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The Zooplankton Species Composition and Abundance in Sombreiro River, Niger Delta, Nigeria

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Abstract: The zooplankton species composition and abundance in Sombreiro River, in the Niger Delta of Nigeria was studied for a period of two years (August, 2007-July, 2009), using filtration technique. 25 µm mesh size plankton net was towed from a dugout boat at about 5-105^{-1} for about a minute. The net content was washed out into a wide mouth plastic container and preserved in 10% formalin solution after proper labeling. A total of seventeen (17) species belonging to six (6) taxonomic groups were recorded from Sombreiro River. The groups Cladocera and Copepoda were represented by five species each consisting of 29.4% by composition. This was followed by three species of Protozoa (17.6%), two species of Rotifera (11.8%), Decapod crustacean (5.9%) and Euphasiacea (5.9%), one specie each. Copepoda was the highest, 46.5%. This was followed by Cladocera (23.3%). The others were Protozoa (11.2%), Euphasiacea (9.6%), Rotifera (7.9%) and Decapod Crustacean (1.5%). The low zooplankton diversity observed in this study is common in tropical waters. The dominance of cladocera and copepoda in the study area is common to River Nun, in the Niger Delta and Schelde estuary in Belgium. Sombreiro River zooplankton abundance is higher than that of River Nun but lower than that of Imo River in the Niger Delta. These differences are attributed to duration of sampling and natural conditions of the water bodies. The zooplankton abundance was well distributed in the stations except *Mysis* sp. (Decapod Crustacean) which showed spatial discontinuity in abundance.

Key words: Abundance, composition, Niger Delta, Nigeria, Sombreiro River, Zooplankton species

INTRODUCTION

Zooplanktons are animal that drift in water column. They graze on primary producers and on organic debris in the water column and thereby play an important role in the integration of energy budget of the ecosystem (Anene, 2003). Zooplanktons are useful indicator of future fisheries health because they are a food source of organisms at higher trophic levels (Davies *et al*., 2009). The biomass, abundance and species diversity of zooplankton are used to determine the conditions of aquatic environment (MBO, 2007).

Zooplankton organisms are identified as important component of aquatic ecosystems (Okogwu 2010). They help in regulating algal microbial productivity through grazing and in the transfer of primary productivity to fish and other consumers (Dejen *et al*., 2004), Okogwu (2010) reported that by grazing on phytoplankton and bacteria zooplankton help in improving water quality. Pinto-Coetuo *et al*. (2005) reported that zooplanktons are considered indicators of water quality.

Zooplanktons make up an invaluable source of protein amino acids, lipids, fatty acids, minerals and enzymes and are therefore an inexpensive ingredient to replace fishmeal for cultured fish (Kibria *et al*., 1997). Zooplanktons are of great importance in bio-monitoring of pollution (Davies *et al*., 2008). They are key component of marine ecosystem. The nature of species occurring, diversity, biomass and season of maximum abundance of zooplanktonic organisms differ in water bodies (FAO, 2006).

The copepod crustaceans are free-living filter feeder zooplankton and are used in bio-monitoring of pollution. They are homoiosmotic; thus any information of pollutants into the ecosystem unit have effect on the metabolism of the fauna and will also cause ecological disturbance in the system. The abundance and species composition of zooplankton are used to assess the biological integrity of the water body. Carney (1990) reported that most zooplankton migrate upward from deeper strata as darkness approaches and return to the deeper areas at dawn. Zooplankton density may be limited

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by both turbidity (which limits phytoplankton production upon which the zooplankton depend) and by river flow (Mclusky, 1981).

Sombreiro River is one of the numerous water bodies in the Niger Delta of Nigeria providing nursery and breeding grounds for a variety of fish species and other aquatic fauna. The large wetlands and coastal waters of Nigeria, in particular the Niger Delta have great potentials for commercially important fishery (Powell *et al*., 1985). The Niger Delta is the richest part of Nigeria in terms of natural resources with large deposits of petroleum products (Moffat and Linden, 1995; Braide *et al*., 2004).

Similarly, the vast coastal features which include forest swamps, mangrove, marsh, beach ridges, rivers, streams and creeks serve as natural habitats for various species of flora and fauna (Alalibo, 1988; Jamabo, 2008). The stretch of the Sombreiro River is one of the most important river systems in the Niger Delta providing nursery and breeding grounds for a large variety of fish species (Ezekiel *et al*., 2002). Research into the composition an abundance of zooplankton in Sombreiro River is important to determine their occurrence in natural conditions.

MATERIALS AND METHODS

Study area: The study was carried out in Sombreiro River, in the Niger Delta of Nigeria for a period of two years (August, 2007-July, 2009). It is one of the rivers that drains the western part of Rivers State. The river provides nursery and breeding grounds for a large variety of fish species (Ezekiel *et al*., (2002). Four sampling stations were established along the length of the Sombreiro River whenever, it was accessible by road. Sombreiro River is located in three local government areas of Rivers stale - Ogba/Egbema/Ndoni and Degema between Latitude 6º30′ and 7º0′ E and Longitude 4º12′ and 6º17′ N. It is a distributary of the River Niger which arises from northern boundary of Rivers State with Imo State. it is one of the series of the Niger Delta rivers which drain into the Atlantic Ocean and is connected to other rivers via creeks in the coastal area of the Niger Delta (Ezekiel, 1986, 2001).

The river is narrow and steep as it flows southwards, it widens and the steep sidedness gradually disappears starting from the middle reaches. The system is lotic throughout the year; the lotic period reaches its peak in January to February (dry season) when the water level has fallen to the maximum. In August - September (wet season), the lotic nature of the river is reduced due to flooding (Ezekiel, 1986). The river is contained within the tropical rainforest although the lower reach is within the brackish mangrove zone.

From upstream the river bed consists of stones and gravels, the middle zone tending to be sandy with the sand bed giving way to a muddy one at the lower reach of the river (Ezekiel, 1986). A part from areas of human disturbance, the river is fringed by riverine forest. Numerous human activities such as fishing, sand nuning, dredging, mangrove cutting, logging of timber and transportation. These may be potential sources of pollution to the environment. Public toilets were observed at each of the sampling stations. Also observed were refuse dumps and run-offs into the river from the rivernie communities. The wastes from the comities may constitute source of pollution to the river.

Four sampling stations were established along the length of Sombreiro River. Stations were chosen in a such a manner to provide for even spread for effective sampling. Each of the stations was visited once a month, usually between the 15th and 22nd. Photographs were taken of each station to illustrate the habitat. Only qualitative description of stations were made in order to classify the stations according to general habitat types. The four stations investigated in this study are described below on the basis of personal visual observations.

Station 1 (Degema): This is the largest of all the sampling stations. The vegetation fringing the river at the left and right banks consists of mangrove plants such as Rhizophora, Avicennia and Nypha Fruticans (*Nypa palm*), arising from a characteristic muddy substrate that produces a foul odor. The water is highly turbid in the rainy months and clear in the dry months. This station is a brackish and tidal environment. There is no observable unidirectional flow of the water at this station due to the very wide nature of the river; thus the surface current is not very distinct to be determined. The bed of the river at this station is a mosaic mud and sand. No farmland was observed at this station but there were public toilets which discharge human wastes directly into the river.

Station 2 (Ogbele): At station 2, mangrove vegetation is replaced by riverine forest consisting mainly of *Raphia*, *Pandanus*, *Sanderiana*, *Calamas* sp. (swamp cane), *Khaya* sp. (Mahogany), *Vapaca* sp., *Ficus Vogeliana* and *Triculia. african*. Aquatic marcophytes include *Nymphace* sp., *Eichornia crassipes, Sagittana* sp., *Pistia stratictes*. The station was flooded in the rainy season when the current velocity is slow. The station has a little tidal influence from the immediate tidal mangrove zone. The bed of the river at this station consists of sand and small gravel. No farmland was noticed but there were public toilets which discharge human wastes directly into the river.

Station 3 (Ihuaba): The vegetation fringing the river at this station is a mixture of riverine and terrestrial vegetation although no farmland was seen. The common plants noticed here are the *Raphia* and *Elaeis guineensis* (palm trees.). The aquatic macrophytes include *Typha*

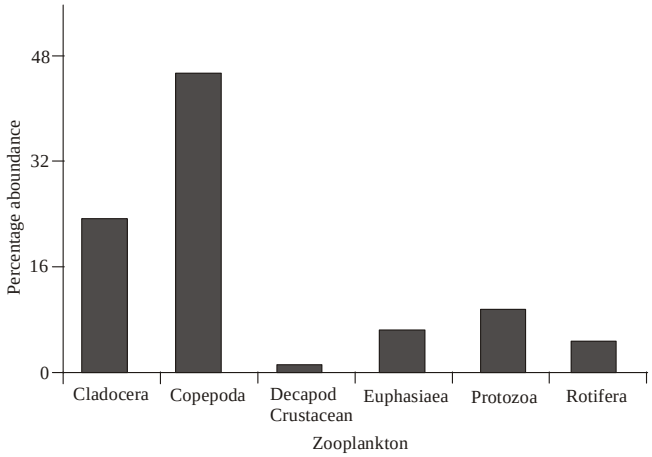

Fig.1: Taxonomic group abundance of zooplankton in Sombreiro river (August 2007-July 2009)

lotifolia (cat tail) and *Potamogetom* sp. (pond weed). The station was flooded from August to October with the flood receding from November to February. The speed of the current is slow in the rainy season. The bottom of the river at this station consists of sand and gravel of various sizes. No farmland was observed but there were public toilets which discharge human waste into the river.

Station 4 (Odiemudie): The vegetation consists of a terrestrial vegetation in which can be seen farmland, and riverine vegetation extending into a large area of swamps. Some include *Raphia*, *Pandanus sanderiana Elaeis guineensis* (palm trees) Aquatic macrophytes include/ *Pomea aquatica*, *Lemna* sp. (duck weed), *Utricularia* sp., *Nympaea* sp. and *Pistia stratiotes* (water lettuce). Current is moderate in the rainy months, becoming fast in the dry months when the flood recedes. The water is clear and the bottom consists of small stones, gravel of various sizes and sand.

Sample collection: In each of the sampling stations zooplankton samples were collected. Zooplankton was collected by filtration technique. 25 μm mesh size plankton net was towed from a dugout boat at about 5 - 105^{-1} for about a minute. The net content was washed out into a wide mouth plastic container and preserved in 10% formalin solution after proper labeling. This was stored in a cool box and taken to the Laboratory (APHA, 1998).

The samples were allowed to stand for at least 24 h in the laboratory for the zooplankton to settle before the supernatant pipetted to concentrate the samples. The concentrated sample was agitated to homogenize before pipetting 1 mL sub sample with sample pipette (IBID). The content was placed in a sedge Wick-Rafter plankton - counting chamber and examined with Leltz-Wetzlar binocular microscope at a magnification of 200x (APHA, 1998). The plankton was identified and total number per species recorded using keys and checklists of Hutechinson (1967). Enumeration of zooplankton was done on natural unit count and reported as units or organisms per mL (APHA, 1998).

Table 1: Checklist of zooplankton in sombreiro River, Nigeria

Taxonomic group	Genus/Species
Cladocera	*Alonella costata*
	Bosmina fatalis
	Daphnia carinata
	Daphnia longippina
	Moina cacrocapa
Copepoda	*Acanthocyclops carinetus*
	Acanthocyclops viridis
	Cyclops stenuis
	Paracyclops afinis
	Paracyclops fimbriatus
Decapod crustacean	*Mysis* sp.
Euphasiacea	*Meganicliphanes norvegica*
Protozoa	*Halteria* sp.
	Spirostomum sp.
	Tintinopsis senensis
Rotifera	*Brachionus calyciflorus*
	Brachionus falcatus

RESULTS

A total of seventeen (17) species belonging to six (6) taxonomic groups were recorded from Sombreiro River (Table 1). The groups Cladocera and Copepoda were represented by five species each consisting of 29.4% by composition. This was followed by three species of Protozoa (17.6%), two species of Rotifera (11.8%), Decapod crustacean (5.9%) and Euphasiacea (5.9%), one specie each (Table 2).

The group abundance of individuals is presented in Fig. 1. Copepoda was the highest, 46.5%. This was followed by Cladocera (23.3%). The others were Protozoa (11.2%), Euphasiacea (9.6%), Rotifera (7.9%) and Decapod crustacean (1.5%).

Table.2: Number of species in each taxonomic group of zooplankton sampled (August 2007 - July 2009)

Taxonomic group	Total no. of species	Species composition (%)
Cladocera	5	29.4
Copepoda	5	29.4
Decapod crustacean	1	5.9
Euphasiacea	1	5.9
Protozoa	3	17.6
Rotifera	2	11.8
Total	17	100

DISCUSSION

Seventeen species belonging to 6 taxonomic groups were recorded in the study area. The zooplankton composition was dominated by Cladocera and Copepoda with 5 species each consisting of 29.4%. Protozoa had 2 species consisting of 17.6%. This was followed by Rotifera (2 species), Decapod crustacean (1species), Euphasiacea (one species) consisting of 11.8, 5.9 and 5.9%, respectively. The low zooplankton densities observed in this study is not unusual. Nilssen (1984) reported that zooplankton communities are usually simplified, with low densities in tropical waters.

The observed dominance of Cladocera and Copepoda in this study is similar to the report of Tackx *et al*. (2004) from Schelde estuary (Belgium) that cyclopoed copepods together with several cladocerans dominated the freshwater and lower brackish water transect of the estuaries. Copepod crustraceans are free-living filter feeder zooplankton and this account for their use in bio-monitoring of pollution (Kibria *et al*. 1997). Yakubu *et al*. (1998) also reported the dominance of cladocera from Nun River, Niger Delta.

This result is higher than the reported 10 species of zooplankton by Yakubu *et al*. (1998) from Num River, and lower than the 24 species reported by Zabbey *et al*. (2008) from Imo River all in the Niger Delta. However, it compared favourably with the reported 18 species (Lagos Lagoon) and 20 species (Lagos Lagoon) of Emmanuel and Onyema (2007) and Nkwoji *et al*. (2010) respectively.

The result of this study further varies considerably from the studies in Nigeria. Davies *et al*. (2008) reported 32 species from Elechi Creek and Okogwu (2010) reported 67 species from Eboma Lake in the middle cross river flood plain. The difference in the number of zooplankton species in this study and other studies may be attributed to the natural conditions of water bodies and time of sampling. FAO (2006) had earlier reported that distributions of zooplankton vary from place to place and year to year due to the dynamic nature of aquatic systems. Carney (1990) also reported that most zooplankton migrate upward from deeper strata as darkness approaches and return to the deeper areas at dawn. Furthermore, Welcomme (1985) and Wetzel (1983) attributed zooplankton abundance to differences in flow, turbidity, dissolved oxygen concentration and conductivity.

CONCLUSION

- The low zooplankton diversity observed in this study is common in tropical waters. The dominance of cladocera and copepoda in the study area is common to River Nun, in the Niger Delta and Schelde estuary in Belgium.
- Sombreiro River zooplankton abundance is higher than that of River Nun but lower than that of Imo River in the Niger Delta.
- These differences are attributed to duration of sampling and natural conditions of the water bodies.
- The zooplankton abundance was well distributed in the stations except *Mysis* sp. (Decapod Crustacean) which showed spatial discontinuity in abundance.

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