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Research Article

The Growth of Algae Due to Physico-Chemical Parameters Concerning Climate Change in Shakambari Conservation Reserve, Rajasthan

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ABSTRACT

Finding biological factors affecting algal development is crucial in managing an ecosystem. Algae are small aquatic plants found as individual cells or in areas of varying sizes. They are an essential link in the aquatic food chain, serving as food for microscopic animals called zooplankton. As a byproduct of photosynthesis, algae also release oxygen into the water for use by fish and other aquatic animals. This paper proposes an approach to estimate algae's biological parameters, which are important factors in controlling eutrophication, using modelling and exploration techniques. Algae growth and respiration rates were estimated using a one-dimensional water quality model and two-dimensional spatially distributed water quality data obtained from Kot Dam of Shakambari Conservation Reserve Jhunjhunu District, Rajasthan. In total, 26 algae were found in the sample. The highest amount of algae corresponds to Green algae, Flagellate algae, Cyanobacteria, and Diatoms, of which 18 and 21 algae were identified in the summer and spring seasons, respectively. Natural freshwater algal growth is determined using a physico-chemical approach that provides an alternative method for estimating the biological parameters of algae beyond sampling and in situ testing.

Keywords: *Algal growth, biological parameters, water quality model, eutrophication, in situ testing.*

INTRODUCTION

Water is most important for Life on earth and for regulating the climate of our Environment. It is one of the most important compounds that profoundly affect Life. The quality of water is often described in terms of its physico-chemical and biological properties. The process of rapid industrialization and the indiscriminate use of chemical fertilizers and pesticides in agriculture cause heavy and diverse aquatic pollution, leading to the deterioration of water quality and depletion of aquatic ecosystems.

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Due to the use of contaminated water, people get water-borne diseases. Therefore, it is necessary to check the water quality periodically. Parameters that can be tested include temperature, pH, turbidity, salinity, nitrate and phosphate. Assessment of aquatic invertebrates can also provide an indication of water quality. Algae are an important component of biological monitoring programs to assess water quality. Algae have been considered a useful tool for assessing long-term ecosystem changes such as those associated with eutrophication, water management, watershed-scale land-use changes, and climate change. In this sense, algae appear as a useful bioindicator because they respond quickly to changes in ecosystem situations, thus allowing rapid assessment of water quality. However, performing continuous analysis is not useful because of specific time and cost constraints. However, biological measurements can reveal all aspects of water quality over time and directly measure the ecological impact of ecosystem variables. Biomonitoring provides a reliable and relatively inexpensive means of recording conditions at several locations. Algae qualify for water quality assessment due to their nutrient requirements, fast reproduction rate and very short life cycle. Algae are significant indicators of environmental health because they react directly to the qualitative and quantitative composition of species in an extensive range of water parameters due to changes in water quality, such as increased water pollution.

MATERIALS AND METHODS

The research work was carried out from the Kot Dam of Shakambari Conservation Reserve, Jhunjhunu District. Shakambari Conservation Reserve is surrounded by Aravalli Hills and spans over 13,100 hectares of forest land. The total geographical area is 144 square kilometres.

Figure 1- Kot Dam in Shakambari Conservation Reserve

Kota Dam, also known as Sarju Sagar Dam (Bandh) is located in the Shakambari Reserve in Aravalli Hills and is 13 km from the Udaipu rwati town of Jhunjhunu. The dam was built between 1923 and 1924 for the purpose of water storage and irrigation.

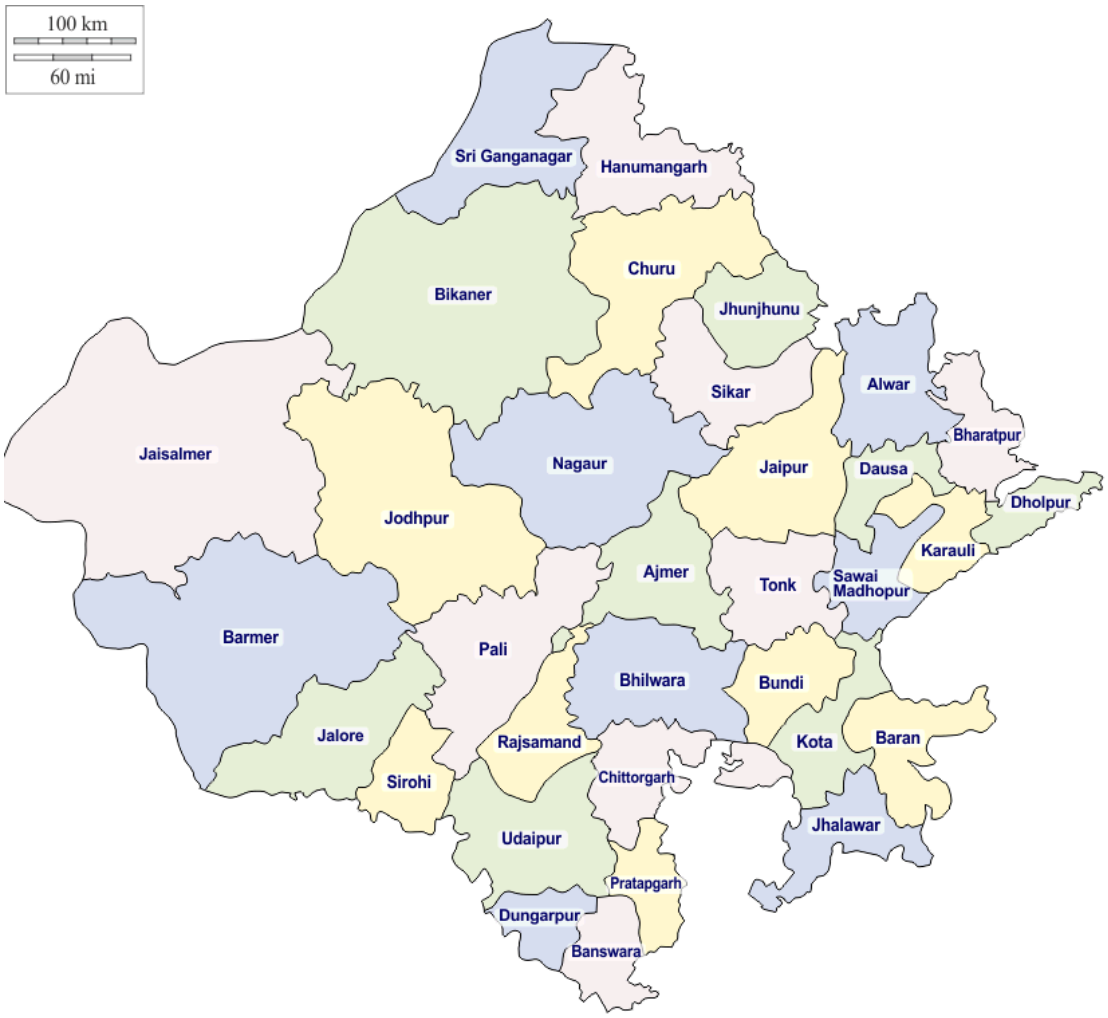

Figure 2- Rajasthan Map

Water sampling–

Water samples will collect monthly from the Kot Dam for the physical-chemical analysis in the 1-liter bottle before 8 am. Some Physico-chemical parameters will study on the spot and others in the laboratory, according to American Public Health Association (APHA), Water Pollution Control Federation (WPCF), and American Water Association (A.W.A.).

Water Testing –

Some physicochemical characteristics of Dam water will be analyzed in the period of two years. Physical factors such as temperature, electrical conductivity (E.C.), colour, odour, total suspended solids (T.S.S.), total solids (T.S.), total dissolved substances (T.D.S.), turbidity and chemical parameters such as pH, alkalinity, hardness, dissolved oxygen (D.O.), biochemical oxygen demand (B.O.D.), chemical oxygen demand (C.O.D.), salinity, chloride, fluoride, phosphate & nitrate were examined.

(a) Temperature–using the centigrade thermometer.

(b) Turbidity–using turbidity meter.

(c) Hydrogen ion concentration (pH)–by using pH meter.

(d) Free carbon dioxide-using titrimetric method.

100 ml sample titrate with 0.1 N NaOH Solution + phenolphthalein indicator

Dissolved oxygen (D.O.)- by using Winkler modified method.

300 ml sample in B.O.D. bottle + 2 ml. Manganese sulphate + 2 ml. Alkali-iodide-azide reagent → shake bottle of 15 mint., ppt appear + 2 ml. conc. H2SO4 → ppt dissolve. Then this 100 ml. solutions titrant with 0.025 N. Sodium thiosulphates. With starch indicator.

A = ml titrant used

N = Normality of Titrant

V 1 = ml of sample

V 2 = ml of MnSO 4 + alkali iodide azide

Biological oxygen demand (B.O.D.) – By using Winkler's modified method.

Algal sampling-

The algal samples will collect from Kot Dam of shakambari conservation reserve. The Algal samples will be collected by plankton net of No.18nylon bolting cloth (mesh size 0.072 mm), transferred into the glass bottle, and preserved in 4% formalin solution. According to laboratory and microscopic study literature, the identification of Algae will be on the basis of their morphological feature up to the level of species.

RESULTS AND DISCUSSIONS

Chemical analysis of water quality, such as organic/inorganic pollutants, and salinity, inorganic nutrients, organic nutrients, is descriptive. However, continuous analysis is not beneficial because of the specific time and cost restrictions. However, biological measurements can reveal all features of water quality over time and arrange for a direct measure of the ecological effect of ecosystem variables. Biomonitoring provides a reliable and relatively inexpensive means of recording conditions at several locations.

In total, 26 algae were found in the sample. The highest quantity of algae has resembled with *Green algae, Flagellate algae, Cyanobacteria, and Diatoms,* respectively, of which 18 and 21 algae were identified in the summer and in spring seasons, respectively.

The following properties of Algae make them more suitable for biological monitoring than other ecosystems -

A. Algae are autotrophs located at the junction between the habitat and the biological constituents of the food web.
B. Algae are mainly stemless; they can't migrate to evade pollution and therefore suffer or die.
C. Algae communities are rich in species, and each has its own tolerance.
D. All algae have short life cycles and are responsive to change, while communities live long enough to absorb impacts over time.
E. Algae are spatially dense and easy to sample and store.
F. Algae are smaller than other populations of organisms and are, therefore, likely to be more sensitive to contamination at lower concentrations.

CONCLUSIONS

In the present study, we investigated and predicted the changes in water quality and evaluated the risk of algal growth in Kot Dam induced by water transfer through the algal growth potential (A.G.P.) test. Our study showed that the growth of algal species could be decreased by 8.7% in Dam water.

Secchi Disc Depth

Secchi Disc depth determines in part, the quality of the water, both aesthetically and visually. Secchi's average records in spring and summer are 3.96 meters and 4.23 meters, respectively. As an outcome, the reservoir has low transparency in terms of algae growth.

The physical and chemical characteristics of the water, the structure of phytoplankton and the diversity of algae, and the basic hydrological data, allowed the study of the Kot Dam. We studied for three months. The influence of severely polluted dam boundaries, surface water and deep water quality is noted. The hydrodynamic dynamics of the system were also discovered by physical and chemical variables and diversity due to algal growth.

The main features of each section are as follows:

Result 1: surface water quality and algal growth, increased concentration of ions and oxygen concentration, limited phytoplankton density due to overflow from the Kot dam. The toxic effect of substances on algae is reduced.

Result 2: Deepwater quality and low algal growth, low oxygen concentration; extremely high nutritional component, nitrogen is mainly in the form of ammonia of nitrogen; eutrophication or super nutrient systems; the

dominance of small central diatoms and Chlorella; Heavy metal concentrations far exceed levels that are protective for aquatic Life.

Result 3: increased depth, breadth, speed and depth of water; improved water quality with the restoration of dissolved oxygen concentrations; nutritional value and chlorophyll corresponding to the eutrophication system; evidence of toxic effects on algae.

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Conflict of Interest:
There is no conflict of interest with this manuscript.

Author Contribution:
Both authors contributed equally to establishing the research and design experiment topic.

REFERENCES

Bergström, A. K. (2010). The use of TN: T.P. and DIN: T.P. ratios as indicators for phytoplankton nutrient limitation in oligotrophic lakes affected by N deposition. *Aquatic Sciences. 72*, 277–281.

Good, G. A. (2005). Harmful cyanobacteria: from mass mortalities to management measures. *Aquatic Ecology. 3*, 1–23.

Reynolds, C. S. (1984). The Ecology of Freshwater Phytoplankton. Cambridge: Cambridge University Press; P- 384-392.

Chellappa, N. T., & Câmara, F. R. A. (2009). Rocha O. Phytoplankton community: indicator of water quality in the Armando Ribeiro Gonçalves Reservoir and Pataxó Channel, Rio Grande do Norte, Brazil. *Brazilian Journal of Biology. 69*(2), 241–251.

European Environmental Agency (1999). Nutrients in European Ecosystems. Environmental Assessment Report No. 4. Copenhagen: *European Environmental Agency*; 155 p.

Padisa'k, J., Ga'bor, V., & Ga'bor, B. (2016). Psychogeography of freshwater phytoplankton: traditional knowledge and new molecular tools. *Hydrobiologia. 764*, 3–27.

Baas-Becking, L. G. M. (1934).Geobiologie of inleiding tot de milieukunde. van Stockum and Zoon, The Hague. P- 234- 243.

Karacaoğlu, D., Dalkiran, N., & Dere, Ş. (2006). Factors affecting the phytoplankton diversity and richness in a shallow eutrophic lake in Turkey. *Journal of Freshwater Ecology. 21*(4), 575–581.

Baykal, T., Akbulut, A., Acikgoz, I., Udoh, A. U., Yıldız, K., & Şen, B. (2002). New records for the freshwater algae of Turkey. *Turkish Journal of Botany*. 141–152.

Gokce, D., & Ozhan, D. (2011). Limno-ecological properties of deep reservoir, Karakaya HEPP, Turkey. *Gazi University Journal of Science. 24*(4), 663–669.

McQuatters-Gollop, A., Gilbert, A. J., Mee, L. D., Vermaat, J. E., Artioli, Y., Humborg, C., & Wulff, F. (2009). How well do ecosystem indicators communicate the effects of anthropogenic eutrophication? *Estuarine Coastal Shelf Science. 82*, 583–596.

Bellinger, E. G., & Sigee, D. C. (2010). Freshwater Algae: Identification and Use as Bioindicators. West Sussex, UK: Wiley-Blackwell; 284 p.

Law, R. J. (2011). A review of the function and uses of, and factors affecting, stream phytobenthos. *Freshwater Reviews. 4*(2), 135–166.

Çelekli, A., & Külköylüoğlu, O. (2007). On the relationship between ecology and phytoplankton composition in a karstic

spring (Cepni, Bolu). *Ecological Indicators. 7*, 497–503.

Demir, A. N., Fakioğlu, Ö., & Dural, B. (2014). Phytoplankton functional groups provide a quality assessment method by the Q assemblage index in Lake Mogan (Turkey). *Turkish Journal of Botany. 38*, 169–179.

Roka, D., Rai, S. K., & Prasad, N. (2022). Seasonal variation of algal diversity in response to water quality at Beeshazari lake, tropical land, Nepal. *Pak. Journal of botany. 54*(4), 1445 – 1452.

Jagdish Prasad, T. (2014). Biodiversity of aquatic plants of Shivani bandh lake of Sakoli tehsil of Bandara district of MS, India, *International Journal of Life Sciences, A, 2*, 211-213.

Meena, S. K. & Shrivastava, P. (2020). Reduction in water pollution in Kalisindh river due to lockdown under COVID-19 pandemic. *International journal of research and analytical reviews (IJRAR). 7*(4).

Srivastava, N., Suseela, M. R., & Toppo, K. (2018). Freshwater algal diversity of central India, *international journal of research and development in pharmacy and life science, 7*(4), 3039 –3049.

Das, M., & Semy, K. (2022). Seasonal monitoring of algal diversity and spatiotemporal variation in water properties of simsag river. *Sustainable water resources management. 8*(1), no. – 1 – 9.