FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 3 No. 1, March, 2019, pp 328 -332

CHANGES IN PHYTOPLAKTON COMMUNITY DYNAMICS DURING THE TRANSITION FROM DRY TO RAINY SEASON: A CASE STUDY OF KPATA LAKE, LOKOJA, KOGI STATE NIGERIA

Abba A.

Department of Biological Sciences, Faculty of Science, Federal University Lokoja, Kogi State

Corresponding Author's Email: Abdin2007@gmail.com; abidina.abba@fulokoja.edu.ng

ABSTRACT

Phytoplanktons changes were studied at Kpata Lake Lokoja in which transitional period between dry and rainy season were captured including other physicochemical properties of the Lake. The study was perfomed from April to May 2017, where five major phytoplankton groups were recorded. Physicochemical parameters analysed during the study include Electrical conductivity, EC Total dissolved Solid TDS, hardness, DO, BOD, Nitrate-nitrogen Posphate-phosporous and temperature. Electrical conductivity EC and Total dissolved solid TDS were at maximum throughout the study period, while the Temperature was very low in May but remains constant in April and June. The results indicate the changes in phytoplankton groups of the lake and it was influenced by temporal variations observed in the months and anthropogenic activities around the catchment and the banks of the lake. These changes show the relevance of short-term and long term observations of the lake for understanding of variation in phytoplankton groups in a freshwater ecosystem. It is therefore recommended that immediate measures to be taken in order to mitigate the level of pollution of the lake by humans, this could be through enlightenment campaigns, as well as proper monitoring and legislation that will enhance the livelihood of the people and provide them an alternative source of water for their activities, Also need for lake restoration is highly recommended.

***Keywords*:** Lokoja, pollution, aquatic productivity

INTRODUCTION

Climate change has been a global environmental challenge which affects the living organisms and environment. There is a link between large-scale climatic features, metrological and hydrographical conditions affecting phytoplankton dynamics in an aquatic ecosystem (Tania H. *et al.*, 2014). Phytoplanktons are a diverse group of microscopic organisms comprising several functional groups, including diatoms, dinoflagellates, prymnesiophytes and flagellates. Kpata Lake like any other freshwater lake has been in a serious pollution threat as a result of climate change and human anthropogenic activities. It is important to note how economically important is the lake to the people residing in the Area as well as environmental monitoring in general.

According to Ahmed *et al*., (2015), planktons by definition are small and microscopic organisms drifting or floating in the sea or freshwater, consisting chiefly the diatoms, protozoan, small crustaceans, the egg and larval stages of large animals. They are organisms that are unable to swim against water currents, most plankton are so small that they can only be seen with the aid of a microscope. They are very numerous and form an important part of aquatic ecosystem. The food chain of a river starts with the phytoplankton and zooplankton. Their presence is very vital to the ecology and survival of life in the aquatic environment. Phytoplanktons are producers, transforming sunlight into food energy (Ahmed *et al.*, 2015). Producers provide food for many different primary consumers. Phytoplankton community structure responds strongly to abiotic variables, according to their ecological preferences (Bellinger and Sigee 2010, Reynolds 1984) Change in any physicochemical parameter brings about a noticeable change in the population of phytoplankton. However, there were no previous studies done on the changes in Phytoplankton dynamics in Kpata Lake Lokoja. The study is aimed at assessing the phytoplankton community changes during transition from dry to rainy season (April, May and June) at Kpata Lake, Lokoja Nigeria. In order to understand the potential impacts of anthropogenic activities on the biodiversity in this water body, it is necessary to understand the baseline and present situation of the phytoplankton population changes in this area. Because phytoplankton stands at the bottom level of the food chain, they bear a significant importance in respect of their roles in aquatic ecosystems and their relations with other living organisms at upper levels of food chain.

MATERIALS AND METHODS

The study was conducted at Kpata Lake, which had a link with the lower river Niger about 2km away from the confluence located at longitude 07^0 5' 0''N and latitude 006^0 40' 00''E.

with four sampling points assigned which were 50 meters apart from each other; mainly based on the strategic activities such as bathing, meat slaughtering and preparation, fishing, washing, defecating, waste disposal and household sewage that are discharged directly into the lake. The sampling points were assigned as I, II, III and IV.

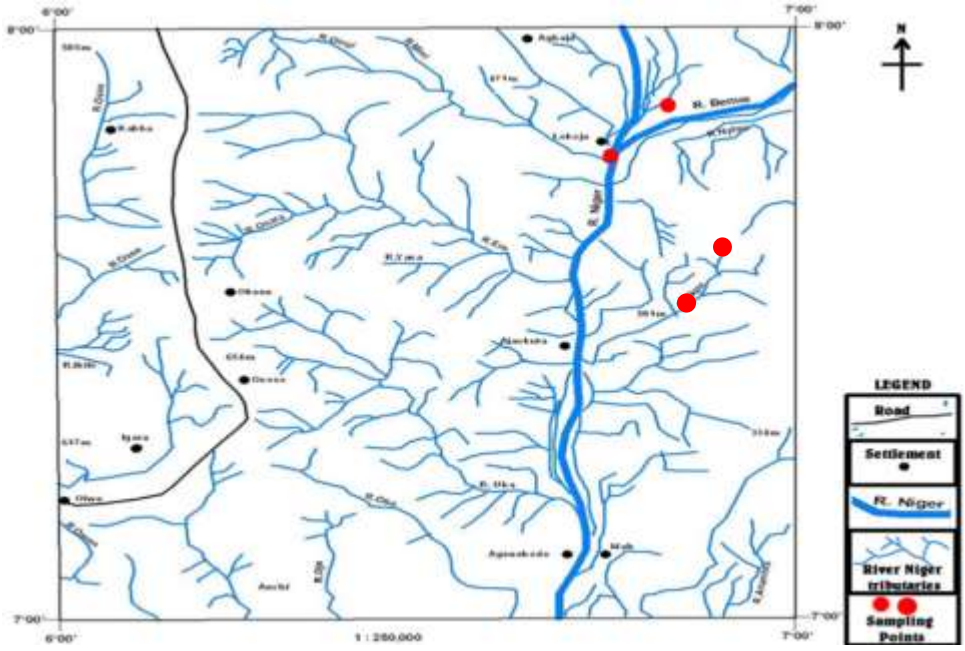

Fig. 1: Kpata Lake Showing the Sampling Sites
Source: Abba A. *et al.*, 2016

Physicochemical Analysis of Water

Physicochemical parameters DO, BOD, Nitrate-Nitrogen and Phosphate-phosphorus in the study were done according to (APHA 1999).

Evaluation of surface water pH, Temperature, EC and TDS

The surface water pH, Temperature, EC, and TDS were determined using HANNA pH/EC/Temp/TDS meter model 210. The meter was turned on and then the meter probe was inserted into the water at the point of collection as described by (APHA, 1999). The values were recorded as displayed on the meter.

Determination of phytoplankton

Phytoplankton sampling and analysis were done following the procedure by Edward and David (2010) and Andy (2007), Sanet *et al.* (2006), Verlencar (2004) and Palmer (1990).

RESULT AND DISCUSSION

The average Temperatures of the Lake were generally higher in April (32.80 ± 0.31^{0}C) followed by May with (31.68±0.10^{0}C), pH was acidic during the study period 7.70 ±0.08, 7.85 ±0.05 and 7.55 ±0.17 for April, May and June respectively. Turbidity was higher in the months of May and June with 4.67 ± 0.95ntu and 4.67 ± 0.95 each (Figure 3). This is similar to the findings of (Ayoade, 2009). Ayoade *et al.*, 2006 observed onset of rain decreased the turbidity in two mine lakes around Jos, Nigeria. Higher intensity of penetration of sunlight energy is important in photosynthesis (Ibrahim *et al.*, 2009). The lower transparency during rainy season could be attributed to influx or turbid flood from the rivers and runoffs into the lakes thereby lowering light penetration. The study indicate rapid growth in the phytoplanktons in the month of June; Bacilliriophyceae are also in the form of the following heirachy June>May>April, study of changes in Phytoplankton abundance is very important in aquatic productivity, it explains much about majority of primary production and mediating biogeochemical cycles in water column. And also to evaluate freshwater aquatic ecosystem functions

.

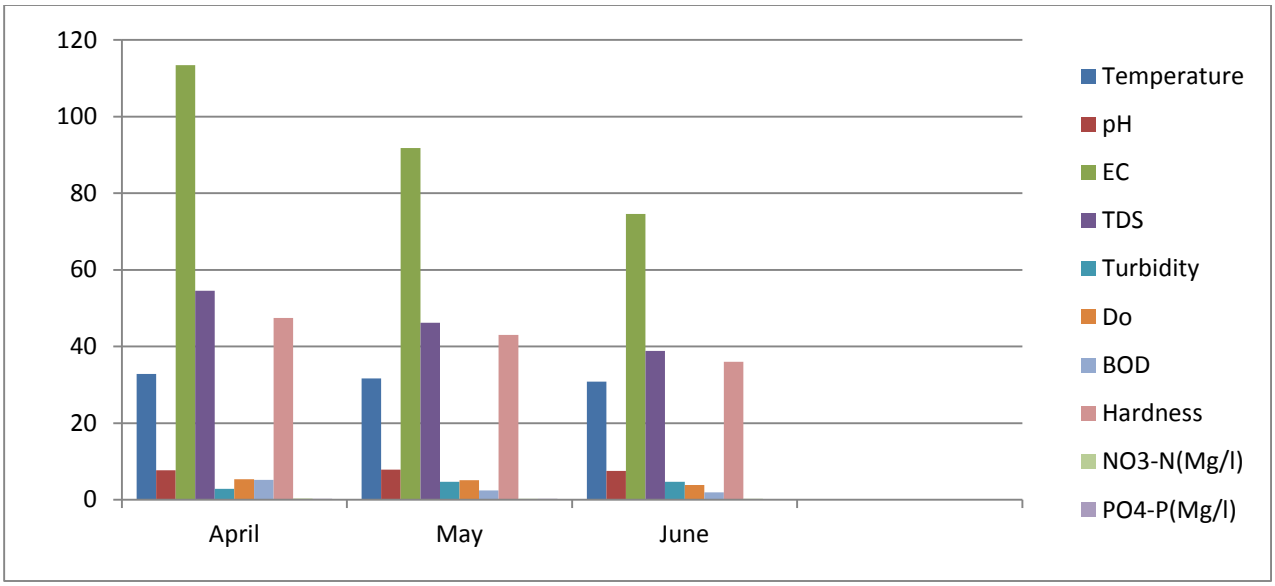

Fig. 2: Average Physicochemical parameters throughout the Study period in Kpata Lake

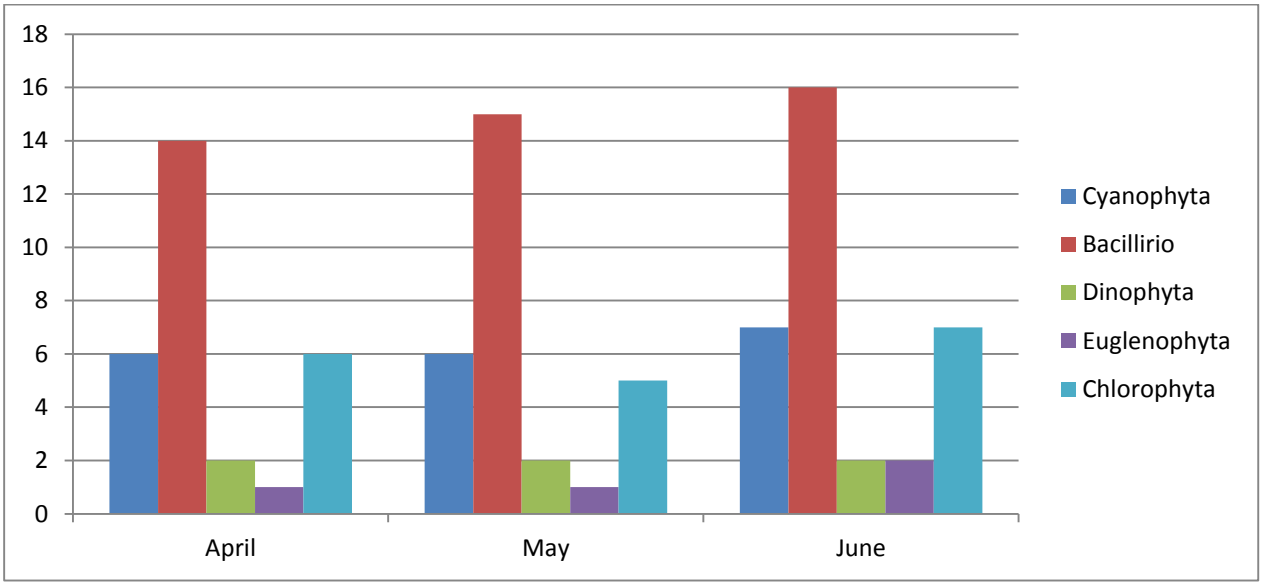

Fig. 3: Changes in the Average Phytoplankton during the Study Period from Aprils to May

The Average Phytoplankton changes observed during the study (Figure 2) indicate that Bacilliriophyceae has the highest concentration throughout the study period (April, May and June), Cyanophyta and Chlorophyta are the second highest group recorded in the month of June, While having equal concentration in April and May respectively. Dinophyceae and Euglenophceae were all third in the hierarchy with equal amount in the month of June. However, Dinophyta show no changes in the month of May as well. While Euglenophyceae had the least Number of cells in May. However, phytoplankton community are much similar from April to May which is similar to the findings of Senming T *et al., 2018* who find out communities of April are much more closer with communities of May and April.

Table 1 Phytoplankton Observed Between Months April to June

Months	Cyanophyta	Bacillariophyta	Dinophyta	Euglenophyta	Chlorophyta
April	6.00 ± 1.47[1]	13.75 ± 3.01[2]	2.25 ± 0.48[1]	1.25 ± 0.25[1]	5.50 ± 1.19[1]
May	5.50 ± 2.10[2]	15.00 ± 1.47[3]	2.00 ± 0.41[12]	1.25 ± 0.48[1]	4.75± 0.85[12]
June	6.75± 1.38[12]	16.00 ± 1.34[3]	1.50 ± 0.65[1]	1.50 ± 0.29[1]	7.2 5± 1.38[2]
Total Mean	6.08±0.89	14.92±1.45	1.92±0.29	1.33±0.19	5.83±0.86

Values are mean ± Standard deviation; values with same subscript in a column are not significant P≥ 0.05 tested by Duncan multiple range test.

Differences in phytoplankton biomass could be due to the higher microzooplankton biomass in indicating a more intense grazing by zooplanktons and other organisms at the high tropic level as observed by Senming T. et al., 2018. Chlorophyta densities dropped in April and May which is in agreement with Liefer et al., 2009 who stated that High phytoplankton abundances occurred in May and June is basically contributed by Bacilliriophyta and better adapted to utilizing high NO3 concentrations during upwelling pulses (Seeyave *et al.,* 2009).

STATISTICAL ANALYSIS

One way Analysis of variance (ANOVA) were done to compare the differences between the sampling locations.

CONCLUSION

The results of indicate the changes in phytoplankton groups of the lake and it was influenced by temporal variations observed in the months and anthropogenic activities around the catchment and the banks of the lake. Also the study showed high abundance generally in the month of June and April and low abundance in May. These changes show the relevance of short-term and long term observations of the lake for understanding of variation in phytoplankton groups in a freshwater ecosystem. It is therefore recommended that immediate measures to be taken in order to mitigate the level of pollution of the lake by humans, this could be through enlightenment campaigns, as well as proper monitoring and legislation that will enhance the livelihood of the people and provide them an alternative source of water for their activities, Also need for lake restoration is highly recommended.

ACKNOWLEDGEMENTS

I wish to acknowledge the support of Laboratory staff of the Department of Biological Sciences Federal University Lokoja, Kogi State for their Help.

REFERENCES

Achionye-Nzeh, C. G and Isimaikaiye, A. (2010). Fauna and Flora Composition and Water Quality of a Reservoir in Ilorin, Nigeria, *International Journal of Lakes and Rivers,* **3**(1): 7-15.

Ahmed U, Abdullahi, S. A and Abolude, D. S. (2015) Determination of Physico-Chemical Parameters and Plankton Composition of Wawan -Rafi Lake in Kazaure, Nigeria.

APHA (1999). *Standard Methods for Examination of Water and Waste Water*. American Public Health Association, New York, U. S.A.

Abba A., Musawa B.B., and Ugya A (2016) Study on Physico-chemical Parameters and Zooplankton Diversity in Kpata Lake, Lokoja Nigeria. *Katsina Journal of Natural and Applied Science* VOL. 5 No. 2 p 144.

Araoye, P.A. (2008) Physical Factors and their Influence on Fish Species Composition in Asa Lake, Ilorin, Nigeria. International Journal of Tropical Biology **57**(1-2): 167-175

Ayoade, A.A. (2009) Changes in Physico-chemical Features and Plankton of Two Regulated High Altitude Rivers Garhwal Himalaya, India. *European Journal of Scientific Research*. 27(1)77-92. Retrieved from http://www.eurojoumals.com/ejsr.htm on 27/12/2015.

Ayoade, A. A, Fagade, S.O. and Adebisi A. A. (2006)Dynamics of Limnological Features of Two Man-Made Lakes in Relation to Fish Production. *African Journal of Bioteclnology* **5**(10): 1013-1021. Retrieved from http;//www.academicjournals.org/AJB .on23/1 2/2015.

Akomeah, P.A., Ekhator, O. and Udoka, C. (2010) Dry Season Phytoplankton Composition Of Ibiekuma Dam, Ekpoma, Edo State. *Ethiopian Journal of Environmental Studies and Management,* (3)3:36-40

Balogun, J.K., Balarabe, M.L and Igberaese, P.M (2005) Some Aspects of the Limnology of Makwaye (Ahmadu Bello University Farm) Lake, Samaru, Zaria. *Academic Journal,*

23(12):850-860 Retrieved from http;//www.academicjournals.org/AJB

Edward, J.B. and Ugwumba, A.A. (2010). Physico-Chemical Parameters and Plankton Community of Egbe Reservoir, Ekiti State, Nigeria. *Research Journal of Biological Sciences* **5**(5):356-367.

Emi, Y. and Andy, G. (2007). *Phytoplankton Identification Guide.* University of Georgia Marine Education Centre and Aquarium. Retrieved from http://www.marex.uga.edu/aquarium

Liefer J D, Macintyre H L, Novoveská L, et al. 2009. Temporal and spatial variability in Pseudo-Nitzschia spp. in Alabama coastal waters: a "hot spot" linked to submarine groundwater discharge? Harmful Algae, 8(5): 706–714, doi: 10.1016/j.hal. 2009.02.003

Misra, S. G and Dinesh, D., (1991). *Soil Pollution.*Ashing Publishing House, New Delhi, India Retrieved from http://www.wiloludjournal.com.

Oguntuase, M.A. (1995). *Environmental Impact of Groundwater Development Projects*. Proc. Nig. Society of Agric. Engineers. Akure, Nigeria PP 205.

Olele, N.F., and Ekelemu, J.K. (2008) Physicochemical and Phytoplankton Study of Onah Lake, Asaba, Nigeria. *African Journal of General Agriculture* **4**(3). Retrieved fromhttp://www.asopha.org

Palmer, C.M (1990) Algae and water pollution. *The Identification of Significance and Control of Algae in Water Supplies and in Polluted Water.* Castle house publication Ltd, P 3-21

Perry R. (2003). A Guide to the marine plankton of southern California [online] http://www.msc.ucla.edu/oceanglobe.

Sanet, J. V., Jonathan, T., Carin, v. G., and Annelise, G. (2006). *Easy Identification of the Most Common Freshwater Algae*. North-West University and Department of Water Affairs and Forestry

Sawane, A. P., Puranik, P. G., and Bhate, A. M., (2006) Impact of industrial pollution on river Irai, district Chandrapur, with reference to fluctuation in CO2 and pH, *Journal of Aquatic Biology*, 21(1), pp 105-110.

Seeyave S, Probyn T A, Pitcher G C, et al. 2009. Nitrogen nutrition in assemblages dominated by Pseudo-nitzschia spp. Alexandrium catenella and Dinophysis acuminata off the west coast of South Africa. Marine Ecology Progress, 379(1): 91–107

Tang Senming, Rachman Arief, Fitria Nurul, Thoha Hikmah, Chen Bin. (2018). Phytoplankton changes during SE monsoonal period in the Lembeh Strait of North Sulawesi, Indonesia, from 2012 to 2015. *Acta Oceanologica Sinica*, 37(12): 9–17, doi: 10.1007/s13131-018-1283-4

Ibrahim, S. (2009) A survey of Zooplankton Diversity of Challawa River, Kano and Evaluation of some of Its Physico-Chemical Conditions. *Bayero Journal of Pure and Applied Sciences*. **2**(1) 19-26.

Indabawa, I.I. (2009) Studies on Limnological Parameters and Phytoplankton Dynamics of Nguru Lake, Yobe State, Nigeria. *Bioscience Research Communications*, **21**(4):183-188.

Tiseer, F.A., Tanimu, Y. and Chia, A.M. (2008) Seasonal Occurrence of Algae and Physicochemical Parameters of Samaru Stream, Zaria, Nigeria. *Asian Journal of Earth Sciences*, **1**(1), 3 1-37.

Verlencar X.N. (2004). *Phytoplankton Identification Manual*, National Institute of Oceanography Dona Paula, Goa India.