenaeus indicus* and *Penaeus monodon*) in a coastal tropical estuary. J. Aquat. Sci., 16: 99-104.
- Kurian, C.V. and A. Sebastian, 1982. Prawns and Prawn Fisheries of India. Hindustan Publishing, India, pp: 286.
- Martinez-Mayen, M. and R. Roman-Contreras, 2000. Aspects of the reproduction of *Atya margaritacea* A. Milne-Edwards, 1864 (Decapoda, Atyidae) in a population from the Mexican pacific. Crustaceana, 73: 913-923.
- New, M.B., 1990. Freshwater prawn culture: A review. Aquaculture, 88: 99-144.
- Okayi, G. and A. Iorkyaa, 2004. Length-weight relationship and condition of freshwater shrimps *Atya gabonensis* and *Macrobrachium felicimum* from the Mu River, Makurdi, Nigeria. Anim. Res. Int., 1: 153-154.
- Powell, C.B., 1982. Fresh and brackish water prawns of economic importance in Niger-Delta. Proceedings of the 2nd Annual Conference of the Fisheries Society of Nigeria, Jan. 25-27, Calabar, Nigeria, pp: 254-285.
- Reed, W., 1967. Fisheries of Northern Nigeria. Ministry of Agriculture, Northern Nigeria, pp: 157.