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Assessment of Primary Productivity and Plankton Population in Anasagar Lake Ajmer and Barali Lake Hurda

Arpita Vijayvergiya*, Reena Vyas

Govt. College Ajmer, Rajasthan, India

ABSTRACT

During the study, the highest value of total alkalinity was in summer 2015-16 and 2016-17 (590mg/l) and lowest value was observed in winter 2005-06 (410mg/l). Total alkalinity shows a positive relationship with temperature, pH, total hardness, TDS, conductivity, chloride and nitrate. The average value of total hardness during the study was lowest value of 315 mg/l in 2015-16 and 2016-17 and highest value of 375mg/l in 2006-07. A sound legal policy is required to protect this unique saline ecosystem. To deal with the problems of Sambhar Lake and its restoration, the existing acts, legislations, and laws must be suitably integrated within a single specific legislation, including possible new legislation. There is a need for assessing water availability and land use in lake catchments. The average value of total hardness during the study was lowest value of 315 mg/l in 2015-16 and 2016-17 and highest value of 375mg/l in 2006-07. This increase in total hardness during summer period is due to higher photosynthetic activity, free carbon dioxide is utilized and bicarbonates are converted into carbonates and precipitated as calcium salts. Total Dissolved Solid (TDS) ranged between 950 mg/l to 1400 mg/l with lowest during winter 2015-16 and 2016-17 and highest during summer 2015-16 and 2016-17 respectively. Higher concentration of TDS also due to the discharge savage and organic matter by the interference of human. Chloride concentration varied between 140 mg/l to 190 mg/l in 2015-16 and 2016-17. Higher chloride concentration during the summer because high temperature and consequent evaporation. In rainy season, lower concentration of this factor due to dilution. According to the study, rich contents of nitrates were observed, with maximum of 4.5mg/l during summer 2015-16 and 2016-17 and minimum of 2.1 mg/l during monsoon 2005-06. This can be attributed to high evaporation which increases the concentration during summers. Nitrate showed positive relation with temperature, pH, alkalinity, total hardness, TDS, chloride and fluoride and productivity, and negative relation with dissolved oxygen. In the present study, the values of fluoride varied between 2.1 to 2.9 mg/l, with maximum value during summer 2015-16 and 2016-17 and minimum during monsoon 2015-16 and 2016-17(Biswas (Mukherji), M. 2015) Fluoride showed positive correlation with pH, dissolved oxygen, hardness and nitrate.

Keywords: TDS, Alkalinity, Hardness, Solubility, Anasagar Lake.

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***Address for Correspondence:**

Arpita Vijayvergiya, Govt. College Ajmer, Rajasthan, India

INTRODUCTION

In the present study the main focus will be on the following objectives.

1. To find out quarterly variation in physio-chemical properties of water of ANASAGAR and BARALI LAKES. Temperature, Turbidity, pH, Total dissolved solids, Alkalinity, Hardness will be analyzed by various chemical methods.
2. To find out quarterly variation in Sediments of both Lakes.
3. To observe variations in Composition and Density of zooplankton population of the lakes.
4. To observe quarterly variations in Primary Productivity in terms of Biomass and Chlorophyll content.
5. To estimate the Biological Oxygen Demand (BOD) with a view to analyze the correlation between BOD and zooplankton Population.
6. To examine the Chemical Oxygen Demand (COD) with a view to point out the correlation between COD and Organic Pollutants.
7. Counting of plankton conducted by method proposed by APHA.

In the present study, the values of fluoride varied between 2.1 to 2.9 mg/l, with maximum value during summer 2015-16 and 2016-17 and minimum during monsoon 2015-16 and 2016-17 (Biswas (Mukherji), M. 2015) Fluoride showed positive correlation with pH, dissolved oxygen, hardness and nitrate.

METHODOLOGY

Sample data collected

In this study, the 40 samples from both lakes were taken in the morning about 10 a.m. These samples were taken using the phytoplankton net in the filtrate 20 litres of lake water for each sample. The samples were taken randomly but still around the entire study area. The water sample was filled into plastic bottles of 500 ml and stored in an ice box containing ice packs to ensure the conditions of phytoplankton remained good and would not die. After the samples were taken, the samples were brought to the lab for analysis.

Cultured Method

In this study, culture methods were also needed so that when the reflection reading of phytoplankton were taken, reflectance was shot exactly on phytoplankton rather than the other solid. The medium used in culturing is called Bold's Basal Medium (BBM). This medium was rotated in an autoclave to sterilize equipment and supplies. After preparing the samples were done, these samples were stored in cultured room.

Optical Instrument and Software

Reflectance of phytoplankton was taken using ASD spectroradiometer (handheld2) with height from sample to spectroradiometer of 30 cm and 1 degree FOV. The reflectance radiation wavelength regions to be recorded range from 325 to 1075 nm and was supported by tripod stand. Each sample was taken ten readings. An average of ten measurements was recorded for each sample. All the results were analyzed by using View Spec Pro software. After reflectance was taken, the sample was taken rapidly for analysis to measure the concentration of chlorophyll *a* from both lakes.

Extract and Measurement Chlorophyll a Concentration

In this study, the samples were extracted by using a solution of 90% acetone. After extracting chlorophyll *a*, the concentration of chlorophyll *a* is measured using spectrophotometry method using model UV-Visible spectrophotometer with selected wavelengths at 750 nm, 664 nm, 647nm and 630 nm and 90% acetone was used as a blank in the spectrophotometer. The concentration of chlorophyll *a* was calculated using formula by Jeffrey and Humphrey, 1975. The absorbance at 750 nm was subtracted from those three wavelengths to give the turbidity-corrected value.

Regression Algorithm

Equations for different wavelength such as (1) and (2) are needed to assess the content of chlorophyll concentration.

$$C_a = a_0 + a_1R_1 + a_2R_2 + a_3R_1R_2 + a\ R^{\ 2} + a_5R_2^{\ 2}{}_1 + a_6\ R_1{}^2R_2 + a_7R_1R_2{}^2 + a\ R^{\ 2}R^{\ 2} \quad (1)$$

$$C_a = e_0 + e_1R_1 + e_2R_2 + a_3R_3 + e_4R_1R_2 + a_5R_1R_3 + a_6R_2R_3 + a_7R_1{}^2 + a_8R_2{}^2 + a_9R_3{}^2 \quad (2)$$

Equation (1) is an algorithm model for two wavelengths. The algorithm for three wavelengths such as equation (2) can produce with enlarged equation (1), where, *j = 0,1,2,...*is the constant of the equation. It can be empirically determined using regression analysis.

Correlation between COD, BOD and zooplankton Population

Data Analysis

The collected data have been coded in the computer programme, through which they have been classified and tabulated. Further, cross tabulation is made focusing on correlation between BOD and zooplankton Population.

The general data interpretation is carried out mainly with the help of percentage analysis. Diagrammatic and graphical representations are also made according to their requirements of the study. In order to test the hypothesis, the ANOVA was applied.

The purpose of research is the discovery of general principles based upon the observed relationship between variables. To achieve this purpose, statistical analysis is done. In descriptive analysis; data are described with the help of statistical measurements. Description of data through mere descriptive analysis does not provide conclusive results. It only helps to describe the properties of a specific sample under study. Thus in order to obtain conclusive results, hypotheses formulated is tested in the research. These hypotheses are tested statistically with the help of statistical techniques.

Analysis of Variance: ANOVA

It is used for comparing more than two groups on a single variable. It is a collection of statistical models and their associated procedures, in which the observed variance is partitioned into components due to the explanatory variables. Analysis of variance or ANOVA is used for testing hypotheses about the difference among three or more means. This technique is used when multiple sample cases are involved. Through this technique the differences among the means of all the populations can be investigated simultaneously. If a variance within and between the groups are computed and compared it is known as one-way analysis of variance.

For computing ANOVA

- First the variance of the scores of all the groups is combined into one known as the total group variances (SST).
- The mean value of the variance of each of the group is computed separately, known as among mean variance (SSm).
- The differences between the total group variances and the among mean variances is calculated as the within group variances (SSW).
- F= Among mean variance Within group variance

Interpretation of F- ratio:

The numerical value of F- ratio thus obtained is compared against table F values, with the degree of freedom (K-1, N-K). If the obtained F is more than the tabulated value of F at 0.05 or 0.01 levels then F is said to be significant at 0.05 or 0.01 levels respectively and the null hypotheses are rejected. If the obtained F is less than the tabulated F then, F is termed not significant and the null hypotheses are accepted. When the ANOVA is significant then each pair of means is subjected to t-test to determine which pair of means differ significantly.

Statistical technique used

Simple percent analysis, ANOVA has been applied to analyse the data collected for the study.

Quarterly variations in Primary Productivity in terms of Biomass and Chlorophyll content in Anasagar lake and Barali lake

Reflectance spectra of phytoplankton

Figure 1 shows the six spectral reflectance graphs of randomly picked samples using spectroradiometer for the study area. In general, the graph shown by the six samples during the study has similar patterns. This could probably because many factors such as distribution, chlorophyll, composition, species, pigment, condition, and measurement instrument while taking the reading. For graph of reflectance against wavelength, there are two obvious peaks in the green (500-600 nm) and NIR (700 nm) regions due to several factors, and high absorption in the blue (400-500 nm) and red regions. Besides, a broad reflectance in this region (500-600 nm) is because of minimum absorption by phytoplankton pigment. Phytoplankton pigments absorb blue and red light, but have minimum absorbance in green light. In the red region, wavelength near 675~677 nm has the lowest reflectance and highest absorbance. In this region the spectra reflectance of phytoplankton was the lowest which also corresponded to high absorption by chlorophyll.

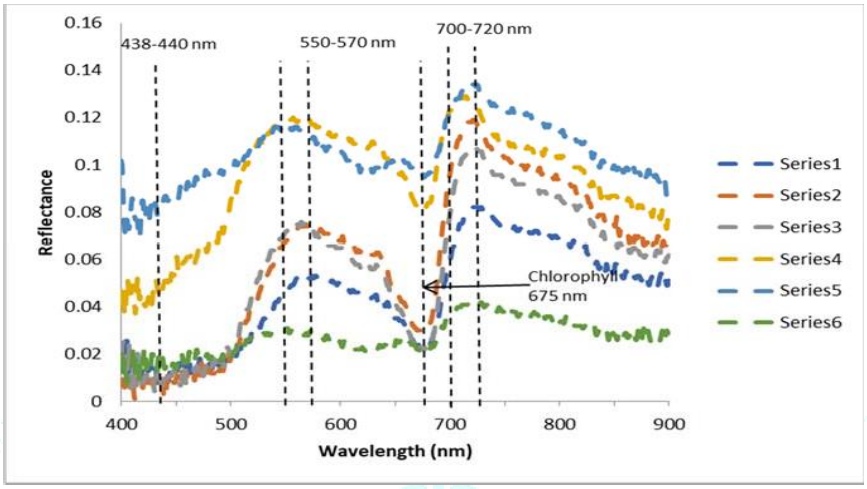
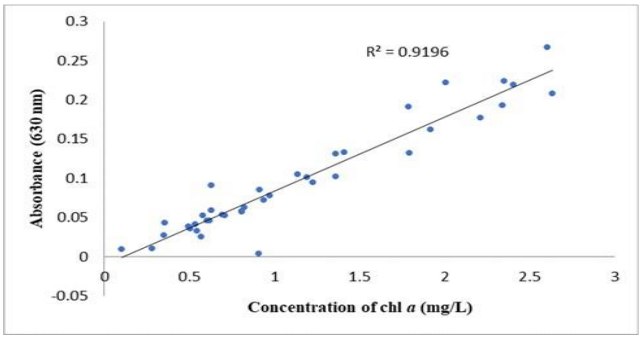


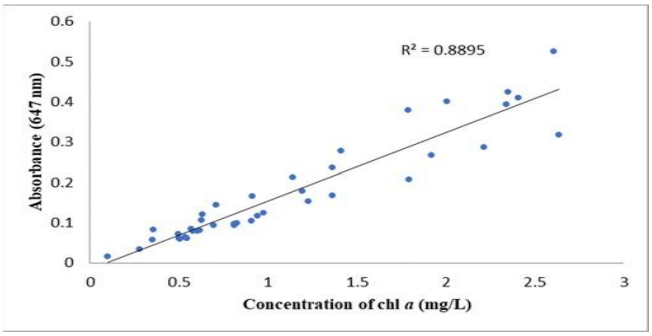
Figure 1: Reflectance spectra of phytoplankton

Correlation between Absorbance and Chlorophyll a Concentration

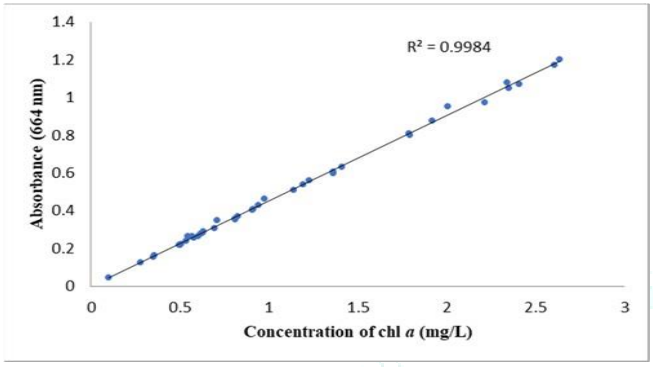
Figure 2(a), (b), (c) and 2(d), 2(e), 2(f) show the scatter plot of the absorbance and concentration of chlorophyll *a* value for phytoplankton of Anasagar and Barali lakes respectively. The absorbance values increased with concentration of chlorophyll *a*. The increasing value was experienced by all the wavelengths. Figure 2 (a), 2(b), 2(c) and 2(d), 2(e), 2(f) also show that these three wavelengths which were 630, 647 and 664 nm produced the higher R^2. The values of R^2 for absorbance for these three wavelengths were 0.9196, 0.8895 and 0.9984. The correlation of these three wavelengths are also quite high and all these three wavelengths are located in the red region. The concentration of chlorophyll *a* for these 40 samples were produced from by using spectrophotometry method. This instrument was chosen to measure the actual values for chlorophyll *a* because spectrophotometry is the classical method of determining the quantity of chlorophyll in surface water. From Figure 2(a) ,2(b) and 2(d), 2(f) the data were not as precise as desired on the points obtained for the trend line analysis compared to Figure 2(c) and 2(f) the all almost closed to the line and the value of R^2 was near to 1. It was assumed that the inconsistencies in the data were due to errors in the dilution of the stock solution when making the phytoplankton samples. By the way, these results indicate still can be accepted because the values of R^2 more than 80%.



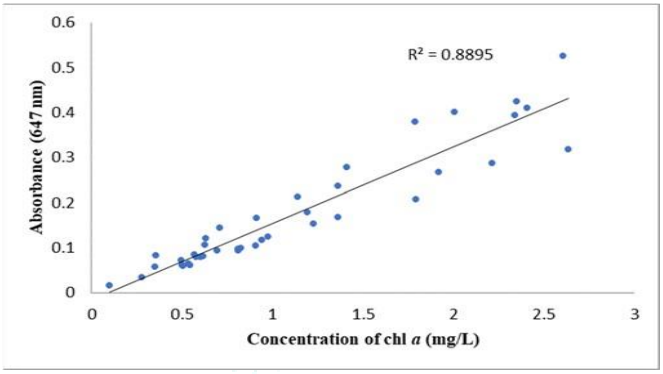
2(a)



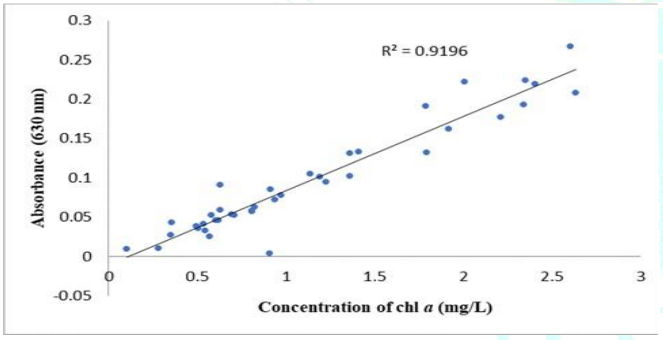
2(d)



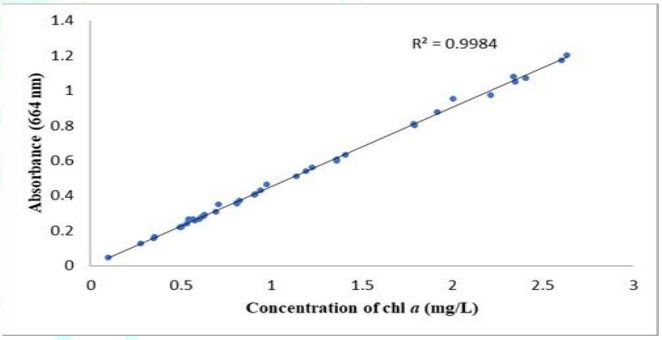
2(b)



2(e)



2(c)



2(f)

Figure 2(a), (b), (c) and 2(d), 2(e), 2(f): Absorbance versus chlorophyll *a* concentration of Anasagar and Barali lakes respectively for 630 nm, 647 nm and 664 nm.

Table 1: ANOVA Test for Correlation between BOD and zooplankton Population in Bareli Lake

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	12	197.11	16.42583	1.078954
Column 2	12	-11.494	-0.95783	0.048772

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	18.13151	1	18.13151			
Within Groups	12.40498	22	0.563863	5.2155	2.4125	4.30095

Table 2: ANOVA Test for Correlation between BOD and zooplankton Population in Anasagar lake

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	12	197.11	16.42583	1.078954
Column 2	12	-11.494	-0.95783	0.048772

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	15.12351	8	15.13271			
Within Groups	11.50496	18	1.562563	3.1125	2.589	4.4582

The table shows that the significant paired mean Correlation between BOD and zooplankton Population in Barali and Anasagar lake and the value for Barali lake is 5.2155 which are more than the critical difference values 4.30095 level of confidence and significant positive relation between BOD and zooplankton Population indicating that there is a significant at 0.05 level. the value for Anasagar lake is 3.1125 which are less than the critical difference values 4.4582 level of confidence and significant negative relation between BOD and zooplankton Population.

CONCLUSION

All the data revealed that the water of Anasagar as compared to Barali lake is not fit for 1-4 guidelines mentioned in CPCB. The quality of water in the lake has improved considerably over the last 5-6 years but it continues to be unfit for day-to-day human consumption. In Anasagar lake. the biological heterogenecity loss driven by local, regional, global and climatic factors, the surface flow adds water into the Barali lake during the rainy season and it also carries urban wastes, fertilizers from agriculture field which is a major threat to the future of our generation directly or indirectly. Lake water is less satisfactory for drinking purposes with an increasing awareness in the field of water pollution and desire of river maintenance at their highest quality level is required. Strict environment compliance is required to check the pollution load.

REFERENCES

1. Abhijna, U.G., Ratheesh, R. and Biju Kumar, A. 2013. Distribution and diversity of aquatic insects of Vellayani lake in Kerala. *Journal of Environmental Biology,* 34:605-611.
2. Abowei, J. F. N. 2010. Salinity, dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria, *Advance Journal of Food Science and Technology*, 2(1): 36-40.
3. Abowei, J.F.N. and Sikoki, F. D. 2005. *Water Pollution Management and Control.* Double Trust Publi. Co., Port Harcourt. pp: 236.
4. Abraham, M. 1978. Studies on the bottom macrofauna of Bhawani sagar reservoir (Tamilnadu). *J. Inland Fish Soc. India,* 11:41-48.
5. Adakole, J. A. and Annune, P. A. 2003. Benthic Macroinverteberates as indicators of environmental quality of an urban stream, Zaria, Northern Nigeria. *J. Aquat. Sci.*, 18 (2): 85- 92.
6. Adakole, J. A., Abulode, D. S. and Balarabe, M. L. 2008. Assessment of water quality of a man-made make in Zaria Nigeria. Sengupta, M. and Dalwani, R., (eds.), *Proceedings of Taal 2007: The 12th World Lake Conference.* pp.1373-1382.
7. Adebisi, A. A. 1981. The physico-chemical hydrology of a tropical seasonal upper Ogun river. *Hydrobiologia,* 79 (2): 157-165.
8. Adholia, U. N., Chakravarty A, Srivastava, V. and Vyas, A. (1990). Community studies on macrozoobenthos with reference to limnochemistry of Mansarovar Reservior Bhopal. *J. Nacton*, 2 (2): 139- 154.
9. Adoni, A. D. and Joshi, G. 1987. Physico-chemical regime of three freshwater bodies in and around Sagar (M. P.). *J. Geobios*., 6: 43-46.
10. Agarker, M. S., Goswami, H. K., Kaushik, S., Mishra, S. M., Bajpai, A. K. and Sharma, U. S. 1994. Biology, conservation and management of Bhoj wetland. I. Upper lake ecosystem in Bhopal. *Bionature,* 14: 1-119.