

PHYSICOCHEMICAL PARAMETERS AND PHYTOPLANKTON DIVERSITY OF KWARE LAKE

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Abstract. Kware lake is a popular natural lake in Sokoto, its known to be used for domestic purposes, irrigation practices and fisheries. Anthropogenic activities are routine at the catchment area. Water and phytoplankton samples were collected for five months. Standard procedures were adapted for determination of physicochemical parameters viz; temperature, depth, turbidity, nitrogen, phosphorus, dissolved oxygen (DO), biological oxygen demand (BOD) etc. These parameters were observed to have varied within the period of study. Five species of phytoplankton were identified, *Volvox globator* recorded the highest percentage distribution during the study. The irregular fluctuations and variations observed between the parameters studied does not exceed the limit approved by WHO and EPA.

Keywords: Kware Lake, Limnological, Phytoplankton, Variables, Water

INTRODUCTION

Lakes and reservoirs are major water resources, both in terms of size and fisheries potentials [1]. Seasonal changes in nutrient availability are the most important variables which determine phytoplankton composition and abundance [12,3,4]. Phytoplankton's quantitative estimates provide good indices of productive capacity of a water body. Lot of work has been done to estimate productivity and plankton analysis throughout the globe [5,6,7,8,9]. Seasonal patterns in tropical

phytoplankton communities are still important in limnology [10]. The estimation of plankton density, productivity and trophic status of lakes are very important for fisheries management. Secchi disk transparency is a standard indicator of water clarity, which is strongly correlated with biomass and annual productivity of suspended algae [11]. This is also closely related to the amount of sandy clay, detritus and organic matter suspended in water and quantity of dissolved elements [12]. There are large density of small reservoirs in most parts of Africa, [13], which have various impacts, these impacts include; changing seasonal flow patterns of streams and rivers, anthropogenic influences[14, 15].The aim of this study was to assess the physical and chemical characteristics and the diversity of phytoplankton species of Kware lake.

MATERIALS AND METHODS

Study Area

Kware Lake is natural water body that is fed by underground water sources located at various places. Its located within longitude $5^{\circ}16'E$ and latitude $13^{\circ}13N$. It is lentic water body (still) and clear in appearance, usually used for irrigation practices as well as domestic uses[16].

Sample collection

Samples were collected at three different locations for the period of five months (February to June). These were taken to the laboratory for analysis. Some of the parameters were measured *in situ*.Photoplankton samples were collected through standard plankton net (25 mesh size).

Determination of physiochemical parameters

Standards methods were followed in determining limnological parameters. Temperature, depth and turbidity were determined *in situ* according [17]. While chemical parameters namely; pH, nitrogen, phosphorus, calcium, magnesium, BOD, DO and TDS were determined as described by[18].

Phytoplankton identification

phytoplankton were identified by pipeting 1ml from the sample on a slide, which was mounted on a light microscope. Each phytoplankton identified was compared with the phytoplankton identification charts[19, 20, 21, 22, 23] before recording the species.

Statistical analyses

The data obtained from both field and laboratory were statistically analysed using Mintab statistical packaged. Two-way Analysis of Variance (ANOVA) was conducted at 5% probability.

RESULTS AND DISCUSSION

Limnological variables in Kware Lake were observed to fluctuate slightly within the period of study. Physical parameters studied include; temperature, depth and turbidity. These parameters were discovered to have varied gradually as the weather changes from February to June. Temperature ranged from 26–32°C. Though the monthly means and standard errors were 27.0±1.00, 31.0±0.58, 30.3±0.88, 31.0±0.58 and 31.7±0.33 for February, March, April, May and June respectively. The maximum temperature of 32°C observed in June for all the three locations may be attributed to the increased photoperiod and longer day length [24]. The lake was found to be

shallower at the beginning of the study period, station 2 tend to be deep than the other stations, in which the highest depth of 3.8cm was recorded at the station. pH values recorded for the present study ranged from 6.9–8.0, though it was observed to increase slightly from February to June which also fall within the acceptable limits of [25, 26]. The level of both nitrogen and phosphorus were also found to be low but slight variation during the period of study was observed with an irregular pattern of fluctuation. Nitrogen recorded a mean and standard error of 0.87 ± 0.18 in February but in June 0.53 ± 0.18 was recorded. Though the minimum and maximum values were 0.20mg/l and 1.20mg/l respectively. While phosphorus recorded a range of 0.13–0.70mg/l, which also fluctuated irregularly (Table 2), this therefore contradicts the findings of [27] whom reported the level of phosphorus and nitrogen to increase from April to September. But in this present study it could be as result of low inputs of sources of both nitrogen and phosphorus from the catchment area. Biochemical Oxygen Demand (BOD) is defined as the amount of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic condition. The range of BOD and DO was found to be from 12.9 mg/l to 40 mg/l, 2.90mg/l to 6.0mg/l respectively. The comparison of BOD and DO in the present study indicated that there was an inverse relationship between both parameters as reported by [28]. Total dissolved solids was found fluctuate irregularly also, with range of 1.00mg/l to 2.00mg/l which is low according the [26] regulations. Five species of phytoplankton were identified in Kware lake during the study period namely; *Spirogyra gratiana*, *Zygnema insigne*, *Volvox globator*, *Centric palmerina* and *Pennate asterionella*. *Volvox globator* has the highest percentage distribution of 57.1% in April, which was followed by *Spirogyra gratiana* with 47.6%

in March (Table 3). The few number of phytoplankton species identified may be due to the fact that phytoplankton species are sensitive indicators of environmental changes [29]. Monthly phytoplankton number per litre recorded has reveal that April and May were months observed to have few number of phytoplankton species(Figure 1) this could be due grazing effect by consumer at that period of study.

CONCLUSION

From the obtained results, we can conclude that change in weather and anthropogenic inputs may have caused the slight variations in physicochemical parameters, and anthropogenic activities has little or no effect on the variations. Which could be as a result of little or none usage of fertilizer, insecticidal and pesticidal applications at the catchment area by farmers. While biotic and other factors were likely to have caused the observed spatial effects on distribution of these phytoplankton species.

Table 1. Monthly Variation of Physical Parameters of Kware Lake from February to June 2013

Parameter	February	March	April	May	June	Min.	Max.
Temp(°C)	27.0±1.00	31.0±0.58	30.3±0.88	31.0±0.58	31.7±0.33	26	32
Depth(m)	2.1±0.30	2.2±0.48	2.8±0.49	3.2±0.27	2.6±0.45	1.7	3.8
Turb (cm)	89.0±30.3	106.7±29.20	125.0±32.79	147.3±3.84	148.3±6.01	55	190

Table 2. Monthly Variation of Chemical Parameters of Kware Lake from February to June 2013

Parameter	February	March	April	May	June	Min.	Max.
pH	7.3±0.21	7.7±0.88	7.2±0.17	7.7±0.56	7.8±0.89	6.9	8.0
N(mg/l)	0.87±0.18	0.67±0.67	0.83±0.15	0.73±0.24	0.53±0.18	0.20	1.20
P(mg/l)	0.20±0.01	0.32±0.00	0.55±0.76	0.13±0.00	0.17±0.01	0.13	0.70
Ca(mg/l)	0.37±0.02	1.52±0.03	1.18±0.80	1.22±0.25	1.71±0.45	0.35	2.30
Mg(mg/l)	0.63±0.06	2.70±0.10	3.02±0.10	2.72±0.42	2.80±0.76	0.55	3.55
BOD(mg/l)	13.83±0.58	33.90±1.63	36.83±2.24	19.13±0.27	18.73±0.73	12.90	40.00
DO(mg/l)	4.63±0.20	3.67±0.19	3.20±0.17	5.67±0.18	4.50±0.25	2.90	6.00
TDS(mg/l)	1.33±0.33	2.00±0.00	1.33±0.33	1.00±0.00	1.33±0.33	1.00	2.00

Table 3. Monthly Distribution of Phytoplankton Species Identified in Kware Lake

Species	February	March	April	May	June
<i>Spirogyra</i>	11(45.8)	10(47.6)	1(14.3)	1(11.1)	9(42.9)
<i>gratiana</i>))		
<i>Zygnema insigne</i>	7(29.2)	1(4.8)	2(28.6)	2(22.2)	2(9.5)
<i>Volvox globator</i>	6(25.0)	7(33.3)	4(57.1)	5(55.6)	4(19.0)
<i>Centric</i>	0(0)	0(0)	0(0)	1(11.1)	3(14.3)
<i>palmerina</i>					
<i>Pennate</i>	0(0)	3(14.3)	0(0)	0(0)	3(14.3)
<i>asterionella</i>					

Footnote: Percentage in Parenthesis

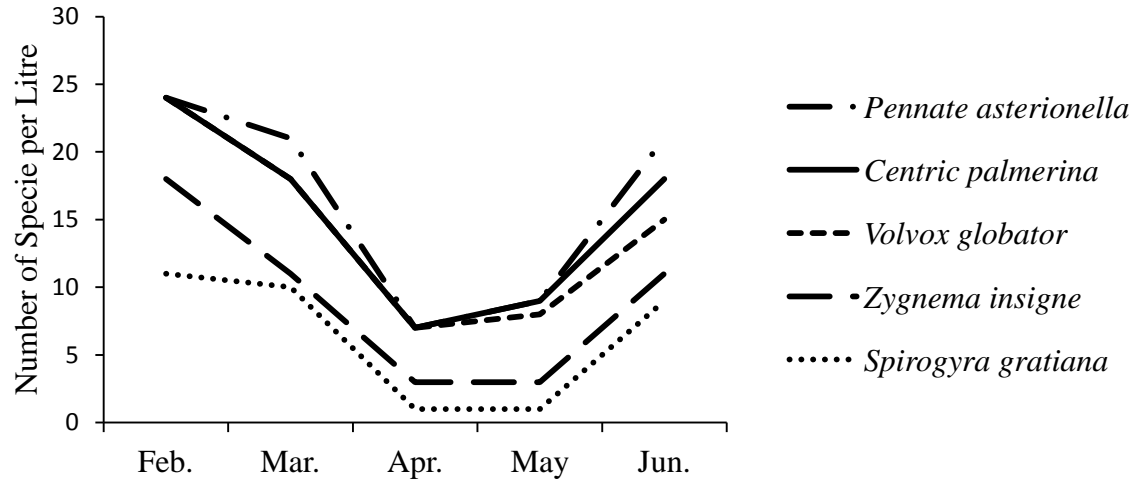


Figure 1: Monthly number of phytoplankton species identified in Kware Lake

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