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# GUT CONTENTS AND FEEDING PATTERN OF *Macrobrachium vollenhovenii* (HERKLOTS, 1857) AND *Caridina africana* (KINGSLEY, 1882) AT ASEJIRE LAKE AND ERIN-IJESA WATERFALLS SOUTHWEST NIGERIA.

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## ABSTRACT
A study with intent towards acculturation was carried out on the gut contents and feeding patterns of *Macrobrachium vollenhovenii* and *Caridina africana* occurring at Asejire lake and Erin-Ijesa Waterfalls respectively for two years using numerical abundance and frequency of occurrence methods of analysis. There was a strong correlation ($p<0.05$) between prawn abundance and food availability. The gut content analysis of *M. vollenhovenii* revealed that juveniles were predominantly zooplanktivorous feeding on copepods and rotifers while the adults were omnivorous utilizing a wider variety of animal foods than plant materials. This changing of diets and patterns as the species advances in age has an implication for its culture potentials. Stomach fullness index was high during the wet season which coincided with high abundance of prawns. *C. africana* fed mainly on diatoms, zooplankton and other micro-phytoplankton, thus an omnivore with herbivorous tendency. The availability of both species in fresh water bodies and their foods revealed that both species can be cultured in earthen ponds since their unspecialized flexible dietary habit is an optimal strategy for sustained productivity.
**Keywords; *Macrobrachium vollenhovenii, Caridina africana*, gut content, acculturation, Asejire lake, Erin-Ijesa Waterfalls, feeding patterns**

## INTRODUCTION
There are large varieties of prawns and shrimps which inhabit water bodies of Nigeria. The African prawn, *Macrobrachium vollenhovenii* is found in inland freshwater rivers, lakes and brackish system (Bello-Olusoji, 1997) while *Caridina africana* which is commonly called Africa rocky prawn co-exists with *Macrobrachium* in freshwater system especially in rocky micro-habitats. *M. vollenhovenii* has been identified as the most suitable species for aquaculture in Nigeria because of its large size (Powell, 1982) while *C. africana* is yet to be recognised in literature as a potential candidate for culturing probably because of its tiny size (Oyekanmi, 2011). Like any other aquatic macro-invertebrates, nature offers a great diversity of organisms that are used as food by prawns and these differ in sizes and taxonomic group. The natural food of freshwater prawns is vegetable wastes, plankton, dead fishes, insect larvae, small worms and micro organisms (Arrignon *et. al.*, 1994). Also, Bello-Olusoji *et al* (2006) reported that prawns are zooplankton feeders with copepods and rotifers constituting the highest percentage of occurrence in their stomach. In Asejire Lake and Erin-Ijesa Waterfalls, Omoniyi *et al* (2012) have reported the abundance of the two prawn species where they support thriving fisheries, hence their acculturation is quite feasible. Brown(1993) reported that development of viable prawn farming requires effective feeding strategy which can be obtained through the knowledge of the food and feeding patterns in their natural habitats. Therefore, this study was carried out on the food and feeding patterns in juveniles and adults *M. vollenhovenii* and *C. africana* obtained from Asejire lake and Erin-Ijesa waterfalls respectively.

## MATERIALS AND METHODS
Asejire Lake and Erin-Ijesa Waterfalls are located in Osun State, Nigeria. Asejire Lake is man-made, constructed on River Osun to provide portable water for Ibadan city and its environs. The lake lies on latitude

7°23' North and Longitude 4°05' East. It has gross storage capacity of 7.403 million litres (pers. comm.). Erin-

Ijesa Waterfalls is located in Oriade Local Government Area of Osun State within latitudes 7°30' and 8°45'

North and longitudes 4°31' and 5°00' East. The Waterfalls which the inhabitants named 'Olumirin' have seven

layers and prawns were found abundant in the first, third and fifth layers. The water flows among the rocks and splashes down with great forces to the evergreen vegetation. The whole scenery is fascinating and ideal for mountain hiking, tourism and recreation. (Figures 1&2)

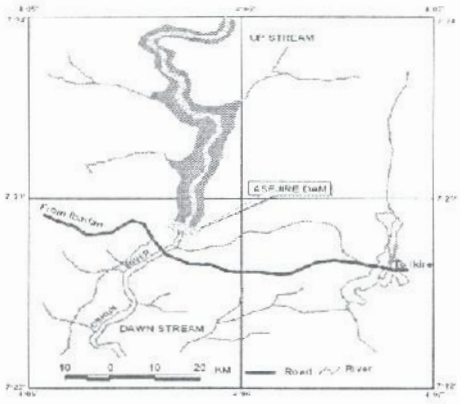


Figure 1. Map Showing Asejire Lake

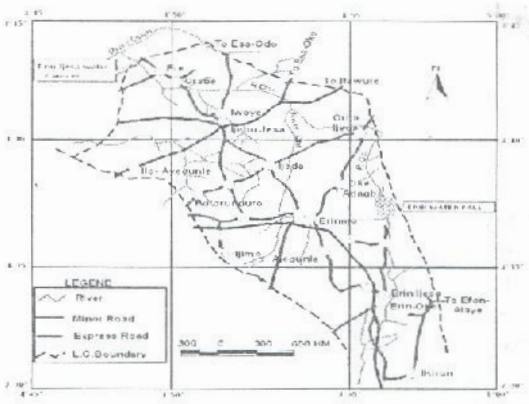


Figure 2. Map showing Erin-Ijesa Waterfall

Sample collection

The prawns were collected twice a month at each of the two study sites for 2 years using baited traps at Asejire lake while plankton and hand nets were used to collect *C. africana* at Erin-Ijesa Waterfalls. The specimens were randomly selected and transported in ice-chest boxes in order to reduce post-mortem digestion to minimum. In the laboratory, the prawns were counted, sorted and identified based on taxonomic keys prepared by Lowe-McConnell (1972). The weight of each prawn was measured to the nearest 0.1g using a top load weighing Mettler balance Model 2000 before the gut was dissected and the entire gut was emptied into petri-dish. Stomachs containing food were size classified according to a table of Olatunde (1978). The content of each stomach was weighed after being placed on a pile of filter papers that soaked away most of the moisture content. The contents of all stomachs were examined immediately or preserved in 4% neutral formalin for a later analysis. Fractions of food content placed on glass slides were observed under varying magnifications of the microscope. The food items were identified based on keys of Jeje and Fernando (1986). Frequency of occurrence and numerical abundance methods as described by Hyslop (1980) were used to analyse the dietary items in the stomachs. Occasionally, some food items were observed crushed and others at varying stages of digestion, hence were enumerated as unidentifiable food items. The periodicity of feeding in juvenile and adult prawns was investigated as well.

## RESULTS AND DISCUSSION

A total of 1530 specimens of *M. vollenhovenii* and 832 *C. africana* were examined. Food occurred fully in almost all the guts but the degree of stomach fullness varied from 1/4 to 4/4 as earlier expressed by Oyekanmi (2011). As revealed in Table 1, only 10% and 9.01% of *M vollenhovenii* and *C. africana* had empty stomachs respectively suggesting that food was available and hence the prawns took to continuous feeding in the habitats. Table 1 also reveals the monthly or seasonal variations in feeding habits of the two species where an increase in the stomach fullness was observed during the wet season and a decrease in the dry season. This could be explained by steady dwindling of food resources in the habitats that were continually decreasing in volumes with the onset of dry season. The months of intensive feeding was during the wet season when rains present a wide variety and abundance of food resources due to high dietary composition of the runoff from land promoting plankton, aquatic plant growth and insect larvae. The summary of food items found in the gut of *M. vollenhovenii* is shown in Table 2, while the dietary items in the gut of *C. africana* are presented in Table 3. In general, the food items found in the gut of these prawns suggested that they are euryphagous (i.e. feeding on a wide range of organisms). The juveniles of *M. vollenhovenii* were more of zooplanktonic feeders than the adults because the rotifers and copepods contributed the highest percentage of occurrence in the diet. The adult *M. vollenhovenii* consumed the algae category which include green and blue-green as well as diatoms in addition to the other animal plankton, invertebrates and plants. The wide spectrum of food items in adult prawns could classify it as omnivorous feeder with more of animal food than plant materials. Bello-Olusoji *et. al.* (2006) had described palaemonid prawns as non-selective feeders. As shown in Table 3, *C. africana* exhibited nearly similar feeding pattern as *M. vollenhovenii*. However, the food preference of juvenile and adult *C. africana* did not show a marked pattern but their feeding range covered more of microscopic plant dietary items than the animal items. Hence *C. africana* can be classified as omnivore with herbivorous tendency in Erin-Ijesa

Waterfalls. Unidentified organic materials contributed substantially to the diet of the species in this habitat. Bello-Olusoji *et. al.* (1995) made a similar observation when they reported detritus or scavenger nature of *M. vollenhovenii* in brackish systems.

Table 1. Average Monthly changes in the number of empty stomach of *Macrobrachium vollenhovenii* and *Caridina africana*

| *M. vollenhovenii* | | | | *C. Africana* | | |
|---|---|---|---|---|---|---|
| Months | Number of specimen examined | Number with empty stomach | % Empty stomach | Number of specimen examined | Number with empty stomach | % Empty stomach |
| January | 103 | 20 | 19.42 | 48 | 9 | 18.75 |
| February | 93 | 16 | 17.20 | 46 | 9 | 19.57 |
| March | 99 | 16 | 16.16 | 50 | 7 | 14.00 |
| April | 119 | 14 | 11.76 | 62 | 5 | 8.06 |
| May | 157 | 7 | 4.46 | 73 | 5 | 6.85 |
| June | 178 | 4 | 2.25 | 92 | 4 | 4.35 |
| July | 167 | 4 | 2.40 | 100 | 4 | 4.00 |
| August | 161 | 4 | 2.48 | 97 | 7 | 7.22 |
| September | 135 | 10 | 7.41 | 102 | 5 | 4.90 |
| October | 95 | 20 | 21.05 | 63 | 4 | 6.35 |
| November | 113 | 21 | 18.58 | 48 | 7 | 14.58 |
| December | 110 | 17 | 15.45 | 51 | 9 | 17.65 |
| Total | 1530 | 153 | 10.00 | 832 | 75 | 9.01 |

Table 2. Frequency of occurrence and numerical abundance in diet composition in the gut of *Macrobrachium vollenhovenii* in Asejire Lake.

| GROUP OF DIETARY ITEMS | ABUNDANCE Adult | | Juvenile | | Total | | FREQUENCY OF OCCURRENCE Adult | | Juvenile | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | Stomach Number | % | Stomach Number | % |
| Blue-Green Algae | 1280 | 12.8 | 376 | 7.4 | 1656 | 11.3 | 335 | 28.4 | 124 | 25.5 |
| Green Algae | 1388 | 13.9 | 800 | 15.9 | 2188 | 14.8 | 621 | 52.6 | 208 | 42.1 |
| Diatoms | 513 | 5.1 | 328 | 6.5 | 841 | 5.7 | 59 | 5.0 | 51 | 10.2 |
| Protozoa | 1007 | 10.0 | 707 | 14.1 | 1714 | 11.6 | 637 | 54.0 | 190 | 38.4 |
| Rotifers | 1496 | 14.9 | 903 | 18.0 | 2399 | 16.3 | 720 | 61.2 | 288 | 58.1 |
| Copepods | 1672 | 16.7 | 864 | 17.2 | 2536 | 17.2 | 673 | 57.3 | 364 | 73.5 |
| Amphipods | 784 | 7.8 | 344 | 6.9 | 1128 | 7.7 | 544 | 46.1 | 140 | 28.2 |
| Cladocera | 928 | 9.3 | 593 | 11.8 | 1521 | 8.8 | 448 | 37.9 | 209 | 42.2 |
| Fish Remains | 198 | 1.9 | - | - | 198 | 1.4 | 473 | 40.1 | - | - |
| Unidentifiable materials | 760 | 7.6 | 106 | 2.2 | 866 | 5.2 | 336 | 28.5 | 63 | 12.7 |

Table 3. Frequency of occurrence and numerical abundance in diet composition in the gut of *Caridina africana* in Erin-Ijesa Waterfalls.

| GROUP OF DIETARY ITEMS | ABUNDANCE Adult | | Juvenile | | Total | | FREQUENCY OF OCCURRENCE Adult | | Juvenile | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | Stomach Number | % | Stomach Number | % |
| Blue-Green Algae | 85 | 16.2 | 25 | 6.3 | 110 | 11.3 | 90 | 9.5 | 60 | 7.6 |
| Green Algae | 92 | 17.6 | 32 | 8.1 | 124 | 14.8 | 64 | 6.8 | 48 | 6.1 |
| Diatoms | 24 | 4.6 | 18 | 4.6 | 42 | 5.7 | 28 | 2.7 | 34 | 4.3 |
| Protozoa | 52 | 9.96 | 33 | 8.4 | 85 | 11.6 | 150 | 15.9 | 120 | 15.2 |
| Rotifers | 61 | 11.69 | 49 | 12.5 | 110 | 16.3 | 72 | 7.6 | 80 | 10.1 |
| Copepods | 71 | 13.60 | 52 | 13.2 | 123 | 17.2 | 30 | 3.2 | - | - |
| Amphipods | 38 | 7.28 | 35 | 8.9 | 73 | 7.7 | 80 | 8.5 | 185 | 23.4 |
| Cladocera | 36 | 6.9 | 60 | 15.3 | 96 | 8.8 | 50 | 5.3 | 62 | 7.9 |
| Unidentifiable materials | 63 | 12.1 | 88 | 22.4 | 151 | 5.2 | 185 | 19.6 | 188 | 23.8 |

Periodicity of feeding in *M. vollenhovenii* during the study revealed that the species was active at night hours because more prawns were caught in the baited traps when retrieved in the morning compared with evening retrieval of traps. This observation suggested that the species is nocturnal and a night feeder that is active at searching for food but it hides during the daytime. Periodicity of feeding could not be monitored in *C. africana* as there was yet to be a trap designed for its small size and the habitat terrified the scientists to monitor at nights with hand or plankton nets. However, more specimens were caught in cloudy days of wet season during the day time suggesting that the species also hides from sharp day light.

## CONCLUSION

The study of food and feeding pattern of a species in its natural habitat is of practical importance especially towards its viable farming programme. This study revealed that both species are omnivorous in feeding habits because they consume both microscopic plant and animal materials as food in their respective habitats. The adult prawns of both species were non-selective feeders though *C.africana* showed tendency to be more herbivorous than *M. vollenhovenii*. The two species were identified to be acculturable as far as their feeding patterns are concerned even in a polyculture system since only minimal inclusion of expensive animal protein would be required in their feeds. *M. vollenhovenii* has been established as a promising candidate for commercial culture.

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