PHYTOPLANKTON COMPOSITION AND ABUNDANCE OF RIVER BENUE, JIMETA, YOLA-NORTH L.G.A. ADAMAWA STATE, NIGERIA

CHUBADO, A.
Department of Biology, Federal College of Education, Yola, Adamawa, Nigeria.

ABSTRACT

This study investigates the phytoplankton composition and abundance in River Benue, Jimeta metropolis, Adamawa, Nigeria. Indiscriminate human activities are widely practiced in the developing nation of the world as it was observed in River Benue at Jimeta metropolis, Yola. Water samples was collected from three different sites (A, B and C) within the period of six months (August, 2016 to January, 2017) for the determination of phytoplankton. A total number of 271 Phytoplankton belonging to 5 taxanomic group were recorded from River Benue, Jimeta metropolis. *Chlorophyceae* was represented by 102 individuals consisting of 37.94% by composition. This was followed by *Bacillariophyceae* with 73 individuals (26.94%), *Cyanophyceae* 55 individuals (20.29%), *Euglenophyceae* 28 individuals (10.33%) and *Rhodophyceae* with 13 individuals (4.80%). Adequate monitoring of the water quality and regulation of human activities in and around the River are to be recommended in order to reduce the excessive human activities in the River and conserve it for a longer period.

Keywords: Abundance, composition, phytoplankton, River Benue, Adamawa, Nigeria.
***Correspondence:** amchubado@fceyola.edu.ng, 08036517029

INTRODUCTION

Phytoplankton are microscopic aquatic plants, occurring as unicellular, colonial or filamentous forms, without any resistance to currents and are free-floating or suspended in the open waters [1]. According to Biddanda & Benner [2] one of the main sources of carbohydrates in many aquatic systems is phytoplankton, where biomass is typically made up of from 15 to 35% carbohydrate. Phytoplanktonic species have different physiological requirements and thus show diverse responses to environmental changes both physical, chemical and biological. The physiological requirement of the phytoplankton affects their distribution and influence variation. Their sensitivity and variations in species composition are often a reflection of significant alteration in ambient condition within an ecosystem [3]. Phytoplankton are recognized worldwide as bioindicator organisms in the aquatic environment [4]. The phytoplankton are the primary producers which serves as food majorly for zooplankton which in turn serves as an important source of food to crustaceans and fish [5]. They therefore, serve as a major source of organic carbon in rivers and may represent an important source of oxygen in low-gradient aquatic ecosystem. The activities executed by human may induce changes and variation in the composition and abundance of phytoplankton. Human activities have been implicated to impair water quality, sometimes to unacceptable limits [6].

Human activities impact serious reduction in freshwater quality, characterized by abundance of organic compounds, toxic chemicals, nitrites and nitrates in water may cause unfavourable effects on the human health. Human activities such as, pond fertilization with fertilizers, obnoxious fishing practice; Fertilizer application, pesticides and herbicides, used in agriculture and forestry are the commonest sources of human induced water pollution that bring about eutrophication, hypoxia, fish kill, disruption of food web and changes in the community ecosystem [7, 8, 9]. Human activities are a major factor determining the quality of surface water through atmospheric pollution, effluent discharges, use of agricultural chemicals and land use. The nutrients introduced in the water through human activities influence the growth of phytoplankton. The growing problem of degradation of river ecosystem due to human activities has made it important for continuous monitoring of water quality of rivers to evaluate their state of pollution. Phytoplankton shows significant differences in composition and abundance on the various site selected for the study as investigated in River Benue, Jimeta, Yola.

MATERIALS AND METHODS

Description of study area

River Benue is a freshwater flowing through Nigeria and it is the second largest river in the country. The river originates from the Adamawa mountains of Cameroun, some bounding the Nigeria frontier and flows eastward through the Nigeria territory before joining the River Niger at Lokoja, Kogi state, Nigeria [10]. The study was conducted at River Benue, Jimeta metropolis, Yola-north Adamawa state. The study area, Jimeta, is located between latitudes $9^0$10‘to 9^0 15‘N and longitudes 12^0 11‘to 12^0 17‘E.

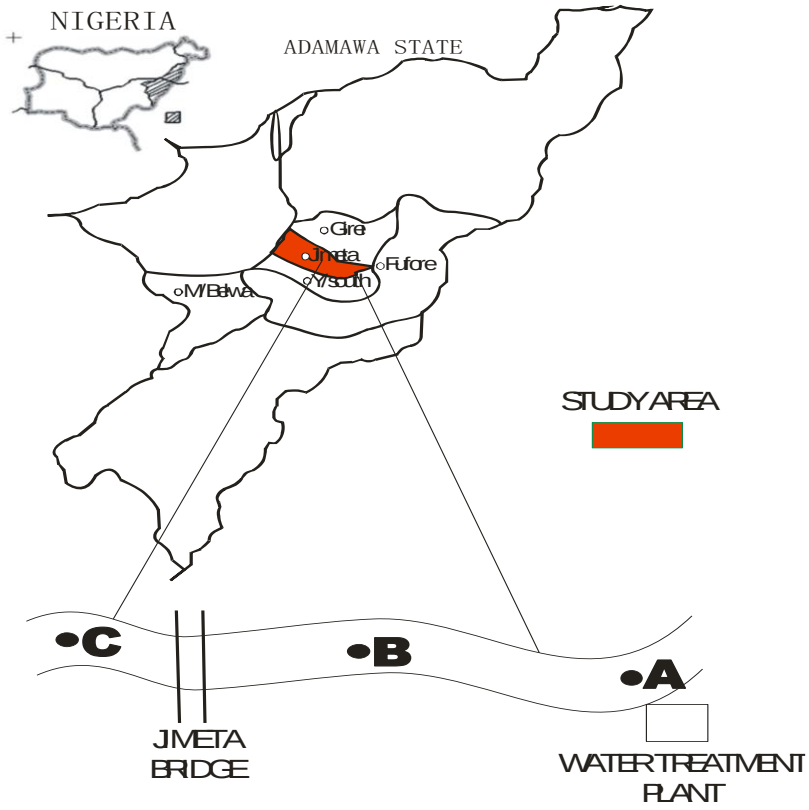

Figure1: Map of Adamawa State showing the study area Jimeta (Yola-North) and sampling stations A, B and C in River Benue

Sampling stations

Three sites (ABC) were selected along the course of the River for the study. Site A is a point where the River enters the town at Boramji near water treatment plant that supplies water to the town. Site B is a point where there are more pronounced human activities such as washing clothes, cars, petroleum tankers, bathing, discharge of solid and sewage waste and loading and uploading of commodities/goods from canoes etc. Site C is the downstream of the River with less pronounced human activities.

Sample collection

The samples were collected using plankton net with a collecting bottle at the base. The net was immersed just below the water surface and then towed through a distance along the side of the boat. The content of the bottle was poured into a wee labeled sampling bottle and preserved with Lugols iodine solution. The samples were then placed in a sampling box and taken to the laboratory for further analysis. Samples were collected once a month for six months (August, 2016-January, 2017) from the selected locations between 15th and 20th of every month.

Phytoplankton analysis

Phytoplankton sample was concentrated to 50 ml volume before the analysis of organisms. Identification and counting of the phytoplankton sample was done using a compound microscope. The concentrated sample was agitated to homogenize before placing a drop of the sample on slide, covered with cover slip and was examined with compound microscope at a magnification of x4, x10, and x40 objectives lenses as describe by Beverages in [11]. The Phytoplankton was identified using standard phycological keys as described by Edward & David [12]. Keys for identification of the algae was used following the methods of Belcher & Swale [13]. Counts were made and records were taken and expressed as total number and percentage

abundance of phytoplankton in each sampling site. Species diversity was determined using Shannon's diversity index (H) as described by Ogbeibu [14] and Odum's index as described by Agouru & Audu [15].

RESULTS

Fifteen species of phytoplankton were identified and recorded during the study which belongs to five taxonomic groups in river Benue at Jimeta metropolis. Chlorophyceae was represented by five species consisting of 37.64% with Spirogyra sp having the highest cell counts, Bacillariophycea have four species consisting of 26.94% with Nitzchia sp having the highest cell counts, Cyanophyceae three species consisting of 20.29% with Oscillatoria sp having the highest cell counts, Euglenophyceae two species consisting of 10.33% with Euglena sp having the highest cell counts and Rhodophyceae one specie consisting of 4.80% represented with only Batrachospermum sp. The phytoplankton species composition and abundance are presented in tables and figures 1 and 2 respectively.

Table 1: Phytoplankton species in River Benue, Jimeta, Yola (Aug, 2016 – Jan, 2017).

Phytoplankton Taxa	**Species**	**Station A**	**Station B**	**Station C**	**Total number of species**	**% Abundance for Species**
Chlorophyceae	*Spirogyra sp*	8	12	8	28	10.33
	Ulothrixtenuissim	5	8	6	19	7.01
	Chlorella sp	7	11	6	24	8.86
	Cladophora oligoclonus	3	8	6	17	6.27
	Mougeotiasp	5	4	5	14	5.17
Bacillariophyceae	*Nitzchiasp*	5	9	8	22	8.12
	Fragillariasp	6	9	5	20	7.38
	Synedra sp	3	10	6	19	7.01
	Ceratiumsp	2	7	3	12	4.43
Cyanophyceae	*Oscillatoria sp*	6	11	7	24	8.86
	Nostocsp	5	7	5	17	6.27
	Anabaena sp	1	8	5	14	5.17
Euglenophyceae	*Euglena sp*	6	9	6	21	7.75
	Phacussp	0	5	2	7	2.58
Rhodophyceae	*Batrachospermumsp*	2	6	5	13	4.79
	Total abundance	**64**	**124**	**83**	**271**	**100.00**
	% abundance	**23.61**	**45.76**	**30.63**		**100.00**
Shannon weiner index	**2.666**					
Odums index		**21.88**	**12.10**	**18.07**		

Table 2: Abundance of Phytoplankton taxa in River Benue, Jimeta metropolis, Yola (Aug, 2016 - Jan,2017)

Phytoplankton taxa	Aug	Sep	Oct	Nov	Dec	Jan	Total Abundance	% Abundance
Chlorophyceae	14	17	18	14	16	23	102	37.64
Bacillariophyceae	14	15	8	10	10	16	73	26.94
Cyanophyceae	7	7	10	12	10	9	55	20.29
Euglenophyceae	4	4	5	5	5	5	28	10.33
Rhodophyceae	2	1	3	3	2	2	13	4.80
Total	**41**	**44**	**44**	**44**	**43**	**55**	**271**	**100**

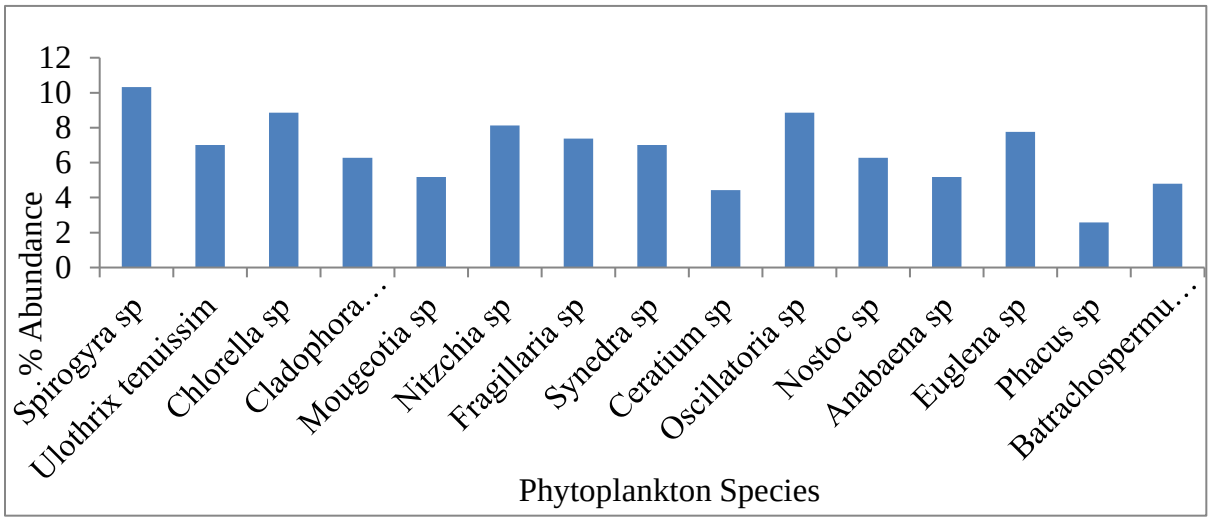

Figure 1: Phytoplankton species composition and abundance in River Benue, Jimeta metropolis (Aug, 2016 –Jan, 2017)

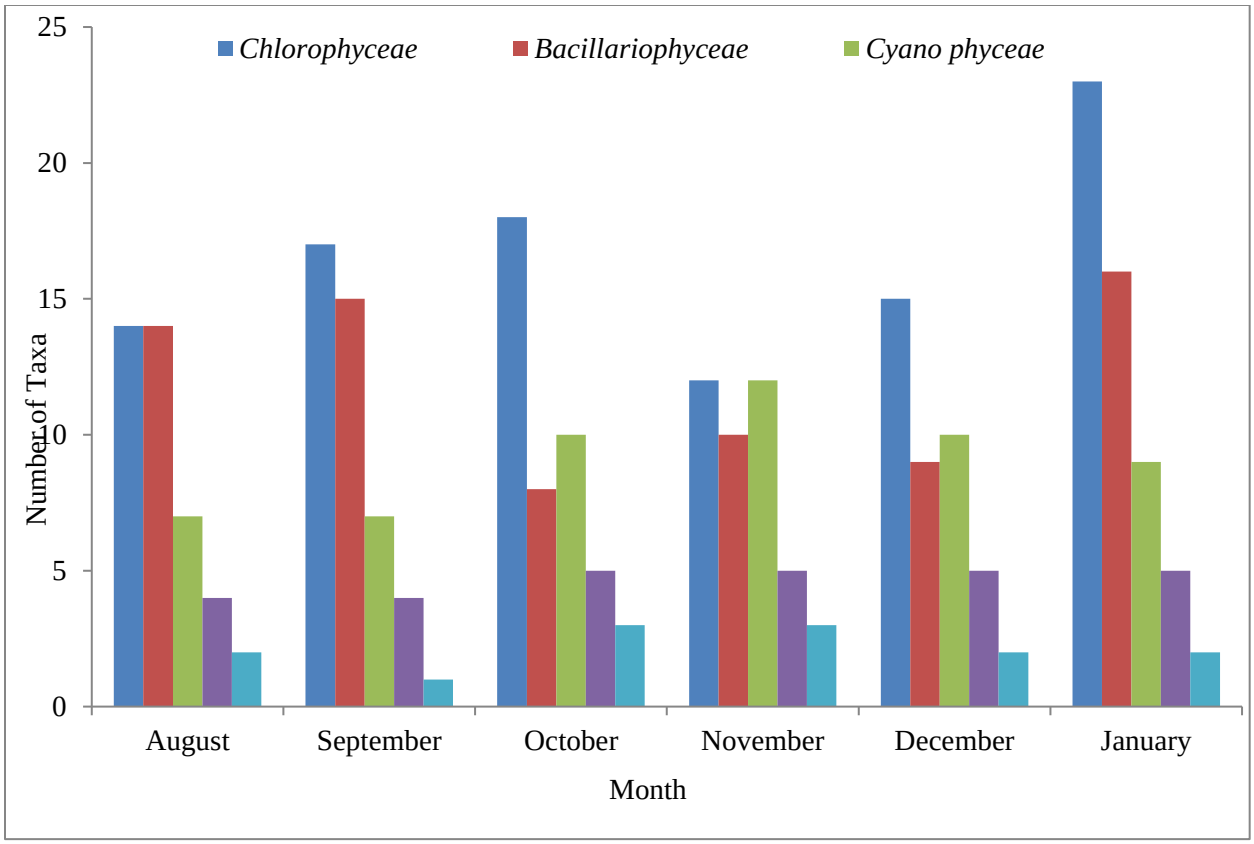

Figure 2: Number of Phytoplankton Taxa in River Benue (Aug, 2016 to Jan, 2017)

DISCUSSION

Generally, the phytoplankton species, composition was similar in all the three sites. This result agrees with the finding of [16], on the studies of the range of plankton in River Benue Makurdi that shows similarities of species between the sites identified for study. The result of this study however, varies considerably from some other studies in Nigeria. [17] reported forty-three species of phytoplankton in Sombreiro River. [18] recorded 26 species of Phytoplankton in great Kwa river, which also varies with the present study that reported 15 species of Phytoplankton in River Benue, Jimeta metropolis. The Phytoplankton composition of this study was dominated by *Chlorophyceae*]. Other studies reported the dominant of *Bacillariophyceae* which disagrees with this study [19]. 15 species of phytoplankton identified from river Wudil [20] agrees with the finding of this study. The highest number of *Spirogyra* species in this study agreed with the finding [21].

The highest percentage abundance of phytoplankton was recorded in site B The variation of phytoplankton between the three sites might be attributed to the human activities carried out in the water such as bathing, washing, irrigation waste and sewage disposal, and so on which have contributed to the input of nutrients in the water that increases the abundance of the phytoplankton with one site (B) harboring the phytoplanktons more than the other sites (A and C). Other studies also confirm the variation of phytoplankton between sites [22]. The biological indices of Phytoplankton of River Benue Jimeta metropolis show that the Phytoplankton diversity index of Shannon Wein er diversity index was 2.666 which is in disagreement with other findings that reported diversity index value of 4.53 and 4.48 in Great KWA River, Cross River. Typical values are generally ranged between 1.5 and 3.5 in most ecological studies [23] which is in agreement with the present study. The lowest value of Odums index in site B indicates the rise in level of pollution which shows that site (B) is under threat of pollution due to the pronounce human activities at the site, that causes the input of nutrients, which enable the abundance of the plankton. This result is in agreement with the statement of others that decrease in Odums index value indicates the rise in the level of pollution.

CONCLUSION

In conclusion, about fifteen species of phytoplanktons were identified with *Chlorophyceae* having the highest percentage abundance of (37.64%), followed by *Bacillariophyceae (*26.94%), *Cyanophyceae* (20.29%), *Euglenophyceae* (10.33%), and *Rhodophyceae* (4.80%). The activities around the catchment of the River Benue have significant effect on the phytoplankton composition and abundance. The present study provides the information on the composition and abundance of phytoplankton in River Benue, Jimeta metropolis which could be useful for further assessment of the water. The results compared favourably with some similar reports and varied with others.

RECOMMENDATION

Adequate monitoring of the water quality and regulation of human activities in and around the River is recommended in order to reduce the pressure in the River and conserve it for a longer period.

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