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FOOD, FEEDING HABITS AND CONDITION FACTORS OF *Macrobranchium vollenhovenii* IN CROSS RIVER BASIN (NDIBE BEACH) AFIKPO, EBONYI STATE, NIGERIA

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ABSTRACT

A total of one hundred and three (103) prawn (*Macrobranchium vollenhovenii*) samples were collected from Ndibe beach in Afikpo North Local Government Area of Ebonyi state which is composed of 21 prawns from the month of September, 20 prawns for the months of October, 34 prawns for the month of November and 24 prawns for the month of December. The feeding capacity of *M. vollenhovenii* varied with time, highest in October with full stomach (28.5%) were observed and the lowest (8.3%) were observed in December. Plankton was the highest food such as cladocers, copepoda, diatoms (brown algae) and dinoflagellates. Others were also identified such as sand grains, macrophytes, insect parts, palm flesh and shell. The overall monthly condition factor values in the abundance of the *M. vollenhovenii* species indicate an increase in the condition factor of the total length of prawn length from the month of September to December. More especially for the month of November which had the highest condition factor values of 3.98. *M. vollenhovenii* exhibits different feeding habits and may be considered as euryphagous.

KEYWORDS: Food, Feeding habits, Condition factor, *Macrobranchium vollenhovenii*

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INTRODUCTION

Freshwater prawns of the genus *Macrobranchium* are decapod crustaceans belonging to the family palaemonidae. The palaemoinds and penaeids have been globally identified as foremost in terms of economic importance and possibility of recruitment into aquaculture (Bello-Olusoji *et al*. 2006). *Macrobranchium* species are found in most inland fresh water areas including ponds, lakes, rivers and irrigation ditches, as well as in estuarine areas (New, 2002, Davassi, 2011). This prawn occurs throughout the West African region (Etim and Sankare 1998, Jimoh *et al*., 2005). Three (3) species have been reported in Nigeria, these are *Macrobranchium Macrobranchion* (Brackish water prawn) *Macrobranchium vollenhoveni* (African river prawn), *Macrobranchium felicinum* (Niger river prawn); with *M. vollenhovenii* and *M. macrobrachion* being the two largest species (Marioghae and Ayinla 1995). These two species have been described to possess the highest commercial potential (Ajuzie and Fagade 1992). *M. vollenhovenii* in addition to its wide distribution is also one of the largest species of *Macrobranchium* 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 Maroghael (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 in its food and feeding habits. According to Wrotton (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. Length-weight relationship has vital importance in fisheries science. It helps in establishing mathematical relationship between the two variables, enables conversion of one variable to another. Morphometric measurements and mathematical models in

aquaculture are highly encouraged because that is the most precise and complete way of analyzing growth data (Hopkins, 1992). The condition factor (k) is an index reflecting interaction between biotic and abiotic factors in the physiological condition of the fishes. It shows the wellbeing of the population during various life cycle stages and assessments of prawn condition bases on weight at a given length are thought to be reliable indicates of the energetic condition or energy reserves in prawn (Lambert and Dutil, 1997). This study therefore provides information on the food, feeding habits and condition factor of the African river prawn, *M. vollenhovenii* in the Cross river basin (Ndibe beach) Afikpo, Ebonyi state, Nigeria.

MATERIALS AND METHODS

Description of the study area

This study was conducted at Ndibe beach in Afikpo North Local Government Area of Ebonyi State. The beach lies between latitude $5^0 57^{'}$ and $5^0 30^{'} 20^{''}$ North and longitude $7^0 58^{'}$ and $5^0 58^{'}$ and $5^0 30^{'} 20^{''}$ East (Federal Ministry of land survey, 1964). It is a few kilometers away from Ndibe town and the market centre. It is 1.88m above sea level. Around the beach, there are farming activities and some mini markets going on near the beach (Fig. 1). There are other beaches alongside with Ndibe beach like Uwana beach and Oziza beach respectively. The vegetation of the beach is mainly tall palm trees, bamboo plants and elephant grasses. The bottom of the River is of fine sand and the surface is colonized randomly by water weeds which form protective covers for the

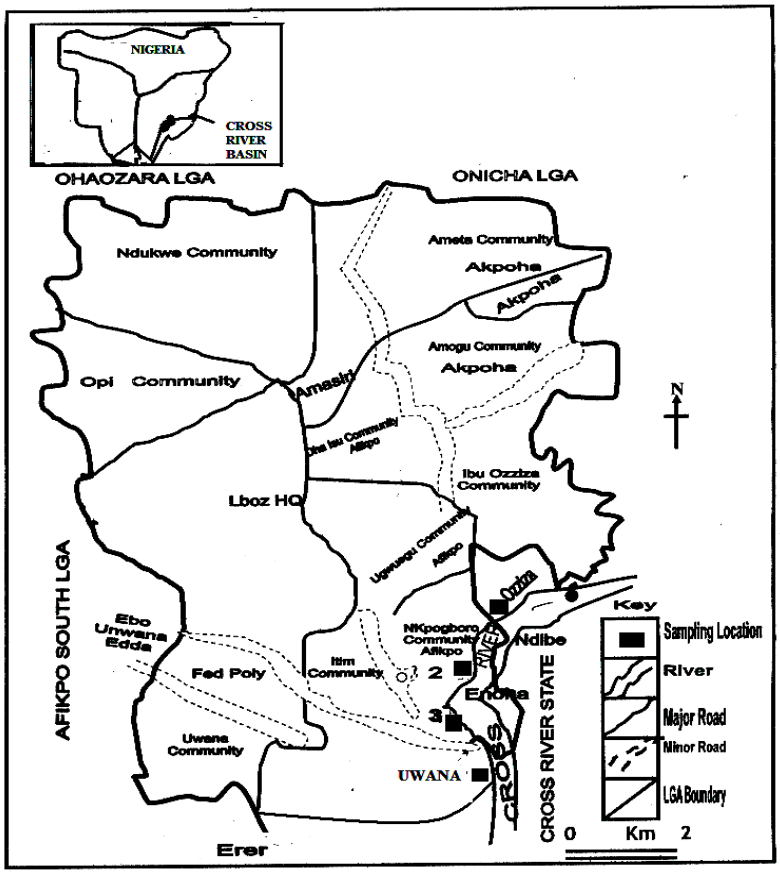

Fig. 1: Map of Afikpo North Local Government Area showing the sampling location in the Cross River basin (Okoh *et al*., 2007).

water organisms. The river is subjected to annual flooding from April to October during which most of the river system is flooded. Fishing activities in the beach become very small towards the dry season because most of the fishermen would abandon fishing and switch over to sand business as a result of low level of water at the beach during that period. Crop farming activities around the river go hand-in-hand with fishing which are altogether closely related to the flooding regime. During flooding periods when the water level becomes extremely high, active farming takes place. However, towards the end of the flooding regime, the above cycle alternates with the resumption of active fishing activities.

Sampling techniques

This study was carried out during the rainy season (September to October, 2012) and dry season (November to December, 2012) in Cross River Basins, Ndibe Beach in Afikpo, Ebonyi State. Bimonthly samples of *M. vollenhovenii* were collected in the river from fisher folks. The fishing was done with cone-shaped bamboo basket traps and also with beach seine and hand pushed trap nets as by-catches. The cone-shaped basket trap for harvesting the prawns is made from bamboo plans, with two non-return valve mechanisms at the centre of the trap. It has a total length and opening aperture of about 1 and 0.3m respectively. Coconut and fresh palm oil fruits are used as baits to catch the prawns described by Solarin *et al.* (2003). The specimens of *M. vollenhovenii* were kept in a bucket with water from the area of study before being taken to the laboratory and preserved with 100% ethanol to prevent decay but more importantly, to reduce posthumous digestion. Sampling was carried out once in a month from the study area for five months. In the laboratory, total length (TL) measured between tip of rostrum and tip of telson of the prawn was measured using inelastic thread. The thread was afterward measured with a meter rule to the nearest 0.01g with weighing balance for the food and feeding habit studies, the stomachs of collected prawn were dissected out that is the guts were opened surgically and weighed with or without food and the gut content were washed into a Petri dish and examined under an Olympus binocular microscope (x 100 and x 10 magnification). The percentage of empty stomach (ES), partially empty stomachs (PES) (¼), partially filled stomachs (PFS) (½), full stomachs (FS) were used to evaluate patterns of feeding activity.

Data analysis

The analysis of the stomach contents was carried out by both frequency of occurrence and numerical methods as described by Hyslop (1980) below.

Frequency of occurrence method: The number of guts in which each food item occurred were listed and expressed as a percentage of the total number of guts examined. The prawn population that red on a particular food item was estimated (Odum and Anuta 2001, Inyang and Nwani 2004).

Numerical method: The total number of each food item in each gut was summed up for all guts and expressed as a percentage of the total number of all food items (Odum and Anuta 2001, Inyang and Nwani, 2004).

Condition factor:

Fulton's condition factor was computed according to Pauly (1984) as $K = 100W/ L^3$

RESULTS

A total of one hundred and three (103) prawn (*M. vollenhovenii*) samples were collected from Ndibe beach in Afikpo North Local Government Area of Ebonyi state which is composed of 24 prawns from the month of September, 21 prawns for the months of October, 34 prawns for the month of November and 24 prawns for the month of December. The result showed that the feeding capacity of *M. vollenhovenii* varied with time highest among all the *M. volllenhovenii* examined in October those that had fall stomach (28.5%) were observed and the lowest (8.3%) are observed in December. Hence, *M. volllenhovenii* with highest empty stomach 50.0% were also recorded in December while lowest was recorded (8.35%) in September (Table 1).

Table 1: Stomach fullness condition and percentage frequency

Month	Full	%	½	%	¼	%	Empty	%
Sept.	5	20.8	5	20.8	12	50.0	2	8.3
Oct.	6	28.5	5	23.8	4	19.1	6	28.5
Nov.	4	11.8	8	23.5	9	26.5	13	38.2
Dec.	2	8.3	2	8.3	8	33.3	12	50.0
Total	17		20		33		33	

Various food items were found after examining the stomach content of *M. volllenhovenii* which showed that plankton was the highest food such as cladocers, copepoda, diatoms (brown algae) and dinoflagellates. Others were also identified such as sand grains, macrophytes, insect parts, palm flesh and shell. From the numerical analysis used cladocera and diatoms were the highest that occurred, amongst the cladocera, *Moina micrura* constitute the highest value (5. 65) and the corresponding value for the frequency of occurrence was 5.6% while the least eaten species of cladocera were *Pseudosida bidentata*, *Macrothrix spinosa*, *Echiniscatrinisca* and *Alona affinis*. In diatoms, the highest eaten species were *melosira* of *spacrica*, *pseudo-nitzschia pungens* and *hemidiscus cuneiforms*, from the numerical analysis, they made up 9.51%, 4.46% and 3.71% and other corresponding values for the frequency of occurrence were 885%, 4.68 and 5.20%. The least eaten diatoms were *Thalassiosira accentrica coscinodiscus granii* and *Nereocystis sp*. (Table 2). The result showed that the cladocera and diatoms are the major food items; they are the most important food in their stomach. With the combination of food and sand grains were found in 12 stomach out of 103 stomach examined, palm flesh found in stomach in 4 stomachs, insect parts found in 3 stomachs, unidentified organisms found in 62 stomachs (Table 3).

Table 2: Analysis of the stomach contents of *M. volllenhovenii.*

Food items	Species	Numerical method		Occurrence method	
		Number	%	Number	%
Cladocera	*Monia Mincrura*	33	5.65	12	6.60
	Monia Reticulate	3	0.51	1	0.47
	Simocephalus Serrulatus	7	1.19	3	1.41
	Pseudosida Bidentata	1	0.17	1	0.47
	Alonella excise excisa	6	1.02	6	2.83
	Marcrothrix spinosa	1	0.17	1	0.47
	Scapholeberis kingi	4	0.67	4	1.89
	Echinisca rosea	7	1.19	6	2.83
	Echinisca trinisca	1	0.17	1	0.47
	Dunkevedia crassa	3	0.51	3	1.42
	Simicephalus vetulus	2	0.34	1	0.47
	Chydrous ventricosus	1	0.17	1	0.47
	Alona cambonei	2	0.34	1	0.47
	Alona karua	4	0.68	1	0.47
	Ceriodaphnia cornuta	15	2.56	1	0.47
	Dadaya macrops	2	0.34	1	0.47
	Eugalona orinetalis	1	0.17	1	0.47
	Alona affinis	1	0.17	1	0.47
	Diaphanosoma excisun	8	1.36	1	0.47
	Camptocerus lilljeboryi	1	1.36	1	0.47
	Chydrous eurynotus	5	0.85	1	0.47
	Macrothrix geoidi	9	1.54	3	0.47
	Echinisca triseralis	3	0.51	1	0.47

	Ephemeroporus barroisi	2	0.34	1	0.47
	Daphria longispina	1	0.17	1	0.47
	Cydrous sphaericus	1	0.17	1	0.47
	Pleuroxus similes	2	0.34	1	0.47
	Guernella raphallis	1	0.17	1	0.47
Copepoda	*Bryocamptus birsteini*	2	0.34	2	0.94
	Microcylope rubellus	4	0.68	2	0.94
	Eucyclops speratus	3	0.51	3	1.42
	Euchaptomus garcilis	1	0.17	1	0.47
	Thermocyclops carssus	1	0.17	1	0.47
	Ectocyclops phaleratus	1	0.17	1	0.47
	Thermocyclops neglectus	1	0.17	1	0.47
Diatoms	*Hemidiscus cureiforms*	16	2.73	10	4.72
	Pseudo-nitzschia pungens	20	3.42	9	4.25
	Thalassionema nitzschcodies	13	2.22	6	2.83
	Melosira spaerica	41	7.02	17	8.02
	Pleurosigma capense	2	0.34	1	0.47
	Thalasiossira decipines	5	0.85	1	0.47
	Leptocylindeicus danicus	4	0.68	1	0.47
	Coscinodiscus granii	1	0.17	1	0.47
	Rhizosolenia hebetate	7	1.19	1	0.47
	Striattella unipunctata	13	2.22	1	0.47
	Pseudo-nitzschia delicatissima	8	1.36	11	5.19
	Skeletonema costanum	2	0.34	7	3.30
	Rhizosolenia imbricate	6	1.03	1	0.47
	Chaetoceros sp.	4	0.68	1	0.47
	Nitzschia sigma	4	0.68	1	0.47
	Licmophora eheribergii	18	3.08	1	0.47
	Thalassiossira anguster lineata	7	1.62	2	1.04
	Thalassiosira accentrica				
	Actinoptychius splendens	1	0.17	9	4.25
	Guinardia delicataula	6	1.03	2	0.94
	Chaetocerus constricts	2	0.34	1	0.47
	Pseudo-nitzschia australis	3	0.51	1	0.47
	Ditylum brightweli	5	0.85	1	0.47
	Navicula sp	4	0.68	1	0.47
	Thassiosira ecentrica	2	0.34	1	0.47
	Protopteridinium subinerme	3	0.51	1	0.47
	Scrippsella trochoidea	6	1.03	1.	0.47
	Fragillaria	2	0.34	1	0.47
	Grammatophora murina	3	0.51	1	0.47
	Nereocystis	1	0.17	1	0.47
	Paiibellus berkeleyi	2	0.34	1	0.47
	Gyrosigma balticium	2	0.34		
		2	0.34		
		2	0.34		
Dinoflagellates	*Protrocentrum micans*				
	Alexandrium catenella				
	Protopteridinum conicoldes				
	Protoperidinum depressum				
	Certaium dens				
	Dniophysis fortill				

Lingulodinum polyedrum *Protoperidinium thrianum* *Certaium furca* *Protoperidinium depressum*				
Unidentified organisms	62	10.60	7	3.30
Sand grains	78	13.30	12	5.66
Macrophytes	15	2.57	6	2.83
Palm flesh	10	1.71	4	1.87
Insect parts	9	1.54	3	1.42

Table 3: Food items and number of prawns in which they were identified

Food items	No of prawns
Cladocera	58
Copepoda	11
Diatoms	96
Dinoflagellates	11
Sand grains	12
Insect parts	3
Shells	4
Palm flesh	4
Macrophytes	6
Unidentified	22

The overall monthly condition factor values in the abundance of the *M. vollenhovenii* species in Ndibie beach in Afikpo indicates an increase in the condition factor of the total length of prawn length from the month of September to December. More especially for the month of November which had the highest condition factor values of 3.98 (Table 4). The total length class condition factor value of *M. vollenhovenii* indicates that the length class of 9-11 had the highest (3.98) condition factor values while the length class of 19-21 had the lowest mean (Table 5). The highest head length class condition factor of *M. vollenhovenii* was recorded in class length of 4-6 (32.92) while the length class of 6-8 (7.41) had the lowest mean condition factor (Table 6). The highest condition factor of standard length was observed in the class length of 13-15 (13.36) while the length class of 17-19 (0.9) had the lowest mean condition factor (Table 7). The total weight class condition factor value of *M. vollenhovenii* recorded that the weight class of 30-40g (1.79) while the weight class of 10-20g (0.56) had the lowest condition factor (Table 8).

Table 4: Monthly condition factor values of M. vollenhovenii

Months	Highest K	Lowest K	Mean
September	1.89	0.15	1.53
October	3.20	1.13	1.46
November	3.98	1.16	1.49
December	2.63	0.62	1.08

Table 5: Total length class condition factor value

Length Class	Highest k	Lowest K	Mean
9-11	3.98	0.16	1.35
11-13	1.79	0.87	1.36
13-15	3.20	0.33	1.47
15-17	1.55	0.87	0.91
17-19	1.63	0.15	0.95
19-21	0.68	0.68	0.68

Table 6: Head length class condition factor value

Length Class	Highest k	Lowest K	Mean
4-6	3.98	0.16	2.04
6-8	2.24	2.64	1.41
8-10	3.20	0.15	1.06

Table 7: Standard length class condition factor value

Length Class	Highest k	Lowest K	Mean
7-9	3.98	0.16	1.35
9-11	1.79	0.87	1.36
11-13	3.20	0.33	1.47
13-15	1.55	0.87	0.91
15-17	1.63	0.15	0.95
17-19	0.68	0.68	0.68

Table 8: Total weight class condition factor value

Weight class	Highest K	Lowest K	Mean
10-20	3.98	0.16	1.35
20-30	1.79	0.33	0.98
30-40	3.20	0.87	1.52
40-50	1.55	0.15	0.77
50-60	1.63	0.68	0.89

DISCUSSION

The Ndibe Beach in South East Nigeria supports major artisanal *Macrobrocium* species that have been sustained for several decades. The *Macrobracium* species occurs regularly and have sustained the local fishery and served as source of income for the communities and other commercial traders from the major metropolitan cities both in Ebonyi state and Nigeria at large. Ndibe Beach in Afikpo, at different periods of the year experiences both decrease and increase *M. vollenhovenii* water salinity ranging from 0.15 to 3.93%. All the food items found in the stomachs of *M. vollehovenii* examined provided the information that prawns feed on different varieties of food that constitute wide range of food items, it has revealed that *M. vollehovenii* is an opportunistic omnivore that feeds on insects, zooplankton, phytoplankton, palm flesh, macrophytes and some unidentified food particles. The knowledge of the diet of a species in nature is important for the establishment of its nutritional need and of its interaction with other organisms (Albertoni *et al.* 2003). The analysis of the gut contents of *M. vollehovenii* revealed that though the prawn feeds on a wide variety of food items it should preference for diatoms. This observation agrees with Jimoh *et al.* (2010), Lee *et al.* (1980), Murthy, Rajagopal (1990), Roy, Singh (1997), Collins, Paggi (1998) and Albertoni *et al.* (2003). The highest food items recorded were diatoms (36.7%) then cladocera (22.83%) which indicated that they feed mainly on planktons because the prawns start out very small at birth. As they grow to adult hood, they float in the ocean instead of walking on the bottom. At around a year old, the large sized prawns stick to the bottom of the ocean. This is where they encounter a variety of meals. and they feed occasionally on insect parts, macrophytes, and these result agrees with Jimoh *et al.* (2010) which indicates that African river prawn, *M. vollehovenii* are non-selective opportunistic feeders. The gut content of various forms of food items such as Cladocera, Diatoms, Copepoda, Dinoflagellates (phytoplanktons) are primary producer, also insect parts are secondary consumer, Shells and Palm flesh are dentrivores. This agrees with what was observed by Bello-Osuji *et al.* (1995) and Jimoh *et al.* (2010) that the prawn can function as a primary consumer, secondary consumer and detritivore in the aquatics system, and hence can be classified as an omnivore. Sand grains were present in the stomach of *M. vollehovenii*, and the presence of these and participles in the stomachs might be considered as the association with the bottom substratum to which some algal species are attached (Jimoh *et al.* 2010). There were palm trees around the river bank and aquatic macrophytes within the river and its bank. This suggests the possible sources of palm flesh and

macrophytes in the stomach contents of *M. vollenhovenii* as Jimoh *et al.* (2010) has described it as an opportunistic omnivores especially when the preferred food diet is not available.

Not all the stomachs examined had food in their stomachs there were stomachs that were observed empty (31.27%) which had high proportion during dry season, this high proportion of empty stomachs during this season (November to December) suggest that the periods of feeding were short or it might be the result of rapid digestion and this may suggest that prawns feed intermittently and or have a high rate of digestion. Other reasons discuss with the unidentified food may be from handling and transportation, some food items may be quickly or partly digested this making identification difficult), if the prawns have been caught in the traps for several hours, since digestion during this time could also reduce stomach fullness (Jimoh *et al*, 2010). Prawns collected during the rainy season (September to October) were observed to have fuller stomach contents that the one made during the dry season (November to December) and this shows the availability of food during the rainy season than the dry season. According to Anetekhai (1986), feeding intensity was higher during the rainy season that the dry season. Another noted reason for the fuller stomach during the rainy season could be that, as a result of subsequent rainfall, there is a lot of nutrients upwelling and insects in the river and also washing of the substratum into the river bodies by run-offs thereby making the food items available in high rate for the prawn (Anetekhai 1986). The overall monthly condition factor values in the abundance of *M. vollenhovenii* species indicated an increase in the condition factor of the total length of prawn from the month of September to December, especially in the month of November which had the most highest condition factor value of 3.98. *M. vollenhovenii* exhibits different feeding habits and may be considered as euryphagous; feeding on any food item it could possibly come across especially when food is not abundance. This information is very useful in the formulation of their artificial feeds for commercial purposes and also useful in providing models of stomach content dynamics (Palmores *et al.* 1997).

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