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Water Chemistry of a lacustrine environment : The Sugaon lake of East Champaran District of Bihar, India

Kumari Priyanka, Susama Kumari[1], Neha Raj[2], Gaytri Gupta[3] and *Safal Kumar Mishra

P.G.Department of Zoology,
B.R.A. Bihar University,
MUZAFFARPUR-842001 (BIHAR), INDIA
[1]Department of Zoology,
R.N. College, HAZIPUR- 844101 (BIHAR), INDIA
[2]Department of Zoology,
P.K.University, SHIVPURI-473665 (M.P.), INDIA
[3]NARKATIAGANJ-845455 (BIHAR), INDIA
*Corresponding Author
E-mail : dr.safalmishra@gmail.com

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ABSTRACT

Water of a lacustrine ecosystem is the most important element of all forms of life. It plays a vital role in determination of the structure and composition of the biotic community on the watery planet earth. Water Chemistry and visual observations revealed that the condition of Sugaon Lake has been deteriorating under anthropogenic pressures, and if proper conservation measures are not taken, this lacustrine ecosystem is likely to further deteriorate.

Figure : 00 References : 19 Table : 01
KEY WORDS : Bihar India, Lake, Sugaon, Water Chemistry.

Introduction

The Gandak basin of the Ganga River System in North Bihar is bestowed with many highly biologically significant naturally formed meanders , the ox – bow lakes . The lake district East Champaran of Bihar has a chain of 28 lakes extending over an area of 7486 acres. Sugaon lake of East Champaran district is one of the largest lake which evidently mark an old bed of the river Great Gandak. Lakes, the heaven of biodiversity , occupy about 1.8% of the planet earth which is 0.19% of the total volume of water in the hydrosphere. Lakes are inland bodies of water that lack any direct exchange with an ocean . A lake and its watershed are often considered to be single ecosystem[10]. An oxbow is a lake that forms when a section is cut off, leaving a separate body of water[11]. Water of a lacustrine ecosystem is a reanewable resource and made up of physical, chemical and biological properties. It is the most important element of all forms of life on the watery planet earth and biosphere . The water chemistry of an equatic ecosystem plays a vital role in determination of the structure and composition of the biotic community . The physico – chemical characteristics are highly influenced by altitude, climate, vegetation, cultural activity in the vicinity of the lakes *etc.* There are a number of studies pertaining to limnology of North Bihar lakes[8,9,14-17,19] but no limnological work has been done on Sugaon lake in the past, hence the present study is aimed to give an account of its history, origin and physico – chemical characteristics of water to suggest conservative measures.

Materials and Methods

Sugaon lake lies between 26^0 16' N Latitude and $84^0$30'- $85^0$10' E Longitude and is located at a distance of about 19.5 km west of Motihari town, the headquater of East Champaran district of Bihar. Lake water samples were collected in the morning (10 – 11 AM) from different sampling sites at monthly intervals for a year (September , 2021 to March, 2022). Water samples were collected at distance of about 5 meters form the bank and at a depth of about 0-25 m. Temperature, Hydrogen ion concentration, Total Dissolved Solids estimation and Dissolved Oxygen chemical fixation were done on the spot. Water Samples were further analysed for their physico - chemical parameters following standard methods[1,18,19].

TABLE-1. Physico – chemical parameters of water samples of Sugaon Lake. All values are in mg/L except temperature, pH and transparency

S. No.	Parameter	Range
1	Colour	Light Yellowish
2	Transparency(cm)	60 -140
3	Temperature (^{0}c)	18 – 34.5
4	pH	7.2 - 8.4
5	Total Solids	160 – 240
6	Total Dissolved Solids	16 – 218
7	Total Alkalinity	205- 480
8	Dissolved Oxygen	4.5 – 15.0
9	Free CO_2	8.5 - 22
10	Chloride	19 - 30

Nomenclature, History and Origin

The nomenclature has originated from United States and is derived from resemblance in shape to the wooden U- shaped collar placed around the neck of a draft – ox and attached to the yoke[6] . The ox –bow lakes are variously termed in various parts of India and abroad.

In North Bihar they are called Maun or lake, in Uttar Pradesh as Tal or Jheels , in Assam and West Bengal Beels. In Australia the ox-bow lakes are called as Bellabongs, in France as Lones and In Germany as Altwasser[6]. The history of Sugaon lake dates back to more than hundred years and it is belived that it originated after the great flood of 1867 A.D. in most siginificant river Burhi Gandak due to the fluviatile activity of the river and its tributaries. The river Burhi Gandak prior to the construction of imbankments changed their courses forming meanders . The meanders were partially or fully cut- off from the original river and assumed the status of open /live or closed /dead ox bow lakes .

Observations and Discussion

Physico – chemical parameters of water samples of Sugaon lake (September, 2021 to March, 2022) and their permissible limits have been depicted in Table- 1. Sugaon lake is U- shaped in extension and is fed by the flood water of the river Dhanauti. The river Dhanauti is a tributary of the river Burhi Gandak. The river Burhi Gandak is also known as Sikrahana .The Sugaon lake is a live, open lake and shows a greater potentialities for fisheries development. The lake is becoming shallow to shallower every year due to silting.

Sugaon lake extend over an area of 80 hactare. Its depth varies from 3 to 20 feet and the water never dries up. The climate of the study area is temperate monsoonic *i.e.* Summer, Winter and Rainy. Lake water colour was light yellowish and transparency ranged between 60 – 140 cm.showing eutrophication status. In the present investigation the marked increase in human population, maximum biotic interferences and associated cultural activities have might caused a reduction in lake water transparency . The temperature ranged from 18 – 34.5^{0}c. Lake water temperature was high in May and lower in the month of December. It depend upon the climate, sunlight and depth of the waterbody and regulate the environmental natural processes. pH range was narrow and usually above 7.0 (7.2 – 8.4). In the present investigation the lake water was always alkaline and its limit was found within the acceptable range for various purposes. The pH was considered to be conductive for aquatic life[13] and pH of water between 6-7 to 8.4 is suitable for most of the aquatic species including fishes[3] .Total Solids and Total Dissolved Solids ranged between 160-240 mg/L and 16-21.8 mg/L respectively .

Dissolved Oxygen, a vital factor for organisms, indicate the health of the waterbody . It fluctuated between 4.5 – 15.0 mg/L , being maximum during the summer season. Oxygen plays the most important role in determining the potential biological activity of water. It is essential for respiration , helps the breakdown of organic detritus and enables completion of biochemical pathway[2]. It is added in the water *via* diffusion and photosynthesis whereas it is removed from the water *via* respiration and decomposition[5]. Free CO_2 is the end product of respiration and aerobic decomposition of organic matter, the absolutely essential for photosynthesis in small quantity[19]. In larger quantities it is rapidly fatal acting as narcotic[4]. In the present study the value of CO_2 ranged from 8.5 – 22 mg/L. In lake water Chloride concentration varied from 19-30 mg/L. Any access of Chloride over 5.5 mg/L in water is associated with contamination by animal organic matter[7] and in the present study this limit always exceeded which indicates pollution through animal and human sources in the lake water. Visual observations revealed that the lake bank is heavily infested with aquatic weeds.

All the cultivated land in the catchment area is under rice, wheat, ,maize and vegetables cultivation. Many other anthropogenic activities like rapid cutting of surrounding vegetation, bathing, washing, open defecation, religious offerings, cultural activities, unsustainable land use and agriculture around the lake using agrochemicals are causative factors for the deterioration of this lacustrine ecosystem and if proper conservation masures are not taken, the lake is likely to further deteriorate.

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