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Research Article

Effects of anthropogenic factors on the phytoplanktons distribution of Watari Dam, Kano State

***[1]Umma M, [2]Ibrahim M, [3]Tasi'u YR, [4]Binta SB, [5]Jamila MH and [5]Hassan KY**

[1]Department of Biology, Kano University of science and technology, Wudil, Kano state
[2]Federal Road Safety Corps, Nigeria
[5]Department of Biology, Sa adatu Rimi College of Education, Kano
[3]Department of Geography, Sa adatu Rimi College of Education, Kano.
[4]Department of Biological Sciences, College of Arts and Sciences, Kano

*Corresponding Author E-mail: triwanuyalwagmail.com

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Abstract

Human pressures continue to change and affect natural and artificial water habitats. Studies were conducted between February, 2011 and January, 2014 on the effects of anthropogenic factors phytoplanktons of the watari water reservoir The phytoplanktons distribution of the reservoir have indicated a substantially higher number of phytoplanktons sparsely distributed throughout the year and varies throughout the study period with significant difference ($p<0.01$) between the seasons. The result has also shown that both phyto were more abundant between the period of May-September (rainy season) than between October – April (dry season). This suggest that the number and distribution of both the phyto depends on the so many anthropogenic activities which in turn depends on the season. The result has also shown that the reservoir water contains different amount of phytoplanktons based on the amount and number of human activities taking place within the water.

Keywords: Phytoplanktons, abundance, human activities, seasons, watari dam

INTRODUCTION

Water is a primary natural resource and its availability has played a vital role in the evolution of human settlements in the course of the development of human societies (MANR, 1982). Water used by man ranges from purely social needs such as recreation, religious worship and regional/cultural uses such as drinking, cooking, laundry, bathing, waste disposal to economic needs such as irrigation, fisheries, animal production, electric power generation and navigation. For most of these uses, man depends mainly on fresh water available in inland lakes and rivers, which constitute less than 50% of the total amount of the water in the biosphere (Wetzel, 1983). The Sudano-Sahelian nature and persistence drought in some parts of Northern Nigeria has necessitated the creation of water reservoir for domestic water supply, irrigation, livestock farming and fisheries production.

In the last two decades, there has been a growing necessity for conservation of our resources, especially water. At the same time, growing populations, progressive industrialization and intensification of agriculture lead to increased pollution of the surface waters, which induces ecological imbalance, deleterious for sustained development of fisheries resources and which sometimes has necessitated the suspension of the beneficial uses of these waters in some places (Chapman and Ronberg, 2008). Man-made lakes are one of the largest single contributions to inland water body impounded or natural that are influenced by chemical and physical factors (Chapman and Ronberg, 2008). Kano state has the largest concentration of manmade lakes in Nigeria with about 26 reservoirs in the state including Kanye, Watari , Tiga, Challawa-Goje, Bagauda, Watari and Bagwai dams which range in size from few hectares to 17,000ha (MANR, 1982). Over the years, climatic changes and increased human activities such as farming activities, both rain fed and irrigation, with the catchments basin of most of the reservoirs have resulted to gradual silting up, nutrient building up and invasion

of aquatic plants. In addition to that water demand is on the increase so also the rate of obstruction of water for both water supply and evaporation.

One important anthropogenic effect is the spread of more invasive and non-native species into wetlands that profoundly further alters the abiotic and biotic conditions of the wetlands (Ramsar, 2000).Anthropogenic activities have great influence on the characteristics and so the phytoplankton abundance in water reservoirs. For example water size, depth and phytoplankton distribution in India and elsewhere in the world are greatly affected by human activity (Prasad, *et al*., 2002). This study aimed at determining the effect of anthropogenic activities on the phytoplankton distribution of Watari dam in Kano state.

MATERIALS AND METHODS

Study Area

Watari Dam is located in the Sudan savannah zone of Northern Nigeria on latitude $11^0$97'N and longitude 8^0.1'E with two distinct seasons (wet and dry). The rainy season period lasts from May to October while the dry season lasts from November to April. Watari Dam is approximately about 47 km away from Kano along old Bichi-Gwarzo road in Bagwai and Bichi Local Governments Area of Kano State and about 1.1 km from Kabo town. It has an area of 17.22 km^2 (MANR, 1982).

Sampling Stations

Four sampling stations were chosen for the study. Station 1: At the entry point of the dam; Station 2: the tower point; Station 3: the deepest part of the reservoir; Station 4: near the middle of the dam.

Phytoplanktons Sampling

Phytoplanktons examination was done using plankton net with conical bag (Net mesh size of 0.01 mm) 25 cm long, attached to 50 ml bottle. At each station, the net was sunk just beneath the water surface and towed for a distance of 1 meter. The samples were transferred to small plastic bottle and preserved in 4% neutral formalin. The samples from each station were taken to the laboratory for identification (Palmer, 1980).

Laboratory Analyses

From the 50 ml collected samples, 1ml was drawn for phytoplankton and zooplankton each into a counting cell and the number of organisms was expressed per litre with the aid of a light microscope (Olympus Japan). Identification was done by using various identification guides such as Palmer (1980), Alan and Elizabeth (1999) and APHA (2005).
Relative abundance of various taxa of phytoplanktons were calculated using the formula below (APHA, 2005).

$$Unit/ml = \frac{no.\ of\ organisms\ counted \times 10^4}{volume\ of\ water\ sample \times CF}$$

$$where\ CF = \frac{volume\ of\ concentrated\ water}{volume\ of\ water\ used\ for\ concentration}$$

relative abundance of various taxa of zooplanktons were calculated using the formula

$$No/m^3 = \frac{C \times 10^4}{V^1 \, {}^1 \times V^{111}}$$

Where
C= number of organisms counted
V^1= volume of the concentrated sample, ml
V^{11}= volume of counted sample, ml, and
V^{111}= volume of the grab sample, m^3
To obtain organisms per liter, each of the result was divided by 1000 (APHA, 2005)

RESULTS AND DISCUSSION

Table 1 and 2 as well as figures 1- 6 shows the total occurrence of phytoplankton at the five sampling stations of Kanye Dam. A total of one thousand one hundred and forty five (1145) species of phytoplanktons belonging to three classes (Bacillariophyceae Chlorophycea and Cynophyceae) were identified, sampling station 2 was found to have the highest density with a total of 352 species followed by station 3 and 4 each with 241 and station 1 with 227 and station 5 with 218 species, respectively.

Table 1. Total occurrence of phytoplanktons at the five sampling stations of Watari Dam February 2013 – January 2014

Class	Genera	1	2	3	4	5	Total
BACILLARIOPHYTA	*Synedra* sp.	23	16	22	31	58	92
	Tabellaria sp.	6	50	74	31	58	219
	Coscinodiscus sp.	4	53	2	-	-	59
	Diatom sp.	27	15	3	28	12	85
	Nitzchia sp.	4	5	8	19	12	48
	Palmella sp.	5	32	17	14	-	68
	Pinnularia sp.	3	5	3	6	4	21
CHLOROPHYTA	*Microcystis* sp.	16	22	12	14	16	80
	Ulothrix sp.	41	21	15	19	38	134
CYANOPHYTA	*Phacus* sp.	32	42	26	17	17	134
	Oscillatoria sp.	12	63	24	27	27	150
	Euglena sp.	54	28	35	35	37	189
Total Taxa per site		227	352	241	241	218	1145

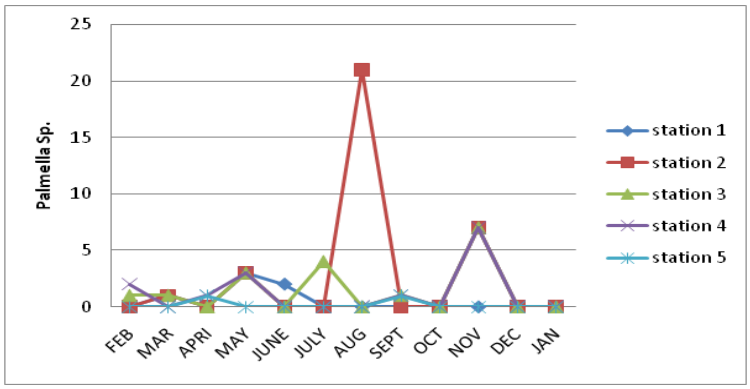

Figure 1. Monthly variation of *Palmella* sp in each station at Watari Dam from February 2013 to January 2014

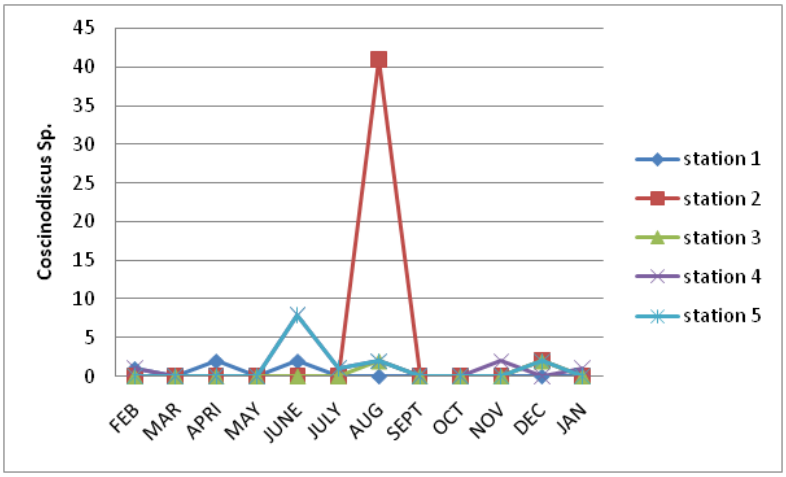

Figure 2. Monthly variation of *Coscinodiscus* sp in each station at Watari Dam from February 2013 to January 2014

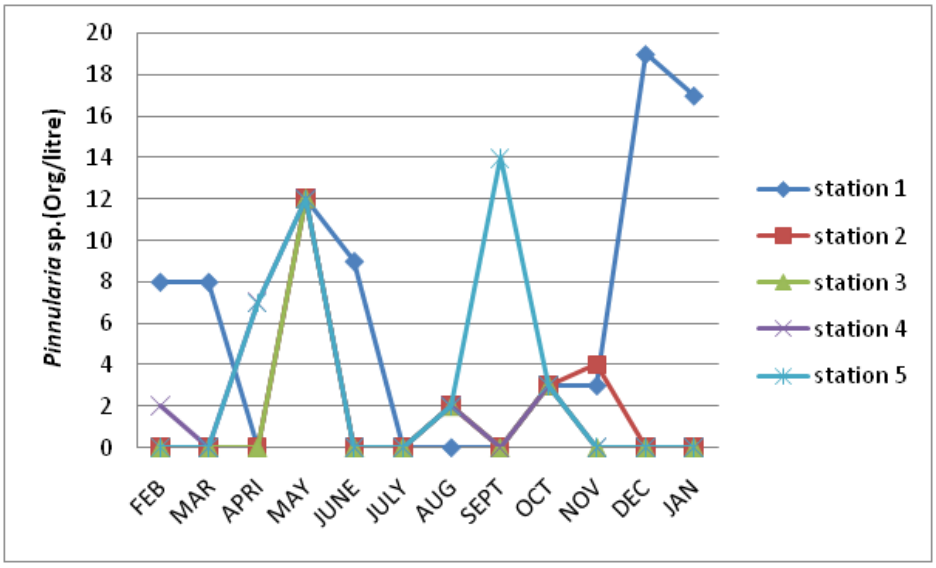

Figure 3. Monthly variation of *Pinnularia* sp in each station at Watari Dam from February 2013 to January 2014

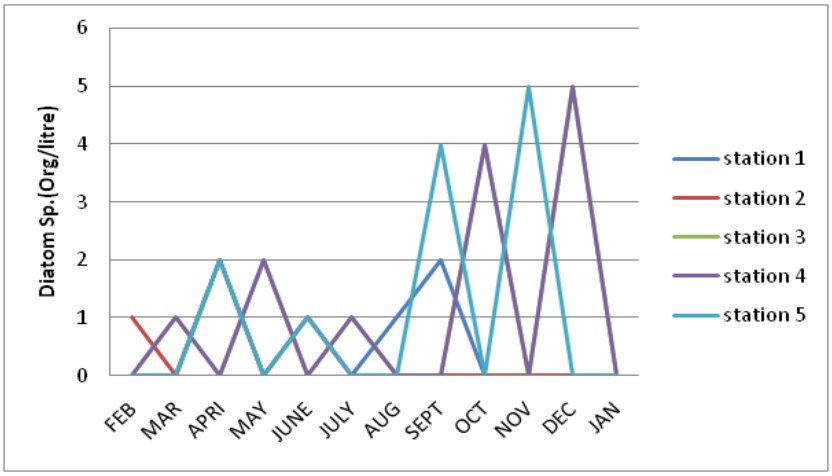

Figure 4. Monthly variation of *Diatom* sp in each station at Watari Dam from February 2013 to January 2014

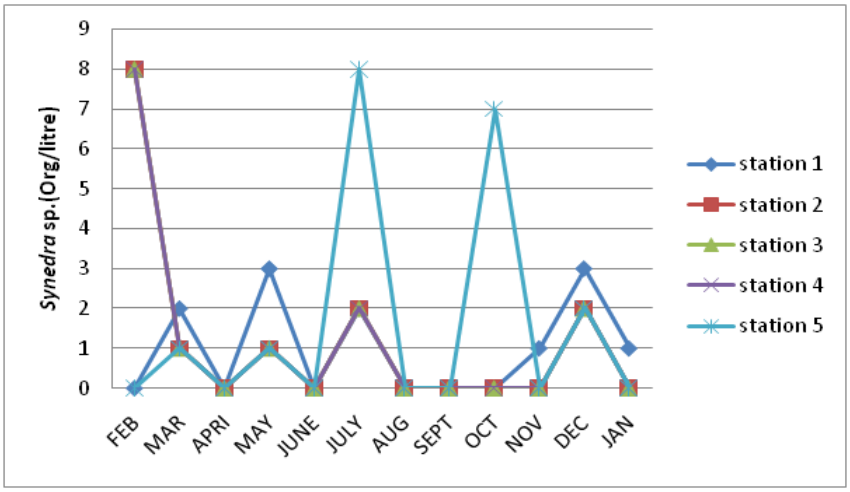

Figure 5. Monthly variation of *Synedra* sp in each station at Kanye Dam from February 2013 to January 2014

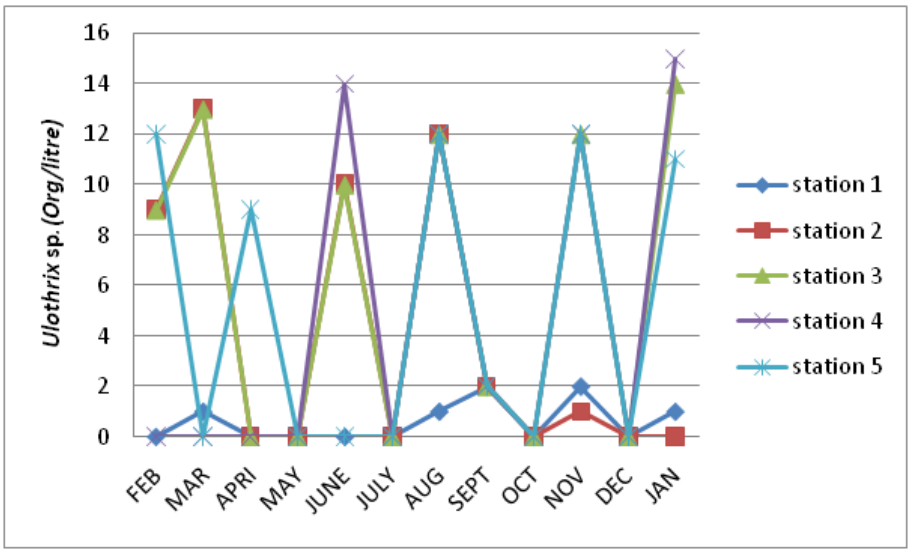

Figure 6. Monthly variation of *Ulothrix* sp in each station at Kanye Dam from February 2013 to January 2014

Table 2: shows the relative percentages of various phytoplanktons at the five different stations. *Bacillariophycea* under which *Tabellaria* Sp. was recorded with the highest percentage of 15.74% followed by *Synedra* Sp. with 6.61%, Diatom Sp. With 6.11%, *Palmella* Sp. with 4.89%, *Coscinodiscus* Sp. with 4.24, *Nitzchina* Sp. with 3.45% and the lowest *Pinnularia* Sp. with 1.51% respectively. *Chlorophyta* class under which *Ulothrix* sp. was recorded with the highest percentage of 9.63% followed by *Microcystis* sp with 5.75% and lastly *Spirogyra* sp. with 0.79% respectively. The class *cyanophyta* sp, under which Euglena sp. was recorded with the highest percentage of 13.59% followed by *Oscillatoria* sp. with 10.78% and lastly *Phacus* sp with 9.63% as showed in table 6.

Table 2. Occurrence, Distribution and relative abundance of Phytoplanktons at the five Sampling Stations of Kanye Dam

Class/genera	SAMPLING STATIONS					FREQUENCY(%)
BACILLARIOPHYCEAE	1	2	3	4	5	
Synedra sp	**	**	**	***	-	80
Tabellaria sp.	*	**	***	**	**	100
Coseinodiscus sp	*	***	*	-	-	60
Daitom sp	**	**	*	***	*	100
Nitzchia sp	*	*	*	**	**	100
Palmella sp	*	***	**	*	-	80
Pinnularia sp	*	*	*	*	*	100
CHLOROPHYCEAE						
Microcystis sp	**	***	**	**	**	100
Ullothrix sp	***	**	**	*	***	100
Spirogyra sp	**	**	***	**	*	100
CYNOPHYCEAE						
Phacus sp	***	***	**	**	**	100
Oscillatoria sp	**	***	**	**	**	100
Euglena sp	***	**	**	**	**	100

Total No, Per taxa (%) 248 (17.82) 369 (26.52) 283 (20.35) 270 (19.84) 276 (19.84)

- = Absent, * = Present

Phytoplanktons found in this study were classified into three major groups which include the Bacillariophyta, Chlorophyta, and Cyanophyta (Table 1). The relative abundance also varied with season as shown in table 2. The phytoplankton's identified in the present study found in all the months from May to October except in some few cases where some seemed to be absent. The abundance could have been due to availability of nitrate-nitrogen and other nutrients as a result of run-off and siltation (Musa, 2009). Similar results was reported by Kolo and Olademeji (1996) and Lamai and Kolo (2003) in Shiroro and Dan Zaria dam in Niger state that their low diversity in some months could be due to high turbidity as against what are obtained in other aquatic ecosystems that are less turbid, Musa (2010).Phytoplanktons represented by three genera and include the Bacillariophyta, Cyanophyta, and Chlorophyta.

These have the following percentages: Bacillariophyta 42.55%, Cyanophyta 34% and Chlorophyta 16.17% respectively were found in the dam. All the phytoplanktons exhibited significant difference (P>0.01) between months and the stations, high number of individual at the early part of rainy season and low number during dry season.

Cyanophyta were represented by three different individual species (*Phacus* sp., *Oscillatoria* sp., and *Euglena* sp.) where *Euglena* sp recorded highest number of individuals throughout the year. The Bacillariophyta were represented by seven individual species which include *Synedra* sp., *Tabellaria* sp., *Coscinidiscus* sp., *Diatom* sp., *Nitzchia* sp., *Palmella* sp., *Pinnularia* sp.; where *Tabellaria* sp. recorded highest number of occurrence in all the stations. Chlorophyta recorded the following number of individuals as follows: *Microcystis* sp.. *Ulothrix* sp. showed highest number of occurrence. The distribution and composition of phytoplanktons of Kanye Dam were affected by variation through fluctuations in environmental variables such as temperature, transparency, pH, Do, Conductivity, and others. This is because in the rainy season, there are usually no any activities of fishing and irrigation taking place. Similarly, Nitrate and Phosphate tends to become higher and therefore support the growth of these phytoplanktons in the dam.

CONCLUSION

The distribution of both phytoplanktons varied with seasons and or period. When fishing and other farming activities are taking place, the phytoplanktons were small than in the rainy season when less of these activities are taking place.

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