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EFFECTS OF ENVIRONMENTAL PARAMETERS ON PLANKTON ASSEMBLAGE IN AJIWA RESERVOIR, KATSINA STATE, NIGERIA

***[1]Suleiman, U. F., [1]Ibrahim, S., [1]Isyaku, H. I., [1]Nabila, T. I., [1]Amir, A., [2]Nadede, A. S. and [2]Bello, L.**

[1]Department of Biological Sciences, Bayero University, Kano
[2]Bioresources Development Center, National Biotechnology Development Agency

*Corresponding author's email: u.f.mindau65@gmail.com +2347060807062

ABSTRACT
The effect of environmental (Physicochemical) and biological (plankton) parameters of Ajiwa reservoir were studied for a period of eight months (March–October 2018). Field and laboratory activities were carried out using standard protocols. Mean monthly values of Temperature ranged between 25.87±3.57°C–29.46±0.66°C, Electrical conductivity was between 32.00±3.46µs/cm–210.00±95.39µs/cm. Dissolve Oxygen, Total Dissolved Solid and Biological Oxygen Demand Means of monthly values ranges between 5.53±0.39mg/l–9.35±0.62mg/l, 33.087±0.06mg/l–84.01±4.37mg/l, and 2.69±0.34mg/l–7.27±1.88mg/l. While phosphate and nitrate means of monthly values ranges between 0.04±0.02mg/l–0.09±0.03mg/l, 0.03±0.01mg/l–0.09±0.02mg/l. Four Phytoplankton phyla dominated by Chlorophyta (387org/L), Euglenophyta (160 org/L), Cyanophyta (83 org/L) and Bacillariophyta (63 org/L) were recorded in the reservoir. The Zooplanktons fauna comprises of Rotifers (180 org/L), Cladocerans (149 org/L) and Copepods (78 org/L). Correlation matrix showed that there were significant correlation between Phytoplankton, Zooplankton and Physicochemical parameters. The composition of planktons in the reservoir were affected by seasonal variations and fluctuation of physicochemical parameters.

Keywords: Phytoplankton, Ajiwa, Reservoir, Physicochemical, Copepod

INTRODUCTION

Among the important features of the Earth's landscape are Reservoirs which are not only the sources of precious water, but provide conducive habitats for plants and animals, moderate hydrological cycles, influence microclimate, enhance the aesthetic beauty of the landscape and many recreational opportunities to mankind (Bhat *et al.,* 2011). In spite of the socio- economic and ecological importance of reservoirs, better knowledge of several ecological aspects (especially regarding species distribution patterns and biogeography, diversity and functional interaction among the different components of the food web) is needed for better understanding of their relationships with environmental variables. Reservoirs had received little attention so far in terms of their biological, diversity, conservation and water management. This is in spite of them becoming increasingly important due to the possible consequences of the global climate change (Hofer *et al*., 2001).

Organisms whose power of movement is insufficient to prevent them from being moved by water currents are collectively termed Plankton. The Plankton can be classified in different ways, this include whether they are true or false plankton, their nutritional requirements (phytoplankton and zooplankton), their size, their environments, and their life history (Rabiu *et al.,* 2014).

Planktons are used in various ways as indicators of water quality. The algal biomass essentially determines the quality eutrophic level of the water (Sarwade and Kamble, 2014). Drinking water supply, recreational activities and fisheries can be impaired by high phytoplankton biomass (Sharma, 2013).

According to Zaky (2015) the quality of any water resource is measured in the form of its physicochemical parameters. The physicochemical properties of water affect the quality of that water and its biological diversity. The changes in the physicochemical parameters tend to change the living conditions, especially in the number, diversity and distribution of the biota of that ecosystem. Fluctuation in physicochemical factors could adversely affect the organisms, limiting their production and interfering with the physiological processes which reduce their ability to compete with other populations within the environment.

The effect of physical factors such as light and heat are of great significance as they are solely responsible for certain phenomena such as thermal stratification, chemical stratification, diurnal and seasonal variations in the distribution and quality of planktons and other aquatic organisms (Ibrahim, 2009; Sharma, 2013; Sarwade and Kamble, 2014).

The aim of this research is to determine the effect of environmental parameters on plankton assemblage in Ajiwa reservoir.

MATERIALS AND METHODS

Study Area

Ajiwa reservoir (Figure 1) is located in Batagarawa local government area of Katsina state and lies between latitude 12°30|-13°00| North, longitude 7° 30|-8° 00 East, in the Sudan savanna ecological zone of Nigeria. The elevation of the site is about 518m above sea level. The Reservoir has catchment areas of 1678km with 12 meters height and spill way of 60 meters, lift-pump of 1040km/hr. capacity. Base on the ecological setting of the area the dam was divided into site (A, B and C) the distance between each sampling points was 150m for the purpose of this study.

Where;
Site A: western part of the reservoir (N12°.494, E7°.749); which is one of the deepest parts of the dam (outlet); human activities (swimming) take place especially during the dry season.
Site B: This lies on latitude (N12°.936, E 7°.743) which is the mid of the reservoir where there are less human activities apart from fishing.
Site C: This site (N12°.930, E 7°.758) is where agricultural activities (irrigation) take place during dry season and vegetations are subjected to chemicals input from fertilizer application, and in turn washed in to the reservoir.

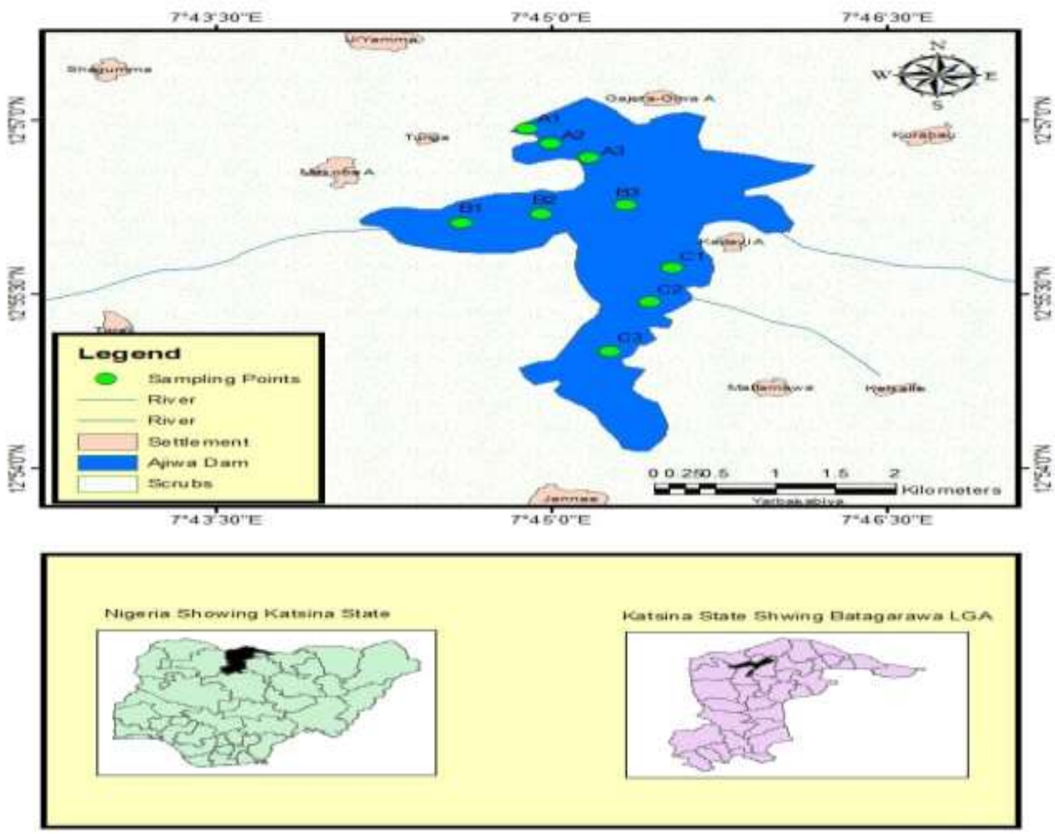

Figure 1: Ajiwa Reservoir, Katsina Showing Marked Sampling Sites (Source: Cartography Lab. Bayero University Kano, 2018).

Sample Collection
Water samples were collected on fortnightly basis between 7:00 and 9:00am from March to October, 2018 (APHA, 2010). Surface water Temperature, pH, Electrical Conductivity and Total Dissolved Solids, were measured using calibrated digital multi-parameter water proof multipurpose HANNAH instrument (HI9813-6) by dipping it below the water and taking readings after it stabilized as described by the manufacturers (APHA, 1999). Dissolved Oxygen was determined using Dissolved Oxygen Meter (JPB-607A model) as described by APHA (2010). Biological Oxygen Demand (BOD_5) was determined after 5 days of sample incubation as described by AWWA (2001). The Nitrate-Nitrogen was determined using Nitrate Test Kit (ISO9001) according to the Manufacturer's instruction. Phosphorus-phosphate (PO_4^{-3}) was measured using API Phosphate Test Kit (1595-01-0806, 1575-02-1504), in accordance with the manufacturers manual. The planktons were sampled with the aid of plankton net (with a fine mesh aperture, 20-60µm, with a small bottle container of 50cm^3 capacity attached to its narrow end). The water sample collected at each site was carefully emptied into a dark screw capped sample bottle. For preservation, 4% formalin was added and transported to the Aquarium Laboratory of Biological Sciences Department, Bayero University, Kano, using a cooler flask. The sample bottles were always rinsed with distilled water in between samples to avoid contamination (Jason, 2012). The volume of the water that passed through the net was then estimated by using a formula (APHA, 2005) as follows:

$V=\pi r^2 d$

Where:
π = 3.142, V = volume of water filtered through the net,
r = radius of the mouth of the net and d = length of the haul

Statistical Analysis
Two way analysis of variance (ANOVA) was used to compare the means of various physicochemical parameters and planktons between months. Tukey's multiple comparison procedures were

used to make comparisons among columns. These analyses were carried out using GraphPad inStat software (version 2.0). Canonical correspondence analysis (CCA) was used for correlations, to test the relationship between various parameters, which was done using XLSTAT (2018).

RESULTS

Tables 1, 2 and 3 show mean values of physicochemical parameters of Ajiwa Reservoir and seasonal variation. The mean monthly variation of phytoplankton in Ajiwa reservoir in relation to months, seasons and physicochemical parameters were recorded. Four Phytoplankton phyla were recorded (Table 4). They were dominated by Chlorophyta then Cyanophyta followed by Euglenophyta and Bacillariophyta in the reservoir. Cyanophyta in the reservoir was represented by *Microcystis* sp. The mean monthly distribution of Cyanophyta showed that, the density of Cyanophyta was highest during the months of March and lowest in the month of July and August. Chlorophyta was represented by *Oedogonium* sp., *Spirogyra* sp., *Closterium* sp. and *Chlamydomonas* sp. Chlorophyta showed highest mean occurrence during the month of March and lowest mean occurrence during the month of July in Ajiwa reservoir (Table5). The Zooplankton were identified and dominated by Rotifers followed by Cladocerans and then copepods (Table 6) in Ajiwa reservoir.

Rotifers in the reservoir are represented by *Keratella quadrata* and *Brachionidae caudatus*, and had their highest monthly distribution in the month of April and least in August. In Ajiwa reservoir Cladocerans are represented by *Daphnia* sp. The highest mean monthly distribution of Cladocerans occurred in the month of April and least in August.

Correlations between the Environmental factors and Planktons of Ajiwa Reservoir

Ordination of CCA, the group environmental bi-plot shows the relations of the groups and environmental variables with the ordination axis. In the graph (figure 2) environmental factors are indicated by the line, length of line represents the degree of relationship between sample plots, the distribution of biota and environmental factors. The length of the arrow indicates the relative importance of the environmental variable in determining the axis. The positions of the group's centers (points) along the ordination axis represent their respective optima along the environmental gradient. In Ajiwa Reservoir, the group environmental correlation with axis correlated well with Chlorophyta and Rotifers, with highest values on this axis. Group with lowest correlation with this axis was Euglenophyta. In addition, the analysis make vertical lines connecting a particular group with the line of environmental factors closer to the connecting point near the line of environmental factor showing strong positive correlation. Further, the most important factors affecting plankton's distributions were water temperature, transparency, TDS, EC and dissolved oxygen (Table 7).

Table 1: Physicochemical Parameters of Ajiwa Reservoir in Relation to Sites and Seasons During the Month of March to October, 2018

		Parameters				
MONTH	**SITES**	**Temperature (°C)**	**pH**	**EC (µS/cm)**	**DO (mg/L)**	**BOD_5 (mg/L)**
MARCH	A	28.31±0.0608[a]	7.41±0.0100[a]	90±0.0000[b]	5.94±0.0115[c]	2.31±0.0100b
	B	29.52±0.3362[a]	7.42±0.0057[a]	100±0.0000[a]	5.49±0.1762[b]	2.86±0.0100[a]
	C	29.11±0.0751[a]	7.41±0.0231[a]	100±0.0000[a]	5.71±0.0057[bc]	2.92±0.0100[a]
APRIL	A	26.13±0.0057[b]	7.45±0.0115[a]	260±0.0000[c]	8.58±0.0115[a]	3.14±0.0057[a]
	B	25.71±0.4244[a]	7.38±0.0057[a]	270±1.0000[d]	8.51±0.0058[a]	2.25±0.0057[b]
	C	25.45±0.0586[a]	6.85±0.0153[c]	100±0.0000[b]	7.53±0.0057[b]	3.23±0.0057[a]
MAY	A	29.92±0.0100[ab]	6.57±0.0100[a]	110±0.0000[a]	5.37±0.0057[a]	3.67±0.0000[b]
	B	30.12±0.0057[b]	6.55±0.0057[a]	130±0.5774[b]	5.24±0.0058[a]	3.11±0.0000[b]
	C	29.80±0.0100[a]	6.51±0.0058[a]	110±0.0000[a]	5.98±0.0058[b]	3.89±0.0115[b]
JUNE	A	25.83±0.0057[a]	5.67±0.0100[a]	95±0.0057[b]	8.35±0.0057[b]	5.44±0.0057[a]
	B	25.19±0.0058[a]	5.52±0.0057[b]	85±0.0000[a]	8.83±0.0057[c]	5.42±0.0100[a]
	C	26.40±0.0057[b]	5.88±0.0057[a]	85±0.0000[a]	7.67±0.0153[bc]	5.59±0.0057[b]
JULY	A	24.70±0.0057[a]	5.36±0.0058[a]	50±0.0000[c]	9.12±0.0057[c]	7.82±0.0100[b]
	B	24.40±0.0100[a]	4.91±0.0057[b]	40±0.0000[b]	8.87±0.0115[bc]	6.87±0.0057[c]
	C	24.80±0.0057[a]	5.47±0.0057[a]	70±0.0000[d]	8.75±0.0057[b]	7.11±0.0058[b]
AUGUST	A	22.10±0.0115[a]	4.13±0.0058[a]	30±0.0000[a]	9.42±0.0058[a]	6.83±0.0057[b]
	B	23.50±0.0057[b]	3.23±0.0058[b]	30±0.0000[a]	9.89±0.0057[a]	7.15±0.0058[c]
	C	22.11±0.0058[a]	4.73±0.0057[a]	36±0.0000[a]	8.48±0.0057[b]	6.37±0.0058[b]
SEPTEMBER	A	25.11±0.0057[a]	4.07±0.0057[a]	30±0.1000[a]	9.52±0.0058[bc]	6.72±0.0057[a]
	B	25.01±0.0100[a]	3.71±0.0057[b]	30±0.0100[a]	9.87±0.0100[c]	7.01±0.0100[b]
	C	25.21±0.0058[a]	4.97±0.0480[a]	36±0.0100[a]	8.67±0.0100[b]	6.12±0.0058[a]
OCTOBER	A	24.23±0.0058[b]	6.72±0.0200[a]	50±0.0000[a]	8.87±0.0519[bc]	5.31±0.0100a
	B	22.12±0.0700[b]	7.12±0.0057[b]	50±0.0000[a]	8.91±0.0100[c]	5.67±0.0000[b]
	C	23.53±0.0100[bc]	6.81±0.0057[a]	50±0.0000[a]	7.64±0.0058[b]	5.23±0.0153[a]
MEANS±SD		25.24±0.0210	6.42±0.0123	87±0.0021	8.67±0.0052	4.87±0.052

Values are expressed as means ± SEM (Standard error of means). Means having different superscripts along columns are significantly different at $P < 0.05$.

Table 2: Physicochemical Parameters of Ajiwa Reservoir in Relation to Sites and Seasons During the Month of March to October, 2018

MONTH	SITES	TDS (mg/L)	Transparency (cm)	Nitrate (mg/L)	phosphate (mg/L)
	A	72.31 ± 0.0100^{a}	19.91 ± 0.0057^{c}	0.03 ± 0.0000^{a}	0.04 ± 0.0057^{a}
MARCH	B	79.01 ± 0.0057^{b}	14.31 ± 0.0057^{b}	0.03 ± 0.0057^{a}	0.05 ± 0.0058^{a}
	C	78.31 ± 0.0153^{b}	21.71 ± 0.0057^{d}	0.02 ± 0.0057^{b}	0.02 ± 0.0139^{b}
	A	78.82 ± 0.0058^{b}	16.29 ± 0.0058^{c}	0.03 ± 0.0058^{a}	0.11 ± 0.1155^{c}
APRIL	B	81.16 ± 0.0057^{c}	14.14 ± 0.0058^{b}	0.03 ± 0.0000^{a}	0.05 ± 0.0057^{b}
	C	80.84 ± 0.0379^{bc}	13.71 ± 0.0057^{b}	0.04 ± 0.0057^{b}	0.03 ± 0.0058^{b}
	A	88.67 ± 0.0058^{c}	11.82 ± 0.0100^{b}	0.03 ± 0.0057^{b}	0.02 ± 0.0057^{b}
MAY	B	80.01 ± 0.0057^{b}	12.05 ± 0.0057^{a}	0.11 ± 0.0057^{d}	0.11 ± 0.0057^{c}
	C	83.35 ± 0.0379^{b}	12.41 ± 0.0057^{a}	0.04 ± 0.0057^{c}	0.03 ± 0.0058^{b}
	A	81.61 ± 0.0153^{b}	10.21 ± 0.0057^{a}	0.08 ± 0.043^{b}	0.06 ± 0.0000^{a}
JUNE	B	80.05 ± 0.0057^{a}	10.01 ± 5.7740^{ab}	0.11 ± 0.0000^{c}	0.12 ± 0.0057^{b}
	C	80.01 ± 0.0057^{a}	9.95 ± 0.0436^{b}	0.09 ± 0.0000^{bc}	0.06 ± 0.0058^{a}
	A	46.61 ± 0.0058^{ab}	5.56 ± 0.0057^{a}	0.12 ± 0.0057^{d}	0.13 ± 0.0057^{c}
JULY	B	40.33 ± 0.0058^{b}	4.91 ± 0.0057^{b}	0.07 ± 0.0057^{c}	0.06 ± 0.0116^{a}
	C	64.33 ± 0.0058^{c}	5.55 ± 0.0058^{a}	0.04 ± 0.0000^{b}	0.05 ± 0.0058^{a}
	A	33.00 ± 0.0000^{a}	4.86 ± 0.0057^{b}	0.09 ± 0.0058^{a}	0.09 ± 0.0116^{bc}
AUGUST	B	33.00 ± 0.0000^{a}	6.14 ± 0.0057^{a}	0.1 ± 0.0000^{a}	0.12 ± 0.0057^{c}
	C	34.00 ± 0.0000^{b}	6.04 ± 0.0058^{a}	0.06 ± 0.0000^{b}	0.07 ± 0.0058^{b}
	A	33.01 ± 0.0057^{a}	4.81 ± 0.0057^{b}	0.08 ± 0.0057^{a}	0.07 ± 0.0057^{b}
SEPTEMBE R	B	33.11 ± 0.0000^{a}	5.9 ± 0.0058^{a}	0.12 ± 0.0058^{b}	0.11 ± 0.0058^{c}
	C	33.11 ± 0.0000^{a}	5.7 ± 0.0057^{a}	0.07 ± 0.0058^{a}	0.08 ± 0.0000^{b}
	A	42.33 ± 0.0100^{a}	8.9 ± 0.0100^{b}	0.1 ± 0.0057^{a}	0.09 ± 0.0058^{c}
OCTOBER	B	46.66 ± 0.0152^{b}	8.21 ± 0.0057^{b}	0.15 ± 0.0058^{a}	0.13 ± 0.0057^{b}
	C	42.65 ± 0.0000^{a}	7.47 ± 0.0100^{b}	0.13 ± 0.0057^{a}	0.14 ± 0.0057^{b}
MEANS±SD		64.23±0.0042	10.25±0.031	0.07±0.0021	0.08±0.0052

Values are expressed as means ± SEM (Standard error of means). Means having different superscripts along columns are significantly different at $P < 0.05$.

Table 3: Seasonal Mean Value of Ajiwa Reservoir from March to October, 2018

PARAMETERS	DRY SEASON	RAINY SEASON
TEMP. (°C)	28.22±1.18	26.76±0.69
pH	6.89±0.73	6.11±0.39
EC (µS/cm)	113.84±73.59	51.42±26.59
DO (mg/L)	7.20±1.88	8.95±0.49
BOD5 (mg/L)	4.00±1.77	6.54±0.76
TDS (mg/L)	68.48±23.79	49.3522.33
Transparency (cm)	12.73±5.54	6.64±2.29
Nitrate (mg/L)	0.05±0.03	0.09±0.01
phosphate PO4-3(mg/L)	0.06±0.02	0.090.01

Table 4: Mean Number of Phytoplankton Population in Ajiwa Reservoir Recorded Between Months of March-October, 2018

Months	Phytoplankton phyla			
	Chlorophyta means ±SD	Bacillariophyta means ±SD	Euglenophyta means ±SD	Cyanophyta means ±SD
MARCH	8.28±0.68	14.00±5.29	18.00±4.00	8.00±9.17
APRIL	7.38±0.91	12.33±7.10	5.67±4.93	6.00±5.29
MAY	4.50±1.00	3.33±0.58	11.00±2.65	1.33±1.53
JUNE	4.20±0.96	0.00±0.00	5.67±1.16	1.33±0.58
JULY	1.53±0.25	0.00±0.00	3.00±1.00	0.67±1.16
AUGUST	1.63±0.58	0.33±0.58	1.67±0.58	0.67±1.16
SEPTEMBER	1.80±0.50	0.00±0.00	3.33±0.58	1.33±1.53
OCTOBER	3.20±1.67	1.00±1.00	5.00±2.00	1.67±1.53

Table 5 : Occurrence, Distribution and Relative Abundance of Phytoplankton Species at Sampling Stations of Ajiwa Reservoir From March– October, 2018

	Sampling stations				
S/no Taxon	A	B	C	Total	
Chlorophyta					
Closterium sp.	23	18	19	60	
Oedogonium sp.	15	11	17	43	
Spirogyra sp.	54	81	84	219	**387**
Chlamydomonas sp.	12	30	23	65	
Bacillariophyta					
Tabellaria sp.	34	12	17	63	**63**
Euglenophyta					
Euglena sp.	46	51	63	160	**160**
Cyanophyta					
Microcystis sp.	20	28	35	83	**83**

Table 6: Occurrence, Distribution and Relative Abundance of Zooplankton Species at Sampling Stations of Ajiwa Reservoir (March– October, 2018)

	Sampling stations				
S/no Taxon	A	B	C	Total	
Copepods					
Cyclopoid sp.	20	36	22	78	**78**
Rotifers					
Brachionidae caudatus	18	17	35	70	
Keratella quadrata	22	41	47	110	**180**
Cladocerans					
Daphnia sp.	40	56	53	149	**149**

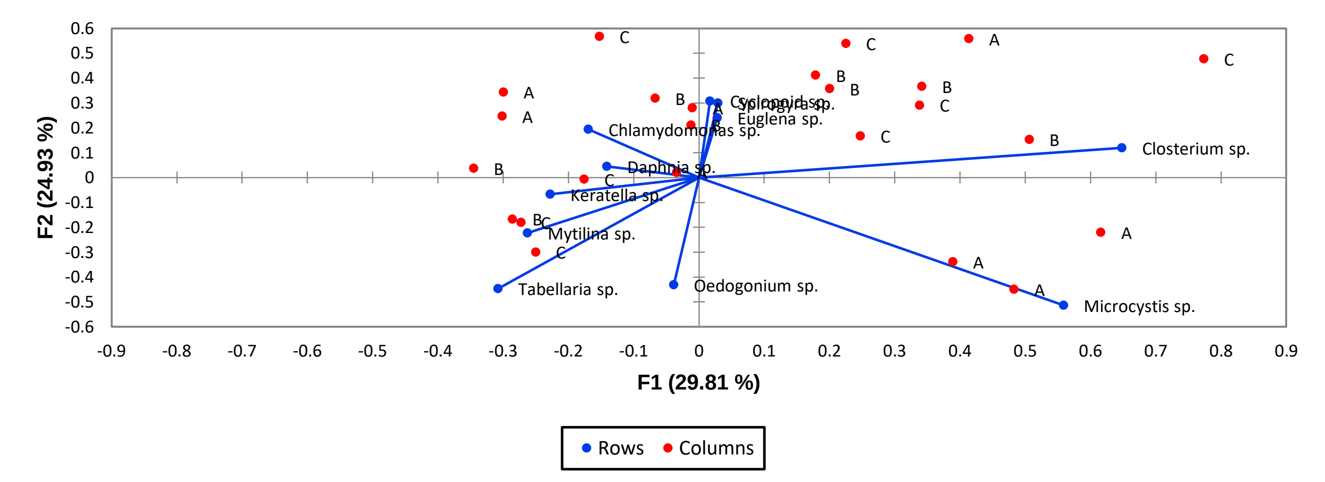

Figure 2: Correlations between Phytoplanktons, Zooplanktons and Locations of Ajiwa Reservoir from March-October 2018

Table 7: Correlation Matrix and Relationship Between Zooplankton, Phytoplankton and Some Physicochemical Parameters of Ajiwa Reservoir.

parameters	Temp.	pH	EC	DO	BOD	TDS	Transparency	Nitrate	phosphate	Phytoplankton	Zooplankton
Temp.	1.000										
pH	0.507	1.000									
EC	0.426	0.634ˣ	1.000								
DO	-0.863	-0.669	-0.315	1.000							
BOD	-0.697	-0.838	-0.727	0.763ˣ	1.000						
TDS	0.744	0.693ˣ	0.696	-0.695	0.761	1.000					
Transparency	0.682ˣ	0.785ˣ	0.634ˣ	-0.709	0.906ˣ	0.0342	1.000				
Nitrate	-0.539	-0.394	-0.517	0.491	0.595	0.532	-0.476	1.000			
Phosphate	-0.549	-0.297	-0.222	0.539	0.47	-0.0465	0.133	0.842ˣ	1.000		
Phytoplankton	0.638ˣ	0.756ˣ	0.539ˣ	-0.717	-0.88	0.662ˣ	0.946ˣ	-0.575	-0.429	1.000	
Zooplankton	0.718ˣ	0.721ˣ	0.678ˣ	0.707ˣ	0.880ˣ	0.562ˣ	0.824ˣ	-0.678	-0.579		1.000

Correlation coefficient with ˣ are highly significant at $P < 0.05$

DISCUSSION

The phytoplankton community in Ajiwa Reservoir was characterized by four (4) phyla (Cyanophyta, Chlorophyta, Euglenophyta and Bacillariophyta). The population size of phytoplankton in the reservoir was 668. The phytoplankton was dominated by Chlorophyta followed by Euglenophyta and Cyanophyta with Bacillariophyta been the least in reservoir. This result agrees with the work by Abdullahi and Indabawa (2005), on the phytoplankton content of Nguru Lake and as such the dominance of Chlorophyta shows gradual deterioration of the water quality. The abundance of phytoplanktons could have been due to availability of nitrate-nitrogen and other nutrients as a result of run-off and siltation. The finding was consistent with findings of past studies by Lamai and Kolo (2003) in Dan Zaria Dam in Niger state. The low diversity in some months could be due to turbidity as against what are obtained in other aquatic ecosystems that are less turbid according to Okogwu and Gerald (2007) and Musa (2010). The research study by Abubakar (2007) indicated that Euglenophta were common in environments rich in decaying organic matter, and large populations of Euglena were favored by the presence of high levels of dissolved organic compounds and high temperatures. In addition, Tanimu *et al.* (2011) showed increase in abundance of the Cyanophyta and Euglenophyta is an indication of organic pollution. It was also observed that the algae were recorded in higher densities in the dry season than in the rainy season, this is in line with the findings of Indabawa (2009) who also recorded higher algal cells in the dry season than in the rainy season. The dominance of Chlorophyta recorded in this study is a typical of most African waters (Kadiri, 1996).

Zooplankton population size in Ajiwa reservoir were 407, the zooplankton consist of three phyla Rotifers, Cladocerans and Copepods. The density of each genera varied with season. Zooplanktons number rose with the early rainy season and gradually decline as the rainy season progresses and as well this fluctuation affect fish population as it served as food for fish. Similar reports were obtained from Balarabe (2001) and Akomeah (2010) in their study of ABU Farm Lake and Nmandi Azikiwe University stream, respectively. The number of Cladocerans and Copepods in Ajiwa Reservoir was relatively low which also indicate low level of pollution and this may be attributed to the absence of aquatic macrophytes or it may be accelerated by the rate of fish predation, which is similar to the work reported by Okogwu (2010) in fresh water reserves in the lake Ehoma in Nigeria. In addition, research conducted by Sarnelle (1992) suggested that fish prefer open waters to feed on zooplankton. Similarly Jeppessen *et al.* (2001) and Havens (2002) observed that the absence of Cladocerans and the low numbers of Copepods could be due to the effects of fish predation, which was found to be the major factor structuring zooplankton assemblage.

CONCLUSION

Plankton phyla recorded in the study area were dominated by Chlorophyta (389 org/L, 57.87%) and least was Bacillariophyta (63org/L, 7.05%) and Zooplankton phyla were dominated by Rotifers (180 org/L) followed by Cladocerans (149 org/L) and then copepods (78 org/L). Physicochemical characteristics of surface water in the study area varied seasonally while spatial variations did not follow any specific trend. The values of physicochemical parameters of the water increased during the dry season, except for nitrate and phosphate. Correlation revealed strong positive significant correlation between plankton and physicochemical parameters (Temperature, Transparency, BOD and Dissolved Oxygen) which were the main factors determining diversity and variations of plankton assemblage in the water bodies during the study period.

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