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Impact of Physicochemical Parameters on Planktons Occurence And Distribution In Mohammed Ayuba Dam, Kazaure Jigawa State, Nigeria

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Abstract
A study on the impact of physicochemical parameters on phytoplanktons and zooplanktons occurrence and distribution was carried out in Mohammed Ayuba dam, Kazaure, Jigawa State Nigeria for a period of eleven (11) month in 2020. Three (3) sampling stations designated as A, B and C was selected. The results of the physicochemical factors showed that, Temperature ranged between 25 – 31⁰C, Transparency 18 – 97 cm, Conductivity 214 – 648 mg/L, Dissolved solids (DS) 1.1 – 2.5 mg/L, Total Dissolved Solids (TDS) 68 – 471 mg/L, pH 6.6 – 7.7 and Biological Oxygen Demand (BOD) 1.1 – 5.8 mg/L. Statistical analyses of the results using Pearson correlation coefficient have shown that, negative correlation was observed between temperature and transparency with Spirogyra, conductivity with Euglena viridis. However, transparency and dissolved solids was positively correlated with Paramecium spp. In conclusion, this study revealed that physicochemical fluctuations has negative impact on the phytoplanktons and zooplankton species occurrence and abundance, thus, the need for the government to establish catchment management agency in order to curtail the menace in Mohammed Ayuba dam that disrupt the aquatic ecosystem.

Keywords: *impact, occurrence, abundance, correlation, physicochemical, planktons. Mohammed Ayuba Dam*

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I. Introduction

Zooplankton is a considerable nutrition resource for waterfowl and fish (Altındağ *et al.*, 2009). The species distribution and abundance of zooplankton in any water body depend upon the physicochemical parameters of water (Patra *et al.*, 2011). Planktons occupy an intermediate position in the food web. Also, they play an important role as indicators of tropic condition in both cold temperate and tropical waters (Ahmad *et al.*, 2011). Mohammed Ayuba Dam was created for different sectors such as, for domestic water supply, irrigation, livestock farming and fisheries production. Chapman and Ronberg 2008), stated that in recent years, there has been increasing concern about the rate at which inland waters are polluted through run offs into streams and lakes and therefore leading to eutrophication which affect the specific composition of planktons through physical and chemical alternations of the environment as well as changing the composition of these water bodies. Zooplanktons are the animal component of plankton and form a vital link in aquatic food chains between microscopic photosynthetic algae and fish. Zooplanktons form major part of fish natural food as main source of proteins (Markovic, 2003). Zooplanktons respond rapidly to environmental changes, and hence their standing crop and species composition are more likely to indicate any damage in the aquatic milieu. Physicochemical parameters influence both vertical and horizontal migration of aquatic organisms. It affects their distribution, diversity and feeding.

Physicochemical parameter and biota of any water body is known to change overtime and so the need to know the prevailing conditions of the biological parameters of Mohammed Ayuba dam water. Factors such as temperature, pH, transparency and electrical conductivity form part of abiotic components of an aquatic ecosystem. When water temperature is outside tolerable range, abundance of zooplankton is affected directly (Abdullahi, 1998; Imam, 2011). High acidic or high alkaline pH could result to the death of aquatic organisms including planktons. Water transparency influences vertical migration of zooplankton, which affects their diurnal rhythms (Verma and Agarwal, 2007). There are some researches which show relations between zooplankton and environmental parameters in various water systems (Makarewicz *et al.*, 1998; Tackx *et al.*, 2004; El-Bassat and Taylor, 2007; Arimoro and Oganah, 2010; Ahmad *et al.*, 2011; Sharma, 2011). Phytoplankton play a key role in the primary production and global nutrient cycles of the Earth (Daniel 2001) by making up the main producers in any given water body (Biddanda and Benner 1997). It colonizes the upper part of the water column, down to the limit of penetration of light. The structure and abundance of the phytoplankton populations are mainly controlled by inorganic nutrients such as nitrogen, phosphorus, and silica (Daniel 2001) and mainly available nitrogen as nitrate, nitrite and ammonia, phosphorus as soluble orthophosphate (USEPA 2000) and silicone as silicate forms. Phytoplankton communities are sensitive to changes in their environment and therefore phytoplankton total biomass and many phytoplankton species are used as indicators of water quality (Reynolds *et al*. 2002; Brettum and Andersen 2005).

This study focused on the impact of physicochemical fluctuations on plankton's occurrence, distribution and relative abundance in Mohammed Ayuba dam, Kazaure, Jigawa State, which is important to updating research information on the dam.

II. Materials And Methodology

2.1 The Study Area

Kazaure is an emirate in Jigawa State of Nigeria. It is a land of 1780 Square kilometers and a population of one hundred and sixty one thousand four hundred and ninety four people (161,494) (Census 2006). The ancient city of Kazaure is a land with many natural elevations, punctuated by hills and bifurcated by the Mohammed Ayuba Dam, with a modern bridge (constructed in 2008) that links the two parts of the city together (Kanti and old city).

Mohammed Ayuba Dam is an artificial reservoir situated between old Kazaure town and new town (kanti). The Dam collects its main source of water from Watari River, in Katsina State, Dambo Dam, Wawan Rafi Dam and receives rain water as well as waste water from the old town and Kanti. The reservoir was constructed from 1974 to 1975. The size of the Dam is 15.65m-high earthen-concrete, with active storage capacity of 4,305 m3 .The total volume of the Dam is 299,500m3, the area of water is 116 ha, maximum base width 96.32 m and length 1,012m (WRECA, 1980).

The Dam reservoir was planned as a multi functional system, with the primary aim of flood control, human consumption, Irrigation and fishing, while the secondary benefit is recreation activities. The reservoir has a significant potential for water supply of settlements in Kazaure town. The dam is located on12039'10"N and 8024'43"E with an altitude of 475 m.

2.3 Sampling Stations

Three sampling stations were selected for the study, designated as A, B. and C. These sampling points were selected based on the rate of human interference and other agricultural activities that have been taking place near the Dam. The three sampling stations selected were:

Station A, where anthropogenic activities such as washing of clothes, cars and motor cycles are taking place.

Station B, points where there is inflow of water into the Dam from Wawan Rafi Dam, Watari River and sewage from both Kanti and old Kazaure town.

Station C (Middle), the point where human interference was less.

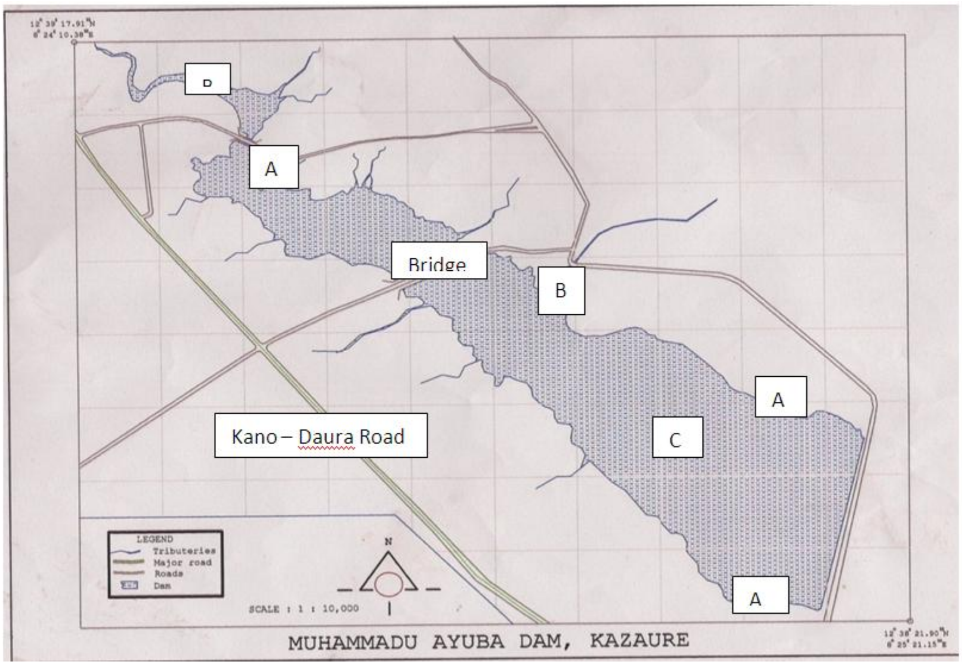

Figure 1 Mohammed Ayuba Dam, Kazaure (Source: Digital from satellite image, 2020)

2.3.1 Sampling

Different types of water require different sampling techniques but share the same need for uniformity, safety and non-contamination of the sample. The sampling has been done in a way that recorded most of the changes in the quality of the water. The sampling frequencies were carried out on monthly basis between 7:00 a.m. and 10:00 a.m. for six month when most of the human activities were taking place. The study was conducted from January to June, 2021.

Water was collected at approximately l.0m depth by holding the sampler bottle near its base in the hand and plunging its neck downward, below the surface. The bottle was pushed until neck was slightly upward and mouth directed toward the current created artificially by pushing bottle forward horizontally in the direction away from the hand (APHA, 1998). In all cases, the sample bottles were rinsed with the water to be collected 2 - 3 times before final collection. After the water sample was collected, it was stored in cold box to arrest any chemical reaction in the water sample. Water sample bottle were labeled with date, time, sample site and parameters to be analyzed. The water sample was then transported to laboratory for analysis.

2.3.2 Plankton Analysis

A microscopic community of plants (phytoplankton) and animals (zooplankton), found usually free floating, swimming with little or no resistance to water currents, suspended in water, non-motile or insufficiently motile to overcome transport by currents, are called "Plankton".

2.3.3 Phytoplankton sampling

Phytoplankton samples were collected from the Dam using silk plankton net of 0.01mm aperture and 25cm diameter attached to a 50ml capacity bottle at the base. At each station, the net was lowered to a depth of 1m (APHA, 1998). The sample was then transferred to 250ml capacity bottle and 2ml of Luggol's iodine solution was added to each sample to preserve the organism, (Bay, 2001; APHA, 2005).

2.3.4 Zooplanktons sampling

Zooplankton were collected by using silk plankton net of 20cm diameter and 70 meshes/cm attached to 50ml capacity bottle at the base. The net was lowered to a depth of 1metre at each station, and the sample was transferred to another sampling bottle. Formalin (4%) was used to preserve the sample before taken to the laboratory for analysis. Light microscope (Olympus, Japan) and identification guide by Bay (2001) and APHA (2005) were used for the identification.

Relative abundance of various taxa of zooplankton are calculated using the formula

$$No./m^3 = \frac{C \times V^{I}}{V^{II} \times V^{III}}$$

Where;
C = number of organisms counted
VI = volume of the concentrated sample (ml)
VII = volume of counted sample (ml)
VIII = volume of the grab sample (m3)
To obtain organisms per liter, result was divided by 1000.

2.4 Determination of Physicochemical Parameters of Mohammed Ayuba dam water

2.4.1 Surface Water Temperature: This was determined using mercury-in glass thermometer by dipping it into the water and allowed to stabilize for 5 seconds, removed and reading immediately recorded (APHA, 2005).

Electrical Conductivity, pH, and Total dissolved solids: These were measured using EC/TDS/ pH/ meter (HANNA 3100 Model) by dipping the probes into the water until the screen showed a fixed reading as described by the manufacturers.

2.4.2 5-Day Biochemical Oxygen Demand (BOD5): It was measured after collecting the samples into a labeled 250mL brown bottle, kept in an incubator at Research laboratory at 21°C for 5-days, then DO was measured again. BOD5 was obtained by subtracting the 5-day DO reading from the 0-day DO reading (APHA, 2005).

2.4.3 Transparency: The transparency of the water was measured using 20cm diameter Secchi disk, which was dipped into the water till the disk disappeared and the depth was recorded, it was then dipped further and then withdrawn carefully and the depth at which it became visible was also recorded. Actual measurement was obtained by taking the average of the two readings (APHA, 2005).

2.4.4 Dissolved Solids: Water with high dissolved solids generally is of inferior palatability and may induce an unfavourable physiological reaction in the transient consumer. The difference in the weight of total solids and the total suspended solids expressed in the same units gives the total dissolved solids.
The difference in the weights of Total Solids (W_1) and Total Suspended Solids (W_2) expressed in the same unit gives Total Dissolved Solids (TDS).
Calculation:
Total Dissolved Solids = $(W_1-W_2) \times 1000/$sample volume (ml)
W_1 = Weight of total solids + dish
W_2 = Weight of total suspended solids

Table 1: Physicochemical and Biological parameters of water samples from Mohammed Ayuba dam, Kazaure 2020

Months	Temp (°C)	Trans (cm)	Cond. (mg/L)	DS (mg/L)	SS (mg/L)	TDS (mg/L)	pH	Sal	TH (g/L)	BOD (mg/L)	Amo. (mg/L)	Spi. (or/L)	Eug. (or/L)	Par. (or/L)	Vol. (or/L)	ML (or/L)
April	30	51	249	1.9	1	210	7.4	0.4	0.69	1.3	2	0	1	1	0	0
May	29	46	253	1.1	0	176	7.3	0.4	0.81	1.2	2	0	1	0	0	1
June	30	30	456	1.3	0	168	7.4	0.3	1.60	2.4	1	0	1	0	0	0
July	31	20	243	1.4	2	170	7.1	0.3	0.79	2.3	1	0	1	0	0	1
August	30	18	514	1.3	2	360	6.9	0.3	1.18	2.1	1	0	1	0	0	0
Sept.	29	18	450	1.1	0	315	7.2	0.2	1.16	2.1	1	1	1	0	0	0
Oct.	28	15	457	1.2	1	370	7.4	0.6	1.02	2.7	2	2	1	0	0	0
Nov.	26	35	642	1.1	0	450	7.0	1.1	0.57	3.1	5	2	3	0	3	0
Dec.	25	43	1157	1.3	0	436	7.3	1.1	1.82	3.6	2	0	0	0	0	0
Jan.	26	15	1200	1.3	0	440	7.7	0.1	2.28	2.5	0	4	0	0	0	0
Feb.	26	15	1235	1.1	0	410	7.7	0.2	3.94	1.1	4	6	0	0	0	0

Keys:
Temp = Temperature Trans = Transparency Cond. = Conductivity DS = Dissolved Solid SS = Suspended Solids TDS = Total Dissolved Solids Col = Colour Sal = Salinity TH = Total Hardness BOD = Biological Oxygen Demand Amo = Amoeba Spi = Spirogyra Eug = Euglena Par = Paramecium
Vol = Volvox
ML = Mosquito Larvae
Station **A,** where anthropogenic activities are taking place.

Table 2: Pearson Correlation Coefficients of Physicochemical and Biological Parameters of Mohammed Ayuba Dam, Kazaure 2020

	TH	BOD	Amo	Spi	Eug	Par	Vol	ML
Temp	-0.52039	-0.41575	-0.45747	-0.61164	0.18325	0.28868	-0.34641	0.43033
Trans	-0.41487	-0.05402	0.23479	-0.53758	0.21652	0.55755*	0.17273	0.18578
Cond	0.80952*	0.27610	0.17011	0.70372*	-0.52135	- 0.31929	0.10598	-0.47725
DS	-0.27193	-0.17354	-0.27418	-0.37039	-0.11334	0.88528*	-0.26038	-0.06793
SS	-0.37368	-0.07885	0.29128	-0.37430	0.08001	0.18380	-0.22056	0.27400

Key:
Temp = Temperature, Trans = Transparency, Cond = Conductivity, DS = Dissolved Solids, SS = Suspended Solids, TH = Total Hardness, BOD = Biological Oxygen Demand, Amo = Amoeba, Spi = Spirogyra, Eug = Euglena, Par = Paramecium, Vol = Volvox and ML = Mosquito Larvae
* indicate positive correlation

Station **A,** where anthropogenic activities are taking place
In table 2 at site A, there was a positive correlation between conductivity with TH (0.80952) and *Spirogyra* (0.70372). There was also a positive correlation between *Paramecium* with transparency and DS. However, a negative correlation was observed between TH with Temperature, temperature with *Spirogyra*, transparency with *Spirogyra* and Conductivity with *Euglena viridis*.

Table 3: Physicochemical and Biological parameters of water samples from Mohammed Ayuba dam, Kazaure 2020

Months	Temp (°C)	Trans (cm)	Cond. (mg/L)	DS (mg/L)	SS (mg/L)	TDS (mg/L)	pH	Sal	TH (g/L)	BOD (mg/L)	Amo (mg/L)	Spi. (or/L)	Eug. (or/L)	Par. (or/L)	Vol. (or/L)	ML (or/L)
April	29	46	420	1.7	1	298	7.0	0.3	0.20	1.1	1	0	1	0	0	0
May	29	51	419	1.9	1	285	6.8	0.3	0.21	1.3	1	0	0	0	0	0
June	28	66	289	1.2	0	275	6.6	0.6	1.35	3.1	1	1	0	0	0	0
July	30	71	400	1.2	0	280	7.3	0.2	0.11	2.2	0	0	1	0	0	0
August	28	74	357	1.3	1	250	7.2	0.3	1.93	4.5	0	1	1	0	0	0
Sept.	28	74	277	1.2	0	208	7.7	0.1	1.1	3.5	1	1	0	0	0	0
October	29	66	289	1.3	1	318	7.8	0.4	1.12	4.2	3	1	0	0	0	0
Nov.	27	53	1028	1.2	0	720	6.7	1.0	0.13	4.5	8	0	2	0	1	0
Dec.	26	48	1200	1.2	1	715	7.0	1.2	1.84	4.1	5	3	0	0	0	0
January	27	41	1154	1.4	0	710	7.7	0.2	4.12	2.2	4	3	0	0	0	0
Feb	26	41	1068	1.2	0	480	7.1	0.1	3.22	1.0	3	3	1	0	0	0

Keys:
Temp = Temperature Trans = Transparency Cond = Conductivity DS = Dissolved Solid SS = Suspended Solids TDS = Total Dissolved Solids Col = Colour Sal = Salinity TH = Total Hardness BOD = Biological Oxygen Demand Amo= Amoeba Spi= Spirogyra Eug. = Euglena Par= Paramecium Vol = Volvox ML= Mosquito Larvae
Station B, the point where there is inflow of water into the Dam

Table 4: Pearson Correlation Coefficients of Physicochemical and Biological Parameters of Mohammed Ayuba Dam, Kazaure 2020

	Temp	Trans	Cond	DS SS	TDS	pH	Sal	ML
Sal	-0.41727	-0.16471	0.43170	-0.24671	0.19152	0.59910*	- 0.49835	1.00000
TH	-0.65283	-0.39590	0.55053*	-0.27107	-0.24155	0.42077	0.36849	-0.20260
BOD	-0.16823	0.52785*	-0.03013	-0.56020	0.10977	0.17227	0.11957	0.56127*
Amo	-0.64116	-0.50666	0.76713*	-0.27725	-0.17660	0.88759*	-0.14314	0.67679*
Spi	-0.78831	-0.46440	0.68083*	-0.36629	-0.13921	0.54561*	0.28033	0.07599
Eug	0.05084	-0.06895	0.20007	-0.16654	-0.20255	0.19268	-0.36326	0.13456
Par	-	-	-	-	-	-	-	-
Vol	-0.23187	-0.11098	0.34050	-0.20255	-0.28868	0.49618 -	0.37784	0.52247*

Key:
Temp = Temperature, Trans = Transparency, Cond = Conductivity, DS = Dissolved Solids, SS = Suspended Solids, TDS = Total Dissolved Solids, Sal = Salinity, Amo = Amoeba, Spi = Spirogyra, Eug = Euglena, Par = Paramecium, Vol = Volvox and ML = Mosquito Larvae
*indicate positive correlation
Station B, the point where there is inflow of water into the Dam

Table 4 indicates positive correlation between conductivity with TH, *Amoeba proteus* and *Spirogyra*. Transparency was also correlated positively with BOD form the same table at site B. A negative correlation was observed between TH with Temperature, BOD with DS, *Amoeba proteus* with Temperature and Transparency

Table 5: Physicochemical and Biological parameters of water samples for site C of Mohammed Ayuba dam, Kazaure 2020

Months	Temp (^{0}C)	Trans (cm)	Cond. (mg/L)	DS (mg/L)	SS (mg/L)	TDS (mg/L)	pH	Sal	TH (g/L)	BOD (mg/L)	Amo (mg/L)	Spi. (or/L)	Eug. (or/L)	Par. (or/L)	Vol. (or/L)	ML (or/L)
April	31	76	638	2.2	0	471	7.3	0.2	0.11	1.2	1	2	0	2	0	0
May	30	81	647	2.4	0	458	7.1	0.2	0.13	1.3	0	1	0	0	1	0
June	29	92	532	2.3	1	460	7.0	0.1	1.04	4.5	0	0	1	0	0	0
July	31	97	642	2.3	0	450	7.5	0.1	1.03	3.1	0	0	0	0	0	0
August	27	89	214	2.5	0	280	7.2	0.3	1.09	5.8	0	0	0	0	0	0
September	28	86	142	2.2	1	299	7.3	0.1	1.6	4.7	0	0	1	0	0	0
October	30	89	210	2.1	0	460	7.5	1.2	1.1	5.0	0	0	2	2	0	0
November	26	81	686	2.1	2	480	7.2	1.2	1.0	5.1	6	0	0	0	6	0
December	24	71	1114	2.1	0	699	7.3	0.7	1.7	3.1	0	6	0	0	0	0
January	26	66	1185	2.1	1	690	7.2	0.1	2.1	2.0	0	2	0	0	0	0
February	26	66	1243	2.4	0	870	7.3	0.1	3.7	1.2	2	2	2	0	0	0

Keys:
Temp = Temperature Trans = Transparency Cond. = Conductivity DS = Dissolved Solid SS =Suspended Solid, Col = Colour
TDS = Total Dissolved Solids Sal = Salinity TH = Total Hardness BOD = Biological Oxygen Demand Amo = Amoeba Spi = Spirogyra Eug = Euglena Par = Paramecium Vol = Volvox ML = Mosquito Larvae
Station **C** (Middle) the point where human interference was less.

Table 6: Pearson Correlation Coefficients between Physicochemical and Biological Parameters of Mohammed Ayuba Dam, Kazaure 2020

	TH	BOD	Amo	Spi	Eug	Par	Vol	ML
Temp	-0.62381	-0.11648	-0.29953	-0.55298	0.05152	0.52232*	-0.23424	-
Trans	-0.53120	0.62249*	-0.19435	0.69295*	0.00422	0.05774	-0.01007	-
Cond	0.54791*	-0.68484	0.18325	0.68646*	-0.11805	-0.29952	0.02104	-
DS	0.03263	-0.08050	-0.23068	-0.29954	0.02310	-0.32781	-0.27651	-
SS	0.01527	0.38267	0.62722*	0.31000	-0.12897	-0.32686	0.71093*	-

Key:
TH = Total hardness, BOD = Biological Oxygen Demand, Temp = Temperature, Trans = Transparency, Cond = Conductivity, DS = Dissolved Solids, SS = Suspended Solids, Amo = Amoeba, Spi = Spirogyra, Eug = Euglena, Par = Paramecium, Vol = Volvox and ML = Mosquito Larvae
*indicate positive correlation
Station **C** (Middle) the point where human interference was less.

Table 6 showed positive correlation between temperature and *Paramecium* abundance. Transparency was positively correlated with BOD and *Spirogyra*. Positive correlation was also observed between conductivity with TH and *Spirogyra*. Suspended solids were correlated positively with *amoeba proteus* and *Volvox* abundance. It can also be deduced from the table that temperature was negatively correlated to TH. Conductivity was also negatively correlated with BOD

Table 7: Occurrence, Distribution and Abundance of Phytoplankton species at sampling stations

	Sample sites				
Taxa	A	B	C	Total	Frequency
Cyanophyta					
- *Microcystis spp.*	73	4	-	77	66.67%
- *Oscillatoria* spp	32	81	30	143	100%
Chlorophyta					
- *Spirogyra* spp	88	-	75	163	66.67%
- *Ulothrix spp*	94	71	54	219	100%
-*Volvox*	70	-	89	159	66.67%
Euglenophyta					
Euglena viridis	83	62	49	194	100%
TOTAL	440	218	297	955	

Table 8: Occurrence, Distribution and Relative Abundance of Zooplankton species at sampling stations

	Sample sites				
Taxa	A	B	C	Total	Frequency
Protozoan					
-*Amoeba proteus*	24	87	91	202	100%
-*Paramecium spp*	-	78	63	141	66.67%
Arthropoda					
- *Cypris* spp	50	21	13	84	100%
-*Mosquitor larva*	81	-	106	187	66.67%
TOTAL	155	186	273	614	

III. Result and Statistical Analysis

Pearson correlation coefficient was performed on the data in order to determine the correlation between the physicochemical and Biological parameters. It was also used to determine if there correlation between physicochemical parameters and planktons in the three (3) sampling stations.

3.1 Phytoplankton Composition

From table 7 only three Phyla of Phytoplankton were found in this study work, these were Cyanophyta which was represented by two species *(Microcystis spp* and *Oscilotaria spp).* Chlorophyta represented by two species (*Spirogyra*, *Ulothrix spp* and *Volvox*). Euglenophyta was also represented by (*Euglena viridis*) specie. Out of these species *Ulothrix spp* has the highest number of occurrence of (219 org/L) number of individuals followed by *Euglena viridis* with (194 org/L) the least was *Microcystis spp* with (77 org/L) number of individuals. The highest phytoplankton density of 440org/L was recorded at station A where anthropogenic activities are taking place in the dam.

3.2 Zooplankton Composition

The zooplankton found was two phylum Protozoa and Arthropoda. The protozoa were represented by two species *Amoeba proteus* and *Paramecium spp* while The Arthropoda was represented by *Mosquito larvae* and *Cypris spp*. Out of these two phyla, Protozoa has the highest number of occurrence and was represented by Amoeba proteus which was the most abundant (202 org/L), followed by paramecium which was (141 org/L). The phyla with least number of occurrence during the study period at both site was Arthropoda represented by *Cypris spp* (84 org/L) and *Mosquito larvae* and is having (187 org/L) throughout the study period, as shown in Table 8.

3.3 Results and Discussion

Table 1 shows the means and ranges of the physicochemical parameters of the dam water. There was fluctuation in temperature, pH, Conductivity, DS and BOD5 throughout the study period. Highest mean temperature of 31°C was recorded in July and lowest temperature of obtained in May and September. This rise in temperature in July could be as a result of break in rainfall and increased intensity of sunlight. Boyd and Licktkoppler, (1979) also reported an optimum temperature of 25°C to 31°C for fish production and the survival of aquatic organisms. i and Ovie and Adenij (1993) reported that temperature range for the survival and optimum growth of aquatic organisms is between 22°C 31°C. The transparency of the dam water at site A ranged from 18cm to 51cm in August and September and April respectively. The higher transparency values in dry season (51 cm) in April compared to that of the rainy season (18cm) in August and September respectively could be due to absence of surface run-offs and settling effect of suspended materials that followed the cessation of rainfall. Kamdirim (1990) reported similar observations of a higher dry season secchi-dics transparency. Low Secchi-disc transparency recorded during rainy season (June – August) agreed with the findings of Wade (1985), who observed that onset of rainfall, decreased the Secchi-disc visibility in two mine lakes around Jos, Nigeria. Lower transparency recorded during rainy season when there was turbulence and high turbidity, has a corresponding low organisms (primary productivity), because turbidity reduces the amount of light penetration, which in turn reduces photosynthesis and hence primary productivity (United States Environmental Protection Agency (USEPA), 1991).

The result obtained from the laboratory analysis of electrical conductivity of the Dam water at station A indicated during the study period showed a range of values from 243mS/cm in the month of July to 456mS/cm in the month of June. Conductivity is affected by temperature, the warmer the water the higher the conductivity.

The Total Dissolved Solids (TDS) results indicated that, TDS values for the dam water at station A showed variations in concentration between dry and rainy seasons. These values varied from 68 mg/L to 370mg/L. However they were within the allowable limit of 1000mg/L and 500mg/L set by WHO and FEPA respectively. The TDS obtained at this site indicate high nutrient contents in the water hence the high density of the Zooplankton and the phytoplankton. The pH range (6.9 – 7.7) at this site also favoured the growth of these organisms. The pH values of Mohammed Ayuba dam recorded during the study period varied from neutral to slightly alkaline. pH values of most natural water are in the range of 6.5 - 8.5 (Chapman, 1996). At station A pH result ranged between 6.9 and 7.4 in the months of August and April respectively. The obtained values were within the recommended level (6.5 – 8.5) of drinking water sets by World Health Organization. High pH value recorded at site A was associated with water points that received wastes from human activities. Boyd and Lichtkoppler (1979) reported pH range of 6.09 - 8.45 as being ideal for supporting aquatic life including fish. Thus, the pH range obtained in this study was within the acceptable level of 6.0 to 8.5 for culturing tropical fish species (Huett, 1977) and recommended levels of drinking water (WHO, 1984). The Biological Oxygen Demand values varied from 1.2mg/L in the month of May to 2.4mg/L in the month of June.

The result of this study shows significant negative correlation between temperature and transparency with *Spirogyra* and conductivity, pH with *Euglena viridis*. However, a positive correlation was observed between transparency, and dissolve solids with paramecium.

The transparency value observed ranged from 46cm to 74cm. The low transparency value was due to the fact that the site was receiving heavy run-off from drained water from town, farmland and watari River. Similar trends of low transparency value in Awash River due to wind and water erosion was reported by Bedelu (2005). There was variation in the result of conductivity between dry and wet seasons. The conductivity was higher in the dry season than in the wet season as obtained during the study. This corresponded with the findings of high dry season conductivity values for Shiroro Lake (Ovie and Adeniji 1993; Kolo and Oladimeji 2004). Conductivity was positively correlated with TDS as observed during the study period.

The results at site C indicated that, the temperature of the dam water ranged from 24^0C in December to 31^0C in April and July. There was a rise in temperature in July due a break in rainfall coupled with increased intensity of sunlight. This was in accordance with the reports by Okonko *et al*. (2008) and National Freshwater Fishing Hall of Fame (2011). Temperatures during the dry seasons were slightly higher than those obtained for the wet seasons except during harmattan. Temperatures were also low during harmattan, as obtained by Ibrahim S. (2009). This temperature range observed during the study period could support fish survival in water bodies in the tropics as reported by Alabaster and Lloyd, (1980). The result agreed with previous reports that the temperatures in tropics vary between 21^0C and 32^0C (Ugwumba and Ugwumba, 1993; Kamran *et al*., 2003; Ayoade *et al.*, 2006). Meske (1985) recommended temperature range of 20 – 30^0C for optimum fish growth. This implies that the temperature range in Mohammed Ayuba Dam, Kazaure is suitable for fish growth. Temperature was positively correlated with transparency.

The transparency of the dam water at station C ranged from 76cm to 97cm. Khan and Chowdhury (1994) reported that higher transparency occurred, during winter and summer due to absence of rain, runoff and flood water as well as gradual settling of suspended particles. Kadam, *et al.* (2007), also reported similar observation from Masoli reservoir. Higher dry season Secchi-disc transparency values were recorded during the dry season while low Secchi-disc transparency was recorded during rainy season. This agreed with the findings of Wade (1985), who observed that onset of rain decreased the Secchi-disc visibility in two mine lakes around Jos, Nigeria. Transparency of the water was lower during the period of heavy rainfall probably due to flooding of the reservoir, which may have been caused by higher amount of rainfall during this period due to high turbidity. It could also be due to decrease in sunlight intensity due to presence of heavy cloud in the atmosphere, which in turn reduced the quantity of light reaching the water (Anetekhai, 1986; Oso and Fagbuaro 2008) thereby decreasing light penetration.

The result of the conductivity obtained from the laboratory analysis of the dam water at station C indicated that the value ranged from 142mS/cm in the month of September to 647mS/cm in the month of May.

Total dissolved solids values at station C ranged from 280mg/L to 4710mg/L in the months of August and April respectively. These values are within the established maximum recommended value set by WHO and FEPA for portable drinking water of 1000mg/L and 500mg/l respectively.

IV. Conclusion and Recommendations

This study revealed that physicochemical fluctuations has negative impact on the phytoplanktons and zooplankton occurrence and abundance, thus, the need for the government to establish an agency in order to curtail the menace that disrupt the dam water and the aquatic organisms at large.

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