

Physico-Chemical Characteristics of Telaria Water Body of the Kaula Chaur (Wetland) in Begusarai District (Bihar)



Zoology

KEYWORDS : Chaur, telaria, pH, FCO₂, alkalinity

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ABSTRACT

The district Begusarai, an important district in the state of Bihar lies on the northern bank of river Ganga. It has two important wetland namely Kaula chaur and Bhagwanpur chaur. The Kaula chaur is large water spread area. Telaria is one of the water logged area of Kaula chaur. The total water logging area of Telaria during monsoon is 40 to 50 ha. The physico-chemical parameters play a vital role in the wetland ecosystems. The present work is an attempt to elucidate the details of the physico-chemical parameters of Telaria viz. water temperature(WT), transparency of water(TW), pH, dissolved oxygen(DO₂), free carbon dioxide(FCO₂), electrical conductivity(EC), total hardness(TH), total alkalinity(TA), phosphate(PO₄³⁻) and nitrate(NO₃⁻). Present investigation shows that Telaria's water has suitable range of WT(16.0 – 33.3°C), alkaline pH(7.12 – 7.93), medium to high level of DO₂ (5.4 – 8.9ppm). It represents moderate level of FCO₂ (6.0 – 9.5ppm), EC(92 – 132 µs), TH(89 – 136ppm), TA(76 – 112ppm), PO₄³⁻(0.07 – 0.19ppm) and NO₃⁻(0.08 – 0.22ppm). Present study will help for further strategy for the development of mentioned wetland.

INTRODUCTION

The district Begusarai is an important district in the state of Bihar. It lies on the northern banks of river Ganga. It is geographically lying between latitude 25°15'N & 25°44'N and longitude 85°45'E & 86°45'E. The Burhi Gandak, Kereha and Ganga are the important flood plains of this district. The flood plains of Burhi Gandak and Kereha are marked by the presence of ox-bow lakes, paleochannel and relict stream viz. Kaula chaur. The Kaula chaur is large water spread area. Wetlands are defined as lands transitional between terrestrial and aquatic eco-system, where the water table is usually at or near the surface or the land is covered by shallow water, Mitsch and Gosselink(1). Wetlands are very productive ecosystems, which help in the regulation of biological cycles, maintenance of water quality, nutrient movement and support for food chains. Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. Wetlands are often described as “**Kidneys of landscape**” Mitsch and Gosselink(1). Around 4-6% of earth's surface is covered by wetlands. India has extensive flood plain wetlands (excluding rivers) is estimated about 5,82,86,000 ha or 18.4% of the country's surface area Sugunan(2). The state Bihar has about 686 registered wet lands under the control of state government with an approximate area 1,40,379 ha (Directory of Bihar). In addition, they provide refuge for endangered species of plants and animals and economic benefits in aquatic fauna. Wetlands reduce the impact of floods by acting as storage areas so it can be described as “**Flood protector of landscape**” (authors view 2014). Stored water percolates downward, getting purified in the process, and replenishes the ground water so wetlands can be described as “**Ground water recharger of landscape**” (authors view 2014). It is interesting to note that wetlands cover a tiny portion of earth surface, but by the nature of their unique ecosystem, it becomes all the more important to protect and conserve them. Wetlands are important components of watersheds and provide many valuable functions to the environment and to society. Now wetlands are shrinking rapidly because of urbanization and industrialization. The physical and chemical characters of the wetlands water can be used to assess the ecological nature of the wetlands. Several studies have been conducted to understand the physical and chemical properties of water and soil viz. Rai and Sharma(3), Oliver III and Hill(4), Parikh and Parikh(5).

Domestic sewage, industrial effluent, mass bathing, rural waste matter, agricultural runoff and solid waste disposal in water body are important sources of water pollution. In view of this an attempt was made to analyze the physico-chemical parameters of Telaria waterbody.

MATERIAL AND METHODS

Water samples were collected from a water body namely Telaria of kaula chaur located in Begusarai District, Bihar. Telaria is a seasonal wetland so samples were collected for a period of nine months from June 2011 to February 2012. Water samples were collected 8 – 12 inch below from the surface layer of water body. Samplings of water were carried out mostly between 7.30 a.m. and 8.30 a.m. throughout the period of investigation. Temperature of water samples was recorded with the help of laboratory thermometer. Transparency of water was measured with the help of Sacchi disc. At sampling sites, pH of water samples were recorded with the help of calibrated digital pH meter. Electrical conductivity was measured by conductivity meter. For DO₂ estimation, water samples were collected in 250 ml water sampler bottle and fixed it immediately with 2 ml of Winkler's A & Winkler's B solution and rest procedure was done in lab. Other chemical parameters namely FCO₂, TH, TA, phosphate & nitrate were done in lab from water samples collected in clean plastic cans by following Standard methods APHA(6).

Result and discussion

a. Physical parameters of water

i. Water temperature (WT): - Water temperature influences the physiological activities of flora & fauna of the water bodies. It was observed that water temperature is influenced by the air temperature. Water temperature greatly influences on the level of oxygen of any water body. Water temperature recorded as minimum value of 16°C and maximum of 33.5°C during the study period with a mean value of 24.18°C ± 6.63 shown in table-1 & 2. In the present investigation, minimum water temperature was obtained during December (winter season) and maximum during June (summer season). This investigation is also in close conformity with the finding of Mishra et al (7).

ii. Transparency of water(TW): - The average depth at which sachhi disc disappears and again reappears from open surface of water is called transparency of water. It is inversely proportional to the turbidity of water. Transparency of water decreases with increase in the various suspended particles such as clay, silt, plankton, algae etc. In the present investigation, the transparency of water was found maximum(37 cm) during the winter season and least(18 cm) transparency was obtained during rainy season with a mean value of 26.44±5.79 shown in table-1 & 2.

iii. Water depth(WD): - Depth of water of chaur (wetland) is closely related to the amount of rain fall. Water depth of any wetland is directly proportional to the activity area of the most aquatic fauna. The maximum water level (175 cm) recorded dur-

ing rainy season especially in the month of August 2011 and minimum water level (39 cm) was obtained during winter (February 2012) in the study period, with mean value of 115.78 ± 48.34 cm, shown in table-1 & 2. The present observation supports the view of Michel(8) and Singh et al.(9).

b. Chemical characteristics of water

i. pH: - pH is one of the most important parameters in water chemistry and is defined as negative logarithm of hydrogen ion concentration ($-\log [H^+]$). During the present study period, the pH of the Telaria water body was observed near neutral to alkaline ranging from 7.12 to 7.93 which was considered to be suitable for aquatic life. The maximum pH recorded during winter season especially in the month of December 2011(8.03) and minimum pH(7.12) was obtained during rainy season (July 2011) with mean value of 7.47 ± 0.29 which shows in table-1 & 2. These findings are also in accordance with Mishra et al.(7) and Tara et al.(10).

Physico-chemical characteristics of Telaria water bodies of the Kaula chaur(wetland) of Begusarai district(Bihar) Year 2011-12

Table No. - 1

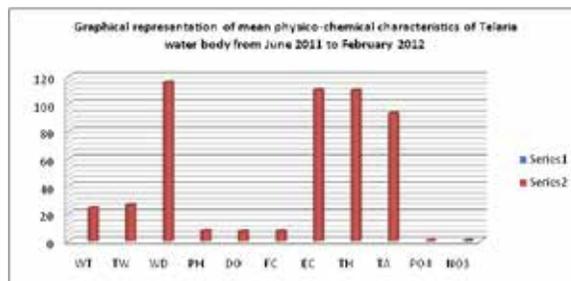
Months	WT	TW	WD	pH	DO ₂	FCO ₂	EC	TH	TA	PO ₄ ³⁻	NO ₃ ⁻
Jun-11	33.3	27	86	7.18	5.4	6.2	123	104	85	0.12	0.16
July-11	32.0	21	174	7.12	7.9	9.5	132	96	79	0.18	0.22
Aug-11	29.2	18	175	7.16	8.2	9.0	113	89	76	0.19	0.21
Sep-11	27.4	24	163	7.32	6.0	8.5	98	96	89	0.15	0.18
Oct-11	23.6	25	135	7.56	6.5	7.0	92	103	95	0.10	0.14
Nov-11	21.7	33	105	7.73	7.2	6.5	99	112	103	0.09	0.14
Dec-11	16.0	37	89	7.93	8.9	6.0	105	127	112	0.09	0.11
Jan-12	16.6	28	76	7.72	7.5	6.4	112	128	106	0.08	0.09
Feb-12	17.8	25	39	7.48	6.3	6.7	119	136	94	0.07	0.08

WT=water temperature(°C), TW=transparency of water(cm), WD=water depth(cm) DO₂=dissolved oxygen (ppm), FCO₂=free carbon dioxide(ppm), EC=electrical conductivity(μs), TH=total hardness(ppm), TA=total alkalinity(ppm), PO₄³⁻=Phosphate(ppm), NO₃⁻=Nitrate(ppm)

Range of physico-chemical characteristics and Mean±S.D. of Telaria water body of the Kaula chaur(wetland) of Begusarai district(Bihar) Year 2011-12

Table No - 2

Characteristics of water↓	Range	Mean±SD
Water temperature(WT-°C)	16.0 - 33.3	24.18±6.63
Transparency of water(TW-cm)	18 - 37	26.44±5.79
Water depth(WD-cm)	39 - 175	115.78±48.34
pH	7.12 - 7.93	7.47±0.29
Dissolved oxygen(DO ₂ -ppm)	5.4 - 8.9	7.10±1.14
Free CO ₂ (FCO ₂ -ppm)	6.0 - 9.5	7.31±1.32
Electrical Conductivity(EC-μs)	92 - 132	110.33±13.04
Total Hardness(TH-ppm)	89 - 136	110.11±16.62
Total Alkalinity(TA-ppm)	76 - 112	93.22±12.25
Phosphate(PO ₄ ³⁻ -ppm)	0.07 - 0.19	0.12±0.04
Nitrate(NO ₃ ⁻ -ppm)	0.08 - 0.22	0.15±0.05



ii. Dissolved oxygen: - Oxygen dissolved in water is a very important parameter in water analysis as it serves as an indicator of the physical, chemical and biological activities of the water body. During the investigation period, the minimum value (5.4ppm) of DO₂ of water was recorded in the month of June 2011 and the maximum value (8.9ppm) in December 2011 with mean value of 7.10 ± 1.14 ppm, shown in tables-1 & 2. The DO₂ value of Telaria water body was high in rainy and winter season and lowest value of DO₂ recorded in the summer month. Hazelwood and Parker stated that, the highest dissolve oxygen in winter may be due to low atmospheric temperature and minimum dissolve oxygen in summer may be due to high metabolic rate of organisms. This was supported by the observations made by Hazelwood and Parker(11).

iii. Free CO₂: - FCO₂ in a water body is generally derived from the atmospheric sources, biotic respiration and decomposition of organic matter by saprophytes. The present study revealed that lowest value of free CO₂ was recorded in the month of December 2011 which was 6.0ppm whereas the highest free CO₂ was recorded in the month of July 2011 which was 9.5ppm during the study period with a mean value of 7.31 ± 1.32 ppm, shown in table-1 & 2. Thus, the present study revealed that higher concentration of FCO₂ is obtained during rainy season and lowest value in winter. The appearance of high concentration of free carbon dioxide during monsoon months could probably be associated with active decomposition of organic matter in the chaur and respiration in the organisms. The present finding is similar to that of Singh et al(9).

iv. Electrical conductivity: - EC value indicates the total concentration of ionized constituents of a water sample. Electrical conductivity is a numerical expression of the ability of a water sample to carry an electric current. During the study period, the electrical conductivity of Telaria water body varied between 92 μs(lowest) to 132 μs(highest) with a mean value of 110.33 ± 13.04 , shown in table-1& 2. Seasonal variations of the present investigations revealed that EC was high during summer beginning of rainy season and low during winter seasons. This result is supported by the findings of Kedar et al.(12).

v. Total hardness: - The total hardness is defined as the sum of Ca and Mg concentrations, both expressed as CaCO₃ in mg/l(ppm). The present study revealed that lowest value³ of total hardness was recorded in the month of August 2011 which was 89ppm whereas the highest total hardness was recorded in the month of February 2012 which was 136ppm with a mean value of 110.11 ± 16.62 ppm, shown in table-1 & 2. This type of water is good for productivity of a water body.

vi. Total alkalinity: - Alkalinity is directly related to the productivity of water bodies because it regulates the pH and free CO₂ of the water bodies. Bicarbonates, carbonates and hydroxides are chief bases in natural water which are responsible for alkalinity of water. During the study period, the value of total alkalinity recorded from the Telaria was between 76 to 112ppm with a mean value of 93.22 ± 12.25 ppm. Its high concentration during winter months may be due to high pH and presence of low carbon diox-

ide. Similar trend was reported by Dhembare(13).

vii. Phosphate: - Phosphorous is available to the aquatic organism as phosphate. Phosphate is considered as the most critical nutrient substance in the maintenance of pond productivity. They are essential for the growth of organisms and a nutrient that limits the primary productivity of the water body. The present study revealed that lowest value of Phosphate was recorded in the month of February(winter) 2012 which was 0.07ppm whereas the highest Phosphate was recorded in the month of July and August(monsoon) 2011 which was 0.19ppm with a mean value of 0.12 ± 0.04 ppm, shown in table-1 & 2. The study also supports the findings of Mishra et al.(7) and Parikh and Mankodi(14).

viii. Nitrates: - The most chemically stable available form of nitrogen is nitrate. High nitrate concentration is responsible for algal blooms in water body. Fertilizers, decayed vegetations and animal matter are the chief sources of nitrates in a water body. The nitrate value of the Telaria varied between 0.08ppm to 0.22ppm with a mean value of 0.15 ± 0.05 ppm in 2011 - 12. The highest value was recorded in July 2011 and lowest value was recorded in February 2012. Similar findings have been recorded by Bhattachariya et al.(15).

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