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Phytoplankton As Indicators Of Water Quality In Gadan Jammel Dam Nangere, Yobe State, Nigeria

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ABSTRACT

Study of phytoplankton as bioindicators of water quality was carried out for a period of six months in Gadal Jammel Dam between July and December, 2019. Water samples for phytoplankton and physicochemical parameters were collected and analyzed using standard methods. Three sampling sites (A, B, and C) were chosen on the Dam. The mean range of physicochemical parameters studied were, water temperature (27.20 – 32.50 °C), pH (6.20 – 7.70), COD (0.0070mg/L – 4.70mg/L), BOD (2.40–2.57mg/L), Chlorophyll, a (3.62 mg/m^2 - 9.31 mg/ m^2), Total Alkalinity (0.0 mg/L-73.3 mg/L), phosphate (1.01-1.06mg/L) Nitrate (5.30 – 6.87mg/L), and Potassium (1.6 mg/L –19.70 mg/L). COD and Potassium only shows there is significant difference between wet and dry season ($P<0.05$) total of 39 phytoplankton species were identified in wet season at site A, B, and C belonging to the following classes: Bacillariophyta (22.122%), Chlorophyta (51.489%), Cyanophyta (20%), Euglenophyta (1.276%) and Zegnematophyta (5.106%). Two hundred and thirty five individual species were recorded from the study sites which were dominated by *Pedrasdrum Spp*, *Coelastrum Spp* And *Ankistrodesmus Spp*. diversity and Evenness Index had the following values in wet season: 3.33 and 0.6099 respectively, total of 37 phytoplankton species were identified in Dry season at site A, B, and C belonging to the classes: Bacillariophyta (20.472%), Chlorophyta (59.055%), Cyanophyta (16.535%), Euglenophyta (0.787%) and Zegnematophyta (3.149%). Two hundred and fifty four individual species were recorded from the study sites which were dominated by *Peddrasdrum Spp, Coelastrum Spp And Ankistrodesmus Spp*. diversity and Evenness Index had the following values in dry season: 3.29 and 0.59 respectively Seasonal variation of phytoplankton taxa indicated more species richness evenness and abundance during wet season than during dry season, The results showed that the water body is impacted with various anthropogenic activities from the inhabitants coupled with natural mineralization, which facilitated fluctuation of phytoplankton abundance, therefore it is recommended that uncontrolled discharge of agrochemicals around the Dam through irrigation and other human activities should be controlled in order to curtail degradation this study will serve as baseline data.

Keywords: Phytoplankton, Physicochemical Parameters, Water Quality, Seasonal Variation Gadan Jammel.

INTRODUCTION

Most aquatic ecosystem around the world, including rivers, lakes and reservoirs ponds etc, have undergone some changes because of anthropogenic disturbances from land use activities (Kuang, Yonghong,Yicheng & Zhenyu. 2004). The use of land by human activities such as rapid urbanization, industrialization and intense agricultural production increase the rate of nutrient in the reservoirs which result into eutrophication, (Xiao-e, Xiang, Hu-lin, & Zhen-li, 2008). Because of their importance to aquatic ecosystems and susceptibility to changes in the environment, the excessive abundance or blooming of eutrophic species has a detrimental effects on the domestic, industrial and recreational uses of water and is in many cases a direct motivation for restorative measures (Bryant 1994).

Phytoplankton is primary producers forming the first trophic level in the food chain (Khattak *et al.*, 2005). Phytoplanktons constitute a starting point of energy transfer; they are highly sensitive to imposed changes in the environment (Eletta *et al.*, 2005). According to Khatri (2014) based on the distribution pattern of the phytoplankton, water quality of an environment can be assessed. Drinking water supply, recreational activities and fisheries can be impaired by high phytoplankton biomass (Khatri, 2014). The use of phytoplankton as biological indicators of pollution has been studied by rating pollution tolerant algae in a water body based on the report of Palmer (1969).

Water is a transparent liquid compound that is colorless, tasteless, and odorless; any physical or chemical change in water quality, either directly or indirectly, indicates water pollution, and adversely affect the organisms or makes the water unfit for its required use, Ehab & Mustafa 2013). (Verma *et al.*, 2012) state that Biological assessment is therefore a useful alternative tool for assessing the ecological quality of aquatic ecosystems since biological communities integrate the environmental effects of water chemistry, in addition to the physical and geomorphological characteristics of water bodies (Suthers and Rissik, 2009).

Among the freshwater organisms, algae are the primary producers of the food chain (phytoplankton) at the first trophic tier (Gayathri, Rajashekhar, Kaneez, Fatima, Vijaykumar, Ratandeep & Mahesh Baburrao., 2011). The algae also have an important role in circulation of the material in aquatic ecosystems by controlling the reproductive capacity and population of aquatic biota (Anjana, Gujarathi & Kanhere, 1998). Algae are important in environmental impact study in as much as they respond to change in the environment and thus indicate environmental changes and fluctuations that may occur (Ingole, Naik, & Kadam, 2010). Phytoplankton is very useful tool for the biomonitoring of a water body with regard to its pollution status (Stoermer, 1977).

In view of the foregoing this research aimed at investigating the phytoplankton in the Gaddan Jammel Dam, Nangere local government, Yobe state species composition with respect to bioindicators of water

MATERIALS AND METHOD

Description of Study Area

Nangere is a Local Government Area in Yobe State, Nigeria. Its headquarters is located in the town of Sabon Gari Nangere, it lies at 11°51′50″N 11°04′11″E. It has an area of 980 km² and a population of 87,823 at the 2006 census. The postal code of the area is 631. (Wikipedia 2008)

The World Bank has collaborated with the Yobe State Government under the Fadama iii project to boost agriculture in the north-east state with the construction of a mini dam and feeder (Olugbode, 2017).

Site selections

The study area will be divided into three sites these are:

Site A; Is located at the drain that receives water from eastern part to the Dam (inlet) where the principal water opens into the River, the area is surrounded with farms and agricultural activities and it has a vegetation cover which consist of both submerged and emergent macrophytes.

Site B; It is located within the main Dam (Gada). The reservoir is steady with little vegetation cover, it consist of both submerged and emergent macrophytes

Section C; It is the outflow from the Dam which flow in string. The vegetation cover is thick with both submerged and emergent macrophytes.

Field data collection

Water for chemical and physical analysis collection will be made on each of the sampling dates (monthly). Water collected in properly rinsed 1.5 liter jug plastic cups. The jugs will be completely immersed in water and filled slowly to maximum capacity, enough samples will be collected in sampling bottles, and the sample will be stored on ice in dark cooler immediately after collection until sample is processed (Holmes & Whitton 1996).

Physical and Chemical parameters

Analysis of physico-chemical properties Surface water temperature was determined in-situ on the field with a mercury bulb thermometer. Water pH and EC was measured on the field with a hand held HACH *pH*/EC meter model 5358236. The surface water Temperature will be determined *in situ* using ordinary mercury in glass thermometer. Transparency is measured by gradually lowering the Secchi disc at respective sampling points; Conductivity was determined in-situ with a hand held HACH conductivity meter model 5358236. Dissolved oxygen (DO) was estimated in-situ with HACH oxygen DO-5509 meter.Nitrate and Phosphate was analyzed using ultraviolet spectrophotometer (APHA 1992). Total hardness will be determined by titration method (APHA, 1995).

Collection Phytoplankton

Plankton net is a field-equipment used to trap plankton. It has a polyethylene, filter of defined mesh Collection of phytoplankton will be carried out with plankton net mesh size 55m towed at low speed for 10 minutes and immediately collected in capped bottles and immediately fixed with 4% formalin until the sample processed.

RESULTS

Physicochemical Parameters

The mean monthly values of water temperature, Temperature, *pH* and COD are presented in Table 1. The range of the water Temperature was observed to be between $27.2^{o}C$ and $32.5^{o}C$ with the lowest value recorded in November and the highest in October. Similarly, mean water temperature during dry season was $29.17\pm3.27^{0}C$ was the least while higher value of 30.90 ± 1.35°C was recorded during wet season as presented in Table 1. Temperature variations between seasons indicated there is no significant difference ($p<0.05$). The range of *pH* values was *pH* 6.20 – 7.70 with the lowest value recorded in August and the highest in November. The seasonal variation of *pH* indicated that the mean *pH* of dry season was 6.40±0.56 while that of wet season was 6.60±0.26 there was no significant difference recorded between the two seasons ($P< 0.05$).

The COD ranged between 0.0 mg/L in July, November and December to 470mg/L in September. Seasonally, the highest mean COD value was 283±249.3mg/L during wet season while dry season had the lowest value of 51±88.3mg/L there was significant difference recorded between the two seasons ($P< 0.05$), (Table 2). The B.O.D mean monthly values recorded during the study period ranged between 2.40 mg/L in September and 2.57mg/L in December (Table 2). The seasonal variations in the mean BOD values indicated that dry season had 2.53±0.53 mg/L while wet season recorded 2.87±0.55mg/L. Statistically, there was no significant difference in BOD between the two seasons ($p<0.05$). Mean monthly values of Chlorophyll a which ranged between 3.62 mg/m^2 in July and 9.31 mg/ m^2 in August. The mean value recorded during the dry season was 7.63±5.58 mg/ m^2 while 8.65±2.29 mg/ m^2 was recorded during the wet season as shown in (Table 4). Mean Chlorophyll a values revealed there was no significant difference between the seasons ($p< 0.05$).

Mean monthly values of Total Alkalinity ranged from 0.0 mg/L in July to 73.3 mg/L in September. The mean value recorded during the dry season was 8.20±mg/L while 31.65±37.66 mg/L was recorded during the wet season. There was high concentration of Nitrate- nitrogen in wet season with 6.87±5.56 mg/L than that of dry season with 5.87mg/L, the mean value recorded during the dry season was 5.90±0.0845mg/L while 6.48±1.58mg/L was recorded during the wet season, was no significant different at $P<0.05$ (Table). Phosphate– phosphorus concentration was observed to be low in wet season, with 1.01mg/L and high in the dry season with 1.06mg/L. The mean value recorded during the dry season was 0.83±0.59mg/L while 0.88±0.43mg/L was recorded during the wet season. Statistically, no significant difference was observed between the seasons ($P<0.05$). The range of Potassium was 1.6 mg/L –19.70 mg/L with the lowest value recorded in December and the highest in November. The seasonal variation of Potassium indicated that the mean of dry season was 11.3±10.0 mg/L while that of wet season was 8.33±2.25mg/L there was significant difference recorded between the two seasons ($P< 0.05$).

Table 1: Mean Monthly Values of Temperature, pH, and Chemical Oxygen Demand from Gadan Jammel Dam (July –December 2019)

	TEMPERETURE (^{0}C)			*pH*			CHEMICAL OXYGEN DEMAND (mg/L)		
MONTH	SITE A	SITE B	SITE C	SITE A	SITE B	SITE C	SITE A	SITE B	SITE C
JULY	32.3	31.6	31.3	6.9	8.8	7.1	0.0	0.0	0.0
AUGUST	29.6	28.5	29.4	7.2	6.9	6.7	80.0	99.0	200.0
SEPTEMBER	31.5	31.8	32.0	6.8	6.6	6.0	90.0	200.0	180.0
OCTOBER	32.5	32.6	32.9	7.6	7.1	6.5	11.0	70.0	72.0
NOVEMBER	27.2	26.9	27.8	6.3	6.2	6.1	0.0	0.0	0.0
DECEMBER	26.4	27.0	26.8	6.4	6.4	6.6	0.0	0.0	0.0

Table 2: Mean Monthly Values of BOD, Chlorophyll a and Total Acidity, from Gadan Jammel Dam (July - December 2019)

	BIOCHEMCAL OXYGEN DEMAND (mg/L)			CHLOROPHYLL a (mg/ m^2)			TOTAL ALKALINITY (mg/L)		
MONTHS	SITE A	SITE B	SITE C	SITE A	SITE B	SITE C	SITE A	SITE B	SITE C
JULY	1.0	2.5	2.2	1.48	1.67	0.47	0.00	0.00	0.00
AUGUST	2.5	1.6	3.2	3.10	3.01	3.20	1.04	10.0	10.6
SEPTEMBER	2.1	1.9	3.2	2.52	2.48	2.98	27.5	22.0	23.8
OCTOBER	2.2	2.6	2.4	2.10	2.20	2.68	1.11	0.60	0.80
NOVEMBER	2.3	2.6	2.4	2.69	2.96	2.31	2.6	3.00	3.20
DECEMBER	3.0	1.9	2.8	2.46	2.88	2.68	5.6	4.10	3.90

Table 3: Mean Monthly Values of Nitrogen, phosphate and Potassium from Gadan Jammel Dam July - December 2019

	NITROGEN (mg/L)			PHOSPHATE (mg/L)			POTASSIUM (mg/L)		
MONTHS	SITE A	SITE B	SITE C	SITE A	SITE B	SITE C	SITE A	SITE B	SITE C
JULY	5.0	10.4	4.2	0.37	0.37	0.45	2.8	2.3	3.1
AUGUST	4.5	8.0	7.3	1.25	0.72	0.88	2.1	2.0	2.0
SEPTEMBER	8.3	6.4	4.2	0.89	0.83	1.3	4.0	3.2	3.4
OCTOBER	4.3	5.3	6.3	0.59	0.54	0.48	1.2	1.3	1.2
NOVEMBER	3.0	7.3	6.3	0.79	0.88	1.51	10	7.0	2.7
DECEMBER	5.4	6.2	9.0	0.69	0.55	0.49	0.1	0.9	0.16

Table 4: Seasonal Variation of Physicochemical Parameters in Gadan Jammel

PARAMETER	DRY SEASON	WET SEASON
TEMPERATURE (^{0}C)	29.17±3.27	30.90±1.35
PH	6.40±0.26	6.60±O.58
COD (mg/L)	283±249.30	51±88.30
BOD (mg/L)	2.53±0.23	2.87±0.88
CHLOROPHYL, a (mg/m^2)	8.65±2.29	7.63±5.58
TOTAL ALKALINITY (mg/L)	31.65±37.66	8.20±5.56
NITRONGEN (mg/L)	20.37±0.06	16.73±7.53
PHOSPHORUS (mg/L)	0.83±0.57	0.88±0.43
POTASSIUM (mg/L)	8.33±2.25	11.3±10.0

Biological Parameters

The total composition and relative abundance of the phytoplankton species from the sampling sites Wet season reveals that a total of 39 phytoplankton species were recorded at site A, B, and C belonging to the following classes: Bacillariophyta (22.122%), Chlorophyta (51.489%), Cyanophyta (20%), Euglenophyta (1.276%) and Zegnematophyta (5.106%). Two hundred and thirty five individual species were recorded from the study sites which were dominated by *Peddrasdrum Spp, Coelastrum Spp And Ankistrodesmus Spp*. Shannon-wiener diversity and Evenness Index had the following values in wet season: 3.33 and 0.6099 as shown in table 5.

In dry season a total of 37 phytoplankton species were recorded at site A, B, and C belonging to the classes: Bacillariophyta (20.472%), Chlorophyta (59.055%), Cyanophyta (16.535%), Euglenophyta (0.787%) and Zegnematophyta (3.149%). Two hundred and fifty four individual species were recorded from the study sites which were dominated by *Peddrasdrum Spp, Coelastrum Spp And Ankistrodesmus Spp*. Shannon-wiener diversity and Evenness Index had the following values in wet season: 3.292 and 0.5945 as reveal in (table 6), Seasonal variation of phytoplankton taxa indicated more species richness evenness and abundance during wet season than during dry season.

Table 5: Phytoplankton Composition, Distribution, Relative Abundance, species diversity Evenness and Richness from Gadan Jammel Dam in wet season (July- Sept, 2019)

ALGAE SPECIES	Number of species	pi	Lnpi	lnpi(pi)
BACILLARIOPHYCEAE				
Anabaena Spp	4	0.01702128	-4.07329115	-0.069333
Asteriolalla Spp	9	0.03829787	-3.26236094	-0.124941
Coscinodiscus	2	0.00851064	-4.76643833	-0.040565
Coscinodiscus Spp	2	0.00851064	-4.76643833	-0.040565
Cyclotella Spp	2	0.00851064	-4.76643833	-0.040565
Diatoma Spp	6	0.02553191	-3.66782604	-0.093647
Ditylum	1	0.00425532	-5.45958551	-0.023232
Gyrosigma Spp	2	0.00851064	-4.76643833	-0.040565
Navacula Spp	5	0.0212766	-3.8501476	-0.081918
Pinnularia Spp	4	0.01702128	-4.07329115	-0.069333
Synedra Spp	12	0.05106383	-2.97467886	-0.151898
Tubellaria Spp	3	0.01276596	-4.36097323	-0.055672
CHLOROPHYCEAE				
Actinastrum Spp	1	0.00425532	-5.45958551	-0.023232
Ankistrodesmus	17	0.07234043	-2.62637217	-0.189993
Chlorella Spp	9	0.03829787	-3.26236094	-0.124941
Coelastrum Spp	18	0.07659574	-2.56921376	-0.196791
Crucigenia Spp	4	0.01702128	-4.07329115	-0.069333
Crucigenia Spp	8	0.03404255	-3.38014397	-0.115069
Desmodesmus Spp	2	0.00851064	-4.76643833	-0.040565
Palmella Spp	3	0.01276596	-4.36097323	-0.055672
Peddrasdrum Spp	21	0.0893617	-2.41506308	-0.215814
Scenedesmus Spp	7	0.02978723	-3.51367537	-0.104663
Scenedesmus Spp	4	0.01702128	-4.07329115	-0.069333
Spirogyra Spp	14	0.05957447	-2.82052818	-0.168031
Tetraspora Spp	2	0.00851064	-4.76643833	-0.040565
Tetraspora Spp	1	0.00425532	-5.45958551	-0.023232
Ulothrix Spp	10	0.04255319	-3.15700042	-0.13434
CYANOPHYCEAE				
Anacystis Spp	2	0.00851064	-4.76643833	-0.040565
Melosira Spp	2	0.00851064	-4.76643833	-0.040565
Merismepodia Spp	14	0.05957447	-2.82052818	-0.168031
Microcystis Spp	3	0.01276596	-4.36097323	-0.055672
Nostoc Spp	11	0.04680851	-3.06169024	-0.143313
Nostoc Spp	5	0.0212766	-3.8501476	-0.081918
Phormidium Spp	9	0.03829787	-3.26236094	-0.124941
Spirulina Spp	1	0.00425532	-5.45958551	-0.023232
EUGLENOPHYCEAE				
Euglena Spp	2	0.00851064	-4.76643833	-0.040565
Eudoria Spp	1	0.00425532	-5.45958551	-0.023232
ZYGNEMATOPHYCEAE				
Closterium Spp	8	0.03404255	-3.38014397	-0.115069
Straurastum Spp	4	0.01702128	-4.07329115	-0.069333
TOTAL	235	1	-157.51949	-3.3302

Table 6: Phytoplankton Composition, Distribution, Relative Abundance, species diversity Evenness and Richness from Gadan Jammel Dam in wet season (Oct- Dec, 2019).

ALGAE SPECIES	Number of species	Pi	Lnpi	lnpi(pi)
BACILLARIOPHYCEAE				
Asterionella Spp	10	0.039370079	-3.234749174	-0.12735233
Coscinodiscus Spp	6	0.023622047	-3.745574798	-0.08847814
Cyclotella Spp	2	0.007874016	-4.844187086	-0.03814321
Diatoma Spp	8	0.031496063	-3.457892725	-0.10891001
Ditylum Spp	1	0.003937008	-5.537334267	-0.02180053
Gyrosigma Spp	2	0.007874016	-4.844187086	-0.03814321
Navacula Spp	7	0.027559055	-3.591424118	-0.09897626
Pinnularia Spp	7	0.027559055	-3.591424118	-0.09897626
Synedra Spp	7	0.027559055	-3.591424118	-0.09897626
Tabellaria Spp	2	0.007874016	-4.844187086	-0.03814321
CHLOROPHYCEAE				
Actinastrum Spp	3	0.011811024	-4.438721978	-0.05242585
Ankistrodesmus Spp	21	0.082677165	-2.492811829	-0.20609862
Chlorella Spp	5	0.019685039	-3.927896355	-0.07732079
Chlorella Spp	5	0.019685039	-3.927896355	-0.07732079
Coelastrum Spp	29	0.114173228	-2.170038437	-0.24776029
Crucigenia Spp	8	0.031496063	-3.457892725	-0.10891001
Desmodrum Spp	2	0.007874016	-4.844187086	-0.03814321
Palmella Spp	2	0.007874016	-4.844187086	-0.03814321
Pedrastrium Spp	9	0.035433071	-3.34010969	-0.11835034
Pedrastrum Spp	17	0.066929134	-2.704120923	-0.18098447
Scenedesmus Spp	14	0.043307087	-3.139438994	-0.13595996
Spirogyra Spp	14	0.05511811	-2.898276937	-0.15974755
Tetraspora Spp	3	0.011811024	-4.438721978	-0.05242585
Ulothrix Spp	10	0.039370079	-3.234749174	-0.12735233
CYANOPHYCEAE				
Anabaena Spp	3	0.011811024	-4.438721978	-0.05242585
Anacystis Spp	1	0.003937008	-5.537334267	-0.02180053
Melosira Spp	2	0.007874016	-4.844187086	-0.03814321
Merismopodia Spp	15	0.059055118	-2.829284066	-0.1670837
Microcystis Spp	2	0.007874016	-4.844187086	-0.03814321
Nostoc Spp	10	0.039370079	-3.234749174	-0.12735233
Phormidium Spp	8	0.031496063	-3.457892725	-0.10891001
Spirulina Spp	1	0.003937008	-5.537334267	-0.02180053
EUGLENOPHYCEAE				
Euglena Spp	1	0.003937008	-5.537334267	-0.02180053
Eudorina Spp	1	0.003937008	-5.537334267	-0.02180053
ZYGNEMATOPHYCEAE				
Closterium Spp	5	0.019685039	-3.927896355	-0.07732079
Straurastrum Spp	3	0.011811024	-4.438721978	-0.05242585
	254	1	-153.0488757	-3.29219668

DISCUSSION

Phytoplankton is very useful tool for the biomonitoring of a water body with regard to its pollution status (Stoermer, 1977). In tropical systems, marked variations in temperature and rainfall between seasons influence the physico-chemical characteristics of water bodies (Adebisi 1981).

Dallas (2004) pointed out that various physicochemical and biological circumstances must be simultaneously taken into consideration for understanding fluctuation of biological population in water body. In Gadan Jammel Dam Yobe state, the physico-chemical parameters were observed to fluctuate slightly during the study period, these parameters varied from July to December. The mean monthly values for the physicochemical parameters were presented in Table 1 - 3.During the study period, mean water temperature of the dam fluctuate between 26.73–32.67°C.The low water temperature recorded in the December, might be due to the characteristic cool dry NorthEast trade wind (Harmattan). This trend of temperature variation is in tandem with the findings of Ibrahim and Nafiu 2017 in Thomas Dam in Danbatta Kano and Gania and Parveen (2010). The pH value recorded in this study (7.20 -7.60) was observed to decrease slightly from July to November. Aken (2008), Stenseth *et al*., (2004) and Tsuchida *et al*., (1984) reported that temperature was the limiting factor for controlling the multiplication rate and standing stock of natural population density of phytoplankton. The *pH* recorded fall within the acceptable limits of 6.5- 8.5 for fresh water bodies set by National Standard for Drinking Water Quality (2007). Chemical Oxygen Demand ranged between 0.0070mg/L – 4.70mg/L, which is quite satisfactory to support aquatic life perhaps due to good aeration rate and photosynthetic activity as reported by Jaji *et al.* (2007). The distribution of Chemical Oxygen Demand in water body has been reported to be governed by a balance between input from the atmosphere, rainfall, photosynthesis and losses by the chemical and biotic oxidations Ibrahim and Nafiu (2017). Chlorophyll, a ranged from3.62 mg/L - 9.31 mg/L, during dry and wet season respectively. The water Chlorophyll, a Estimates of community biomass based on the Ash Free Dry Weight (AFDW) and chlorophyll *a* have been an integral part of ecological studies of aufwuchs concerning production (as biomass accumulation overtime) (Ho 1976), both as a productivity indicator or index of the photosynthetic potential and as an indicator of nutrient stress or community conditions (Clark *et al.* 1979). Total Alkalinity of the water body also varied according to the season it ranged from 0.0 mg/L-73.3 mg/L, The Total Alkalinity of reservoirs and Man made lakes depend largely on that of inflowing rivers, turnover rates and the soil of the catchment area (Payne 1986).

Nitrate- nitrogen with 23.73 – 31.93mg/L. Phosphates- phosphorus ranges between 0.40-1.06 mg/L and The values recorded were higher than the standard limit for fresh water set by FEPA (1991).This corroborates with the findings of Ibrahim and Nafi'u (2017) who recorded higher values of both nitrate and phosphate in their work on seasonal comparison of physicochemical parameters in Thomas Dam, Kano State, also The algal species that will proliferate in the reservoir must not only be able to withstand conditions of nitrogen limitation but also be able to utilize ammonia as a nitrogen source or be a nitrogen-fixing species (Raymont 1980, Paerl and Tucker 1995). The higher values of phosphate and nitrate concentrations could be attributed to the inputs from agricultural activities around the study area; Phosphorus (P) and Nitrogen (N) are often considered as the principal limiting nutrients for aquatic algal production (Cecilia, 2011 and Hutchinson, 1967).

The values recorded were higher than what was reported by Kefas *et al*., (2015) in Lake Geriyo, Adamawa state, Nigeria. The value of Potassium range from 1.6 mg/L to19.70 mg/L. when large amounts of elements such as nitrogen, phosphorus, and potassium flow into the surface water with a slow flow rate and long renewal period, causing the growth of algae and other aquatic organisms so that the rate of organic production is far greater than the consumption rate, ultimately leading to the accumulation of organic matter in water and destruction of the aquatic ecological balance (Wei 1998, Smith and Schindler 2009).

The high phytoplankton species diversity recorded may be due to the favorable physiochemical parameters that greatly influenced their growth as reported by Muhammad and Saminu (2012) in Salanta River, Kano. Similar observation was made by Anago *et al*., (2013) who reported that in water body where domestic and agricultural activities persists pollution is accelerated through the growth of

Chlorophyta and *Cyanophyta*. The presence of bloom producing species such as *Microcystis* sp., *Anabaena* sp. And *Oscillataria* sp. Analysis of community structure using The Shannon-Weiner diversity index standard for freshwater bodied as proposed ranged of greater than 4 (> 4) is clean water; between 3-4 is mildly polluted water and less than 2 (< 2) is heavily polluted water (Shekhar *et al*., 2008). In the present study it revealed that wet season has 3.3302 dry seasons with 3.2921 as shown in (Table 5) which indicates that the water is mildly polluted. Similar observation was reported by Tanimu *et al.* (2012). The occurrence of *Coscinodiscus, Ulothrix Anabaena and spirogyra* algae species and certain *chlorophyata, diatoms* like Gyrosigma*, Melsoria, Chorella and Navicula* species were recorded. Thus, algal communities can served as indicators of pollution for assessing the water quality of this lake of international importance (Nandan and Aher, 2005).

CONCLUSION

The present study identified bioindicator phytoplankton species such as *Microcystis* sp. *Spirogyra* sp, *Scenedesmus* sp, *Euglena* sp. *Phacus* sp *Melosira* sp *Ulothrix* sp and *Anabaena* sp which clearly indicate organic pollution in the Dam. Climatic influence, and anthropogenic activities such irrigation, construction and other domestic activities close to the Dam influenced seasonal variations in the phytoplankton composition and physicochemical characteristics of the dam. The results showed that the water body is impacted with various anthropogenic activities from the inhabitants coupled with natural mineralization, which facilitated fluctuation of phytoplankton abundance and physicochemical parameters, It is therefore necessary from the viewpoint of ecological research and the future management purposes of the Gadan Jamel Dam to establish baseline information to detect major pattern in algae species composition and the ecological factors that influence them over time. Information obtained on physico-chemical attributes of the reservoir can provide water quality managers and public a better perspective of the condition of the reservoir.

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