ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

Visit: www.ijmrsetm.com

Volume 1, Issue 2, November 2014

Correlation of Algal Groups with Physico-Chemical Factors at Makrera Lake Near Beawar City, Ajmer, Rajasthan

Dr. Nisha Sharma

Dept. of Botany, S.D. Govt. College, Beawar, Ajmer, Rajasthan, India

ABSTRACT: Makrera lake was critical in aquatic ecology environments, but how environmental factors affected the distribution and change characteristics of algal communities in it was found. Here, we investigated the algal community and evaluated the effects of water quality parameters on algae. The results indicated that the significant differences on physicochemical parameters existed in Makrera lake. The maximum concentration of total phosphorus in urban lakes was 0.18 ± 0.01 mg/L and there was a phenomenon of phosphorus limitation. In addition, 15 genera of algae were identified and *Chlorella* sp. was the dominant algal species, which was affiliated with Chlorophyta. Network analysis elucidated that this lake had a unique algal community network and the positive correlation was dominant in the interaction between algae species, illustrating that mature microbial communities existed or occupied similar niches. Redundancy analysis illustrated that environmental factors explained 20.34% variance of algal species-water quality correlation collectively, indicating that water quality conditions had a significant influence on the temporal variations of algae. Structural equation model further verified that algal community structure was directly or indirectly regulated by different water quality conditions. The Physico-chemical characteristics of Makrera lake was analysed using standard procedures.

KEYWORDS: algae, community, correlation, environmental, water quality, aquatic, ecology

INTRODUCTION

Algae are known with many detrimental impacts on drinking water quality. Discharge of municipal and agricultural wastewater into the receiving water resources make desirable conditions for algae growth and consequently cause eutrophication phenomena. Water samples were withdrawn from Makrera lake. To identify algae species, micronutrients, and physical parameters such as temperature, depth of Secchi disk (SD) and pH on their growth were evaluated.[1,2] The average phosphate in spring and summer were observed to be 0.034 and 0.028 mg/L, respectively. The results obtained from the present study indicated that the volume and depth of the water reservoirs were less critical on total phosphorus compared with the concentration of algal cells and total nitrogen. The mean pH for water samples in Makrera lake in spring and summer were observed to be 8.4 which is suitable for algae growth. Furthermore, the mean temperature (>20 °C) in both seasons were found to be desirable for the growth of algae, especially cyanobacteria in the CN. Moreover, the mean SD in spring and summer samples was 96.16 m and 119.83 m, respectively. As a result, the reservoir had low transparency in terms of algal growth. Totally, most of the identified algae were chlorophyceae, cyanophyceae, rhodophyceae, pheophyceae, and xanthophyceae. [3,4]

The physical and chemical parameters including temperature, dissolved oxygen, electrical conductivity and pH value were measured directly in the field according to APHA. Temperature was determined in situ. It was measured using mercury- in-glass thermometer. pH was measured by electrometric method using the laboratory pH Meter Hanna model HI991300. The conductivity of water was determined in the laboratory using the Hanna 911 conductivity meter which was standardized with 0.01 N potassium chloride (KCl) solutions APHA. Total dissolved solid was determined in accordance with APHA [9] and was calculated as TDS = (A-B) x 103 mg/l Where A = weight of dish + solids (mg) B = weight of dish before-use (mg). Total suspended solid was determined by subtracting the result of total dissolved solids from total solid. Total solids (TS) - Total dissolved solids (TDS) = Total Suspended solids (TSS) APHA. The samples were placed in a clean, dry turbidity vial. It was placed into the AQ4500 sample chamber and covered with vial cap. The measurement keys were pressed, the results were displayed on the instrument (Turbidity meter) and the result was

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

Visit: www.ijmrsetm.com

Volume 1, Issue 2, November 2014

read and recorded . Dissolved Oxygen in water was determined by Winkler Method in accordance with APHA. Means and standard error (mean ± SE) were computed using SPSS software (version 20).[5,6]

Water Temperature- This varied from 23.00 to 32.10 °C, with a mean of 29.08 °C ± 0.28 during the study period .Values were higher in the dry season (30.73 °C ± 0.23) than in rainy season (28.10°C ± 0.68) with an overall peak (31.20 °C) recorded and least values (25.33 °C) recorded in during study period. There was a significant seasonal variation in water temperature but was not significant ($p > 0.05$) across the lake water sample throughout the study duration .

pH- pH ranged from 4.00 to 7.34, with a mean of 5.27 ± 0.17 .Concentrations were higher in the rainy season (6.86 ± 0.14) than dry season (6.69 ± 0.19) of the sampling period .There was significant difference ($p < 0.05$) in seasonal variation of mean pH .. The highest pH value of 7.34 was recorded in while least value (6.68) was found during different seasons of spring and winter during the study period. No significant differences ($p > 0.05$) in pH concentrations were recorded across the lake .The pH concentration correlated significantly at $p < 0.05$ with turbidity, total dissolved solid, and sulphates ions. [7,8]

Total hardness- This ranged from 43.50 to 58.52 mg/L during the study period, with a mean level of 51.86 ± 0.60 mg/L . The seasonal concentration was higher in dry (54.79 ± 1.03 mg/L) than the rainy (49.52 ± 0.98 mg/L) period. There was significant difference ($p < 0.05$) in total hardness levels between the rainy and dry seasons during the study period.
Total dissolved solids- Total dissolved solid (TDS) concentrations ranged between 7.06 and 13.80 mg/L, with a mean value of 10.53 ± 0.22 mg/L .Rainy season concentrations (10.42 ± 0.32 mg/L) were higher than dry season concentrations (9.19 ± 0.37 mg/L). There was significant seasonal variation in mean TDS at $P< 0.05$.
Dissolved oxygen (DO) -ranged from 3.22 to 7.01 mg/L, with a mean concentration of 5.41 ± 0.14 mg/L . DO concentrations were higher in the rainy season (5.36 ± 0.17 mg/L) than dry season (4.92 ± 0.27 mg/L) without a significant seasonal differences ($P< 0.05$) [9,10]

Total suspended solids -The total suspended solids (TSS) of the Lake varied from 6.01 to 12.05 mg/L, with a mean of 9.51 ± 0.20 mg/L .Concentrations were higher in the rainy season (9.57 ± 0.19 mg/L) than in dry season (8.50 ± 0.31 mg/l) during the sampling period, with the highest concentration of 10.91 mg/L recorded while the least concentration of 7.46 mg/L was recorded

II.DISCUSSION

One critical problem faced by Makrera lake is the cultural eutrophication which leads to excessive phytoplankton growth, and sometimes further deteriorates into algal blooms (e.g. cyanobacteria blooms).[11,12]

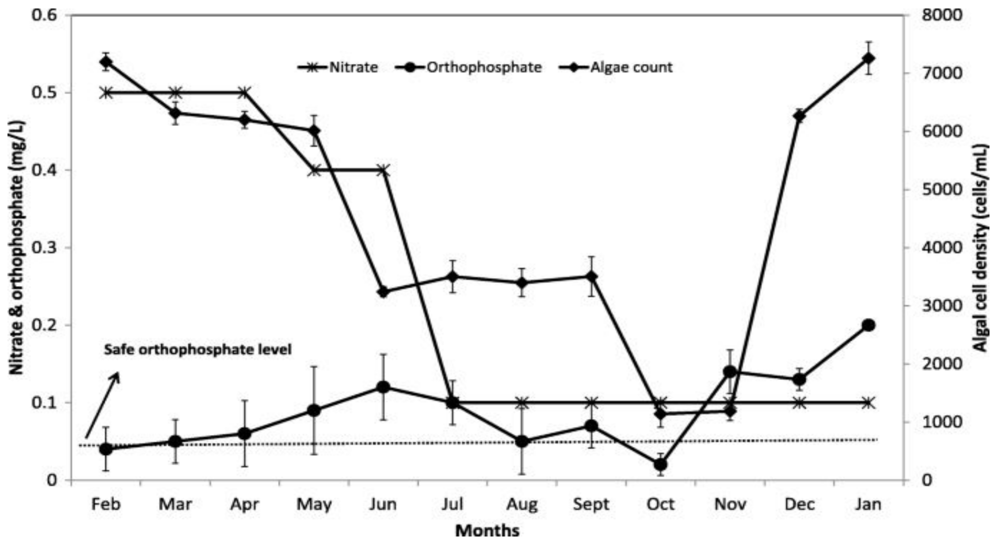


Figure 1: Assessment of the physico-chemical quality and extent of algal proliferation in water from Makrera lake prone to eutrophication

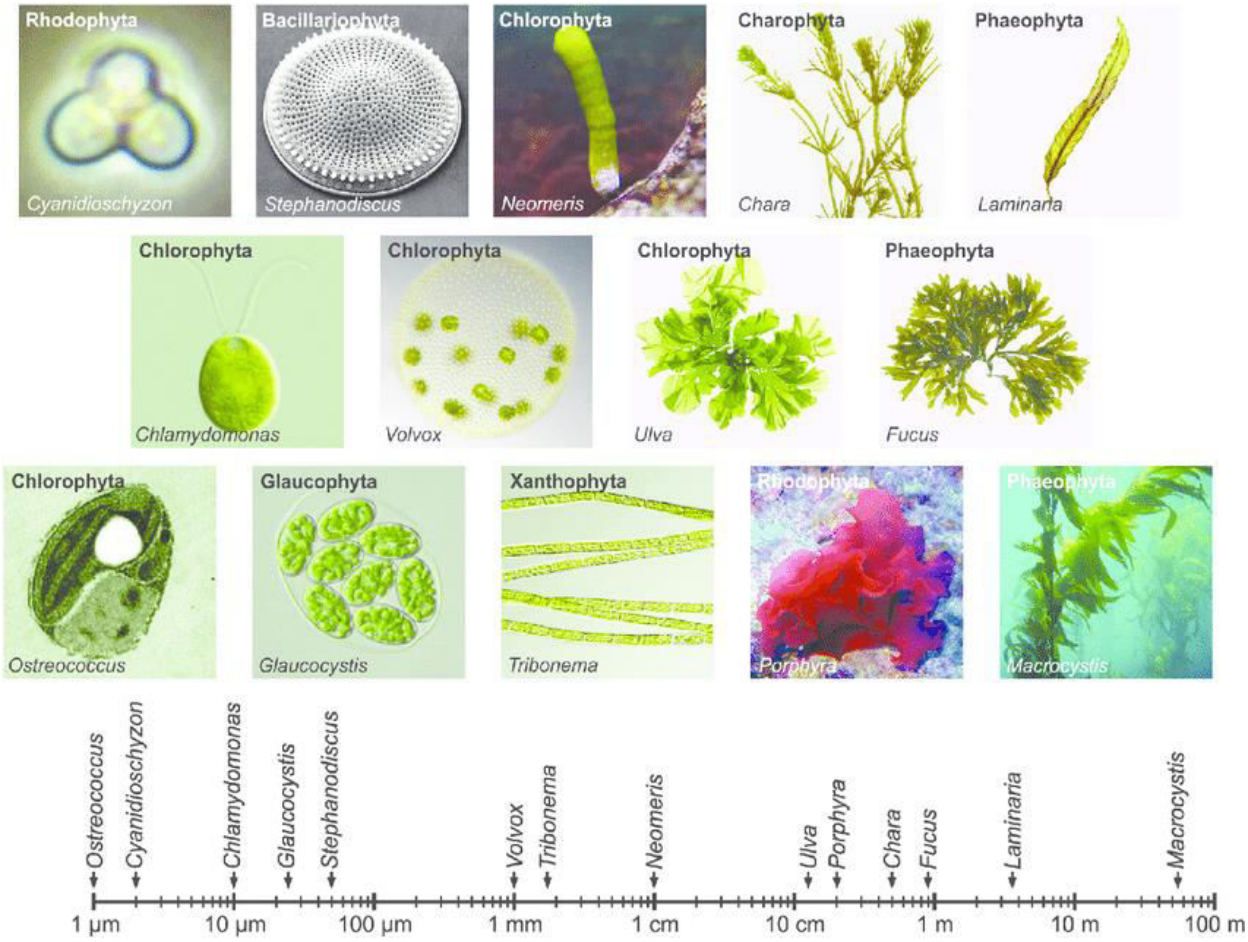
ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

Visit: www.ijmrsetm.com

Volume 1, Issue 2, November 2014

Such blooms can harm aquatic communities, limit recreational and economic functions of lakes, and even threaten human health. Thus, controlling eutrophication and mitigating algal blooms are important and essential issues for Makrera lake management. The eutrophication of lake is basically due to cyanophyceae viz. *Nostoc, Anabaena*. The other species of algae identified from Makrera lake were *Chlorella, Spirulina* , *Oscillatoria, Vaucheria, Gelidium, Volvox, Fucus*, *Stephanodiscus, Neomeris, Chara, Laminaria, Chlamydomonas, Ulva, Ostreococcus, Glaucocystis, Tribonema, Prophyra, Macrocyctis* etc.[13,14]



Hence it was seen that maximum dominance was of chlorophyceae.

The lake bottom was covered by mud due to sedimentation of particles in the water, which comprise inorganic silt derived from surrounding lands and organic particles of dead plants and animals sinking down the water column. These act as food for the bottom dwelling animals and source chemicals to the water. [15,16]

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

Visit: www.ijmrsetm.com

Volume 1, Issue 2, November 2014

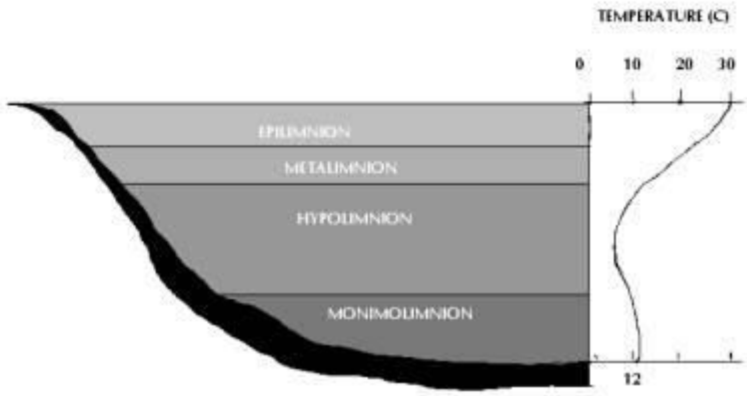


Figure 2: Thermal stratification of Makrera lake in Beawar

These bottom sediments are principal sites of decomposition. Sediments with high organic content contain large numbers of bacteria, which break them into smaller inorganic molecules. These bacteria require oxygen and when the sediment becomes totally devoid of oxygen, they start to adsorb it from the overlying water. The Makrera lake is stratified, then there is no mixing of hypolimnion and hence no replenishment of oxygen to the lower layers. This leads to anoxic conditions and death of animals. When the sediments are devoid of oxygen, some processes of decomposition cannot occur, but other chemical reactions that occur only in the absence of oxygen take over. Anaerobic bacteria can operate without oxygen and break down large quantities of organic matter in the mud to produce methane gas (made up of carbon and hydrogen CH_4). The released methane is used as energy by other bacteria, which are aerobic and can live only in oxygenated conditions. Other anaerobic bacteria can use sulphates and the by-product of their activity is hydrogen sulphide. [17]

Results

Makrera is a fresh water lake showing well balanced ion compositions.

Anions	Percent	Cations	Percent
HCO_3	73%	Ca^{2+}	63%
SO_4	16%	Mg^{2+}	17%
Cl	10%	Na^+	15%
		K^+	4%
Other	<1%	Other	< 1%

Table 1: Ion balance for fresh water in Makrera lake

Preventing nutrient contamination in water doesn't completely solve the issue. Growth, decay, gravity, and eutrophication will continue the internal phosphorus cycle in Makrera lake. Plus, human activities such as agriculture accelerate eutrophication. This, in turn, further releases nutrients stored in the sediment. Concerningly, this can lead to irreversible, long-term damage in the ecosystem. Sustainable algae management practices aim to reduce the inflow of nutrients in water bodies. Long-term success requires changes in policies and human activities. Therefore, it can take several years to significantly improve water quality of Makrera lake near Beawar.Excessive cyanobacteria and green algae in water bodies can deteriorate water quality. These organisms can releases potent toxins that often lead to massive fish and animal die-offs.They can also impact humans, causing illness, paralysis, liver cancer, or even death. Contaminated water can endanger the entire water supply, as these toxins and metabolites dissolve in water, escaping the conventional treatment.[16]

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

Visit: www.ijmrsetm.com

Volume 1, Issue 2, November 2014

IV.CONCLUSIONS

The Makrera lake is useful economically because the algal population can be used for biofuel production. This can help the villagers. Also employment opportunities would increase by treating freshwater of lake regularly and fish cultures can be increased. Spirulina found in this lake is an important nutritive algae. Its cultivation by culturing in tanks and drying into cakes and powder is useful protein source for man. Spirulina capsules can be made and sold economically. Thus we can gain many economic benefits and employment opportunities from Makrera lake.[17]

REFERENCES

[1] Adoni, A., D. G. Joshi, K. Gosh, S. K. Chourasia, A. K. Vaishya, Mano Yadav and H. G. Verma: Work book on limnology. Pratibha Publishe Sagar. pp. 1-166 (1985).

[2] Agarker, M. S., H. K. Goswami, S. Kaushik, S. M. Mishra, A. K. Bajpai and U. S. Sharma: Bionature, 14, 250- 273 (1994)

[3] Indian standard (IS: 3025-1964) Methods of sampling and Test (Physical and Chemical) for water used in Industry. Bureau of Indian standards, New Delhi. 122 pp.

[4] APHA, (1998). Adv. Appl. phycol. II B:3-4.

[5] Bartram, J. & Rees, G. 2000. Monitoring bathing waters –A practical guide to the design and implementation of assessments and monitoring programmes. World Health Organisation, Boundary Row, London.

[6] Chaturvedi, R. K., K. P. Sharma, Kamayani Sharma, S. M. Bhardwaj and S. Sharma: J. Environ. Pollut., 61, 77- 84 (1999).

[7] Chia, A. M., Abolude, D. S., Ladan, Z., Akanbi, O. & Kalaboms, A. 2009a. Research Journal of Environmental Toxicology 3:170-178.

[8] Gandhi. H. P. (1998) Freshwater Diatoms of Central Gujarath.Bisen Sing Mahendra Singh Pal Singh pub. Deharadun.

[9] Goldman, C. R. and A. J. Horne. 1983. Limnology. McGraw-Hill.

[10]Giriyappanavar. B. S. and Patil. R. R. Proceedings of the National conference. Karnataka University Dharwad. 2011. 104–108p.

[11]Hosmani. S. P. (2010) The Ecoscan 4(1):53-57.

[12]Hosmani. S. P. and S.G. Bharathi (1980) PHYKOS 19(1):27-43.

[13]Hutchinson, G.E. (1967). A Tritese on Limnology. Vol. II. Introduction to lake biology and the Limnoplankton. John Wiley and Sons Inc. New York. Pp.1115.

[14]Mackenzie, C. L., Morrison, A., Taylor, D. L., Burrell, V. G., Arnold, W. S., and Wakida-Kusunoki, A. T. 2002. Quahogs in Eastern North America: Part I, Biology, Ecology, and Historical Uses. Marine Fisheries Review 64:1–55.

[15]M. F. Ansari, R. F. Ankalgi and S. R. Ankalgi (2008).

[16]Monastersky, 1995. science news 148:220-222.

[17]Palmer, M. A., Covich, A. P., Finlay, B. J., Gibert, J., Hyde, K. D., Johnson, R. K. and Kairesalo, T. 1997. 17. Biodiversity and ecosystem process in freshwater sediments. Ambio, 26(8).