

Wetland ecology: seasonal variations in selected Physico-chemical properties of Bharmela pond of Menar village, District Udaipur (Rajasthan), India

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ABSTRACT

The present study deals with the seasonal investigations related to the certain physico-chemical characteristics of the wetland Bharmela located in village Menar (Rajasthan). The surface water samples for this study were collected during January, 2018 to December, 2018. The water quality parameters were tested following standard methods at preselected sampling site of the pond. The range of physico-chemical parameters observed for temperature was between 18.2-27.3 °C, for pH between 7.8-9.3, 70-80 ppm for the Total alkalinity, 7.3-9.4 ppm for D.O., 22.72-36.92 ppm, for Chloride, 1.00-2.00 ppm for nitrate, 28.0-38.0 ppm for sulphate and 0.05-0.10 ppm for phosphate whereas the depth of visibility during the study period ranged between 27.0-54.0 cm. The results of physico-chemical parameters indicate that water quality of this pond remained congenial for supporting good biological production at different trophic levels which obviously helps to attract several bird species from far distances. However, considering importance of this wetland as an important bird site, it is necessary to control influx of any type of waste and undesirable human activity in this water body.

Key words : Wetland ecology, Physico-chemical parameters, Bird paradise

Introduction

Water is one of the priceless gift of nature on planet earth. It is the most vital resource for all forms of biodiversity existing in our biosphere. In order to ensure sustained use of any water body, there is need to understand the dynamics of nutrients by conducting appropriate water quality studies. Such study would obviously comprises of evaluation of selected physical and chemical properties of concerned ecosystem.

Sustainable use of water resource requires the better understanding of surface water in order to ensure proper monitoring program which may help in decision making (Giardino *et al.*, 2007). As it is

well known that polluted water is unsuitable for drinking, recreation, scenic beauty, agriculture and industries or even as a safe habitat for the aquatic life. Pollutants are generally associated with the direct input of waste products generated from the nearby habitation if not channelled properly. Moreover, rapid urbanization have exaggerated sewage problems and mostly it is untreated or partially treated that contributes significant quantities of nutrients, suspended solids, dissolved solids, oil and biodegradable organic carbon to the water environment (Verma *et al.*, 2013). Eventually, it is also a hazard to human health if such contaminated water is used as source of drinking water. Thus, preserving desirable water quality is a matter of great concern

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to cope with the growing water crisis.

The present study was done to analyse physical and chemical characteristics of Bharmela wetland of Menar village in Udaipur district of Rajasthan. This wetland is situated along NH 76 on Udaipur-Chittorgarh Road about 40 kilometres from Udaipur city. The area of wetland is about 32.27 hectares with maximum depth of 8.5 m. In winter season large number of local and migratory birds thus making this site a bird paradise.

Materials and Methods

Water sample for the present study were collected from January, 2018 to December, 2018 for the three seasons *viz.* winter, summer and monsoon. The water temperature pH and D.O. were analysed immediately on the spot soon after the collection of surface water sample whereas the analysis of remaining parameters was done in the laboratory.

The collected water samples were analysed according to the methods described by APHA (1985).

Results and Discussion

Data collected on various water quality parameters are presented in Table 1.

Temperature

The temperature is basically important for its effects on the water chemistry and biological reactions in the water (Trivedy and Goel, 1984). The maximum (27.3 °C) temperature was recorded during Summer season and minimum (18.2 °C) was recorded during the winter season.

pH

pH is the measure of intensity of acidity or alkalinity

and it measures the concentration of hydrogen ions. pH of water gets drastically changed with time due to the exposure to air, biological activity and temperature changes. Significant change in pH occurs due to disposal of industrial wastes, acid mine drainage etc. In the present study maximum pH(9.3) of pond water was recorded during summer season and minimum pH(7.8) was recorded in monsoon season. Such changes in pH are assigned mainly to natural alterations in the seasonal dynamics of nutrients and gases along with changing scenario of biological activities in the ecosystem of this wetland. The amount of human interference into this water body is almost negligible.

Dissolved Oxygen

Dissolved oxygen is one of the important parameters in water quality assessment. It reflects the biological and physical processes prevailing in the water. Its presence is essential for the metabolic activity of aquatic ecosystem and their inhabitants. Main source of dissolved oxygen in natural waters are mainly attributed to photosynthesis by biota and diffusion gradient at the air- water interface and to some extent by the wind driven mixing (Sharma and Saini, 2003). A minimum of 5 ppm of dissolved oxygen is required for survival and growth of aquatic life and particularly for fish species. The value of dissolved oxygen varied between 9.4 to 7.3 ppm. In the present studies, the maximum amount of dissolved oxygen of was recorded during summer and minimum was recorded during monsoon. According to Kataria *et al.*, (2006) depletion in dissolved oxygen in water is due to high temperature and increased microbial activity. The high dissolved oxygen recorded in summer period may be due to increased photosynthetic activity in the pond mainly contributed by algal communities.

Table. Season wise physico-chemical parameters of Bharmela wetland, Menar.

Parameter	January, 2018 to December, 2018		
	Summer	Monsoon	Winter
1 Temperature °C	27.3	24.6	18.2
2 pH	9.3	7.8	8.2
3 Dissolved oxygen (ppm)	9.4	7.3	8.7
4 Depth of visibility (cm)	27.0	54.0	30
5 Chloride (ppm)	36.92	36.92	22.72
6 Nitrate (ppm)	2.00	1.00	2.00
7 Sulphate (ppm)	38.0	38.0	28.0
8 Phosphate (ppm)	0.10	0.10	0.05
9 Total Alkalinity (ppm)	70	80	80

Depth of visibility: Depth of visibility of water is inversely proportional to the turbidity, which in turn is directly related to the amount of suspended organic and inorganic matters. Turbidity is also a measure of the light scattered by suspended particles. A reduction in turbidity is associated with a reduction in suspended matter and microbial growth (Verma *et al.*, 2013). The maximum turbidity in water was recorded during monsoon season and minimum turbidity was recorded during summer season (27.0 cm). This indicates that role of silt during monsoon in this wetland was not very significant as it is not directly connected to any major river. The visible variations in turbidity are due to changing population density of plankton.

Chloride

Chloride is widely distributed in natural waters, generally in the form of sodium chloride (NaCl), Potassium Chloride (KCl) and Calcium Chloride (CaCl₂). The most important source of chlorides in the inland waters is the discharge of domestic sewage. Therefore, chloride concentration serves as an indicator of pollution of animal origin. The minimum value was recorded during winter season and the maximum during summer and monsoon season. In summer water concentration due to evaporation occurs whereas in monsoon there is influx of organic wastes from the catchment area.

Nitrates

Nitrate represents the highest oxidized form of Nitrogen. The most important source of the nitrate is biological oxidation of organic nitrogenous substances which come in sewage and industrial wastes. The maximum value of nitrate was recorded during summer and winter seasons (2.00 ppm) and minimum value (1 ppm) was recorded during monsoon.

The NO₃ is usually derived from anthropogenic sources like agricultural field, domestic sewage and other waste effluents containing nitrogenous compounds (Das and Acharya, 2003). Sometimes other forms of nitrogen such as ammonium and/or nitrate are also found as a by product of organic decomposition.

Sulphate

The sulphate ions are usually second to carbonate as the principal anion in freshwater although chloride occasionally surpasses it. Sulphates are mainly de-

rived from sedimentary rocks. The maximum (38.0 ppm) sulphate of water was recorded during summer and monsoon seasons and minimum (28.0 ppm) value was recorded during the winter season.

Phosphates: Phosphate is considered to be the most significant among the nutrients responsible for eutrophication of wetlands and such inland waters as it is the primary factor for biological production. The excess amount of phosphate may however, cause eutrophication leading to extensive algal growth (algal blooms). It may be due to addition of human waste and release of detergents into the aquatic environment (Verma *et al.*, 2013). In the present study maximum (0.10 ppm) phosphate in water body was recorded during summer and monsoon seasons and minimum (0.05 ppm) phosphate was recorded during winter season. Higher levels of phosphate in summer and monsoon can be explained for the concentration of this nutrient in summer and influx from the catchment in monsoon.

Alkalinity

The value of alkalinity in water provides an idea of natural salts present in water. The change in alkalinity depends on quantities of carbonates and bicarbonates, which in the turn depends upon release of CO₂. The maximum value (80 ppm) of alkalinity of water was recorded during monsoon and winter seasons and minimum value (70 ppm) was recorded during summer season. The degradation of plants & other living organisms and organic wastes might also be one of the reasons for variations in a carbonate and bicarbonate, resulting an increase in alkalinity (Chaurasia and Pandey, 2007; Verma *et al.*, 2011). However, seasonal variations in alkalinity were rather marginal in this wetland which affirms that such changes were on account of internal nutrient dynamics and not because of extraneous factors.

Conclusion

The present study deals with the analysis of certain physico-chemical parameters of Bharmela wetland of Menar. A seasonal physico-chemical study of water during all the three seasons revealed the water body depicted appreciable seasonal fluctuations mainly due to internal nutrient dynamics. The influence of anthropogenic factors on water quality was very limited as also evident from the water quality scenario which is a positive aspect of this wetland

ecology. Such pristine status of Bhermela wetland may be a major factor which help in attracting birds.

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