A Study on Phytoplanktonic Composition in Dadin-Kowa Dam, Gombe State, Nigeria

ISAH Zainab^{1*}, ABUBAKAR K. A.², UMAR D. M.¹ and HASSAN S. K.¹

¹Department of Biological Sciences, Gombe State University, Nigeria

²Departement of Zoology Modibbo Adama University of Technology (MAUTECH) Yola, Nigeria

ARTICLE INFO

Article No.: 070318093

Type: Research

DOI: 10.15580/GJBS.2018.3.070318093

Submitted: 03/07/2018

Accepted: 25/07/2018

Published: 08/08/2018

*Corresponding Author

Zainab, Isah

E-mail: zainabmamy@yahoo.com

Phone: +2348063659434

Keywords: Phytoplankton,
Physico-chemical Parameters,
Dadin - kowa Dam, Gombe,
Nigeria.

ABSTRACT

This study was carried out to evaluate species composition and distributions of phytoplankton in relation to changes in some physico-chemical characteristics of water in Dadin-Kowa Dam, Gombe State, Nigeria. Samples were collected using plankton net by hauling for five meters. Samples were kept in plastic containers and preserved in 4% formalin and logols iodine solution. 1 ml of sub-sample was observed under microscope. Physico-chemical parameters recorded include water temperature which ranged between 28°C and 31.9°C, pH ranged from 7.1 to 8.9, Transparency ranged from 0.06m to 0.16m, Dissolved oxygen range from 1.7 to 3.9mg/l and Conductivity ranged from 81 to 100µs/cm. 22 species of phytoplanktons were recorded and the maximum mean density was 92,105 cell/L and minimum was 44,317 cell/L. The dominant phytoplankton was Bacillariophyceae 38.1%, followed by order Chlorophyceae 35.4%, Myxophyceae 25.3% and Chrysophyceae 1.22%. (The phytoplankton varied significantly with months of sampling.

INTRODUCTION

Aquatic environment is the most diverse ecosystem in the world. The first life originated in the water and first organisms were also aquatic where water was the principle external as well as internal medium for organisms. Thus water is the most vital factor for the existence of all living organisms. Water covers about 71% of the earth of which more than 95% exists in the oceans; an average depth of 3800 meter (12,500 feet), the volume being about $1370 \times 10^6 \text{ km}^3$. A much less amount of water is contained in rivers (0.00015%) and lakes (0.01%) which comprise the most valuable fresh water resources (Tideman, 2000).

The plankton community is a mixed group of tiny plants and animals floating, drifting or feebly swimming in the water mass (Hensen, 1997). Plankton is diverse group of organisms that live in the water column and cannot swim against a current. The name plankton is derived from *plantos*, meaning errant, and by extension "wanderer" or drifter. Some forms are capable of independent – movement and can swim hundreds of meters vertically in a single day; their horizontal position is primarily determined by the surrounding currents (Hensen, 1997).

Phytoplankton

The photosynthetic component of the plankton is known as the phytoplankton. It consists of phytoplankton classes includes: Bacillariophyceae, Cyanophyceae and Dinophyceae. Phytoplankton is microscopic single celled aquatic plants forming the prime component in the food chain of an aquatic ecosystem. The fertility of sea is determined by its bio productivity. Phytoplankton production contributes about 95% of total production in the marine environment (Mani, 1993).

The complex plankton community comprises primary producers, herbivores, carnivores, detritivores and decomposer organisms. Thus, prokaryotes, plants and animals are the plankton. Primary producers are the basis for the planktonic food web and food energy in other aquatic communities (Porter, 1976).

Aim of Study: This study is aimed at providing information on the phytoplankton population in Dadin-kowa Dam, by identify the species, composition and distribution of phytoplankton in each sampling site.- Evaluate monthly variations in the abundance and distribution of phytoplankton species among sampling sites.- Determine the physico-chemical characteristics of the water as it influence phytoplankton distribution in the Dam.

Study area: The research work was carried out in Dadin-kowa Dam, located at Yamaltu Deba local Government area of Gombe State in Northeast of Nigeria.

Its lies between latitude $10^{\circ} 19' 10''\text{N}$ and longitude $11^{\circ} 28' 54''\text{E}$ with a capacity of 800 million cubic meters of water and a total surface area of 300 km^2 . The average

annual temperature is about 24°C and mean annual rainfall of 850mm, relative humidity range from 15-80%. The area experiences two seasons, the wet (April-October) and dry season (November-March), with Sudan savanna vegetation. (Mike, 2010).

Sample collection: Samples were collected from three different locations: Station A, where fishing activities occurs, Station B, where anthropogenic activities take place and Station C, where Irrigation activities occur. Samples were collected from each station using plankton net of mesh size $55\mu\text{m}$ by hauling the sampler horizontally for five meters according to the method of Anene (2003). The resultant concentrated plankton samples were then transferred to plastic containers, and preserve in 4% formalin solution and Logols iodine solution according to the method of Boney (1983) and Anene (2003) in the field. Samples were collected once a month for six months (July- December 2014).

Determination of Physico-Chemical Parameters

Some water quality parameters monitored during period of the study where, Water temperature was measured using thermometer (Model; YXI 550) by dropping the thermometer into the plastic sample bottle. The reading was recorded insitu in the field.

The transparency was measured using black-white Secchi disc. The measurement was done by lowering the disc into the water gradually until it disappeared from sight, then it was removed gently till it appeared. The average depth of its disappearance and reappearance was noted.

Multiphotometer dissolved oxygen analyzer (model; YXI 550) was used to determine the dissolved oxygen. This was done by collecting water sample in a cylindrical bottle and putting the tip of the analyzer to take the reading.

The conductivity of the water was taken using conductivity meter (model; YSI 63) and the reading was recorded.

The pH was determined using pH-meter (model; YSI 63) by inserting the tip soft of the meter in sampling bottle containing water. The corresponding pH values were recorded.

Sample Analysis: Phytoplankton samples were concentrated to 30ml volume before the analysis was done. Sample was homogenized by inverting the container or bottle few times, with a wide mouthed pipette, 1ml of the plankton sub-sample was withdrawn from the field samples, and placed on a sedge-wick rafter-counting chamber with cover slip and observed by direct microscopy. Keys provided by standard works of Botes, 2001, Emi and Catlin, 2007, APHA 1998 and various authors were used for species identifications. Counts were made in triplicates and their averages were taken and expressed as cell/ml of water.

Statistical Analysis: The number of organisms per liter of water was calculated from the following relationship.

$$\text{Number of organisms} = \frac{\text{organisms per ml of concentrate} \times \text{volume of conc}}{\text{per liter of water} \quad \text{volume of dam water filtered}}$$

The volume of the Dam water filtered by the sampler was calculated using the equation:

$$V = \pi r^2 L,$$

Where $\pi = 3.1415$, r = diameter of the net sampler $\div 2$

L = length haul by net in meters (Robert, 2003). ANOVA was used to analyzed the data.

RESULTS

The physico-chemical parameters recorded in Dadin-kowa Dam indicating various range of the parameters; The air temperature range from 26°C to 38°C and water temperature range from 28°C to 31.9°C (Table 1). The lowest mean water pH value of 7.5 was recorded in Site A and highest pH value of 8.9 was recorded at Site B & C during the sampling

periods (Table 1). The lowest mean transparency value of 0.06m was recorded at Site A & B and the highest value of 0.16m at Site B & C. The lowest mean dissolved oxygen value of 1.7mg/l was recorded at Site C and highest value of 3.9mg/l was recorded at site A (Table 1). The conductivity of the water body recorded its lowest mean water value of 81 μ S/cm at site A & B and the highest conductivity value of

100 μ s/cm was recorded at site A during the sampling periods (Table 1).

A total number of three phytoplankton taxa were identified at Site B and C and four taxa at site A with ten plankton species identified at both sites. A total of phytoplankton crop was 69475 cell/l recorded in the Month of July in all the site samples. Four Phytoplankton taxa were identified at site B and C and three taxa at site A, with ten phytoplankton species recorded in August. The number of cells recorded per liter of water sample is 92,105cell/l. Three phytoplankton taxa were identified at site A and C and four taxa at site B with fourteen species recorded in the Month of September with 89,475cell/l.

Four phytoplankton taxa identified per each site, with ten species and a total number of cells per liter of water sampled for October recorded as 72,105cell/l. In November, four phytoplankton taxa were identified each at site A and B and three taxa at site C with 13 species recorded. The number of cells recorded per liter of water sample was 61,580cell/l. During the Month of December, three phytoplankton taxa were recorded per site with a total number of eight species and the total phytoplankton crop of 44,317cells/l.

Table 1: Measurement of Physico-Chemical Parameters Sampled in Dadin-kowa Dam from July to December 2014

Site	A		B		C	
Parameters	Mean ($\bar{x}$)	Range	Mean ($\bar{x}$)	Range	Mean ($\bar{x}$)	Range
Air temperature $^{\circ}$ C	31.1	26-35	31.8	28-35	33.0	26-38
Water temperature $^{\circ}$ C	28.8	28-30	29.2	28-31.9	28.9	28-31.6
pH	8.1	7.5-8.8	8.3	8.0-8.9	8.3	7.6-8.9
Transparency (m)	0.12	0.06-0.15	0.13	.06-0.16	0.13	.07-0.16
Dissolved Oxygen (mg/l)	3.2	2.3-3.9	2.7	1.8-3.5	2.6	1.7-3.6
Conductivity (μ s/cm)	91.8	81-100	90.0	81-97.2	91.7	85-97

Table 2: Phytoplankton taxa and species composition which recorded at different stations during July, 2014

Site	Phytoplankton taxa	Species	No. of cells/L	Abundance %
A	Chlorophyceae:	<i>Ankistrodesmus sp.</i>	5789	21.1
		<i>Chlorella sp.</i>	4211	15.4
		<i>Ulothrix sp</i>	1581	5.8
	Bacillariophyceae:	<i>Fragilaria sp</i>	7895	28.8
		<i>Tabellaria sp.</i>	1052	3.8
	Myxophyceae:	<i>Aphanocapsa sp.</i>	4211	15.4
		<i>Oscillatoria sp.</i>	526	1.9
		<i>Anabaena sp.</i>	1579	5.8
B	Chrysophyceae:	<i>Synura sp</i>	526	1.9
	Chlorophyceae:	<i>Ankistrodesmus sp</i>	6842	25.5
		<i>Chlorella</i>	3684	13.7
	Bacillariophyceae:	<i>Fragilaria sp</i>	6842	25.5
	Myxophyceae:	<i>Aphanacopsa sp</i>	7894	29.4
		<i>Anabaena sp</i>	1,579	5.8
C	Chlorophyceae:	<i>Enteromorpha sp</i>	1053	6.9
		<i>Chlorella</i>	2105	13.8
	Bacillariophyceae:	<i>Fragilaria sp</i>	5263	34.5
	Myxophyceae:	<i>Aphanocopsa sp</i>	6315	41.4
		<i>Oscillatoria sp</i>	526	3.5
	Chrysophyceae:	-	-	-
Total			69,475	

Table 3: Phytoplankton taxa and species composition recorded at different stations during, August, 2014

Site	Phytoplankton taxa	Species	No. of cells/L	Abundance %
A	Chlorophyceae:	<i>Chlorella sp</i>	6316	17.9
		<i>Ankistrodesmus sp</i>	9474	26.9
	Bacillariophyceae:	<i>Fragilaria sp</i>	11053	31.3
		<i>Navicula sp</i>	526	1.5
		<i>Nitzschia sp</i>	1053	2.9
	Myxophyceae:	<i>Aphanizomenon sp</i>	1579	4.5
		<i>Aphanocopsa sp</i>	5263	14.9
B	Chlorophyceae:	<i>Ankistrodesmus sp</i>	8421	34.8
		<i>Closterium sp</i>	526	2.2
	Bacillariophyceae:	<i>Fragilaria sp</i>	7895	32.6
		<i>Nitzschia sp</i>	526	2.2
	Myxophyceae:	<i>Anabaena sp</i>	1053	4.4
		<i>Aphanocopsa sp</i>	5263	21.7
	Chrysophyceae:	<i>Mallomonas sp.</i>	526	2.2
C	Chlorophyceae:	<i>Ankistrodesmus sp</i>	7368	32.6
		<i>Chlorella sp</i>	5263	23.3
	Bacillariophyceae:	<i>Fragilaria sp</i>	10526	46.5
		<i>Navicula sp</i>	1053	4.7
	Myxophyceae:	<i>Aphanocopsa sp</i>	7368	32.6
	Chrysophyceae:	<i>Mallomonas</i>	105.	4.7
	Total		92,105	

Table 4: Phytoplankton taxa and species composition recorded at different stations during September, 2014

Site	Phytoplankton taxa	Species	No. of cells/L	Abundance %
A	Chlorophyceae:	<i>Ankistrodesmus sp</i>	7895	27.3
		<i>Closterium</i>	526	1.8
		<i>Eudorina</i>	1053	3.6
		<i>Ulothrix</i>	1579	5.5
	Bacillariophyceae:	<i>Cyclotella</i>	2632	9.1
		<i>Fragilaria sp</i>	9474	32.7
		<i>Nitzschia sp</i>	526	1.8
B	Myxophyceae:	<i>Aphanocapsa sp</i>	5263	18.2
	Chlorophyceae:	<i>Ankistrodesmus sp</i>	6842	19.1
		<i>Oocystis</i>	2632	7.4
	Bacillariophyceae:	<i>Cyclotella</i>	5263	14.7
		<i>Fragilaria sp</i>	10526	29.4
		<i>Tabellaria</i>	526	1.5
	Myxophyceae:	<i>Aphanocopsa sp</i>	7895	22.1
C	Chlorophyceae:	<i>Anabaena sp</i>	1053	2.9
		<i>Mallomonas</i>	1053	2.9
	Chlorophyceae:	<i>Ankistrodesmus sp</i>	5263	21.3
		<i>Ulothrix</i>	1053	4.3
		<i>Zygnema</i>	1053	4.3
	Bacillariophyceae:	<i>Cyclotella</i>	1053	4.3
		<i>Fragilaria sp</i>	8947	36.2
		<i>Cymatopleura</i>	526	2.1
	Myxophyceae:	<i>Aphanocapsa sp</i>	6842	27.7
	Total		89,475	

Table 5: Phytoplankton taxa and species composition which recorded at different stations during October, 2014

Site	Phytoplankton taxa	Species	No. of cells/L	Abundance %
A	Chlorophyceae:	<i>Ankistrodesmus sp</i>	7368	27.9
		<i>Closterium sp</i>	1053	4.0
		<i>Microspora sp</i>	1053	4.0
	Bacillariophyceae:	<i>Fragilaria sp</i>	6842	26.0
		<i>Nitzschia sp</i>	526	2.0
		<i>Tabellaria sp</i>	526	2.0
	Myxophyceae:	<i>Anabaena sp</i>	1053	4.0
		<i>Aphanocapsa sp</i>	6316	24.0
	Chrysophyceae:	<i>Mallomonas</i>	1053	4.0
B	Chlorophyceae:	<i>Ankistrodesmus sp</i>	5263	21.3
		<i>Closterium sp</i>	526	2.1
		<i>Microspora sp</i>	1053	4.3
	Bacillariophyceae:	<i>Fragilaria sp</i>	7895	31.9
		<i>Navicula sp</i>	526	2.1
		<i>Tabellaria</i>	526	2.1
	Myxophyceae:	<i>Anabaena sp</i>	1053	4.3
		<i>Aphanocapsa sp</i>	7895	31.9
	Chrysophyceae:	<i>Mallomonas</i>	526	2.2
C	Chlorophyceae:	<i>Ankistrodesmus sp</i>	6842	32.5
		<i>Closterium sp</i>	526	2.5
		<i>Microspora sp</i>	526	2.5
	Bacillariophyceae:	<i>Fragilaria sp</i>	6842	32.5
		<i>Navicula sp</i>	1053	5.0
	Myxophyceae:	<i>Aphanocapsa sp</i>	4737	22.5
	Chrysophyceae:	<i>Mallomonas sp.</i>	526	2.5
	Total		72,105	

Table 6: Phytoplankton taxa and species composition recorded at different stations during November, 2014

Site	Phytoplankton taxa	Species	No. of cells/L	Abundance %
A	Chlorophyceae:	<i>Ankistrodesmus sp</i>	4211	18.6
		<i>Closterium sp</i>	1053	4.7
		<i>Oocystis sp</i>	2632	11.6
		<i>Ulothrix sp</i>	526	2.3
	Bacillariophyceae:	<i>Cyclotella sp</i>	1579	6.9
		<i>Fragilaria sp</i>	7895	34.9
		<i>Navicular sp</i>	526	2.3
	Myxophyceae:	<i>Aphanocapsa sp</i>	4211	18.6
	Chrysophyceae:	<i>Mallomonas sp</i>	1053	4.0
B	Chlorophyceae:	<i>Ankistrodesmus sp</i>	5263	27.0
		<i>Eudorina sp</i>	526	2.7
		<i>Oocystis sp</i>	1579	8.1
	Bacillariophyceae:	<i>Fragilaria sp</i>	7368	37.8
		<i>Tabellaria</i>	526	2.7
	Myxophyceae:	<i>Anabaena sp</i>	526	2.7
		<i>Aphanocapsa sp</i>	3158	16.2
	Chrysophyceae:	<i>Mallomonas sp</i>	526	2.7
C	Chlorophyceae:	<i>Ankistrodesmus sp</i>	2632	13.5
		<i>Oocystic sp</i>	2632	13.5
		<i>Microspora sp</i>	1053	5.4
		<i>Zygnema sp</i>	526	2.7
	Bacillariophyceae:	<i>Cyclotella sp</i>	2632	13.5
		<i>Fragilaria sp</i>	4737	24.3
	Myxophyceae:	<i>Anabaena sp</i>	1053	5.4
		<i>Aphanocapsa sp</i>	3684	18.9
		<i>Oscillatoria sp</i>	526	2.7
	Total		61,580	

Table 7: Phytoplankton taxa and species composition recorded at different stations during December, 2014

Site	Phytoplankton taxa	Species	No. of cells/L	Abundance %
A	Chlorophyceae:	<i>Ankistrodesmus sp</i>	2632	17.1
		<i>Closterium sp</i>	1053	6.9
		<i>Oocystis sp</i>	2105	13.7
		<i>Microspora</i>	526	3.4
	Bacillariophyceae:	<i>Cyclotella sp</i>	632	4.1
		<i>Fragilaria sp</i>	4736	30.8
	Myxophyceae:	<i>Anabaena sp</i>	1053	6.9
		<i>Aphanocapsa sp</i>	1632	17.1
B	Chlorophyceae:	<i>Ankistrodesmus sp</i>	3158	19.4
		<i>Microspora</i>	1053	6.5
	Bacillariophyceae:	<i>Cyclotella sp</i>	2105	12.9
		<i>Fragilaria sp</i>	5789	35.5
	Myxophyceae:	<i>Anabaena sp</i>	1053	6.5
C	Chlorophyceae	<i>Aphanocapsa sp</i>	3158	19.4
		<i>Ankistrodesmus sp</i>	2632	20.8
		<i>Closterium sp</i>	526	4.2
		<i>Oocystis sp</i>	1579	12.5
	Bacillariophyceae:	<i>Cyclotella sp</i>	2632	20.8
		<i>Fragilaria sp</i>	2632	20.8
	Myxophyceae:	<i>Aphanocapsa sp</i>	2105	16.7
		<i>Anabaena sp</i>	526	4.2
	Total		44317	

Table 8: Mean percentage distributions of phytoplankton classes at the different sites during the study period, 2014.

	% Distribution			
	A	B	C	Average
Chlorophyceae	40	32.1	33.3	35.1
Baccillariophyceae	37.7	38.2	38.4	38.1
Myxophyceae	21.3	28.2	27.0	25.5
Chrysophyceae	1.0	1.4	1.3	1.2

DISCUSSION

A total number of twenty two species of phytoplankton, were identified during the study period. Out of these 10 were Chlorophyceae, 6 Bacillariophyceae, 4 Myxophyceae and 2 Chrysophyceae. This is similar with the finding of Mohamed *et al* 2009 and Anagoet *al* 2011 who reported phytoplankton and zooplankton taxa in a study of phytoplankton diversity on Koil Coastal waters India and Awba Reservoir Ibadan Nigeria. Dike and Adedolapo (2012) reported that Bacillariophyceae (53.25%), Cyanophyceae (21.25%), Chlorophyceae (10.33%), Chrysophyceae (4.84%), Pyrrophyceae (4.57%), Xanthophyceae (3.39%), and Euglenophyceae (2.42%) in studies of seasonal

dynamics in plankton abundance and diversity of freshwater body in Nigeria. As compared to the findings of present study, Bacillariophyceae (38.1%), Chlorophyceae (35.4%), Myxophyceae (25.3%), and Chrysophyceae (1.22%). Their distributions might be due to availability of nutrients in water. This also agreed with the findings of Koloet *al* (2010), Jerling and Wooldridge (1995) who recorded that the zooplankton was dominated by Copepoda and phytoplankton with Bacillariophyceae (diatoms) which were more abundant after flood.

The Bacillariophyceae and Chlorophyceae had the highest mean population in all the three stations during the rainy season. This could be attributed to availability of more nutrients, which favour their growth

during that period as a result of agricultural and irrigation activities and nutrients might have washed up into the water by runoff. In term of planktonic populations between the months of study. High population of phytoplankton were observed during the month of August (92,105 cell/L and the minimum recorded in November and December (44,317 cell/L) Mohamed *et al.*(2009) reported this results with a maximum of 137,800 cell/L in the Month of May and a minimum of 76,150 cell/L. This could be attributed to the changes in temperature, pH, nutrients levels during the period.

The rainy periods recorded the highest phytoplankton abundance than the dry season. The result of this study also agrees with findings of Khan and Ejike (1984) who observed greater plankton population density in the rainy season as compared to the dry season.

The Month of August recorded the highest plankton value of 21.9% as compare to the least value of December as 11.4%.The abundance of plankton in the rainy season might be attributed to the availability of more nutrients, suitable temperature range, conductivity, pH and dissolved oxygen that allow plankton to reproduce. This findings agrees with the work of Jerling and Wooldridge(1995) in Sunday River, South Africa who recorded high abundance of both phytoplankton and zooplankton during rainy periods. This also agrees with the findings of Rabi'u et al.(2007) in Kusalli Reservoir, Kano who revealed that phytoplankton was generally more numerous during rainy season than in dry season and dominated by Chlorophyceae (36.25 %) and Cladoceran in zooplankton.

Spatial distribution of planktons were very abundant in site A (37.8%) than site B (33.9%) and site C appeared to have the least value of (28.3%).Analysis of variance showed significance of abundance between the sites.The variation between the sites might be attributed to the different activities such as fishing, bathing, washing, irrigation, watering ground for animals and so on occurring in the sites, which might have been contributed to the abundance of plankton with one site harbouring the plankton than others. This agrees with the findings of Adeyemi- Ale et al.,2014, in study of physico-chemical properties and plankton diversity in Osere, Ilorin with sites and one harbouring the plankton than the rest. There were great significance differences of plankton abundance between the sites.

Relationship between physico-chemical parameters and plankton abundance

Temperature is an important factor that influences primary production in water (Lewis, 2000). Also, Wetzel (1983) observed that increasing of the temperature led to increasing the rate of molting and brooding. The temperature of air increased from 26°C to 38°C while that of water temperature ranged from 28°C to 31.9°C. This study shown gradual increase in temperature during the sampling periods and might be a driving factor responsible for plankton abundance in the water shown by its significant difference in the

period of study. Therefore water temperature increases the rate of reproduction in water bodies. Dissolved oxygen; this is a crucial factor that help in the survival of aquatic organisms. The dissolved oxygen concentrations ranged from 1.7 mg/L to 3.9mg/L and thus, the concentrations were within the acceptable range. McNeely *et al.*, (1979) reported that natural surface water has dissolved oxygen less than 10mg/L. Low dissolved oxygen affect the growth of many aquatic life, helps in metabolic activities(Charles,2003),therefore, adequate dissolved oxygen is necessary element to all processes of life. The relationship between temperature and oxygen is that, as the temperature increases, the oxygen level decreases, in other word, cold water hold more oxygen than warm water. Conductivity ($\mu\text{S}/\text{cm}$), referred to the ability of liquid to transmit heat, electrical charges or sound from one area to another. Conductivity ranged from 81 to 100 $\mu\text{S}/\text{cm}$ and ANOVA showed significant difference between the Months of study. The mean value was 91.2 $\mu\text{S}/\text{cm}$ this showed that the conductivity level was intermediate. Conductivity levels below 50 are considered as low, those between 50 – 600 are medium and above 600 $\mu\text{S}/\text{cm}$ are high (Adeleke,1982).

Transparency is referred to the clarity of water or the measure of how clear the water is. The transparency ranged from 0.06m to 0.16m.This range indicated that the water was not very turbid, therefore, all the stations received relatively equal amount of light from the sun, and this might be responsible for the presence of plankton in all the stations. The relationship between conductivity and transparency is that, an increased in transparency, increases suspended materials in water and subsequently, decreases conductivity which results in a decrease in light penetration and phytoplankton growth. pH; this is the measure of hydrogen ions concentration. The pH range from 7.5 to 8.9 which was within the normal range for aquatic life, therefore, this indicated that various anthropogenic activities inputs did not alter the ambient pH. High water pH can affect reproduction, cause death to many aquatic organisms, inability to dispose metabolic wastes and low pH can cause shock and sudden increase in number of some plankton species (LCAA).

In conclusion, about twenty two species of phytoplankton were identified. In terms of phytoplankton population, the bacillariophyceae was dominated with 38.1%from the total of phytoplankton classes. Phytoplankton abundance were influenced by seasons and by sites and species composition was significantly influenced by seasons not sites. Thus, plankton abundance and distribution were closely associated with environmental conditions. Hence, the present study provides the baseline information on plankton population which could be useful for further assessment of the water.

REFERENCES

- Adeyemi-Ale, OA; Aladesida, AA; Esenowo I.K (2014). The Effect of Detergent Effluent on the Physico-Chemical Characteristics and Plankton Diversity of

- Osere Stream, Ilorin, Nigeria. *Journal of Applied Science & Environmental Management*. 18 (1): 99-103
- American Public Health Association (APHA)(1998). *Standard Methods for the Examination of Water and Wastewater*. Washington DC. APHA/AWWA/WEF
- Anago, I. J, Esenowo, I.K and Ugwumba, A.A(2011). The Physico-chemistry and Plankton Diversity of Awba Reservoir University of Ibadan, Nigeria. *Research Journal of Environmental and Earth Sciences*. 5(11):638-644
- Anene, A. (2003). *Techniques in Hydrobiology Research Techniques in Biology & chemical Sciences*. Owerri. Springfield publishers Ltd.174-189
- Boney, A. D (1983). Phytoplankton publication. Photo Books Ltd.174-189
- Botes, L (2003). Phytoplankton Identification Catalogue – Saldanha Bay, South Africa, April 2001. GloBallast Monograph Series No. 7. IMO London.
- Charles E. O (2003). Temperature and pressure on solubility. Elmhurst College; Virtual Chembook.
- Dike, H.O. and Adedolapo A. A. (2012). Seasonal Dynamics in Plankton Abundance and Diversity of a Freshwater Body in Nigeria. *Journal of Environmental and Natural Resources Research* 2(2):75-81
- Emi Yamaguchi & Caitlin Bell (2007). *Zooplankton Identification Guide*, The University of Georgia Marine Education Center and Aquarium <http://www.marex.uga.edu/aquarium>
- Hensen, V. (1997). Planktonic organisms. *Journal of Paleontology*. 60(2):329
- Jerling, H. L. and Wooldridge, T.H(1995). Plankton distribution and abundance in Sundays Rivers South Africa. *Journal of Marine Science*. 15(1):165-184
- Khan, M.A. and Ejike, C (1984). Limnology and Plankton periodicity of Jos Water. *Hydrobiologia* 114(3):189-199
- Kolo, R.J, Ojutiku, R.O. and Musulmi, D.T (2010). Plankton Communities of Tagwai Dam Minna, Nigeria. *Continental Journal of Fisheries and Aquatic Science* 4: 1 - 7,
- Lake in Anyigba, Kogi State . *International Refereed Research Journal*, 11(2):114-125
- Mani, P.(1992). Natural Phytoplankton communities in Pitchavaran mangroves. *Indian journal of marine science*. 21(4):72-77
- Mike, O. (2010). Gombe Rural Communities enjoy potable water. *Daily Independent*.
- Mohamed, A .A. S., Thurumaran, G. Arumugam, R., Ragupathi, R.K and Anantharaman, P (2009). Studies of plankton Diversity from Koil Coastal waters, India. *Global Journal of Environmental Research*. 3(2):118-125
- Porter, H. J (1976). Observation on Tropical trends in plankton diversity. *Journal of Limnology Society of South Africa*. 5(13):1-6
- Rabiu, M.K., Mohammad, M.A. and Mohammad, L.B (2007). The Plankton as Indicators of Water Quality in Kusalla Reservoir: *Journal of Pharmacy and Biological Sciences*. 9(3):12-15
- Robert, P (2003). A guide to the Plankton of Southern California 3rd Edition. *Marine Science Centre*, Ocean GLOBE and Malibu High School, USA
- Tideman, E. M.(2000). Watershed management: Guidelines for india conditions, *Omega Scientific Publishers New Delhi*.