IJEAST

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

VOLUME : 5 ISSUE : 6 Print / Issue Publication Date: 21-Dec-2020

ISSN : 2455-2143

DOI : 10.33564/IJEAST.2020.v05i06.018

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editor@ijeast.com

International Journal of Engineering Applied Sciences and Technology, 2020
Vol. 5, Issue 6, ISSN No. 2455-2143, Pages 128-137
Published Online October 2020 in IJEAST (http://www.ijeast.com)

DISTRIBUTION AND ABUNDANCE OF PHYTOPLANKTON SPECIES IN BODNA RIVER IN KWALI, ABUJA

Sani Bilkisu Mohammed
Department of Zoology, Nasarawa State University, keffi, Nigeria

Banyigyi, A. H. and Makpo, J.D
Department of Zoology, Nasarawa State University, keffi, Nigeria.

ABSTRACT- Abstract: Rivers are vital and vulnerable freshwater systems that are critical for the sustenance of all life. The Bodna River was analyzed for the abundance and distribution of phytoplankton species. The main aim of the study was to determine the presence of phytoplankton distribution and effects of human activities on the biological properties of the river, to further enhance conservation and management. Samples were collected insitu from the four sampling stations using plankton net of mesh size 50 µm. The water sample was concentrated to 100ml level into phytoplankton bottle,1ml of Lugol solution was added and allowed to sediment for 24 hours. 91ml of the water sample decanted and left with 10ml of the sample used for species count with drop count method. Descriptive analysis of bar charts and Analysis of variance (ANOVA) were used to determine the percentage abundance of phytoplankton. The result showed 117379 phytoplankton species; four major families with 14 species of phytoplankton which include *Chlorophyceae* with species like *Chlorella ellipsodea, Closterium species, Spirogyra species, Hormidium species and Ulothrix species; Bacillariophyceae* with Melosira *granulata, Fragillaria species, Nitzchria species, Diatomella species, Tabellaria species* and *Synedra species; Cyanophyceae with species such as Aphanocarpsa species, Oscillatoria species* and *Euglenophyceae with Phacus species.* The most abundant species of phytoplankton from this study was *Chlorella ellipsodea with total abundance* of 26,556 and the least was *Synedra species* with a value of 1,970. There were variations within the sampling stations and within seasons. This study findings could be helpful to the community for sustainability of live food for the biological composition in the river.

Key words: phytoplankton, distribution, drop count, seasonal and River Bodna.

I. INTRODUCTION

Water is a unique liquid, it is essential for life and the most important medium through which living organisms can grow and flourish. Rivers are vital and vulnerable freshwater systems that are critical for the sustenance of all life, providing main water resources for domestic, industrial and agricultural purposes (Farah *et al*., 2002). Unfortunately, river waters are being polluted by indiscriminate disposal of sewage, industrial waste and a plethora of human activities that affect their physicochemical parameters and microbiological quality (Oboh *et al*., 2017, Efe, 2000). Aquatic ecosystem is a critical component of the global environment. In addition to being an essential contribution to biodiversity and ecological productivity, they also provide a variety of services for the human population such as irrigation, recreational opportunity and habitat for economically important fisheries (Dankishiya *et al*,, 2013).

Plankton is the basic food source for a variety of marine species, from tiny fish larvae such as cod all the way up to giant baleen whales. Phytoplankton are very important group of freshwater organisms. They occupy the primary trophic level as primary producers and food source for invertebrate and vertebrate groups in the aquatic environment. In nature, phytoplankton is fed on by zooplankton, which is equally fed on by other higher animals such as larger zooplankton, fin fish and shellfish. Almost all aquatic life depends on zooplankton at least at an early stage of their life. In nature, larvae of most fish and shellfish species eat small phytoplankton and zooplankton. Such a diet does not only provide a much-diversified composition, but has an auto digestion characteristic that facilitates nutrient uptake in the larvae.

Lovik and Kjellberg (2003) observed that trophic changes in lake environments could be highlighted through the study of the structure and composition of the planktonic communities, and the observation of the principal physical and chemical parameters of the waters. Such changes allow us to draw useful pictures about the state of water quality in the lake and on its trophic state. Studies by Boyd *et al.* (2000) have shown that the mineral element iron can cause increased blooms of many kinds of phytoplankton. Mizuno (1990) also theorized that large-scale “Seedling” of the world’s oceans with iron would generate such massive blooms of phytoplankton to draw enough carbon dioxide to counteract the Greenhouse effect (or global warming). Direct exudation of dissolved organic carbon from phytoplankton is variable but often varies within 5 to 20% of the primary production, so when phytoplankton are growing carbohydrates activity are released in large amounts, and can contribute up to 70% of the Dissolved Organic Carbon (DOC) (Sondergaard *et al.*, 2000). Levels of chlorophyll –a in phytoplankton are used to determine the level of primary production. However according to Jeffrey *et al.* (1997) a diverse range of pigments has evolved in the phytoplankton, conveniently providing important chemo taxonomic information concerning community composition and certain key pigments are signatures for various phytoplankton groups.

According to Pannard *et al.* 2007 depending on the season, phytoplankton responses differ in response to nutrient and light conditions, and to the intensity of stratification and mixing. Crul (1993), states that phytoplankton development in aquatic ecosystems is greatly enhanced by increased level of the major plant nutrients. This is because some of the nutrients are involved in the intercellular metabolic regulation and as building blocks in protein molecules. Both zooplankton and phytoplankton not only play a vital role in the stability of the marine ecosystem, but they also serve as an indicator of water health, since they are affected by slight changes in the environment (Barlow *et al.*, 2006).

II. MATERIALS AND METHOD

Study Area

In Kwali region of FCT Nigeria, the problem is getting portable water because of environmental pollution and degradation. Bodna River in kwali area council of FCT, is a tributary to lower Usman dam. The river has a tremendous economic importance to the indigenous settlers which ranges from domestic usage, irrigation for agricultural activities and fishing. These activities are source of employment opportunities to some of the community members. However, less attention has been given to the Bodna River despite its importance in the lives of the inhabitants of the area, who rely mainly on the river for drinking, domestic water supply, fishing, farming, bathing, laundry and sand mining. The river is being polluted by the human activities such as; bathing, washing, refuse dumping and defeacation around the river banks. These activities in one way or the other affects the physico-chemical parameters of the water body. Four sampling stations were used for this research.

Station 1 (Tukurwa): The River flows from the same source with a distance 10km from the source. This area is surrounded sparsely by houses; fishing and irrigation farming is the predominant activity. The station coordinates are: Latitude 8^0 50^1 N, longitude 7^0 2^1 E. NIMET,(2013).

Station 2 (Oversea quarters): This River runs along the main source across settlements. It is used for domestic purposes and block molding with station coordinates at latitude 8^0 49^1 N and longitude 7^0 3^1 E.

Station 3 (Bonugo): This site is equally surrounded by houses; farming activities, washing and block molding as the major activities. Evacuation of soil also takes place as they dig out the soil for building construction. Station coordinates are: Latitude 8^0 49^1 N and longitude 7^0 1^1 E.

Station 4 (Koroko): This River is surrounded sparsely by houses; irrigation farming is majorly practiced. Excavation of the top soil also takes place for building constructions. Station coordinates are: Latitude 8^0 49^1 N and longitude 7^0 2^1 E.

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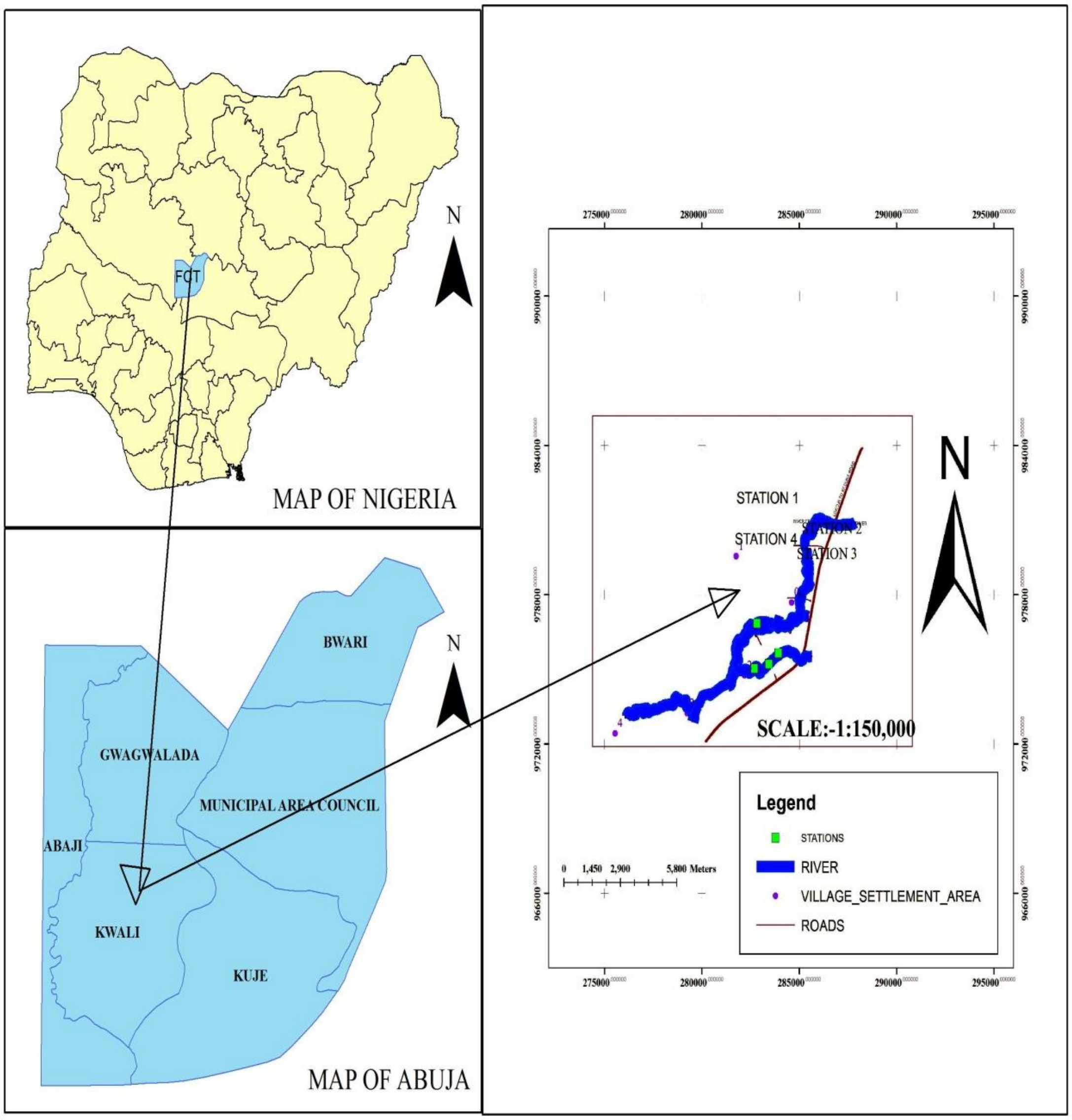

SOURCE: ADMINISTRATIVE MAP KWALI AREA COUNCIL (2018)

Figure 1.Map of Abuja showing the study Area in Kwali.

III. MATERIALS AND METHODS

Phytoplankton enumeration

Samples were collected insitu from the four sampling stations using plankton net of mesh size 50 µm. The collection was done using a scoop net trawled horizontally in the river. The water sample was concentrated to 100ml level into phytoplankton bottle,1ml of Lugol solution was added and allowed to sediment for 24 hours. 91ml of the water sample decanted and left with 10ml of the sample used for species count, (Prescott, 1982).

Drop count method was used. One ml of the sample was dropped on the slide covered with a cover slip and mounted on the Olympus Biological Microscope to view and number of cells counted. Prescott (1982) identification method was used.

Statistical analysis

Descriptive analysis of bar charts was used to determine the percentage abundance of Phytoplankton species in the Bodna River. Analysis of data was based on monthly data collection by identification and counting. Analysis of variance (ANOVA) was used to analyse the data using SPSS (2015) version 26 statistical package of 95% confidence level.

IV. RESULTS

Distribution and Abundance of Phytoplankton in Bodna River

The distribution and abundance of phytoplankton in Bodna River were presented in Table 1 and percentage distribution in Figure 2. There were 117379 phytoplankton species encountered in the Bodna River during the study period. There are four major families with 14 species found in the Bodna River which include *Chlorophyceae* represented by *Chlorella ellipsodea*, *Closterium species, Spirogyra species, Hormidium species, and Ulothrix species*. *Bacillariophyceae* had the following species, M*elosira granulata, Fragillaria species*, *Nitzchria species Diatomella species Tabellaria species* and *Synedra species. Cyanophyceae* had *Aphanocarpsa species and Oscillatoria species while* the forth group was *Euglenophyceae* represented by *Phacus species*. The phytoplankton with the highest abundance was *Chlorella ellipsodea* with values 26,556 followed by *Closterium species* with 19,956 then *Nitzchria species* with 13,364 and the least was *Synedra species* with 1,970. The highest percentage was equally observed in *Chlorella ellipsodea* with 22.6% followed by *Closterium species* with 17.0% then *Nitzchria species* with 11.4% and least was *Synedra species* with 1.7% (Figure 2).

However, it was observed that there were variations in the availability and number of some species in the sampling stations of the river. The mean distribution of phytoplankton according to the stations is shown in Table 2. In station I, *Chlorella ellipsodea* was observed to have the highest values 13,050 followed by *Closterium species* with 8,250 then *Nitzchria species* with 7,770 and the least was *Ulothrix* with 217 and *Oscillatoria species* with 217 (Table 2). Station II was rich in *Chlorella ellipsodea* with 4460 followed by *Melosira granulata* with 3617 and the least was *Fragillaria species* with 40. In sampling station III, *Spirogyra species* was observed to be the highest with 3,698 followed by *Closterium species* with 2,114 and the least was *Hormidium species* with10. Similarly, station IV had the highest C*hlorella ellipsodea* with 9,046 followed by *Closterium* with 7,788 and the least was *Ulothrix species* with 800 (Table 2).

However, some species were not found in some study stations and these had no percentage values. The variations in the seasonal distribution of Phytoplankton as observed in this study indicated highest percentage of phytoplankton with 66.3% in the wet season and 33.7% in the dry season as shown in Table 3.

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Table 1: Relative Abundance of Phytoplankton in Bodna River 2018 to 2019

Family	Species	Number	Percentage (%)
BACILLARIOPHYCEAE	*Melosira granulate*	6025	5.1
	Fragillaria species	4034	3.4
	Nitzchria species	13364	11.4
	Diatomella species	7894	6.7
	Tabellaria species	4551	3.9
	Synedra species	1970	1.7
EUGLENOPHYCEAE	*Phacus species*	3104	2.6
CHLOROPHYCEAE	*Chlorella ellipsodea*	26556	22.6
	Closterium species	19956	17.0
	Spirogyra species	11724	10.0
	Hormidium species	3524	3.1
	Ulothrix species	4465	3.8
CYANOPHYCEAE	*Aphanocarpsa species*	2444	2.1
	Oscillatoria species	7768	6.6
Total		117379	100%

Note: *% means percentage*

percentage

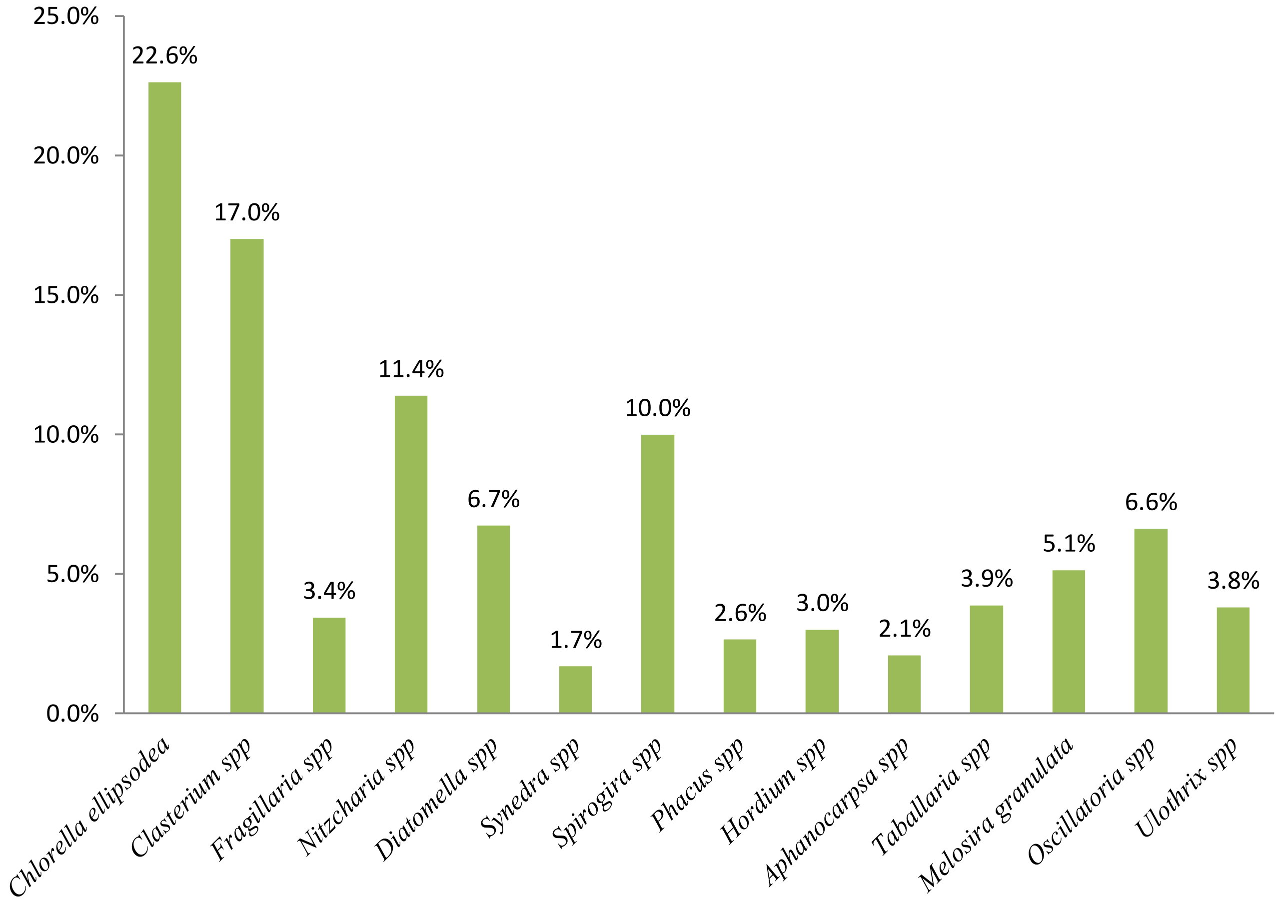

Figure 2: The percentage distribution of Phytoplankton abundance in Bodna River

Table 2: Mean Distribution of Phytoplankton of Bodna River in 2018 to 2019 According to Stations

Species	Stations							
Phytoplankton	I		II		III		IV	
	No.	Percentage %	No.	Percentage %	No.	Percentage %	No.	Percentage %

Melosira granulate	417	1.01	3617	17.24	1991	14.60	-	-
Fragillaria species	2010	4.85	40	0.20	-	-	1984	4.80
Nitzchria species	7770	18.76	860	4.19	-	-	4734	11.46
Diatomella species	2480	5.98	90	0.43	550	14.03	4774	11.56
Tabellaria species	260.00	0.63	2490	11.87	1801	13.20	-	-
Synedra species	1770	4.27	-	-	200	1.41	-	-
Phacus species	990	2.39	2114	10.08	-	-	-	-
Chlorella ellipsodea	13050	31.48	4460	22.00	-	-	9046	21.90
Closterium species	8250	19.90	1804	8.60	2114	15.50	7788	18.85
Spirogyra species	1630	3.93	1834	8.74	3698	27.11	4562	11.04
Hormidium species	1730	4.17	-	-	10	0.07	1784	4.32
Ulothrix species	217.00	0.52	1844	8.79	1604	11.76	800	1.94
Aphanocarpsa species	660	1.59	-	-	-	-	1784	4.32
Oscillatoria species	217.00	0.52	1827	8.71	1674	12.27	4050	9.80
Total	41451	100%	20980	100%	13642	100	41306	100%

Note: Stations with (-) means absence of specie

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Table 3: Mean Seasonal Variation of Phytoplankton Distribution in Bodna River 2019

Species Phytoplankton	Seasons			
	Wet		Dry	
	No.	Percentage %	No.	Percentage %
Melosira granulate	4004	5.1	2021	5.1
Fragillaria species	2421	3.1	1607	4.1
Nitzchria species	8992	11.6	4372	11.1
Diatomella species	587	6.8	2607	6.6
Tabellaria species	2764	3.5	1787	4.5
Synedra species	1280	1.6	690	1.7
Phacus species	11627	2.1	1477	3.7
Chlorella ellipsodea	19263	24.7	7293	18.4
Closterium species	12919	16.5	7037	17.7
Spirogyra species	7722	9.9	4002	10.1
Hormidium species	2212	2.8	1312	3.3
Ulothrix species	2914	3.7	1551	3.9
Aphanocarpsa species	1647	2.1	797	2.0
Oscillatoria species	4777	6.1	2991	7.6
Total	77835	100%	39544	100%

Note: Highest percentage of phytoplankton was found in the Wet season at 66.3% and the lowest percentage in the dry at 33.7%

V. DISCUSSION

Phytoplankton

There was a rich population of phytoplankton in the Bodna River represented by four families with 14 species. The families include, *Chlorophyceae, Bacillariophyceae, Cyanophyceae* and *Euglenophyceae* which gave the total abundance of species at 117379 during the study with the Chlorophyceae having the highest abundance. This is similar to the study conducted by Idowu *et al,* (2018), which showed a representative of six families with 33 species, Abdullahi, (2005) and Abubakar (2009) who worked on Hadejia Nguru wetlands which was dominated by *Chlorophyta, Lyanophyta, Bacillariophyta* and *Dinophyta*.

The composition of phytoplankton in Bodna River is an indication that the River is not polluted. This also corresponds with the finding of Venvuren *et al*, (2007) in Mohale Dam in South Africa but differs from the work of Abubakar (2009) on Aspects of Ecology and Fisheries of Nguru Lake indicated that the family *Cyanophyceae* was more dominant in most sites which caused deterioration of water quality. The phytoplankton of Bodna River undergoes seasonal changes in both composition and relative abundance. There was a decline in the population during the dry season between November and March. This may be attributed to fluctuations in the physical, chemical and biological characteristics of the River. This finding disagrees with the work of Abubakar (2009,2015) with phytoplankton declining during rainy season at Nguru lake. Similarly, the relationship between phytoplankton and physical and chemical parameters was positive which contradicts Abubakar (2009,2015) that reveals negative relationship.

VI. CONCLUSION

The distribution and abundance of phytoplankton in the four sampling stations belongs to major group of the families; *Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. H*owever, it was observed that there are variations in the ability and number of some species in the sampling stations and the family *Chlorophyceae* was highest in abundance. The zooplankton community in the river were represented by three main groups which includes; *Rotifera, Cladocera* and *Copepoda*. There was species variation within the sampling stations and from season to season while the highest abundance was observed in the wet season with *Rotiferans* as the highest.

VII. RECOMMENDATION

Area of further studies should focus on some specific useful phytoplankton and zooplankton in the river as live food for the fish species to enhance management and sustainability of fishing resources in Kwali Area Council.

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2455-2143