PLANKTON PERIODICITY AND SOME PHYSICOCHEMICAL PARAMETERS OF THE IN TAKE CHANNEL OF LAKE CHAD.

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ABSTRACT:

This study examines zooplankton periodicity and some physico-chemical parameters of the intake channel of lake Chad.

Nine different zooplankton species were identified at the sampling (station 1) of the intake channel of lake Chad, while seven different zooplankton species were identified at the sampling (station 2) of the intake channel of lake Chad. Each identified zooplankton species was grouped according to its major group of either copepods, cladocera or rotifera. The copepods dominated the total zooplankton with highest numbers of occurrence as cyclopedia species throughout the course of study at both station 1 and 2 of the intake channel of lake Chad as indicated in Tables 1 and 2.

There was a clear evidence of influences of organic manure nutrients on total zooplankton population at station I when compared to that of station 2.

The water quality variables measured in the course of this study show that the surface water temperature in station I ranges from 27.5°c to 30.5°c. the pH ranges from 6.8 to 8.5, while D.O. contents ranges from 2.9mg/L to 6.1mg/L and Alkalinity recorded was ------- 172.00 to 208.00.

At the station 2 water quality parameter obtained shows that surface water temp. ranges from 27.3°C to 30.2°C, pH ranges between 6.9 to 8.5, while the D.O contents ranges from 3.0mg/L to 6.2mg/L Alkalinity ranges from 172mg/L to 212 mg/L.

INTRODUCTION

Lake Chad has been undergoing some drastic ecological changes for the past years due to the prevailing drought and natural seasonal variation of the water level. The resultant reduction in surface waters, water depth and near absence of open waters, may have brought changes in the lake basin and the Baga intake channel. Thus, monitoring the zooplankton and some aspect of the physico-chemical variables in time and space is essential in establishing the trend of changes undergone by these variables. The establishment of the trend of changes is important to updating the research information on the lake basin, as it is possible to utilise the intake channel water for aquacultural practices.

All living things have tolerable limits which they perform optimally. A sharp drop or increase within these limits have adverse effects on their functions. Since zooplankton are so closely linked to the environment and since they tend to respond to changes more rapidly than do larger aquatic animals such as fish, these micro-organisms have proved to be valuable indicators of apparent and subtle alterations in the quality of freshwater systems (Gibbons and Funk 1982).

Adeniji and Ovie (1981, 1982) observed that temperature, turbidity, suspended solids, dissolved Oxygen concentration are among other primary factors that determine the quality of a water body. Hence, the quality of a water body is measured by its chemical and biogenic productivity. These factors are invaluable, which may not exist independently and too high a level of any of these primary factors, may render it a polluting agent in addition to the well known pollutants (Herbicides and Pesticides).

Therefore, the physico-chemical factors are very vital for the life of aquatic organisms, including fish. Temperature is generally essential for metabolism and indeed, to the existence of the aquatic organisms. It directly influences the migration pattern, growth rate and spawning of the fishes as there is a certain range of temperature fish can tolerate (Viner, 1970).

Oxygen is considered as one of the most essential limnological factors for the existence of all aquatic organisms. Most aquatic organisms including fish, require oxygen in the water body for respiration. Dissolved oxygen is essential for the metabolism of all aquatic organisms that posses aerobic biochemistry, thus properties of solubility and especially the dynamics of oxygen distribution in lakes and reservoirs are basic to the understanding of aquatic organisms.

Azionu (1983) showed that in Shen Reservoir, Jos, Nigeria, that the carbon dioxide sources in natural water include bacterial decomposition of organic matter, photosynthesis, respiration by animals and plants flowing river and run-offs with their reservoir of nutrients.

Alkalinity is a measure of the acid combining capacity of the water. pH, free carbon dioxide and alkalinity are related to the amount of which have an alkalinity of 50 to 200 ppm are the most productive for fishes.

The finding were designed to provide updated information on the recent changes undergone by zooplankton distribution, periodicity and abundance, including such physico-chemical parameters as surface water temp; pH, dissolved oxygen, water transparency, conductivity and atmospheric temperature in the intake channel of lake Chad.

STUDY SITE

The two contrasting stations that were use for this study are located within the same ecological region of Lake Chad basin, in the campus of Federal college of Freshwater Fisheries Technology, Baga in Kukawa Government Area of Borno State, Nigeria.

The in-take of Lake Chad channel resulted from the impoundment of a channel by the Chad Basin Development Authority to provide water for irrigation project, it also provide a landing site for Federal College of Freshwater Fisheries Technology, Baga. The channel is linked with the open lake. The estimated distance from the channel end to the open lake is about 40-50km. The fisheries college uses this channel as one of their sources of water supplies to their ponds, hatchery complex and for training students on fishing practical.

The volume of the water from the channel increase toward December just as the lake water increases. During highest volume, the channel usually has minimum and maximum depth of 3-6m and width of about 60m.

METHODOLOGY OF THE STUDY

The study started in January 2001 and ended in September 2001. Along the in-take channel of Lake Chad, two sampling stations were chosen (i.e. lower part of the in-take channel near the College landing site and the upper part of the channel, toward the open lake). This was done in order to define adequately the comparative abundance and distribution on zooplankton periodicity of both sampling points.

Parameters studies on each of sampling points were surface water temperature, pH, D.O. Secchi-disc transparency, conductivity, and zooplankton estimates. The methods used in samples collection, preservation and analysis were those described by APHA (1980).

SURFACE WATER TEMP.

Temperature values were recorded from a thermometer graduated in unit of 1^0C interval (0^0-4^0C). The thermometer was dipped into the water after air shade temperature as determined by holding the thermometer about 6cm above the water level for at least three minutes until the mercury came to a standstill. At that point the temperature was recorded. For surface water temperature, the thermometer was immensed slightly under the surface of the water until the mercury stood out one place. At this point the temperature value was taken. pH determination, a pH battery operated electronic meter of DIGITAL pH/MV and temperature meter model 7065 were used. The electrode was mounted on the tripod stand (electrode holder). Two different buffer solutions pH7 and pH4 were used to standardise the pH meter with their temperature taken and adjusted according to their buffering solution.

The electrode was rinsed with distilled water, cleaned with a filter paper before it was dipped into the water samples. The pH meter was then switched on and its reading were taken.

DISSOLVED OXYGEN

Oxygen samples drawn from the two sampling points of the in-take channel were fixed in the field and analyses shortly by the winkler method as reported by Mackereth (1963). 125ml of dissolved oxygen sample bottle used was immersed inside the water until it filled to the brim excluding air bubbles. Iml of manganous sulphate solution was added followed by addition of Iml Alkali-iodide-oxide reagent. The bottle was stoppered carefully to exclude air bubbles and mixed by inventing bottles a few times. When the precipitate had settled to leave clear super-natant solution above the manganic oxide fold, 1ml of concentrated suphuric acid was added. The bottle was restoppered and mixed by gentle inversion. Unit dissolution of precipitate was complete.

This solution was then titrated by taking 10ml for titration with 0.025N sodium thisulphate solution using freshly prepared starch solution as indicator. The dissolved oxygen concentration was then calculated using the relationship:

$$D.O.\ (mg/L) = \frac{A}{B} \times 200$$

where: A =Volume of 0.25N thiosulphate used
B =Volume of sample used for titration.

SECCHI- DISC TRANSPARENCY:

Water transparency of the two sampling points was taken by using secchi-disc. Secchi-disc is a circular metal plate, 20cm in diameter. The upper surface of which is divided into four equal quadrants and so painted that two quadrants directly opposite each other are black and the intervening ones white. Secchi-disc measurement was achieved by lowering the disc in to the water gradually until it just disappears. The average depth of disappearance and reappearance was recorded as the water transparency depth.

CONDUCTIVITY:

Conductivity of the water samples was measured with HACH conductivity meter. The meter was standardised with distilled water, the probe was inserted into the water sample with the instrument at the ON position. The conductivity meter was then read as displayed on the meter. This value was then recorded as the conductivity of the water sample.

ZOOPLANKTON SAMPLING AND ESTIMATES

Zooplankton samples were collected from both sampling stations by filtering 10 litres of water sample through a standard zooplankton hand net with a diameter of 12.5cm attached with a No 10 straining net. Samples were then collected from the zooplankton straining bucket into sample bottles and preserved with 10% formalin solution.

The major zooplankton groups were identified according to Jeje and Fernando (1986).

Quantitative enumeration of each group of the zooplankton was done by concentrating each sample at 10ml by using pipette with a siphon. Attached to the end part of the pipette is a 158Nm mesh size net prevent accidental lose of zooplankton from the sample (Adepoju, 1989). This was put into a counting chamber and examined under leitz inverted compound microscope.

Total count of the content was done twice and the mean number was taken as the zooplankton estimates per litre of water.

RESULTS AND DISCUSSION:

Nine different zooplankton species were identified at the sampling station I of the intake channel of Lake Chad. These were grouped in the three major classes: as copepods, cladoceran and rotifera. At sampling station I copepods dominates with cyclopedias species (i.e. copepods, as the dominated zooplankton species (Table I). The zooplankton species are grouped according to their major groups.

Table 2 shows that seven different zooplankton species were identified at the station 2 (i.e. upper part of the intake channel: towards the open lake. These were grouped in the three major classes: as copepods, cladocera and rotifera. At station 2 (upper part of the intake channel of lake Chad) copepods dominates with cyclopedias. In general copepods dominated the zooplankton species. The total zooplankton organisms in each of these stations (i.e. station 1&2) of the intake channel were indicated in table 3.

The result obtained shows that station 1 (i.e. lower part of the in-take channel) supports high population density of zooplankton as the total zooplankton density ranges from 8.10 numbers per litre to 10.10 numbers per litre in station 1. The lowest zooplankton population density was obtained at the station 2 (towards the open lake ranges between 1.70 individual per litre and 3.00 individuals per litre.

The variation in zooplankton distribution and periodicity may be possibly due to accumulated cow dung manue at station 1. (lower part of the in-take channel). Which is the spot where cattles usually drink water daily before and after grazing. Manure as an organic local raw material supports production of bacteria and protozoan which are good food source for zooplankton. (Hart and Seater, 1994). These findings agree with those obtained by Taub and Dollar (1968) which revealed that local raw materials such as chicken manure are good and important food zooplankton.

Mean monthly variations in water quality parameters were shown in tabe 4. The surface water temperature in station I range from 27.5°C to 30.5°C while in station 2 surface water temperature ranges between 27.3°C-30.2°C pH level at station I ranges from 6.8 to 8.5 unit. In station 2 pH ranges between 6.9 to 8.5 Unit.

Dissolved oxygen content at station I ranges from 2.90 mg/L -6.10 mg/L while at station 2 D.O. ranges from 3.00 mg/L 6.20 mg/L. And Alkalinity recorded were between 127.00mg/L to 280.00mg/L in station I while 172mg/L 212mg/L Alkalinity were obtained. The variations in the level of conductivity ranges from 270-320 pmho3/cm at station I while at station 2 260-320pmho3/cm of conductivity were obtained. Water transparency of station I ranges 0.2m throughout while 0.3m were obtained in station 2 of the intake channel. The mean atmospheric temperature (°C) ranges between 29°C - 31°C throughout the research work.

This findings agreed with that of Boyd (1979) who suspected that the use of organic manure in fish culture should be properly monitored to avoid eutrophication and water quality problems. To increase productivity in any unfertilized environment such as the intake channel of lake Chad, possible actions should be taken to effectively use local waste materials in the system, if in future it is needed for aquacultural practise. Fertilization of culture ponds have been recommended by many authors (George 1975).

CONCLUSION AND RECOMMENDATIONS:

The zooplankton periodicity and some physico-chemical parameters of the intake channel of lake Chad is very useful research information basically to fisheries resources management and exploitation have been obtained from the short term work. More detailed and longer oriented research work should be designed for future workers for better understanding of the dynamics of this important aquatic ecosystem in conjunction with the limnological study. This study has highlighted the level of primary productivity of the channel, the findings has shown in table 4 all the water parameters measured were within the tolerable limit of aquatic organisms/animals (fishes). This findings agreed with that of (Gibons and

Funk 1982) which reveals that: all living things have tolerable limits within which they perform optimally, since zooplankton are so closely linked to the environment and since they tend to respond to changes more rapidly than do large aquatic animal such as fish, hence this micro-organisms have proved to be valuable indicator apparent and subtle alternations in the quality of freshwater system.

It has also been indicated that the zooplankton abundance occurs at the station 1 of the intake channel as a result of animal waste/organic manure deposited. This also agreed with (Adeniji and Ovie 1994) that: the predominant use of organic manure such as cow-dung, chicken dung and pig-dung in culture systems is highly commendable as this is a major way of channelling animal waste into production of fish. Consequentially there are situations where excess or wrong use of these fertilizers have adverse affects on the quality of the water such as eutrophication, and its turbid effect on water transparency and disturbance in decomposition and production of poisonous gases such as CO_2, H_2S and methane, most especially during the lake flooding period towards December months.

I hereby recommend the need to constantly study the water quality parameters of the intake channel to ascertain the proposed cage culture practise in the in-take channel by federal college of freshwater technology, Baga. Further more it is also necessary to monitor the water quality/ Aquatic weeds (macrophyte) of the channel constantly in order to control eutrophication and other water quality problems which may hinder aquacultural practice such as pollution from nearby adjacent farm lands which could pollute the channel water through run-off. More fisheries activities will be enhanced if proper management of the channel is ensure based on the result obtained in this research.

TABLE 3: COMPARATIVE VARIATION IN TOTAL ZOOPLANKTON DENSITIES (Nos/L) AT THE IN-TAKE OF LAKE CHAD CHANNEL: SAMPLING STATIONS 1, (LOWER PART OF THE CHANNEL) AND 2 UPPER PART OF THE CHANNEL (TOWARDS THE OPEN LAKE)

SAMPLING MONTHS	LOWER PART OF THE CHANNEL (STATION 1)	UPPER PART OF THE CHANNEL (STATION 2)
JANUARY	8.8	2.7
FEBURARY	8.6	1.7
MARCH	8.4	2.0
APRIL	8.0	1.9
MAY	9.9	2.6
JUNE	8.1	2.6
JULY	9.4	1.9
AUGUST	10.1	3.0
SEPTEMBER	9.2	2.5

Table 2: **TOTAL ZOOPLANKTON DENSITY (NOS/L) PERCENTAGE COMPOSITION IN-BRACKET AT THE IN-TAKE OF LAKE CHANNEL: (STATION 2 AT THE UPPER PART OF THE CHANNEL**

	COPEPODA		CLADOCERA	RETIFERA				TOTAL	
SAMPLING MONTHS	Cyclopiods spp	Copepodit spp	Calanoids spp	Moina spp	Branchionus spp	Asplanchna spp	Polyarthra spp	Nos/1	%
JAN.	1.0 (37.04)	0.6 (22.2)	- (-)	0.6 (22.22)	0.1 (3.70)	0.2 (7.41)	0.2 (7.41)	2.7	100%
FEB.	1.1 (64.71)	0.3 (17.65)	- (-)	0.2 (11.76)	- (-)	0.1 (5.88)	- (-)	1.7	100%
MAR.	1.3 (33.33)	0.2 (13.10)	- (-)	0.2 (10.0)	- (-)	0.2 (10.0)	0.1 (5.0)	2.0	100%
APRIL	1.0 (52.63)	1.0 5.26)	0.3 (15.79)	0.4 (21.05)	- (-)	0.1 (5.26)	- (-)	1.9	100%
MAY	1.1 (42.31)	0.7 (26.92)	0.2 (7.69)	0.1 (3.85)	0.2 (7.69)	0.3 (11.54)	- (-)	22.6	100%
JUNE	1.3 (50.0)	1.0 (38.46)	- (-)	0.2 (7.69)	0.1 (3.85)	- (-)	- (-)	2.6	100%
JULY	1.2 (23.40)	0.5 (19.15)	- (-)	- (-)	0.1 (5.26)	0.1 (5.26)	- (-)	1.9	100%
AUG.	1.7 (56.67)	0.9 (30.0)	0.1 (3.33)	0.1 (3.33)	0.1 (3.33)	0.1 (3.33)	- (-)	3.0	100%
SEPT.	1.6 (64.0)	0.6 (24.0)	0.1 (4.0)	0.1 (4.0)	- (-)	0.1 (4.0)	- (-)	9.2	100%

Table 1: **TOTAL ZOOPLANKTON DENSITY (NOS/L) PERCENTAGE COMPOSITION IN-BRACKET) AT THE IN-TAKE OF LAKE CHANNEL: (STATION 1 AT THE LOWER PART OF THE CHANNEL**

SAMPLING MONTHS	COPEPODA Cyclopiods spp	Copepodit spp	CLADOCERA Calanoids spp	Moina spp	RETIFERA TOTAL Branchionus spp	Polyarthra spp	Filinia spp	Keratella	Asplouchina spp	Nos/1	%
JAN.	2.0 (22.73)	2.1 (23.8)	1.3 (14.77)	2.1 (23.86)	0.9 (10.23)	- (-)	0.1 (1.10)	0.2 (2.27)	0.1 (1.4)	8.88	100%
FEB.	2.1 (24.42)	2.3 (26.74)	0.5 (5.81)	1.3 (15.12)	0.4 (4.65)	0.6 (6.98)	0.1 (1.16)	1.1 (12.76)	0.2 (2.33)	8.6	100%
MAR.	2.8 (33.33)	1.1 (13.10)	1.2 (14.29)	1.3 (15.48)	0.7 (8.33)	0.9 (10.71)	- (-)	0.1 (1.19)	0.3 (3.57)	8.4	100%
APRIL	3.0 (37.5)	1.3 (16.25)	0.9 (11.25)	1.2 (15.0)	1.1 (13.75)	- (-)	- (-)	0.3 (3.75)	0.2 (2.5)	8.0	100%
MAY	2.2 (22.22)	2.0 (20.20)	1.0 (10.10)	2.0 (20.20)	1.0 (10.10)	1.1 (11.11)	0.3 (3.03)	0.3 (3.03)	- (-)	9.9	100%
JUNE	1.8 (22.22)	1.1 (13.58)	1.1 (13.58)	2.1 (25.93)	1.0 (12.35)	0.7 (8.64)	0.1 (1.23)	0.2 (2.47)	- (-)	8.1	100%
JULY	2.2 (23.40)	1.8 (19.15)	0.9 (9.57)	3.0 (31.91)	1.1 (11.70)	- (-)	0.2 (2.13)	0.1 (1.06)	0.1 (1.06)	9.4	100%
AUG.	2.0 (19.80)	2.0 19.80)	2.0 (19.80)	2.1 (20.79)	1.0 (9.90)	0.8 (7.92)	- (-)	0.2 (1.98)	- (-)	10.1	99.99
SEPT.	3.0 (32.60)	2.0 (21.74)	1.0 (10.87)	2.0 (21.74)	0.9 (9.78)	0.1 (1.09)	0.1 (1.09)	- (-)	0.1 1.09)	9.2	100%

Table 4: **MONTHLY VARIATIONS IN WATER QUALITY PARAMETERS AT THE IN-TAKE OF LAKE CHAD CHANNEL: SAMPLING STATION 1: (LOWER PART OF THE CHANNEL) AND STATION 2 (UPPER PART OF THE CHANNEL: (TOWARDS THE OPEN LAKE).**

SAMPLING MONTH	SAMPLING STATION	SURFACE WATER TEMP (^{0}C)	pH (UNIT)	D.O (mg/L)	ALKALINITY mg/L	CONDUCTIVITY (1Nhos/cm)	WATER TRANSPIRENCY S.D.(m)	ATMOSPHERIC TEMP. (^{0}C)
JAN.	STATION 1 STATION 2	29.20 29.00	8.50 8.50	6.10 6.20	190.00 190.00	230 230	0.2 0.3	26 27
FEB.	STATION 1 STATION 2	28.20 28.10	8.22 8.22	6.00 6.00	206.00 204.00	240 240	0.2 0.3	22 22
MAR.	STATION 1 STATION 2	28.71 28.52	7.66 7.63	4.60 4.70	208.00 207.00	220 220	0.2 0.3	30 30
APRIL	STATION 1 STATION 2	30.50 30.20	7.97 7.96	4.60 4.60	211.00 212.00	310 310	0.2 0.3	31 31
MAY	STATION 1 STATION 2	30.00 20.00	7.86 7.66	4.30 4.30	192.00 193.00	290 280	0.2 0.3	31 31
JUNE	STATION 1 STATION 2	29.00 29.00	8.01 8.00	3.60 3.60	203.00 203.00	280 260	0.2 0.3	30 30
JULY	STATION 1 STATION 2	28.00 28.00	7.20 7.20	2.90 2.90	192.00 192.00	270 270	0.2 0.3	30 30
AUG.	STATION 1 STATION 2	27.00 27.00	6.90 6.90	3.00 3.00	173.00 174.00	280 280	0.2 0.3	28 28
SEPT.	STATION 1 STATION 1	29.00 29.00	6.80 6.88	4.00 4.00	172.00 172.00	280 280	0.2 0.3	29 29

REFERENCES

1. Adeniji H.A. and S.I. Ovie (1981). Study of the abundance and distribution of zooplankton in Asa Lake. KLRI Annaul Report, 1981 pp. 19-22.

2. Adeniji H.A. and S.I. Ovie (1982). Study and appraisal for the water quality of the Asa Oli and Niger Rivers. NIFFR Annual report, 1982, pp. 15-20.

3. Azionu, B.C. (1983). Spatial and diet variations in some hydrobiological features of the Shen Reservoir, Plateau State. MSC thesis Department of Zoology, University of Jos, Nigeria.

4. APHA (1980). Standard methods for the examination of water and waste waters 15th edition. American Public Health Association Inc. American water works Association, water pollution control federation. P 240 - 242.

5. Adepoju F.A. (1989). Physico-chemical parameter and zooplakton abundance in National Institute for Freshwater Fisheries Research fish pond. HND project report, Federal freshwater fisheries school New-Bussa pp. 97.

6. Boyd c.E (1979). Water quality management in ponds fish culture. Aubum inter. Centre for Aquaculture A.E. station p.30.

7. Benneth, G.W.(1970). Winter kill of fishes. In an Illionois lake management reports. Illinois Biology note 9191, p 1-9.

8. Charkroof M. (1976). Freshwater fish pond culture and management (published by volunters Institute for Tropical Agriculture) (VITA).

9. Gibbons, W.M. and Funk H.W. (1982). Seasonal patterns in the zooplankton community of an eutrophic lake in eastern Washington prior to multiphase restoration J. Freshwater. Eco 1:1 L. b 15 - b28.

10. Jeje C.Y and Fernando C.H (1986). A practical guide to the identification of Nigerian zooplankton (cladocera. Copepoda and Rotifers) KLRI New ??? Bussa. p. 142.

11. Mackenthun Keal (1967) Biological associated problems in freshwater environments; their identification, investigation and control by K.M. Mackenthun and W.M. Ingram Washington. USGPO. 1967 551: 487:632.1 ???

12. Viner A.B. (1970) Hydrobiology of the Volta lake. Ghana I. Statification and circulation of water. Hydrobiological 35: 209 - 229 pp.