International Scholars Journals

Advances in Aquaculture and Fisheries Management ISSN: 9424-2933 Vol. 7 (6), pp. 001-006, June, 2019. Available online at www.internationalscholarsjournals.org © International Scholars Journals



*Full Length Research Paper*

# Analysis of the stomach content of African river prawn (*Macrobrachium vollenhovenii*) in Epe Lagoon, Nigeria

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Accepted 25 April, 2019

**The study investigated the stomach contents of *Macrobrachium vollenhovenii* from the commercial artisanal catches in Epe Lagoon in Lagos, southwest Nigeria from July to October 2008 and April to May 2009. The stomach analysis was carried out using frequency of occurrence and numeric methods. It was observed that the prawn fed on a variety of plankton species, which included chlorophyta, euglenophyta, xantophyta, chrysophyta, cladocera, copepoda, protozoa, dinoflagellate, diatoms, insect parts and unidentified food items, with chlorophyta and diatoms forming the most important food items. Chlorophyta constituted 32.00% by number and 83.62% by occurrence, diatoms constituted 31.55% by number and 65.09% by occurrence. Amongst the chlorophyta, *Cosmarium granatum* was the most preferred, constituting 7.93% by number and 17.67% by occurrence, followed by *Ankistrodemus falcatus* with 7.57% by number and 16.38% by occurrence, respectively. The least eaten food item was insect parts. The results indicated that M. vollenhovenii can be considered as an omnivorous detritivore.**

**Key words:** Feeding habits, *Macrobrachium vollenhovenii*, Epe Lagoon.

## INTRODUCTION

Freshwater prawns of the genus Macrobrachium are decapod crustaceans belonging to the family Palaemonidae. The palaemonids and penaeids have been globally identified as foremost in terms of economic importance and possibility of recruitment into aquaculture. *Macrobrachium* species are found in most inland freshwater areas including ponds, lakes, rivers and irrigation ditches, as well as in estuarine areas (New, 2002). These prawns occur throughout the West African region; however, of the about 200 species that make up the genus, four (4) species have been reported in Nigeria. These are *Macrobrachium vollenhovenii* (African river prawn), *Macrobrachium macrobrachion* (brackish water prawn), *Macrobrachium felicinum* (Niger river prawn) and *Macrobrachium* dux (Congo river prawn), with *M. vollenhovenii* and *M. macrobrachion* being the two largest species. These two species have been described to posses the highest commercial potential (Ajuzie and Fagade, 1992). *M. vollenhovenii* in addition to its wide distribution is also one of the largest species of Macrobrachium known (New, 2002). The African river prawn is a hardy prawn in many ways; it thrives in murky waters and will survive in water with dissolved oxygen as low as one part per million while Marioghae (1982) reported its capture from water with natural salinities of 19‰.

Consequent upon the aquaculture potential of this prawn, there is the need to provide information on its food and feeding habits. According to Wootton (1992), food and feeding habits are indispensable part of biological and taxonomic studies because it is an essential function of an organism as growth, development and reproduction are all dependent on energy that enters in the form of food. Prawns are known to feed on a wide variety of small epibenthic animals, especially polychaetes, molluscs and other crustaceans. This study therefore provides information on the food and feeding habits of the African river prawn, *M. vollenhovenii*.

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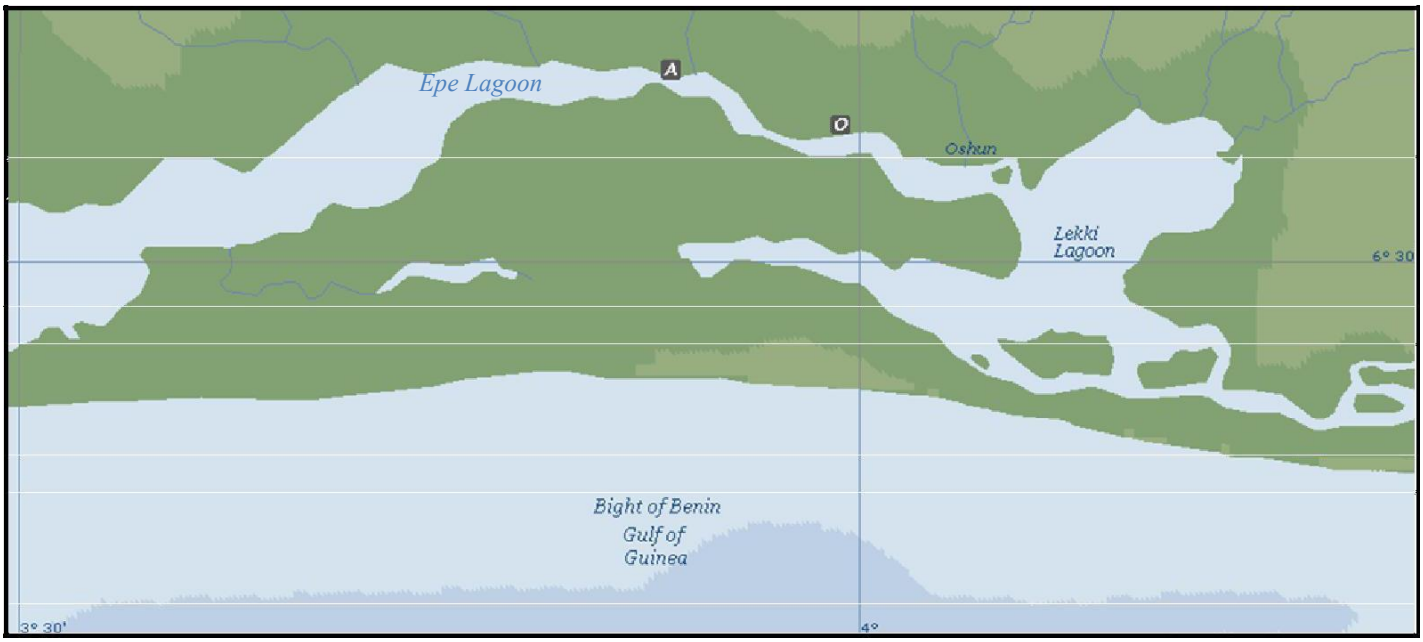


**Figure 1.** Map of Epe Lagoon showing sampling stations (A – Ajegbende, O – Oluwo Market).

## MATERIALS AND METHODS

### Sample collection

The specimens of *M*. *vollenhovenii* (n = 240) used in this study were obtained from the commercial artisanal catches at two stations, Ajegbende and Oluwo market along the Epe Lagoon. These are major prawn landing stations in Epe Town, southwest Nigeria. Epe Lagoon (Figure 1) which lies between longitude 3°30′ and 4°05′E and between latitudes 6°29′ and 6°38′N is fed by River Oshun. With a surface area of about 225 $km^2$ and a maximum depth of 6 m, the lagoon is sandwiched between the Lagos and Lekki lagoons. However, a large area of the lagoon is relatively shallow with a minimum depth of 1 m, and the vegetation surrounding the Lagoon is of the mangrove swampy type (Balogun, 1987).

The lagoon opens into the Gulf of Guinea via the Lagos Harbour. The prawns were caught mainly with beach seine and basket traps, and hand- pushed trap nets as by-catches. The cone-shaped basket trap used for harvesting the prawns is made from bamboo plants, with two non-return valve mechanisms at the centre of the trap. It has a total length and opening aperture of about 1 and 0.3 m respectively. Coconut and fresh palm oil fruits are used as baits to catch the prawns. The specimens of *M*. *vollenhovenii* were kept in ice chests before being taken to the laboratory and examined immediately or kept in a deep freezer (-20°C) to reduce posthumous digestion. Sampling was carried out once a month for each of the stations for six months, July to October 2008 and April to May 2009. No sampling was carried out from November to March because prawns were relatively scarce during these periods. In the laboratory, the total length, TL (measured between tip of rostrum and tip of telson) of the prawn was measured with a metre rule to the nearest 0.1 cm, while the body weight was measured, to the nearest 0.01 g with a top-loading Mettler balance (Model PE 1600). For the food and feeding habit studies, the stomachs of collected prawns were dissected out with the contents washed into a Petri dish and examined under a binocular microscope (x100 magnification). The analysis of the stomach contents was carried out by both frequency of occurrence and numerical methods as described by Hyslop (1980). Various diet components were identified and enumerated with a Sedgjwick Rafter Counting Chamber and are categorized into algae, insect parts, unidentified organisms and sand grains. The respective guts were matched with the prawn being examined based on the methods employed by Marioghae (1982).

## RESULTS

A total of 240 stomachs of *M*. *vollenhovenii* were examined, out of which 8 had empty gut. Table 1 shows the variety of food items found in the stomach of *M*. *vollenhovenii*, with plankton being the major food item. The plankton found in the stomach of *M*. *vollenhovenii* included chlorophyta (green algae), euglenophyta, xantophyta, chrysophyta cladocera, copepoda, protozoa, dinoflagellate and diatoms (brown algae). Insect parts, unidentified organisms and sand grains were also encountered. Using the numerical analysis, amongst the chlorophyta, *Cosmarium granatum* made up 7.93%, and this was followed by *Ankiostrodemus falcatus* which accounted for 7.57%. The corresponding values for the frequency of occurrence estimates were 17.67 and 16.38% respectively. The least eaten chlorophyta species were *Chodatella brevista*, *Clostridium strigosum*, *Asteriococcus limneticus* and *Tetradesmus wisconinensis* . The numerical analysis showed that, amongst the diatoms, *Surirella robusta*, *Melanosira varians* and *Melanosira listans* constituted 12.07, 8.61 and 4.24% respectively, with the frequency of occurrence estimates being 19.40, 17.24 and 15.52%. The least eat-en diatoms were *Nitzchia closterium* and *Stephanodiscus hantzschii.*

**Table 1.** Analysis of the stomach contents of *M. vollenhovenii* from Epe Lagoon, southwest Nigeria.

| Food items | Species | Numerical method Number | % | Occurrence method Number | % |
|---|---|---|---|---|---|
| Chlorophyta | *Chlamydomonas atactogama* | 62 | 2.02 | 15 | 6.47 |
| | C. *ehrenbergii* | 103 | 3.36 | 33 | 14.22 |
| | *Heteromastrix angulata* | 41 | 1.34 | 11 | 4.74 |
| | *Ankistrodemus falcatus* | 232 | 7.57 | 38 | 16.38 |
| | *Cosmarium granatum* | 243 | 7.93 | 41 | 17.67 |
| | *Clostridium strigosum* | 24 | 0.78 | 3 | 1.29 |
| | *Tetradesmus wisconinensis* | 14 | 0.46 | 1 | 0.43 |
| | *Tetraedon victoriae* | 64 | 2.09 | 6 | 2.59 |
| | *Staurastum paradoxum* | 74 | 2.41 | 15 | 6.47 |
| | *Chodatella brevista* | 36 | 1.17 | 4 | 1.72 |
| | *Asteriococcus limneticus* | 19 | 0.62 | 2 | 0.86 |
| | *Hyalotheca dissiliens* | 69 | 2.25 | 25 | 10.78 |
| Euglenophyta | *Euglena tripteris* | 50 | 1.63 | 4 | 1.72 |
| | *E. vorax* | 41 | 1.34 | 13 | 5.60 |
| | *E. sanguinea* | 35 | 1.14 | 8 | 3.45 |
| Xantophyta | *Tribonema minus* | 45 | 1.47 | 18 | 7.76 |
| | *T. viride* | 34 | 1.11 | 15 | 6.47 |
| Chrysophyta | *Mallomonas caudata* | 121 | 3.95 | 21 | 9.05 |
| | *Uroglenopsis botrys* | 59 | 1.92 | 21 | 9.05 |
| | *Chrysamoeba radians* | 53 | 1.73 | 6 | 2.59 |
| Cladocera | *Sida crystallina* | 62 | 2.02 | 11 | 4.74 |
| | *Ceriodaphnia setose* | 58 | 1.89 | 11 | 4.74 |
| Copepoda | *Neutrodiaptomus tungkwanensis* | 38 | 1.24 | 16 | 6.90 |
| Protozoa | *Arcella arenaria* | 128 | 4.18 | 42 | 18.10 |
| Dinoflagellate | *Cryptomona obovata* | 59 | 1.92 | 5 | 2.15 |
| Diatoms | *Melosira varians* | 264 | 8.61 | 40 | 17.24 |
| | *Melosira listans* | 130 | 4.24 | 36 | 15.52 |
| | *Nitzchia sigmoidea* | 69 | 2.25 | 8 | 3.45 |
| | *N. closterium* | 29 | 0.95 | 4 | 1.72 |
| | *Stephanodiscus hantzchii* | 44 | 1.44 | 11 | 4.74 |
| | *Surirella robusta* | 370 | 12.07 | 45 | 19.40 |
| | *Cocconeis diminuta* | 61 | 1.99 | 7 | 3.02 |
| Insect parts | | 85 | 2.77 | 18 | 7.76 |
| Unidentified organisms | | 156 | 5.09 | 35 | 15.09 |
| Sand grains | | 93 | 3.03 | 21 | 9.06 |

Insect parts and the unidentified food items accounted for 2.77 and 5.09% by number respectively, and occurred in 7.76 and 15.09% of the stomachs examined.

Chlorophyta and diatoms constituted the most important food items occurring in every stomach examined. Chlorophyta and diatoms formed the major constituents of the stomach constituting about 32.00 and 31.55% of food items by number (Figure 2) and 83.62 and 65.09% by occurrence, respectively (Figure 3). The least eaten food item was insect parts, which constituted 2.77% by number and 7.76% by occurrence. The guts were found to contain food items in association with sand grains which constituted 3.03% by number and 9.06% by occurrence. Also observed were unidentified organisms, which probably were part of the detritus matter or undigested food item.

## DISCUSSION

The knowledge of the diet of a species in nature is important for the establishment of its nutritional needs and of its interaction with other organisms (Albertoni et al., 2003), and decapod crustaceans have been described as opportunistic omnivores, taking their food from the bottom of their habitats or from the fauna associated with submerged and shore vegetation in the

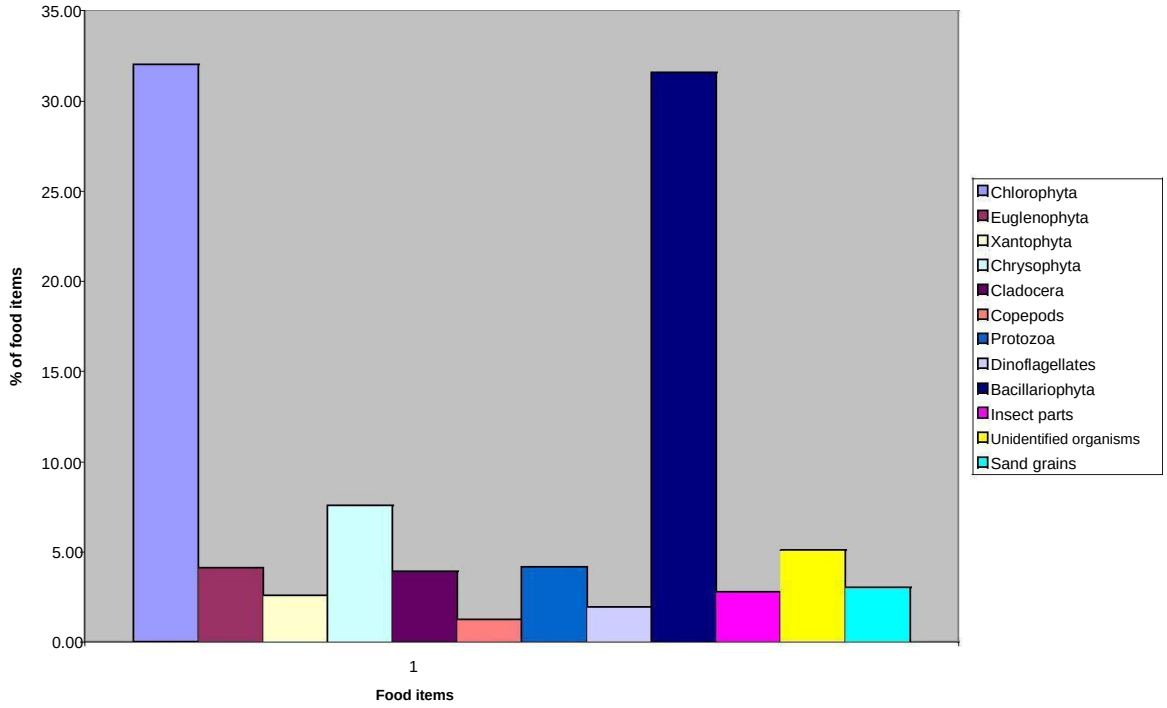


**Figure 2.** Numerical distribution of food items in the stomach of *M. vollenhovenii* from Epe Lagoon, southwest Nigeria.

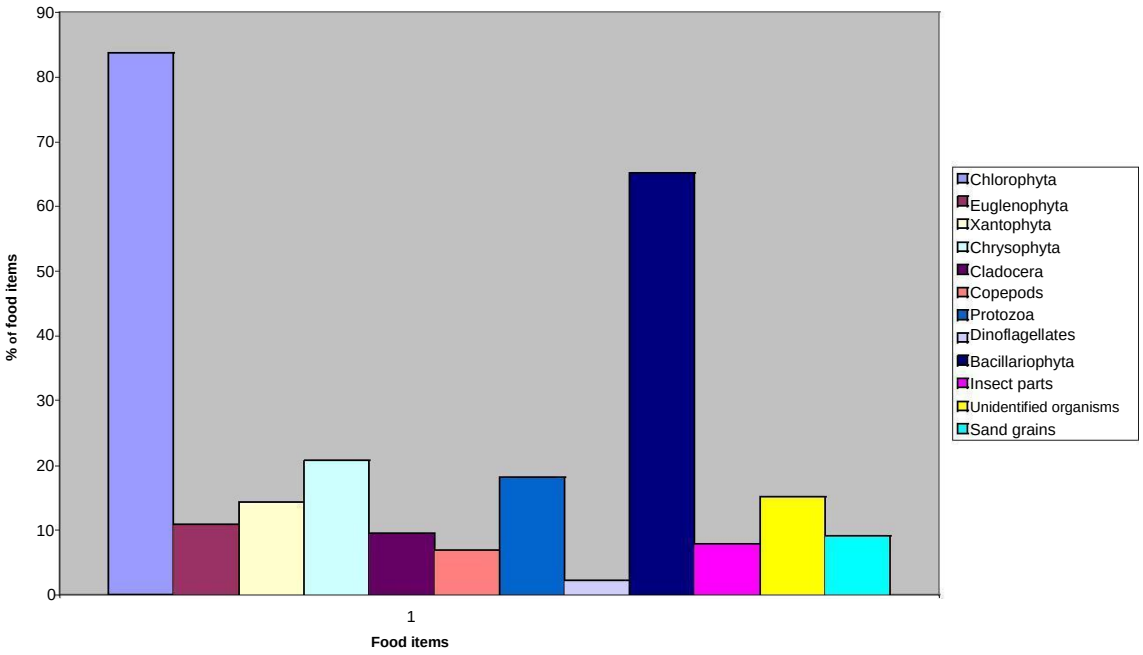


**Figure 3.** Frequency of occurrence distribution of food items in the stomach of *M. vollenhovenii* from Epe Lagoon, southwest Nigeria.

water bodies (Williams, 1981). The analysis of the gut contents of *M. vollenhovenii* revealed that, though the prawn feeds on a wide variety of food items, it showed preference for algae. This observation agrees with Lee et al. (1980), Murthy and Rajagopal (1990), Roy and Singh (1997), Collins and Paggi (1998), Albertoni et al. (2003)

and Sharma and Subba (2005) who reported that the prawns *Macrobrachium* sp. were omnivorous and that their diet included algae, detritus, insect parts, plant parts and other animals. Most aquatic animal species appear to be opportunistic feeders, consuming a large diversity of prey (Cortes, 1999), and results from this study indicate that the African river prawns are non-selective opportunistic feeders and their diets include a diverse species spectrum of plankton, but with chlorophyta and bacillariophyta (diatoms) being the dominant food items. The animal appears to feed on the available edible plankton in its environment.

Abby- Kalio (1990) also reported that penaeid prawns are not selective in their feeding. Bello- Olusoji et al. (1995) observed that the bigger-sized *M. vollenhovenii* (7.8 cm and above) feed on a wide variety of organisms, both plants and animals, with polychaetes, small crustaceans and fish remains accounting for more than 40.85%. The gut contained various forms of food items which included zooplankton, phytoplankton and animal matter, and this agrees with what was observed by Bello-Olusoji et al. (1995) that the prawn can function as a primary consumer, secondary consumer and detritivore in the aquatic system, and hence be classified as an omnivore. However, it was observed that plant matter was more common than animal matter in the gut contents of *M. vollenhovenii*. The possible reason could be that animal tissues are digested relatively faster and that the animal observed in the gut actually represented undigested leftovers (Roy and Singh, 1997) . Sand grains (3.03%) were also encountered in the guts of *M. vollenhovenii*, and the presence of these sand particles in the gut of the prawn might be considered as incidental and associated with the bottom substratum to which some algal species are attached.

It was observed that 96.67% of the prawns examined had food in their stomach while 3.33% had empty stomachs. The low proportion of empty stomachs may suggest that the periods of feeding were short, followed by longer periods of rapid digestion. This may also suggest that, the prawns feed intermittently and/or have a high rate of digestion. Other reasons for this may be that during handling and transportation, some food items may be quickly or partly digested, thus making identification difficult. Moreover, with high rates of digestion, some food particles may be difficult to observe or identify, if the prawns have been caught in the traps for several hours, since digestion during this time could also reduce stomach fullness. Prawns collected during the rainy period especially at the peak of the rainy season (July to October) were observed to have fuller gut contents than collections made during the dry season (April to May), and this might be attributed to more food availability during the rainy season than the dry season. According to Anetekhai (1986), feeding intensity was higher during the rainy season than the dry season. Moreover, another possible reason for the fuller guts during the rainy season could be that, as a result of the heavy and incessant rains, there is a lot of nutrient upwelling and washing of the substratum into the water bodies by run-off, all resulting in increased availability of food for the prawns.

## Conclusion

From the results of the qualitative analysis of the stomach contents using the frequency of occurrence and numerical methods, it shows that *M. vollenhovenii* exhibits various feeding habits; this was also observed for *Macrobrachium rosenbergii* (Klimley, 1994). Hence, *M. vollenhovenii* may be considered as euryphagous; feeding on any food item it could readily come across particularly when food is not in abundance. This is particularly important for the culture of this organism. *M. vollenhovenii* has been reported to possess high commercial aquaculture potential, but this is yet to be realized in Nigeria. Data on stomach composition of fish is vital in providing models of stomach content dynamics (Palmores et al., 1997), and with the knowledge of the feeding habits of *M. vollenhovenii* from this study, it should be possible to formulate artificial diets necessary for the mass production of this organism. This will help to meet local demands and possibly generate foreign exchange for the country.

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