PHYTOPLANKTON COMPOSITION AND ABUNDANCE IN MBIAKONG RIVER, CROSS RIVER ESTUARY, NIGER DELTA, NIGERIA

Abstract
The phytoplankton composition and abundance in Mbiakong River, Cross river estuary, Niger Delta, Nigeria was studied for a period of one year (March, 2021-February, 2022). Plankton net of mesh size 55µm was used to collect plankton samples from below the water surface, after towing for 5 minutes. The content was emptied into plastic containers and fixed immediately with 4% formalin in the field for preservation. After 48hrs in the laboratory, the preserved plankton samples were concentrated to 10 ml. The concentrated sample was agitated to homogenize before pipetting 1ml sub sample with sample pipette. Enumeration and identification were performed using a zeis inverted microscope at x400 and x 1000 magnification. Species identification was done using recommended keys and guides. A total of six hundred and fifteen (615) individual organisms comprising of thirty-five (35) species belonging to five (5) taxonomic groups were recorded from Mbiakong River. The most abundant group was the Bacillariophyceae which was represented by 12 species (302 organisms) consisting of 49.11%. This was followed by Chlorophyceae represented by 10 species (199 organisms) consisting of 32.36%, Cyanophyceae represented by 12 species (109 organisms) consisting of 17.72%, Euglenophyceae represented by 1 species (3 organisms) consisting of 0.33% and the least abundant was the Dinophyceae represented by 1 species (2 organisms) consisting of 0.14%. The study revealed that species composition and abundance was high in June.

Keywords: Abundance, composition, Niger Delta, Nigeria, phytoplankton species, Mbiakong River

1.0 Introduction

Phytoplanktons are tiny aquatic plants, appearing as unicellular, colonial or filamentous forms, with no opposition to currents and are usually drifting or hanging in the open water (Samuel *et al*., 2015). They are vital water quality indicators due to their short life cycles, and ability to respond to environmental changes, hence, their standing crop and species composition reflects the quality of aquatic health (Abagai and Tiseer, 2011). They are the most vital factor for organic matter production in the aquatic ecosystem and are often at the bottom of aquatic food web. Majority of reservoirs usually need a considerable amount of planktons for productive and sustainable fisheries (Akpan, 2012). The synergy of physical, chemical and biological properties of water most often results in the production of phytoplankton, while their assemblages are structured by these factors (Samuel *et al*., 2015). Therefore, any disruptions in these factors may result in alterations of their assemblage which could in turn cause a significant impact on water quality and fishes in the ecosystem (Mustapha and Nabegu, 2011).

Alternations in the abundance and composition of phytoplankton species indicates environmental variables like pH, temperature, nitrate, phosphate total dissolved salt, nutrient levels, and alkalinity are sensitive indicators of pollution when compared with phytoplankton (Davis *et al*., 2009). Freshwater phytoplankton communities are necessary guard for environmental changes. They consolidate the effects of increased nutrient loads, and can be more sensitive to the synthesized impacts of stressors than a single stressor (Sagert *et al*., 2008). Knowledge of phytoplankton population dynamics is essential because temporal and spatial fluctuations in its composition and biomass may be excellent indicators of natural or anthropogenic perturbations in the aquatic

ecosystems. The main primary producers of the aquatic environment are phytoplankton which deposits energy to the system by the process of photosynthesis, amalgamating carbon dioxide and water to produce carbohydrates (Hillel *et al.,* 2015).

Research into the abundance and composition of phytoplankton in Mbiakong River is aimed at providing baseline data to complement existing data and to determine their occurrence in natural conditions for management decisions.

2.1 Materials and Methods

2.1.1 Study Area

The study was conducted in Mbiakong River (Fig. 1). Mniakong river lies between latitude 5^{o} 2’ 57.84”N and longitude 8^{o} 3’5.04”E within the tropical rainforest of Niger Delta region, Nigeria. The Watershed covers an area of approximately 315.9 Km^{2}. The area is mostly shaded by overwhelming canopy of riparian vegetation like *Elaeis guinensis*, *Raphia hookeri, R. venifera* and other tropical forest trees. Aquatic macrophytes are mainly *Nymphaea, Vossia and Musanga crinium sp*. Sand dredging has been going on upstream of the river for over two decades. Riparian communities make a living from these activities. However, the consequences of these activities on the environment are enormous.

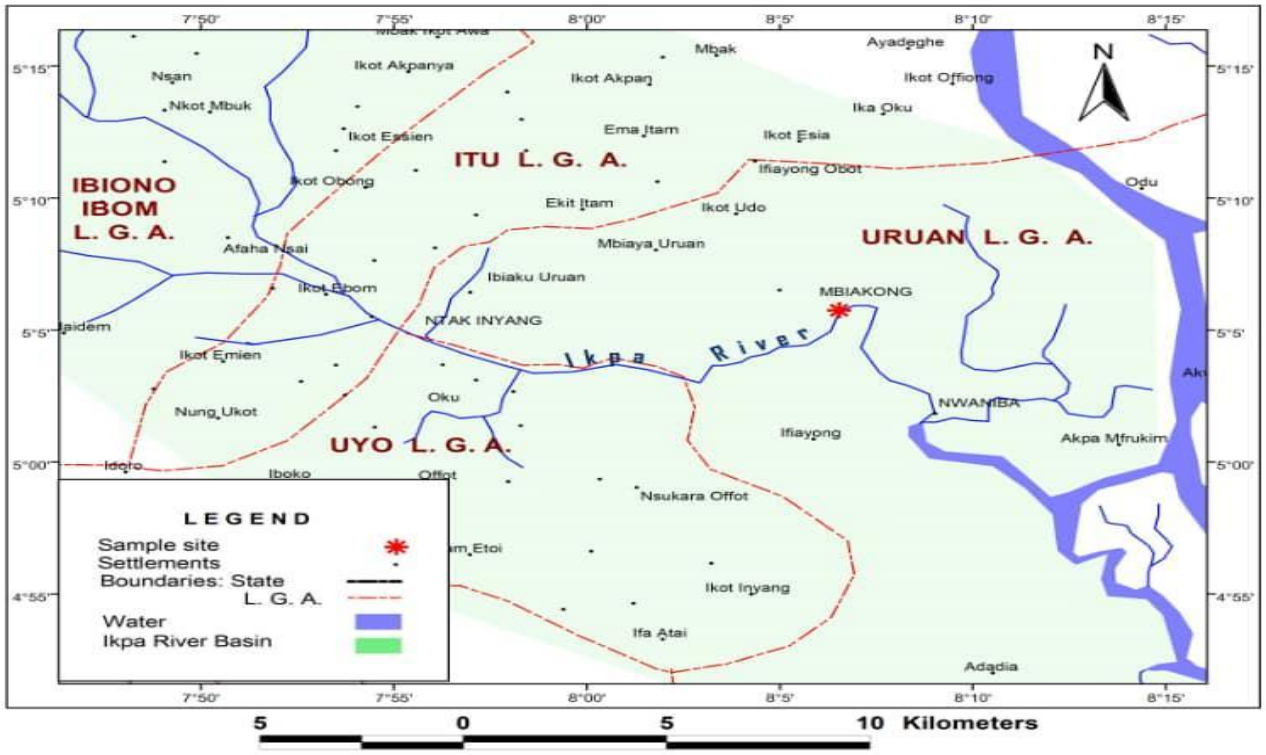

Fig. 1: Map showing Mbiakong River

2.1.2 Data Collection

The study was carried out for a period 12 months (March, 2021 - February, 2022), with sampling done in the morning hours between 8:00 and 10:00 am covering the wet and dry seasons. Plankton net of mesh size 55µm was used to collect plankton samples from below the water surface after towing for 5 minutes. The content was emptied into plastic container and fixed immediately with 4% formalin in the field for preservation (Onyema, 2007). All samples were taken at ebb tide to reduce tidal and diurnal variation. The samples were transported to the laboratory for analysis. After 48hrs in the laboratory, the preserved plankton samples were concentrated to 10 ml (Babatunde and Shagbo, 2015). Enumeration and identification were performed using a zeis inverted microscope at x400 and x 1000 magnification. Species identification was done using keys in Needham and

Needham (1975); as well as guides provided by Newell and Newell (1977); APHA (1985) and Egborge (1973).

3.0 Results

The phytoplankton recorded during the study showing a total of thirty five (35) species with six hundred and fifteen (615) individuals belonging to five (5) taxonomic groups were recorded from Mbiakong River (Table 1). The most abundant group was the Bacillariophyceae which wasrepresented by 12 species (302 organisms) consisted of 49.11%. This was followed byChlorophyceae represented by 10 species (199 organisms) consisted of 32.36%, Cyanophyceaerepresented by 12 species (109 organisms) consisted of 17.72%, Euglenophyceae represented by 1species (3 organisms) consisted of 0.33% and the least abundant was the Dinophyceae representedby 1 species (2 organisms) consisted of 0.14% (Table 2 and Fig. 2).

Table 1: Phytoplankton species in Mbiakong River, Niger Delta, Nigeria

SN	TAXA	CODE	Total
	BACILLARIOPHYCEAE		
1	*Nitzschia sigma*	*Nit.sig*	79
2	*Gomphonema accuminatum*	*Gom.acc*	26
3	*Diploneis ovalis*	*Dip.ova*	8
4	*Gyrosigma attenuatum*	*Gyr.att*	9
5	*Melosira granulata*	*Mel.gra*	43
6	*Novicula affinis*	*Nov.aff*	35
7	*N. gracilis*	*Nov.gra*	11
8	*Melosira sigoum*	*Mel.sig*	20
9	*Nrtzschia sigmiodae*	*Nrt.sig*	23
10	*Nitzschia closterium*	*Nit.clo*	37
11	*Tabellaria binalis*	*Tab.bin*	9
12	*Tabellaria fenestrate*	*Tab.fen*	2
	CHLOROPHYCEAE		
13	*Ulothrix sp*	*Ulo.sp*	16
14	*Ankistrodemus spirilliformis*	*Ank.spi*	62
15	*Chlamydomonas reticulate*	*Chla. ret*	43
16	*Ankistrodesmus acicularis*	*Ank.aci*	10
17	*Actinastrium gracilinum*	*Act.grac*	24
18	*Schroedenia sp.*	*Sch.sp*	19
19	*Scenedesmus quadricauda*	*Sce.qua*	10
20	*Euastrum elegans*	*Eua.ele*	13
21	*Staurastrum apiculatum*	*Sta.api*	2
	CYANOPHYCEAE		
22	*Aphanizomenon species*	*Aph.spe*	11
23	*Phormidium species*	*Pho.spe*	17
24	*Lyngbya limnetica*	*Lyn.lim*	9
25	*Oscillatoria limnosa*	*Osc.lim*	7
26	*Anabaena circularis*	*Ana.cir*	13
27	*Spirulina platensis*	*Spi.pla*	22
28	*Lyngbya birgei.*	*Lyn.bir*	13
29	*Chroccocus sp.*	*Chro.sp*	10
30	*Phormidium cincinnatum*	*Pho.cin*	1
31	*Gomphosphaeria aponia*	*Gom.ap*	2
32	*Spiriluna major*	*Dac.aci*	3
33	*Oscillatoria tenius*	*Osc.ten*	1

	DINOPHYCEAE/ EUGLENOPHYCEAE		
34	*Peridinium bipes*	*Per.bip*	**2**
35	*Euglena acus*	*Eug.ac*	3
	Taxa/Species		**35**
	Individuals		**615**

Table 2: Number and percentage compositions of Phytoplankton Families in Mbiakong River

Taxonomic group	Total no. of species	Percentage species composition (%)
Bacillariophyceae	302	49.11
Chlorophyeae	199	32.36
Cyanophyceae	109	17.72
Dinophyceaea	2	0.33
Euglenophyceae	3	0.49
Total	615	100

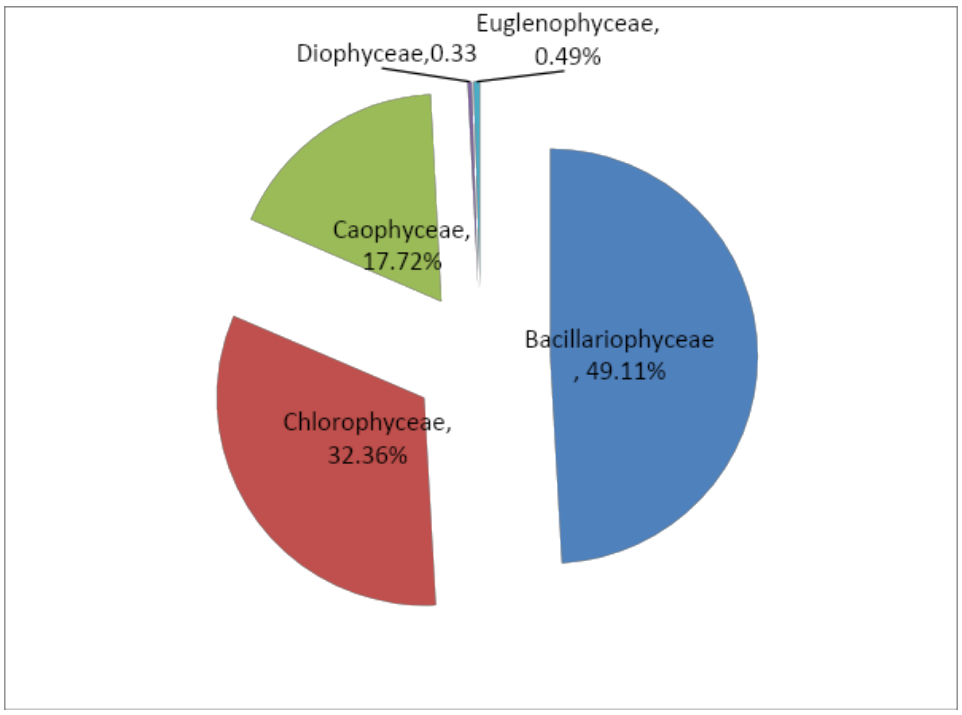

Fig. 2: Relative abundance of phytoplankton species in Mbiakong River

DISCUSSION

Thirty-five (35) species belonging to 5 taxonomic groups were recorded in the study area. Similar trends in abundance of phytoplankton groups were also reported by Abowei *et al.,* (2011), Ogbuagu *et al*., (2012) and Esenewo *et al*., (2017) in Koluama River, Bayelsa State, Imo River, in Etche Local Government Area, Rivers State, and Nwaniba River, South-South, Nigeria respectively. This result also corroborates with the reported 38 species in Nasarawa reservoir, Yusuf (2020), 39 species in Lubara Creek by Abowei *et al*. (2008), 36 species of from the Lagos Lagoon by Nkwoji *et al*. (2010), 43 species in Sombreiro River by Ezekiel, *et al*. (2011), 45 species from the Lagos Lagoon by Ugbeyide and Ugwumba (2021), as well as 51 species from Ikpa River, Ekwu and Udo (2014).

The result of this study, however, varies considerably from some other studies in Nigeria. Effiong *et al*. (2018) reported 85 species in Eastern Obolo River Estuary. Ogamba *et al*. (2004) reported 143 species in Elechi creek. Davies *et al*. (2009) recorded 169 species in Elechi Creek and Emmanuel and Onyema (2007) reported 82 species in Lagos Lagoon. Furthermore, Edogbolu and Aleleye-Wokoma (2007) reported 198 species from Ntawogba Creek, Port Harcourt. Phytoplankton abundance is influenced by water temperature, velocity of current, availability of nutrient and light penetration into the water (Ezekiel *et al.,* 2011). The distribution of phytoplankton in water bodies are not even due to its characteristic patchiness which reduces predator pressure. Phytoplankton show temporal variation in abundance which is influenced by nutrient availability, dynamics in water currents and transparency (Sharma and Bhardwaj, 2011). Planktons exhibit high surface area proportional to volume ratio owing to their microscopic nature. This relationship is important as movement is easier in proximity to the surface due to less frictional force between the organism and the water.

The dominance of diatom species such as *Nitzschia sigma* and *Melosira granulata*; green algae *Ankistrodemus spirilliformis*; blue-green algae *Anabaena circularis* and *Oscillatoria limnosa* strongly showed that the river is eutrophic which an evidence of pollution in the water body. Phytoplankton could be a viable tool both for long term and community based monitoring of reservoirs putting into consideration its inexpensive nature and ease to collect data. Its recommend that a sustainable management plan should be formulated and implemented in order to preserve the reservoirs ecosystem.

Conclusion

Information about phytoplankton is necessary in understanding the structure and functions of the water bodies; they are important indicators of trophic status of various aquatic biotopes. Appearances of various phytoplanktonic forms indicate good ecological condition of the river. Planktons are ubiquitous. The most characteristic feature is their variability over space and time in aquatic ecosystem. The dominance of diatom species such as *Nitzschia sigma* and *Melosira granulata*; green algae *Ankistrodemus spirilliformis;* blue-green algae *Anabaena circularis* and *Oscillatoria limnosa* strongly showed that the river is eutrophic. Since phytoplankton play a major role in the food chain, it is pertinent to monitor natural and anthropogenic changes in plankton populations. The study therefore recommends the need to create educational awareness to the inhabitants of this study area and the general public on the effects of anthropogenic activities in aquatic ecosystems for a sustainable management and healthy productivity.

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