RESEARCH ARTICLE

PHYTOPLANKTON POPULATION OF RIVER KADUNA, KADUNA STATE NIGERIA

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INTRODUCTION

Phytoplanktons are photosynthesizing microscopic organisms that inhabit the upper surface layer of almost all oceans and bodies of fresh water. Their distribution, abundance and diversity reflect the physico-chemical conditions of an aquatic ecosystem in general and its nutrients status in particular (Abowei et al., 2012). Phytoplanktons require light, oxygen and nutrients such as nitrogen and phosphorus to grow. In aquatic ecosystem, the phytoplanktons is the foundation of food web in providing a nutritional base for zooplanktons and subsequently to other invertebrates, shell fish and fin fish (Abowei et al., 2012). Phytoplanktons are of great importance in bio monitoring of pollution because of their short life cycles and ability to respond to environmental changes, hence their standing crop and species composition indicate the quality of water (Ali et al., 2011). Rivers are important systems of biodiversity and are among the most productive ecosystem on the surface of the earth because of favourable conditions that support number of fauna and flora. River ecosystem is one of the natural resources which come in to the service of mankind in many parts of the world (Komala et al., 2013). Urbanization, expansion of irrigation and increasing trend of industrialization has contributed towards the demand for water. River Kaduna, like many rivers in Nigeria, serves as a center for re-creation, fishing and irrigation purposes, and also as a sink for disposal municipal and industrial wastes. This research work aims at evaluating the phytoplankton index as the water quality criteria with reference to fresh water bodies polluted by various anthropogenic activities.

MATERIALS AND METHODS

The research was carried out within four areas in Kaduna North, Kaduna state, Nigeria. Kaduna metropolis is located within the guinea savannah with co-ordinates latitude 10°31’ 23° N, Longitude 7°26’ 25°E. Four sampling sites were selected within Kaduna metropolis.

Site I: This site is situated at Gamji Park, where river Kaduna passes through the Park. Here, pollutants in to the river are generated from Kaduna State University (KASU), Police College and nearby settlements.

Site II: This site is situated at Kabala costain, where river Kaduna passes. Here, the pollutants are high domestic discharge and light agricultural discharges.

Site III: This site is situated at the point of raw water intake into Malali water treatment works. This will serve as a control for the study.

Site IV: This site is situated at Unguwan rimi. Here, a lot of agricultural (farming and fishing activities) are taking place.

Monthly sampling of the four sites was carried out from each sampling site for a period of eight months covering both the dry and the rainy season between 8:00am and 11:00am every sampling day. Phytoplankton samples were collected with one liter transparent plastic bottle by dipping the container, sliding over the upper surface of water with its mouth against the water current to permit undisturbed passage of the water in to the bottle (Ibrahim, 2014). Samples were preserved with...
Lugol’s solution and be brought to the laboratory for analysis. Slides were prepared and observed under a binocular microscope with various magnifications. Taxonomic identification of phytoplanktons were carried out with the help of Taxonomic keys (Edward and Ogwumba, 2006). The results obtained for phytoplankton abundance were subjected to Analysis of Variance (ANOVA) to test the level of significance at p< 0.05; between the four locations.

RESULTS

The phytoplankton composition identified in the four stations belonged to four groups which include Bacillariophyta, Chlorophyta, Chrysophyta and Cyanophyta. Phytoplankton percentage composition (Table 4.15) indicated that Bacillariophyta has 75 which represent 26.5% of the total population. Chlorophyta and chrysophyta each have the same number which is 99 and represent 34.98% of the total population; this is the highest percentage composition. Cyanophyta has the least abundance with total of 10 which represent 3.53% of the percentage composition of phytoplankton. Analysis of variance revealed that there was a significant difference between the four stations in population abundance of chlorophyta at p<0.05. There was also a significant difference in population abundance between wet and dry season at p<0.05 (Table 4.16). The species observed are microspora spp, characiopsis spp, chlorella spp, spirogyra spp and stigeoclonium spp. Among chlorophyta, chlorella has the highest population abundance while characiopsis has the least population abundance. There was also a significant difference in population abundance of chrysophyta between wet and dry seasons at p<0.05 (Table 4.17). The only species observed was Uroglena spp during the rainy season in the months of July and August at stations 2 and 3. In this study, analysis of variance revealed no significant difference between the four stations in population abundance of Bacillariophyta p>0.05. There was significant difference in population abundance of Bacillariophyta between wet and dry season at p<0.05 (Table 4.18). The species observed are Gyrosigma spp, Navicula spp, Gomphonema spp, Diatoma spp and Synedra spp. Among Bacillariophyta, Navicula spp has the highest population abundance while Gyrosigma spp has the least population abundance. In this study, analysis of variance revealed no significant difference between the four stations in population abundance of cyanophyta at p>0.05. There was significant difference in population abundance between wet and dry seasons at p<0.05 (Table 4.19). The only species observed was Anabena spp in the months of December, January and February during the dry season at station 1 and 2.

DISCUSSION

The phytoplankton identified in this study belonged to four groups of algae; Chlorophyta, Chrysophyta, Bacillariophyta and Cyanophyta. In general, chlorophyta and chrysophyta have the highest percentage composition. The monthly and seasonal variations of composition and abundance of phytoplankton may be due to the fluctuations of water and physico-chemical parameters in the river. Olele and Ekelemu (Olele and Ekelemu, 2008) made a similar observation in which they reported that phytoplankton species occurrence, composition and diversity was influenced by water chemistry / nutrients composition, temperature gradient, light intensity and predator level of the lake. Adesalu and Nwankwo (Adesalu and Nwankwo, 2006) also reported that the increase and decrease of phytoplankton populations and replacement of one form by another throughout the season is controlled by the varying environmental parameters such as phosphate – phosphorus, nitrate – nitrogen and rainfall. This study however recorded very less number of phytoplankton when compared with the past studies due to difference in water quality at the various sampling locations. The low nutrients levels such as phosphate – phosphorus and nitrate – nitrogen recorded during the present study also affect the abundance of phytoplankton at the sampling locations. A total of 12 phytoplankton species belonging to four groups were observed in the present study. Five species were recorded for Bacillariophyta (Gyrosigma spp, Navicula spp, Gonfonema spp, Diatoma spp and Synedra spp), five species in Chlorophyta (Microspora spp, Characiopsis spp, Chlorella spp, Spirogyra spp and Stigeoclonium spp), one in Chrysophyta (Uroglena spp) and one in Cyanophyta (Anabena spp). Higher abundance of phytoplankton recorded during the dry season mostly at stations 1 and 2 indicated that the water was not productive during the season. This is similar to the work of Adesalu and Nwankwo (Adesalu and Nwankwo, 2012) and Kumar and Arvind (Kumar and Arvind, 2015) where they recorded higher abundance of phytoplankton during the dry season. Lower abundance of phytoplankton during the rainy season may be due to flood water which dilutes the physico-chemical environment, reduced retention time, reduced transparency and flush out phytoplankton population. In this study, higher values of turbidity recorded during the rainy season also coincides with low count of phytoplankton abundance. In the present study, the phytoplankton species which are represented by members of chlorophyta, bacillariophyta, chrysophyta and cyanophyta are almost similar with the findings of Zakariya et al. (2013) and Ewebiyi et al. (2013) in respect to phytoplankton distribution. The most dominant phytoplankton was chlorophyta which constitutes 35% was also reported by many authors Olele and Ekelemu (2018), Ewebiyi et al. (2013), Kumar and Arvind (2015) as the dominant. The dominant species found were Microspora spp, Characiopsis spp, Chlorella spp, Spirogyra spp and Stigeoclonium spp. Among the bacillariophyta, the dominant species include Gyrosigma spp, Navicula spp, Gonfonema spp, Diatoma spp and Synedra spp. The most abundant species was Navicula spp which agrees with the work of Ewebiyi et al. (2013). The chrysophyta recorded only Uroglena spp which was found to be in abundance only in rainy season in the months of July and August in stations 2 and 3. The cyanophyta was found to be the least in terms of abundance and recorded only Anabena spp which was only recorded in the dry season from December to February. The maximum occurrence of phytoplankton was in dry season at stations 2 and 3 which shows that the two stations were more polluted due to domestic discharge and effluents from run-off that empty in to the river which promote the growth of phytoplankton compared to other stations. At station 4 which served as control for the study there was no record of phytoplankton. This shows that there are less human activities along the site and therefore less pollution and suitable for human consumption.

Conclusion

The chlorophyta, chrysophyta, bacillariophyta and cyanophyta all varied with months and seasons. Higher abundance of phytoplankton during the dry season indicates that the river is more productive.
REFERENCES


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