

***Macrobrachium macrobrachion* (Herklots, 1851) Class Structure and Sex Ratio in Luubara Creek, Ogoni Land, Niger Delta, Nigeria**

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Abstract: *Macrobrachium macrobrachion* class structure and sex ratio was studied in Luubara creek of Ogoni land in the Niger Delta area of Nigeria for a period of two years (January, 2006 to December, 2007). Majority of male shrimps were found in the 8 to 16 mm class. In 2006, the size class (8-16 mm) recorded 232 shrimps and constituted 32.08% of the sample population. However, in 2007 most of the male shrimps occurred in the 12-16 mm class, (157 shrimps) and constituted 28.91% of the sample population. In the females, the dominant size class was 8 to 16 mm. In 2006, a total of 324 females were observed in this size and this constituted 49.24% of the sample population. In 2007, a total of 170 female shrimps were obtained in the 8 to 12 mm size class and this constituted 38.20% of the population. There were no female shrimps caught in the 24 to 28 mm class during the study period. Amongst the berried females most of shrimps were found in the size class of 8-20 mm. In 2006 there were 274 berried females in the 8-12 mm group and this constituted 51.40% of the sample population. In 2007 a total of 167 berried females were caught in 8-12 mm group and this constituted 47.87% of the sample population. The sex ratios of shrimps in Luubara creek were variable. There were more females than males. The overall male to female ratio was 1:1.6. It was only in the month of October 2006 that the numbers of male were more than the female with a ratio of 1 male: 0.9 female. The male to female ratio was more than 1:2 in four months namely January, 2006 (1:2.9), June, 2006 (1:2.6), September, 2007 (1:2.7) and October, 2007 (1:2.8). In other study months the male: female was less than 1:2. Only three months i.e. January, 2007, June, 2007 and July, 2007 had 1 male: 1 female ratio.

Key words: Class structure, luubara creek, *Macrobrachium macrobrachion*, Niger Delta, Nigeria, sex ratio, ogoni land

INTRODUCTION

Macrobrachium macrobrachion is a fresh water shrimp belonging to the Phylum, *Arthropoda*; Class, *Crustacea*; Subclass, *Malacostraca*; Series, *Eumalacostraca*; Order, *Decapoda*; Suborder, *Natantia*; Section, *Caridea*; Family, *Palaemonida*; Genus, *Macrobrachium*; Species, *M. macrobrachion* Powell (1980). It is typically a freshwater species however found in low salinity brackish water (Powell, 1985).

Like other *Macrobrachium* species its body is divided into three main divisions: the head, thorax and abdomen. The head and thorax are joined to form a cephalothorax, which carries the mandibles, flagella, rostrum and the eyes containing a stalk and has five pairs of walking legs. The abdomen has six body segments with the last segment bearing a uropod or telson. The other five segments bear swimming apparatus known as swimmerets. A definite feature of *Macrobrachium* is that the second walking legs are modified to form the chelae.

Most species are distinctively colored having either blue or brownish colors. The legs also have definitive features such as hairs or furs.

There are significant differences between male and female shrimps (Abowei and George, 2010). Mature males are considerably larger than females and the second walking leg is much thicker. The cephalothorax is also proportionally larger in the male than female while abdomen is narrower in the female. In *Macrobrachium* the genital pores of the male are between the bases of the fifth walking leg (New and Singholka, 1982) where as the female has the genital pores at the base of the third walking legs. The pleura of the abdomen are lower and the abdomen itself is broader in the female than in the male. The pleura of the female form a brood chamber in which the eggs are carried between laying and hatching. A ripe ovigerous female can easily be identified because the ovaries can be seen as large orange-colored mass occupying a large portion of the cephalothorax.

The gear used for collecting the shrimp is locally known as "Kara". It is cone shaped and has two non-

return value mechanisms at the center of the trap. The trap is constructed from either the blades of bamboo plant or blades of raffia fronds which are woven around three round frames made from cane. The total length of each trap was between 0.95 and 1 m while the opening aperture was between 25 and 30 cm. Fresh palm oil fruits were used as bait to set the trap along the creek lets against the water current.

Shrimps and prawns of the genus *Macrobrachium* and *Penaeus* are highly cherished by the people of the Niger Delta. They are used as condiments in the preparation of food because of their high protein value (Umoh and Bassir, 1977; Deekae and Idoniboye-Obu, 1995). They are highly priced and are in high demand in the market (Marioghae, 1990). It has been observed that there is significant reduction of the natural stock of shrimps in our coastal waters (Nwosu, 2007). This may be due to environmental degradation which is detrimental to the abundance and life cycle of *M. macrobrachion*. Also, there are few fishers now to exploit the available species as a result of rural migration (Abowei *et al.*, 2006).

The unfriendly fishing methods of local fishers who use poisons and chemicals are affecting the shrimp catch (Abowei *et al.*, 2008). Therefore understanding the biology, environmental parameters and population structure is essential to optimize production from the wild. The shrimp *M. macrobrachion* is exploited in Luubara creek Rivers State in large quantities yet there are no reports on the population biology of this species in the area. A study of the class structure and sex ratio of *Macrobrachium macrobrachion* from Luubara creek provides base line data for management decision in the management of the species in the area and similar water bodies.

MATERIALS AND METHODS

Study area: The study was carried out in Luubara creek of Ogoni Land in the Niger Delta area of Nigeria for a period of two years (January, 2006 to December, 2007). The creek is a tributary of the Imo River and is located between longitudes 7°15'E - 7°32'E and latitudes 4°32'-4°37'N in the eastern part of the Niger Delta. The upper part of the creek extends from Bori and meanders through Wiiyaakara, Luegbo, Duburo and joins the Imo River at Kalooko.

The creek is divided into two distinct sections brackish water and freshwater. The brackish water stretch is between Bane and Kalooko while the freshwater stretch extends from Bane to Bori. The brackish water area has the normal mangrove vegetation comprising of trees such as *Rhizophora racemosa*, *Avecenia africana*, *Laguncularia racemosa* etc., whereas the freshwater has dense vegetation comprising of large trees, various palms and

aquatic macrophytes at the low intertidal zone. In freshwater area are *Cocos* species, *Eliasis* species, *Nymphaea* species, *Lemna* species and *Raffia* species.

It is characterized by high ambient temperature usually about 25.5°C and above; high relative humidity which fluctuates between 60 and 95% and high rainfall averaging about 2500 mm (Gibo, 1988). This high rainfall often increases the volume of water in the creek hence providing good fishing opportunity for the residents. Fishing is one of the major activities going on along the creek because it is the main water route of the Khana people in Ogoni area of the Niger Delta.

The fishes caught in the area include chrysidichthys auratus, *C. nigrodigitatus*, *Hydrocynus forskalii*, *Clarias gariepinus*, *Pellonula leonensis*, *Malapterurus electricus*, *Gymnarchus niloticus*, *Synodontis nigri Hepsetus odoe*, *Hernichromis fasciatus*, *Tilapia zilli*, *Tilapia guineensis*; *Sarotherodon melanotheron* and *Eleotris senegalensis* and shellfish (crabs and shrimps) especially *Uca tangeri* *Callinectes amnicola*, *Goniopsis pelli*, *Cardisoma armatum* *M. macrobrachion*, *M. vollenhoveni*, *M. equidens*; *Palaemonetes africanus*; *Caridina africana* and *Desmocaridina tripisnosa*.

Specimen sampling: The shrimp samples were collected fortnightly from three stations along the creek: namely Wiiyaakara, Luegbo and Duburo. Selection of the stations was purposefully based on fishing activities, ecological zonation and accessibility of site. For each station five fishermen were engaged and three traps were used. At each station the fishermen set the three sets of traps against the water current among aquatic macrophytes and left them overnight. The traps were retrieved the following day after about twelve hours corresponding to another low tide. The shrimps collected at each station were sorted into male and female; females were later separated into berried (ovigerous) and non-berried (non-ovigerous). Sampling lasted for twenty-three months from January 2006 to November 2007. The shrimp samples were then preserved in 4% formaldehyde and transported to the RSUST Fisheries laboratory for analysis after each day's sampling. The species was identified by use of the keys of Powell (1980, 1982) and Holthius (1980).

Shrimps were separated into the sexes; the number in each sex (i.e., male or female) was recorded. Catch composition was estimated from total catch of each monthly sample after knowing the sex. The sex ratio the catch composition and class structure was recorded monthly for the duration of the study. The class structure was based on 4mm class interval which grouped the shrimps into 8 classes: 0-4 mm; 4-8 mm; 8-12 mm; 12-16 mm; 16-20 mm; 20-24 mm; 24-28 mm.

The sexes of the shrimps were determined based on morphological characteristics as stated by New and

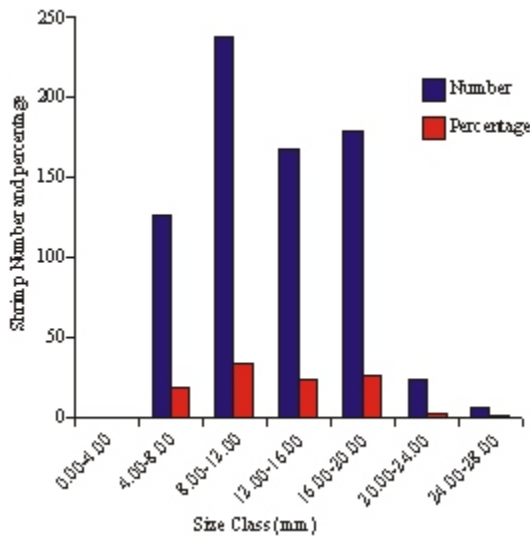


Fig. 1: Size composition and percentage of male *M. macrobrachion* in Luubara creek (2006)

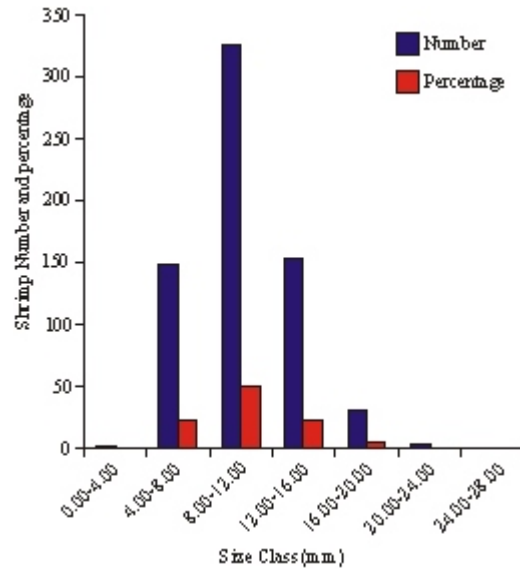


Fig. 3: Size composition and percentage of female *M. macrobrachion* in Luubara creek (2006)

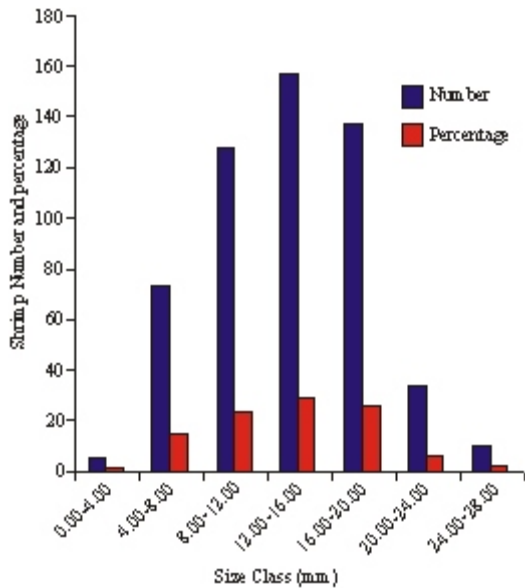


Fig. 2: Size composition and percentage of male *M. macrobrachion* in Luubara creek (2007)

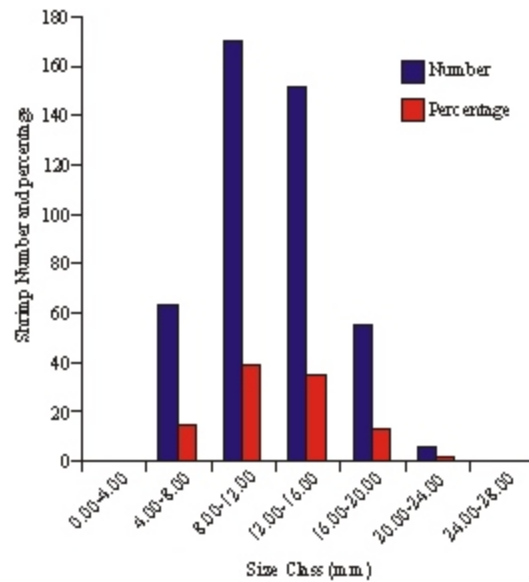


Fig. 4: Size composition and percentage of female *M. macrobrachion* in Luubara creek (2007)

Singholka (1982). Male shrimps possess appendix masculina on the second pleopod while females have none. Females were broader than the males.

RESULTS

The results of *M. macrobrachion* class structure in Luubara creek are Fig. 1, 2, 3, 4, 5 and 6. Majority of male shrimps were found in the 8 to 16 mm class. In 2006, the size class (8-16 mm) recorded 232 shrimps and

constituted 32.08% of the sample population. However, in 2007 most of the male shrimps occurred in this size class, (157 shrimps) and constituted 28.91% of the sample population.

In the females, the dominant size class was 8 to 16 mm. In 2006, a total of 324 females were observed in this size and this constituted 49.24% of the sample population. In 2007, a total of 170 female shrimps were obtained in the 8 to 12 mm size class and this constituted 38.20% of the population. There were no female shrimps caught in

Table 1: Total monthly abundance, percentage distribution and sex ratio of *Macrobrachium macrobrachion* collected in Luubara creek (2005-2007)

Yr/Month	Total No. Shrimps	Sex distribution			Percentage distribution (%)			Sex Ratio	
		Male	Non-Ovigerous Female	Ovigerous Female	Male	Non-Ovigerous Female	Ovigerous Female	Male	Female
2006									
Jan.	246	63	67	116	25.60	27.23	47.16	1	2.9
Feb.	202	72	57	73	35.64	28.21	36.13	1	1.8
March	209	81	47	81	38.76	22.48	38.75	1	1.5
April	181	71	67	43	39.22	37.01	23.75	1	1.5
May	191	77	72	42	27.09	37.69	21.98	1	1.4
June	155	42	87	26	35.25	56.12	16.77	1	2.6
July	139	49	62	28	41.44	44.60	20.28	1	1.8
Aug.	111	46	37	28	45.19	33.33	25.22	1	1.4
Sept.	104	47	46	11	51.92	44.23	10.57	1	1.2
Oct.	104	54	31	19	51.92	29.80	18.26	1	0.9
Nov.	137	49	53	35	35.76	38.68	25.58	1	1.7
Dec.	126	53	40	33	42.06	31.78	26.19	1	1.3
2007									
Jan.	172	84	54	34	48.83	31.39	19.76	1	1.0
Feb.	131	46	13	72	35.11	9.92	54.96	1	1.8
March	135	55	59	21	40.75	43.70	15.55	1	1.4
April	99	45	39	15	45.45	33.39	15.15	1	1.2
May	106	39	36	31	36.79	33.9	29.24	1	1.7
June	115	50	33	32	43.47	28.69	27.82	1	1.1
July	114	53	37	34	46.49	23.68	29.82	1	1.1
Aug.	111	49	44	18	44.14	39.63	16.21	1	1.2
Sept.	107	30	47	30	28.03	43.96	28.03	1	2.5
Oct.	103	27	47	29	26.21	45.63	28.15	1	2.8
Nov.	133	54	33	46	40.60	24.81	34.58	1	1.4
Total	3,241	1,236	1,108	897	38.25	34.29	27.76	1	1.6

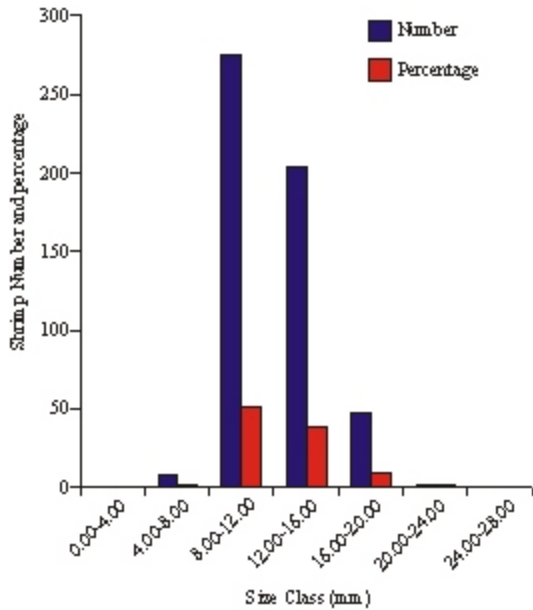


Fig. 5: Size composition and percentage of berried female *M. macrobrachion* in Luubara creek (2006)

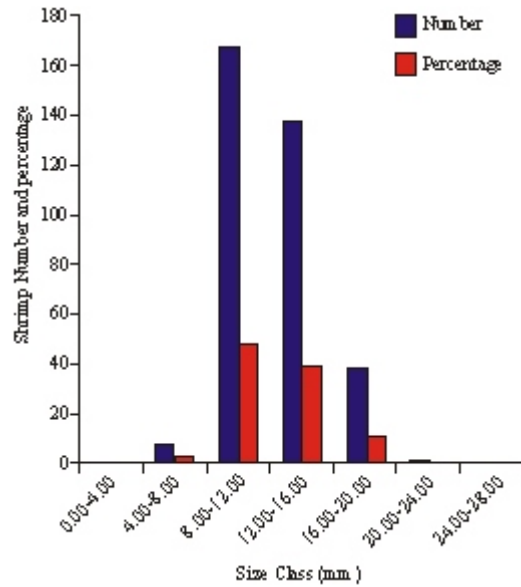


Fig. 6: Size composition and percentage of berried female *M. macrobrachion* in Luubara creek (2007)

the 24 to 28 mm class during the study period. Amongst the berried females most of shrimps were found in the size class of 8-20 mm. In 2006 there were 274 berried females in the 8-12 mm group and this constituted 51.40% of the sample population. In 2007 a total of 167 berried females were caught in 8-12 mm group and this constituted 47.87% of the sample population.

Table 1 shows the size composition of male, female and berried female shrimps. The sex ratios of shrimps in Luubara creek were variable. There were more females than males. The overall male to female ratio was 1:1.6.

It was only in the month of October 2006 that the numbers of male were more than the female with a ratio of 1 male: 0.9 female. The male to female ratio was more

than 1:2 in four months namely January, 2006 (1:2.9), June, 2006 (1:2.6), September, 2007 (1:2.7) and October, 2007 (1:2.8). In other study months the male: female was less than 1:2. Only three months i.e. January, 2007, June, 2007 and July, 2007 had 1 male: 1 female ratio.

DISCUSSION

The largest male shrimp measured 107mm (total length)(TL) and the largest female was 92 mm (TL). This showed that Luubara creek had small specimens when compared to the Cross River which had mostly adult sizes of 110 mm (Enin, 1995). In New Calabar River, Marioghae, (1987) reported 138 mm while Rutherford, (1971) gave 125 mm by for Cape Coast in Ghana while Miller (1971) reported adult sizes as low as 7 mm in St. Paul river, Liberia. Males were larger than females but the females carrying eggs are more in weight. Marioghae and Ayinla (1995) gave the maximum adult size in their studies of the New Calabar River as 135 mm.

The catches of *M. macrobrachion* in Luubara creek was observed to be dominated by females which totaled 2005 individuals (62.05%) as against males (38.25%) in the sample population. Amongst the three population groups, however, males (38.25%) were dominant followed by non ovigerous females (34.29%) and ovigerous females (27.76%).

When the shrimp sample population of the stations were subjected to analysis, there were significant differences between the population of male and female shrimps in station 1 ($p < 0.05$) but there were no significant differences between the population of male and female shrimps in station 2 ($p > 0.05$). However, there were significant differences in female shrimps in station 2 ($p < 0.05$). There were also no significant ($p > 0.05$) observed in the male population in 2006 and 2007 in station 2. Also, no significant differences were observed between the yearly population of male and female in station 3 ($p > 0.05$).

Motoh (1981) observed that there were variable sex ratios in shrimps. (1 male: 1 female; 1 male: 2 females and 1 male: 3 females). Marioghae (1982) stated that the male and female ratio of *M. macrobrachion* in Lagos lagoon was 1:1.4 while Kavu (1985) reported a ratio of 1:1.2 for the New Calabar River. Thus the females were considerably more in the population.

The composition of ovigerous females (those with eggs) also vary with season. More ovigerous females were found in the peak breeding season in the New Calabar River (Kavu, 1985). Garcia and Reste (1981) noted that tides, lunar period and dial rhythms affect shrimp migrations hence the sex ratios obtained at such period could be affected. The type of net used and the mesh size of nets also determine the sex ratio of shrimps. Nets with

large mesh size (more than 3 mm) will obtain the adults only and thus the sex ratio of such samples will be affected.

M. macrobrachion have been reported to occur all year round (Powell, 1982). The abundance of an organism is determined by a number of factors, such as rainfall, temperature, light, pH and salinity. Others are concentration of dissolved gases, types of pollutants, presence or absence adequate of anions and cations, the nature of substratum, the number of predators and presence or absence of disease causing organisms (Williams, 1955; Loesh, 1965;). Zabbey (2007) is of the opinion that catches of coastal shrimps vary according to season. He reported that 60% of fishermen obtained good catches in the rainy season while 40% claimed that catches were better in the dry season.

Furthermore, 50% of local fishers who operate in the creek claimed that their peak period of catch was the rainy season while the remaining 50% mentioned dry season. Lack of catch data on abundance hinders comparative analysis. However, studies by Enin *et al.* (1991) on *Nematopalaemon hastatus* fishery in the outer estuarine region of Cross River, Nigeria showed that the catch rates rose to a major peak (24%) between March and June i.e. end of dry season and early rainy season.

They also reported a secondary peak (17%) in October/November which is a period between rainy and dry season. According to their findings (Enin *et al.*, 1991), poorer catch rates were obtained in the middle of the rainy months of July and September. Waribugo (2005) reported that the two peak periods of abundance of *Nematopalaemon hastatus* and *Palaemon maculatus* in the Nun River estuary, Bayelsa State were between October and December and from March to April which coincides with early dry season and early rainy season respectively. Nwosu and Holzohner (2004) studied lunar and seasonal variations in the catches of *Macrobrachium* in Cross Rivers estuary and reported two maxima, May - July and November - December.

CONCLUSION

- Luubara creek had small specimens when compared to results from other studies.
- Males were larger than females but the females carrying eggs are more in weight.
- The catches were dominated by female.
- The composition of ovigerous females varied with season.
- The sex ratios of shrimps in Luubara creek were variable.
- There are more females than males. The *M. macrobrachion* fishery in Luubara creek has great potential for high productivity. Hence the need for it effective management.

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REFERENCES

- Abowei, J.F.N., N. Sabina, S.N. Deekae, C.C. Tawari and M.E. Allison, 2006. A Review of shrimp fisheries in Nigeria. Pre-Joe publishers, Port Harcourt, pp: 33. ISBN: 978-37136-9-8.
- Abowei, J. F.N., A.O. Davies and S.A. Ngodigha, 2008. The recruitment patterns of two palaemon shrimps and some physic - chemical characteristics in the River Nun Estuary, Nigeria. Int. J. Nat. Appl. Sci., 4(4): 396-401.
- Abowei, J.F.N and A.D.I. George, 2010. The morphology, abundance size and sex distribution of *Callinectes amicola* (De Rochebrune, 1883) from Okpoka Creek, Niger Delta, Nigeria. Curr. Res. J. Biol. Sci., 2(1): 27-34.
- Deekae, S.N. and T.I.E. Idoniboye-Obu, 1995. Some aspects of commercially important molluscs and crabs of the Niger Delta, Nigeria. Environ. Ecol., 13(1): 136-142.
- Enin, U.I., 1995. First estimates of growth, mortality and recruitment parameters of *Macrobrachium macrobrachion* Herklots, 1851 in the Cross River Estuary, Nigeria. Dana, 2(1): 29-38.
- Enin, U.I., U. Lowenberg and T. Kunzel, 1991. The *Nematopalaemon hastatus* (estuarine shrimp) fishery in the outer estuarine region of the Cross River, Nigeria. Arch. Fischwiss, 41(11): 67-88.
- Garcia, S. and L. Reste, 1981. Life cycles, dynamics, exploitation and management of coastal peneid shrimp stocks. FAO Fisheries Technical paper No. 203, pp: 215.
- Gibo, A.E., 1988. Relationship between rainfall trends and flooding in the Niger- Benue River basin. J. Meteorol., 13: 132-133.
- Holthius, L.B., 1980. Shrimps and prawns of the world: An annotated catalogue of species of interest to fisheries. FAO Fisheries Synopsis, 125: 271.
- Kavu, B.W., 1985. *Macrobrachium macrobrachion* (Herklots, 1851), its availability and effects of salinity on the growth of its juveniles. M.S. Thesis, Aquaculture, Rivers State University of Science and Technology, Port Harcourt/African Regional Aquaculture, Centre, Port Harcourt, Nigeria, pp: 96.
- Loesh, H., 1965. Distribution and growth of peneid shrimp in Mobile Bay, Alabama. Publications of the Institute of Marine Science, 10: 41-58.
- Marioghae, I.E., 1982. Note on the biology and distribution of *Macrobrachium vollenhovenii* and *M. macrobrachion* in Lagos Lagoon (Crustacea Decapoda, Paleamonidae) Review de Zoologie. Africaine, 96(30): 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.
- Marioghae, I.E., 1990. Studies of fishing methods, gear and marketing of *Macrobrachium* in the Lagos Area. Nigerian Institute of Oceanography and Marine Research Technical Paper, No. 53, pp: 20.
- Marioghae, I.E. and O.A. Ayinla, 1995. The reproductive biology and culture of *Macrobrachium vollenhovenii* (Herklots, 1857) and *Macrobrachium macrobrachion* (Herklots, 1851) in Nigeria. Nigerian Institute of Oceanography and Marine Research, Technical Paper No 100, pp: 16.
- Miller, G.C., 1971. Commercial fishery and biology of the freshwater shrimp, *Macrobrachium* in the lower St. Paul River, Liberia. 1952 - 53. United States Department of Commerce Special Report No 626, pp: 13.
- Motoh, H., 1981. Studies on the fisheries biology of the giant tiger prawn, *Penaeus monodon* in the Philippines. Southeast Asia Fishereis Development Commission. Technical Report, No. 7. Tigbauan Iloilo, Philippines. Aquaculture Department, pp: 128.
- New, M.B. and S. Singholka, 1982. Freshwater prawn farming: Manual for the culture of *Macrobrachium rosenbergii*. FAO Fisheries Technical Paper, 225, pp: 116.
- Nwosu, F.M. and S. Holzlohner, 2004. Lunar and seasonal variations in the catches of *Macrobrachium* fishery of the Cross River Estuary, South East Nigeria. Indian J. Hydrobiol., 7(1-2): 177-181.
- Nwosu, F., 2007. The Problem of by Catch Associated with Industrial Shrimping: Implications for Inshore Demersal Fisheries in the Niger Delta. In: Zabbey, (Ed.), Small Scale Shrimp Fisheries in Nigeria. Centre for Environment, Human Rights and Rural Development (CEHRD), Eleme, Rivers State CEHRD/TECH/CONSERV/01/2007, pp: 32-48.
- Powell, C.B., 1980. Key to shrimps and prawns (crustacea: decapoda, natantia) of the Niger Delta Basin Development Authority Area. Consultancy Report, pp: 5.
- Powell, C.B., 1982. Fresh and brackishwater shrimps of economic importance in the Niger Delta. Proceeding 2nd Annual Conference Fisheries Society of Nigeria. Calabar 25-27 January 1982, pp: 254-285.
- Powell, C.B., 1985. The Decapods Crustaceans of the Niger Delta. In: Wilcox, H.B.R. and C.B. Powell, (Eds.), Publication committee, University of Port Harcourt, pp: 226-238.

- Rutherford, A., 1971. Freshwater shrimps in the area of Cape Coast, Ghana. *Ghana J. Sci.*, 11(2): 87-91.
- Umoh, I.B. and O. Bassir, 1977. Lesser known sources of protein in some Nigerian peasant diets. *Food Chem.*, 2: 315-329.
- Waribugo, S.A., 2005. Aspects of the biology and fisheries of some palaemonid shrimps in River Nun Estuary, Bayelsa State, Nigeria. M.S. Thesis, Rivers State University of Science and Technology, Port Harcourt, pp: 60.
- Williams, A.B., 1955. A contribution to the life histories of commercial shrimps (peneidae) in North Carolina. *Bull. Mar. Sci. Gulf Carribean*, 5(2): 116-146.
- Zabbey, N., 2007. Small scale shrimp fisheries in Nigeria Centre for Environment, Human Rights and Development, Eleme, Rivers State. Technical Report, CEHRD/TESH/CONSERV/01/2007, pp: 64.