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Full Length Research

The Abundance of Phytoplankton In River Nggada and River Ngadda-Bul, Maiduguri Metropolis, Borno State, Nigeria

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The study was aimed at exploring and studying the ecology of phytoplankton of some selected water bodies in Maiduguri metropolis by increasing existing bio-limnological knowledge on their ecology and the effect of hysic-chemical parameters of the water bodies on their abundance. The study was limited to identification of phytoplankton and the effects of Physico-chemical parameters such as pH, Temperature, TDS, Nitrate concentration, Phosphate concentration, Sulphate concentration and DO on phytoplankton of River Nggada and River Nggadabul, Maiduguri. The studies found that phosphate being a limiting factor together with nitrogen (nitrite), aid the growth, development and subsequent abundance of phytoplankton but yet in Sampling Stations were sulphate concentration was high, it tends to inhibit their abundance and distribution even when phosphate and nitrite concentration was high. The study recommends ecotoxicological studies on the effect of sulphate concentration in aquatic ecosystem with special reference to the plankton and the review of the highest permissible limit of sulphate concentration in surface water bodies set by NESREA.

Keywords: Phytoplankton, River Nggada and River Ngadda-Bul, Maiduguri, Borno State, Nigeria

INTRODUCTION

Background of the Study

Plankton are mostly microscopic in size and inhibits both the photic and aphotic zones of surface waters. Their abundance and distribution varies horizontally, vertically and seasonally with light in the case of phytoplankton being the primary cause of the variability, (Agouru and Audu, 2012).

The ecological studies of plankton, their abundance, distribution and their interrelationship with other aquatic organisms and their environment is very important due to the fact that plankton serve as the basis upon which the aquatic ecosystem is supported and also the phytoplankton in specific generate most of the earth's oxygen, (Dimowo, 2013).

Phytoplankton being the first link in all aquatic food chain are the primary producers confining to only the photic zone of surface water, are highly important, without which the biodiversity and abundance of other aquatic biotas will be endangered, (Gregg and Patricia, 2013). The phytoplankton serve as food to zooplankton which in turn serve as food to almost all secondary consumers in the aquatic ecosystem.

The abundance and distribution of plankton are strongly dependant on the hysic-chemical parameters of the aquatic environment. Environmental conditions like availability of light, ambient nutrient concentration, the physical state of the water, water current and the abundance of other aquatic biotas has been reported to play role on the abundance and distribution of plankton, (Agouru and Audu, 2012; Hideki and Tsutomu, 2002).

The aquatic ecosystem in general is affected by deterioration of the water quality which has led to the destruction of ecosystem balance, (P. S Verma and V. K Agarwal, 2008). The adverse change in the aquatic ecosystem is mainly due to anthropogenic activities releasing large quantity of pollutants into the aquatic environment thereby impacting negatively on the aquatic ecosystem, (Annalakshmi and Amsath, 2012). Changing the hysic-chemical parameter of any aquatic environment is an attempt to destroy the ecosystem balance of that particular aquatic environment; this has being confirmed to result in loss of aquatic biotas.

The ecological studies of the abundance, distribution and interrelationship between and within the plankton and other aquatic organisms will go a long way in improving the health status of our surface waters and also this will ensure food security. Annalakshmi and Amsath, 2012 reported that "*some fishes are exclusively zooplankton feeder and therefore their population are directly linked to their presence and again, any adverse effect to the plankton will results in reduction of the fish population*". This therefore, suggest that the plankton can serve as biological indicators of pollution and by monitoring them, they could act as forewarning in the fisheries sectors, especially when the level of pollution affect the food chain.

The pollution of surface water is of serious concern to environmentalist due to the well known fact that pollution affects ecosystem balance. Pollution into surface water bodies can either be of a point source or a non-point source. Point source of pollution arises as a result of emission or discharge of pollutants directly into water bodies from industrial or municipal wastewater pipe, while a non-point source is the indirect release of pollutant into water bodies like agricultural run-off, (J. C. Akan et al, 2011). Pollution of surface water has resulted in a number of ecological issues like eutrophication; loss of aquatic biodiversity e.t.c. plankton can serve as biological indicators of the level of pollution of some certain element like nitrogen and phosphorus in surface water.

Objectives of the Study

The main objectives of the study were to:

I. Examine the abundance (population) of the phytoplankton of some selected water bodies in Maiduguri metropolis.
II. Relate the abundance of phytoplankton population with the physico-chemical parameters of the study area.
III. Examine the influence and impact of human activities on the population of phytoplankton of the study area.

The Aim of the Study

The study was aimed at exploring and studying the ecology of phytoplankton of some selected water bodies in Maiduguri metropolis by increasing existing bio-limnological knowledge on their ecology and the effect of physico-chemical parameters of the water bodies on their abundance.

The Scope and Limitation of the Study

The study was limited to identification of phytoplankton and the effects of Physico-chemical parameters such as pH, Temperature, TDS, Nitrate concentration, Phosphate concentration, Sulphate concentration and DO on phytoplankton of River Nggada and River Nggadabul, Maiduguri.

REVIEW OF LITERATURE

Plankton forms the basis for the aquatic food web, and are therefore vital part of the aquatic ecosystem. The aquatic ecosystems are well known to support varieties of aquatic organism, which interact with other organisms and their environment, (A. N Dede and A. L Deshmukh, 2015). An ecosystem is a natural unit of living and non-living components that interact to produce a stable system, (http://www.marine.usf.edu/pjocean). The aquatic ecosystem is classified into lotic and lentic ecosystem. The lotic ecosystems are also called riverine ecosystem, are the flowing water bodies like rivers, stream e.t.c. while the lentic ecosystem also known as lacustrine ecosystem, are the still water bodies which include lake, ponds e.t.c, (A. Abbator, 2015).

The aquatic environment is in a constant stage of dynamism which results from a number of issues either anthropogenically or naturally induced factors. The anthropogenic induced change in our surface waters has led to the destruction of many ecosystem balances, (P. S Verma and V. K Agarwal, 2008). The abiotic component of the aquatic ecosystem can be regarded as a network of variables like pH, temperature, Oxygen concentration, ambient nutrient concentration e.t.c that are linked and co-linked, any change in this physico-chemical parameters can affect the aquatic biotas in a variety of ways, (Annalakshmi and Amsath, 2012).

The plankton are drifting organism that inhibit the pelagic zone of many surface water bodies and flows with water currents. The phytoplankton are driven by the impact of solar energy, confining primary production to the surface waters and to geographical locations and seasons having abundant light, (Agouru and Audu, 2012).

A surface water body that is highly saturated with phytoplankton is likely to be enriched with nitrogen and/or phosphorus due to the fact that these aid their growth, development and subsequently their abundance. Eutrophication being defined as the high rate influx of nitrogen and/or phosphorus compounds into surface water, has being identified to lead to a condition known as "algae bloom" in the aquatic environment, a situation that triggers a number of crisis in the aquatic ecosystem, (Madakan S. P, 2014).

Limnological studies on the abundance and ecology of plankton (phytoplankton) is very vital due to the fact that aquatic organisms like other organisms respond to environmental stress in a number of ways but little is known of phytoplankton of the study area, therefore this will contribute to the knowledge of the limnological biodiversity of the study area, (Vitor and Manuela, 2001; Gregg and Patricia, 2013).

The plankton are reported to be on the mercy of the water current for their dispersal and abundance in an area, (Gregg and Patricia, 2013), but yet, ambient nutrient concentration (such as nitrogen and phosphorus), light e.t.c also plays role in their abundance in an area spatially and temporally, (George E.E, Samuel I.U and Andem A. B, 2012; P. S. Verma and V. K Agarwal, 2008; A. N Dede and A. L Deshmukh, 2015).

The Phytoplankton

The word "phytoplankton" consists of two Greek words, "phyto" meaning plants and "plankton" meaning "wanderers", (Gregg and Patricia, 2013; NIO, 2004). The phytoplankton consists of the assemblage of small plants having no or very limited powers of locomotion, they are therefore more or less subjected to distribution by water movement.

The phytoplankton are the primary producers of the aquatic ecosystem, (A. Abbator, 2015). Some species of phytoplankton can have harmful effects on organisms at different trophic levels. The blooms of some otherwise harmless species have been reported to result in massive Fishkill by depleting dissolved oxygen or even by clogging the gills of other aquatic organisms, (Gregg and Patricia, 2013).

The different divisions of phytoplankton in surface fresh water bodies include Cyanophyta, Chlorophyta, Bacilliarophyta, Chrysophyta, Euglenophyta, Dinophyta and Rhodophyta. The Cyanophyta, Chlorophyta and Euglenophyta are the dominant species in fresh water bodies, (Agouru and Audu, 2012; George E. E et al, 2012; Vitor and Manuela, 2001; Harold G.M, 2006; Andras Abonyi et al, 2002).

The phytoplankton inhibit only the photic zone of the surface water and their abundance and overall distribution are strongly influenced by the physico-chemical parameters of the surface water and the presence of other aquatic organisms, (Hideki and Tsutomu, 2002; Agouru and Audu, 2012; Annalakshmi and Amsath, 2012).

The Physico-Chemical Parameters of an Aquatic Ecosystem

The abiotic components of an aquatic ecosystem include a variety of variables (physical and chemical variables) which constitute the physico-chemical parameters of that particular aquatic environment.

The physico-chemical parameters of an aquatic ecosystem provide the basis for the assessment of the health status, productivity and sustainability of that environment, (P. S Verma and V. K Agarwal, 2008; Syed Aftab Iqbal, 2011). The measurement of physico-chemical parameters in any bio-limnological studies is vital due to the fact that they provide the basis for trophic dynamics and they themselves are the measure of the environmental dynamism of any surface water, (Frances Harris, 2012; J. C Akan et al 2010 and 2011).

THE STUDY AREA

Maiduguri is the capital and the largest city in Borno State, Nigeria which is located on latitude 11^0 51' 42''N and longitude 013^0 09'' 35E and lies within the northern Sudan Savannah with a distinct dry and wet (rainy) seasons. The town has an annual mean temperature of 37^0C.

The town has two (2) main river systems (Nggadabul and Nggada Rivers) which met and continues to flow as River Nggada; both rivers are freshwater bodies which are remarkable for their circular shape.

Water from both the two (2) rivers are used for irrigation, human consumption, domestic purposes and various industrial activities.

Wastes are constantly discharged into the rivers from municipal drainage systems, abattoir, dyeing industries, commercial areas and irrigation sites along the bank of the rivers.

Sampling

The two (2) rivers were sampled into six (6) different stations based on judgmental sampling technique by the researcher.

The choice and marking of the stations was largely due to the peculiarities of the activities along the bank of each station (table 1).

Table 1 Sampling Stations

S/N	STATION	LOCATION	GPS COORDINATE	ACTIVITIES/REMARK
1	**A**	Beside Water Treatment Plant	N11^0 47' 28.1" E013^0 11' 33.8"	✓ Sludge discharge ✓ Irrigation sites
2	**B**	Fori ward	N11^0 48' 10.2" E013^0 10' 18.9"	✓ Washing/bathing ✓ Irrigation sites ✓ Cattles drinking
3	**C**	Beside Lagos bridge	N11^0 49' 28.1" E013^0 11' 33.8"	✓ Road construction ✓ Dyeing industry ✓ Refuge dump
4	**D**	Beside Anguwan Doki bridge	N11^0 49' 52.0" E013^0 09' 28.9"	✓ Refuge dump ✓ Waste water from Monday Market and Municipal drainage from Anguwan Doki
5	**E**	Gwange (Point of confluence)	N11^0 49' 49.2" E013^0 09' 31.3"	✓ Fishing ✓ Cattle drinking ✓ Refuge dump ✓ Sewage discharge
6	**F**	Custom Area	N11^0 51' 29.8" E013^0 11' 01.0"	✓ Irrigation sites ✓ Waste water from Gumburu market, abattoir house and municipal drainage system.

Experimentation

Water sample for the plankton (phytoplankton) were collected at each sampling station using grab sampling techniques.

A 40µm mesh size standard plankton net was used to filter 20l (4L x 5) of the grab sample, and then filled into air tight 120ml well labeled sampling bottles at each station.

The plankton samples were preserved with 4% formalin within two (2) minutes of collection and then taken to the laboratory for analyses using the drop-count method with microscope and plankton identification manual and keys.

The physico-chemical parameter, temperature was recorded at each sampling station using mercury thermometer. Nitrate concentration (mg/L), phosphate concentration (mg/L), DO (mg/L) and TDS (mg/L) was analyzed using smart spectrophotometer, American Model 2000 while pH was analyzed using pH Mettle Toledo using standard method of Water analysis at NAFDAC, Maiduguri laboratory.

Determination of Relative Abundance

Relative abundance (%Ra) was determined using the formula

$$\%\mathbf{Ra} = \frac{n(100)}{N}$$, cited in (George E.E et al, 2012).

Where **n** = total number of plankton under consideration
N = total number of all the species of the plankton group

RESULTS AND DISCUSSION

Physico-Chemical Parameters

Table 2: Physico-chemical parameters of the sampling stations

S/N	STATION	NITRITE CONCENTRATION (mg/L)	PHOSPHATE CONCENTRATION (mg/L)	SULPHATE CONCENTRATION (mg/L)	potentia Hyhrogenii (pH)	DISSOLVED OXYGEN (DO) (mg/L)	TOTAL DISSOLVED SOLIDS (TDS) (mg/L)	WATER TEMPERATURE (°C)
1	**A**	**0.78**	**0.22**	**41.0**	**7.340**	**13.0**	**200.0**	**21**
2	**B**	**0.92**	**0.56**	**44.0**	**7.477**	**25.0**	**180.0**	**22**
3	**C**	**0.72**	**0.34**	**48.0**	**8.286**	**16.0**	**280.0**	**23**
4	**D**	**1.39**	**0.60**	**41.0**	**7.799**	**7.8**	**286.0**	**16**
5	**E**	**0.55**	**0.71**	**29.0**	**7.873**	**11.8**	**280.0**	**22**
6	**F**	**0.52**	**0.43**	**97.0**	**7.474**	**16.0**	**760.0**	**25**

In table 2, the physico-chemical parameters of the different stations show that nitrite concentration ranges from 1.39 mg/L in Station D to 0.52mg/L in Station F while phosphate was highly concentrated in Station E (0.71mg/L) and the highest Sulphate concentration was recorded in Station F (97.0mg/L). The pH ranges from 8.286 in Station C to 7.340 in Station A.

Total Dissolved Solute (TDS) has the highest value in Station F (760.0mg/L) and was at lowest rate in Station B (180.0mg/L), even the colour of the water in Station F was reddish brown due to high level of effluent discharge from abattoir, municipal drainage system and Gamburu market while that of Station B was colourless.

Temperature ranges from 25°C in station D to 16 °C in Station F. The low temperature in Station D is supported with the fact that the sampling station is located beside the bridge in Anguwan Doki and the soil is highly clay which has effect on reducing or lowering water's temperature (traditionally clay is used in cooling water i.e. earth pot) and again the bank of the site was greenish in colour, indicating high primary production at the bank but yet it was also having the lowest value of Dissolved Oxygen (DO) (7.8mg/L) probably due to decomposition and utilization of the oxygen by the other aquatic organisms in the station.

Plankton Abundance in the Sampling Stations

In Table 3, a total of twenty-six (26) different species from eight (8) different classes of Phytoplankton were identified from the six (6) sampling stations.

Table 3: Phytoplankton distribution in the sampling Stations

S/N	CLASS	A	B	C	D	E	F	TOTAL
A	**CHLOROPHYCEAE**							
1	*Pteromonas*	-	4	1	-	-	-	
2	*Oocystis*	-	-	-	-	-	2	
3	*Ankistrodemus*	-	-	2	-	-	3	
4	*Batryococcus*	9	3	-	-	69	8	
5	*Spirogyra*	24	23	14	20	14	-	
6	*Ulothrix*	-	-	-	5	-	-	
7	*Microspora*	-	14	-	-	-	-	
8	*Closterium*	-	-	1	-	59	-	
9	*Cladophora*	-	-	-	4	-	-	
	TOTAL	**33**	**44**	**18**	**29**	**142**	**13**	**279**
S/N	**CLASS**	**A**	**B**	**C**	**D**	**E**	**F**	**TOTAL**
B	**CRYPTOPHYCEAE**							
13	*Crytomonas*	6	11	-	2	-	-	
	TOTAL	**6**	**11**	**0**	**2**	**0**	**0**	**019**
C	**CHRYSOPHYCEAE**							
14	*Synura*	-	1	-	-	2	-	
15	*Uroglena*	-	-	-	29	-	-	
	TOTAL	**0**	**1**	**0**	**29**	**2**	**0**	**032**
D	**CYANOPHYCEAE**							
16	*Chroococcus*	16	9	-	-	2	-	
	TOTAL	**16**	**9**	**0**	**0**	**2**	**0**	**027**
E	**EUGLENOPHYCEAE**							
17	*Euglena*	17	13	6	-	-	-	
18	*Phacus*	7	10	-	-	-	-	
	TOTAL	**24**	**23**	**6**	**0**	**0**	**0**	**053**
F	**RHODOPHYCEAE**							
19	*Asterocytis*	7	12	-	-	-	-	
	TOTAL	**7**	**12**	**0**	**0**	**0**	**0**	**019**
G	**BACILLARIOPHYCEAE**							
20	*Melosira*	6	9	-	-	-	-	
21	*Navicula*	-	-	-	-	2	-	
22	*Pinnularia*	-	-	-	2	-	-	
23	*Surirella*	-	-	31	7	9	-	
24	*Tabellaria*	3	7	-	-	-	-	
25	*Diatoma*	12	5	-	-	-	-	
	TOTAL	**21**	**21**	**31**	**9**	**11**	**0**	**093**
H	**XANTHOPHYCEAE**							
26	*Tribonema*	-	-	-	3	4	-	
	TOTAL	**0**	**0**	**0**	**3**	**4**	**0**	**07**
								529

In table 4, Station E has the highest relative abundance of *Chlorophyceae* and Phytoplankton in general, which was also having the highest concentration of phosphate (0.71mg/L), an expected result because phosphate is known as limiting factor to the phytoplankton.

Table 4: Abundance of Phytoplankton in the sampling stations

S/N	CLASS	A	B	C	D	E	F	TOTAL	%Ra
1	*Chlorophyceae*	33	44	18	29	142	13	279	52.7
2	*Cryptophyceae*	6	11	0	2	0	0	019	03.6
3	*Chrysophyceae*	0	1	0	29	2	0	032	06.1
4	*Cyanophyceae*	16	9	0	0	2	0	027	05.1
5	*Euglenophyceae*	24	23	6	0	0	0	053	10.0
6	*Rhodophyceae*	7	12	0	0	0	0	019	03.6
7	*Bacillariophyceae*	21	21	31	9	11	0	093	17.6
8	*Xanthophyceae*	0	0	0	3	4	0	07	01.3
	TOTAL	**107**	**121**	**55**	**72**	**161**	**13**	**529**	**100.00**

Table 5: Relative abundance (%Ra) of the different classes of Phytoplankton across the Sampling Stations

S/N	CLASS	%Ra						TOTAL
		A	B	C	D	E	F	
1	*Chlorophyceae*	11.8	15.8	06.4	10.4	50.9	04.7	100.0
2	*Cryptophyceae*	31.6	57.9	00.0	10.5	00.0	00.0	100.0
3	*Chrysophyceae*	00.0	03.1	00.0	90.6	06.3	00.0	100.0
4	*Cyanophyceae*	59.3	33.3	00.0	00.0	07.4	00.0	100.0
5	*Euglenophyceae*	45.3	43.4	11.3	00.0	00.0	00.0	100.0
6	*Rhodophyceae*	36.8	63.8	00.0	00.0	00.0	00.0	100.0
7	*Bacillariophyceae*	22.6	22.6	33.3	09.7	11.8	00.0	100.0
8	*Xanthophyceae*	00.0	00.0	00.0	42.8	57.2	00.0	100.0

Chlorophyceae (52.7%) was the most abundant class of phytoplankton in the sampling stations, then *Bacillariophyceae* (17.6%) and *Euglenophyceae* (10.0%). This agrees with (Agouru and Audu, 2012; George E. E et al, 2012; Vitor and Manuela, 2001; Harold G.M, 2006; Andras Abonyi et al, 2002 and also Dimowo, 2013).

Table 5 the relative abundance (%Ra) of the different class of phytoplankton across the sampling station shows that *Cyanophyceae* and *Euglenophyceae* are the most abundant class in Station A (59.3% and 45.3% respectively) while station B has *Cryptophyceae* (57.9%) and *Rhodophyceae* (63.8%) as the most abundant class of phytoplankton.

Chrysophyceae was the most relative abundant class in Station D (90.6%) while *Xanthophyceae* was most relatively abundant in Station E (57.2%).

The classes *Chlorophyceae* and *Xanthophyceae* can be said to be bio-indicators of high influx and concentration of phosphate where sulphate concentration is low in an aquatic ecosystem, this is supported with the fact that Station E, has the highest relative abundance of the classes, *Chlorophyceae* (48.9%) and *Xanthophyceae* (57.2%) but again having the highest concentration of phosphate (0.71mg/L) with the lowest sulphate concentration (29.0mg/L) of all the sampling stations.

The high concentration of sulphate in sampling Station F (97.0mg/L), may be the reason for the low relative abundance of phytoplankton in the sampling station with the presence of only one class, *Chlorophyceae* (04.5% in Station F) similar data was presented by (O. A Davies and O. A Ugwumba, 2013; Onyema I. C and Popoola R. T, 2013).

Effect of the Physico-chemical parameters on Phytoplankton in the Sampling Stations

In table 6, Phosphate is a limiting factor for the phytoplankton and was high at sampling Station E (0.71mg/L), an indication of eutrophication backed upon by “algal boom” (30.43%) in the sampling station.

Although nitrite and phosphate concentration was high at sampling Station D (1.39mg/L and 0.60mg/L respectively), DO was at the lowest rate (7.8mg/L) indicating high level of phyto – zoo planktonic relationship and/or high rate of decomposition.

Sulphate concentration has direct effect on the phytoplanktonic abundance in the sampling stations. Sampling Station E has the lowest concentration of sulphate (29.0mg/L) and was having the highest relative abundance of phytoplankton (30.43%) while sampling station F was having the highest concentration of

Table 6: Relative abundance of Phytoplankton in the sampling Stations

	A	B	C	D	E	F	TOTAL
Phytoplankton Relative abundance (%Ra)	20.23	22.87	10.40	13.61	30.43	02.46	100.00

sulphate (97.0mg/L) and at the same time having the lowest phytoplanktonic relative abundance (02.46%), similar data was presented by (O. A Davies and O. A Ugwumba, 2013; Onyema I. C and Popoola R. T, 2013).

DO was at the highest rate at sampling station B (25.0mg/L) indicating high primary production over utilization and decomposition by higher trophic organisms including zooplankton.

TDS was at the highest rate at sampling Station F (760.0mg/L) which was as a result of high rate of effluent from abattoir, Gamburu market, Irrigation sites and municipal drainage system thereby making the station highly polluted with dissolved substances which hinders phytoplanktonic relative abundance (02.46%) in the sampling station.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The planktonic ecology involves the study of both the biotic and abiotic influences on the growth, development and abundance of the plankton. The abiotic influences on plankton include a variety of physical and chemical variables (Physico-chemical parameters) that act to regulate the aquatic ecosystem balances.

The physico-chemical parameters affect phytoplankton in a number of ways. Phosphate act as a limiting factor and together with nitrite (nitrogen) they aid their growth, development and abundance. It was found that where sulphate concentration was high, even when there was high influx of phosphate and nitrite (eutrophication), the phytoplanktonic abundance tends to be low, and only one class (*Chlorophyceae*) registered their presence in areas where sulphate concentration was high indicating that high sulphate concentration is toxic to the phytoplankton.

Conclusion

Finally, it was discovered that the physico-chemical parameters of the different sampling Stations have effect on the phytoplankton of the area.

Phosphate act as a limiting factor to phytoplankton but yet phytoplankton are affected negatively by high concentration of sulphate even when the phosphate concentration is high.

Recommendation

In-line with the findings, the following recommendation is made:

I. Wastewater from the Water Treatment Plant, abattoir, Gamburu Market, dyeing industries e.t.c. should be treated before discharging into the aquatic environment as they can affect the aquatic ecosystem balances.
II. The national environmental regulators (NESREA and FMEnv) should revisit the maximum permissible sulphate concentration limit in aquatic environment (100mg/L) as other developed nations set theirs as 50mg/L but still suggesting a reduction in their surface water bodies, (NESREA, 2011; www.ky.gov/nrepc/water)
III. There is need for further research on the Ecotoxicology of sulphate with special reference to its effects on the aquatic ecosystem with special attention to the plankton.
IV. There is also need on further studies on the plankton of the study area when the rivers are in full season (August – January).

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