Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 13 [2] January 2024 : 178-183

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

ORIGINAL ARTICLE **OPEN ACCESS**

Physicochemical analysis of water collected from wetland at Keoladeo National Park, Bharatpur, Rajasthan

Komal Sharma*, Vinay Kumar Meena, Bindu Sharma
Department of Botany, University of Rajasthan, Jaipur- 302004
Email: komalsharma041997@gmail.com

ABSTRACT

Bharatpur, located in the state of Rajasthan, is the site of Keoladeo National Park (KNP), a protected area designated as a wetland under the Ramsar Convention. The present study entailed the examination of physico-chemical properties of water samples collected from five distinct wetland areas inside Kruger National Park (referred to as B, D, E, L, and K). The samples were collected throughout three distinct periods: pre-monsoon (July-October), monsoon (November-February), and post-monsoon (March-June) in the year 2020-21. Measurements were taken for concentrations of dissolved oxygen, chloride, sulphate, phosphate, nitrate, carbonate, and bicarbonate, as well as pH and electrical conductivity. The parameters' standard values were derived from reputable sources such as the Central Pollution Control Board (CPCB), Bureau of Indian Standards (BIS), and World Health Organization (WHO), and all values were thereafter compared to these established standards. Based on the results obtained, it can be concluded that the water quality inside the wetlands of Keoladeo National Park is deemed sufficient and appropriate to support the many fauna species that depend on it. Certain parameters, however, had already reached their maximum value. Hence, it is imperative to maintain regular surveillance in order to safeguard the water supply.
Keywords: Keoladeo national park, wetlands, physico-chemical, standard vale etc.

Received 19.10.2023 Revised 07.11.2023 Accepted 25.12.2023

INTRODUCTION

Wetlands offer a diverse array of advantages and are recognized as highly productive ecosystems on a global scale. The provision of water and primary productivity by these entities is crucial for the survival of several plant and animal species. India's Keoladeo National Park is well recognized as a highly effective conservation area for waterfowl. The area was officially classified as a "national park" in the year 1982. Since 1985, the park has been officially declared as a Ramsar Convention wetland and has also received recognition as a UNESCO World Heritage Site. The KNP encompasses a diverse array of ecosystems, encompassing wetlands, woodlands, shrublands, and grasslands. The park harbors over 375 distinct species of angiosperms, of which 90 are exclusive to wetland habitats [1]**.** A total of 350 avian species, 27 mammalian species, 13 reptilian species, 7 amphibian species, and 43 piscine species have been observed inside that particular area [2].

The hydrological characteristics of a wetland predominantly influence its biological attributes. Modifications to the water quality of the wetland can have extensive ramifications for the plant and animal species that depend on it. The influx of an excessive amount of nutrients into the ecosystem can lead to an overabundance of development, resulting in the obstruction of wetland areas. Conversely, an insufficient supply of nutrients can impede growth to a significant extent. The aforementioned phenomenon has implications for herbivorous organisms, including avian and mammalian species. The presence of pesticides in the water that is discharged into the wetlands presents a comparable hazard to the local fauna. In the past, the park's water supply, derived from Anjan dam situated on the Gambhir River, typically depleted by May or June, resulting in the retention of only a limited number of deep ponds. Scavengers consume deceased aquatic organisms found in desiccated reservoirs. During this period, several turtles engage in hibernation or retreat to deeper ponds as a means of seeking refuge. However, it is important to note that despite these protective measures, they remain vulnerable to predation. Nevertheless, the issue has been mitigated by the construction of the Govardhan Dam on the Chambal River. Consequently, the park will benefit from a consistent and uninterrupted water supply throughout the entire year.

Nevertheless, there is a potential disparity in the water quality between the Chambal and the Gambhir rivers.
The current study is centered on the research of water quality, specifically examining physical, chemical, and biological factors. The aim is to assess the overall quality of the water and determine its suitability for supporting species within the park.

MATERIAL AND METHODS

The study sites

The KNP is located within the geographical coordinates of 27º7'6''N 27º12'2''N and 77 º29'5'' E 77º33'9''E. The distance measures 2 kilometers. Located approximately 38 kilometers southeast of Bharatpur, Rajasthan, is... Situated at a distance of 50 kilometers to the west of Agra in the Indian state of Uttar Pradesh, and in the southeastern direction of Mathura. The overall area encompassed by the park is approximately 29 square kilometers. The topography of the area is rather flat, with a slight gradient towards the central region, resulting in the formation of a depression spanning around 8.5 square kilometers. The aforementioned aquatic feature serves as the principal attraction within the park. The region under consideration exhibits an average elevation of 174 meters. The undersea region has been partitioned into multiple distinct and uneven portions by means of dykes (see Figure 1). The current study was conducted at blocks B, D, E, K, and L. The specific information on these blocks may be found in Table 1.

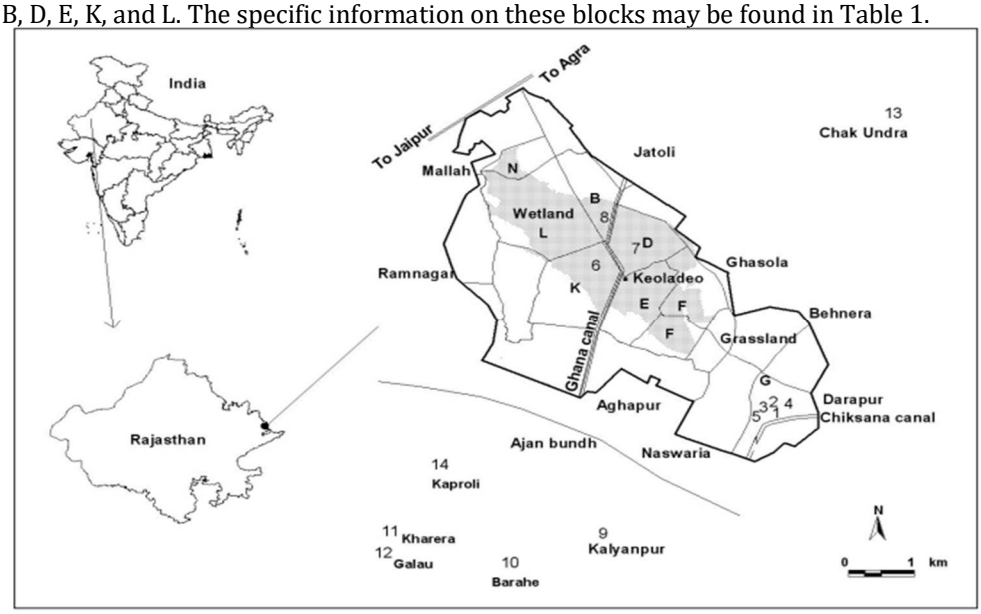

Figure 1: Map of the study area.

Table 1: details of the study sites at KNP.

S. No.	Name of the block	Latitude	Longitude
1	B	27 º10'22.52''N	77 º30'14.52''E
2	D	27 º10'11.12''N	77 º31'35.81''E
3	E	27 º09'50.87''N	77 º31'45.26''E
4	K	27 º10'01.64''N	77 º31'14.84''E
5	L	27 º10'23.51''N	77 º31'06.47"

Sample collection

The water samples were obtained using sanitized sampling vials with a volume of 250 ml, which were labeled with stickers. The specimens were transported to the laboratory under refrigerated conditions and afterwards stored at a temperature of 4°C until they were to be utilized for further experimentation. The specimens were obtained throughout the Monsoon season (July-October), Post-Monsoon season (November-February), and Pre-Monsoon season (March-June) spanning the years 2020 to 2022.

Sampling procedure

Samples were collected at a distance of approximately two to three meters from the water's edge. The collection of water samples involved the utilization of pre-sterilized bottles, which were affixed to the distal end of an elongated bamboo pole. This procedure was conducted subsequent to the observation of visual cues on the water's surface, indicating the potential existence of organic substances. Upon reaching its

maximum capacity, the cap was tightly affixed to the bottle. The sample bottle was affixed with a label containing pertinent information.

Physico-chemical analysis

Water samples from KNP and Bharatpur were obtained using a consistent methodology and afterwards examined for several physical and chemical attributes. These attributes encompassed pH, electrical conductivity (EC), total hardness (TH), total dissolved solids (TDS), dissolved oxygen (DO), as well as sulphate, nitrate, chloride, carbonate, and bicarbonate levels.

The assessment of water quality in this study involved the examination of both physicochemical and biological attributes in the aforementioned five regions of the park. Various approaches were employed to analyze the chosen physicochemical parameters [3,4,5,6].

RESULTS AND DISCUSSION

The outcomes of the five chosen blocks for physical and chemical characteristics are presented in Tables 2 and 3, correspondingly. Graphical representations of the data in several seasons are depicted in Figures 2 to 11. Table 4 presents a comparison between the average values of the parameters collected and the standard norms.

pH: The fundamental concern in water treatment is the degradation of pH. Although minor fluctuations in pH do not directly pose health risks, pH values below 4 and beyond 8.5 can result in the development of unpleasant alkaline tastes. The pH of a water source can be utilized to ascertain its level of acidity or alkalinity. Aquatic organisms are adversely affected by extremely low pH levels, excessively high pH levels, and significant fluctuations in pH. The pH values of the water samples collected ranged from 7.4 to 8.5, which aligned with the established standard guidelines. The pH exhibited greater values during the pre-monsoon period, but it reached its lowest levels during the post-monsoon period.

EC: The quantification of a material's capacity to facilitate the flow of an electric current is determined by its electrical conductivity. The detection of the ionic condition of water is a significant physical metric [7]. This is due to the fact that the majority of salts dissolved in water exist in their ionic state, allowing them to conduct electrical current. In the present investigation, the electrical conductivity (EC) ranged from 1041 µs/cm (block K) to 1311 µs/cm (block B). Based on established protocols, it is recommended that the electrical conductivity (EC) level should not exceed 1500 µs/cm.

TDS: Total dissolved solids (TDS) plays a crucial role in assessing the potential range of uses for a given water source. The quantification of saltiness involves the examination of the concentration of total dissolved solids (TDS) in a specific solution. Water that exceeds a specific threshold of Total Dissolved Solids (TDS) is deemed unsuitable for human consumption due to various negative physiological consequences and unpleasant mineral flavors. The total dissolved solids (TDS) levels observed ranged from 318 mg/L to 491 mg/L, which falls below the recommended recommendation of 500 mg/L. The total dissolved solids (TDS) exhibited its highest levels during the pre-Monsoon period, whereas it reached its lowest levels during the Monsoon season.

TA: Alkalinity refers to the capacity of water to function as a buffering agent against acidic conditions. The protection of aquatic organisms against the detrimental consequences of abrupt fluctuations in water pH is of utmost importance. The measure of alkalinity in water signifies the presence and concentration of buffering agents. In the current investigation, the alkalinity levels ranged from 156 mg/L (block K) to 204 mg/L (block E). In each of the blocks, the Teaching Assistant (TA) adhered to the established standard requirements.

DO: The measurement of dissolved oxygen in water is a significant parameter for assessing water quality as it provides insights into both the physical and biological processes occurring within the water [8]. The concentration of DO in the present investigation ranged from 6.20 mg/L in block B to 9.24 mg/L in block E. Based on established conventions, it is recommended that the value be greater than 6.

Chemical parameters

Sulphate ions: Sulfate, a resultant of the processes of weathering, atmospheric hydrological cycles, and the presence of heavy metal sulfides, can be found in significant amounts in all naturally existing water sources. The presence of soluble sulfate salts is responsible for the hardness of water, constituting a significant proportion of the available water resources. The consumption of water with a sulphate concentration exceeding 400 mg/L [9] may lead to the development of Cantharis and gastrointestinal discomfort. The analysis of the obtained samples revealed the existence of sulphate ions ranging from 45.62 mg/L (block L) to 154.4 mg/L (block D).

Nitrate: The harmful effects of nitrate and nitrite concentrations in surface water on aquatic life and human users of the water are generally acknowledged. Infants exhibiting heightened amounts of nitrate are frequently diagnosed with methemoglobinemia. The presence of nitrite-nitrogen in drinking water has the

potential to induce significant health complications, particularly among vulnerable populations such as newborns and pregnant women. The nitrate concentrations observed in all wetland areas examined in the present study were found to be below the established reference criterion. The concentration of the substance was found to be the lowest in L block, measuring 47.15 mg/L, whereas it was seen to be the greatest in D block, with a concentration of 89.37 mg/L.

Chloride: Chloride is ubiquitously found in various aqueous environments over the Earth's surface. The combination of calcium, magnesium, or sodium frequently leads to the formation of salts. Various sources of drinkable water encompass precipitation in the form of rain, snow, and air precipitation, as well as bodies of water such as rivers, lakes, streams, and seas. Chloride exhibits a high solubility in naturally occurring solutions that contain cations. The chloride level observed in this investigation ranged from 88 mg/L to 231 mg/L, which aligns with the established standard criteria.

Carbonate and bicarbonate: The alkalinity of any given river system is mostly attributed to the presence of naturally occurring ions, including HCO3-, CO3-, and OH-. The study observed that the levels of carbonate and bicarbonate ions were within standard values across all blocks for the whole duration.

Table 2: Physical parameters of the water samples collected from KNP.

	pH			EC (µs/cm)			TDS (mg/L)			TA (mg/L)			DO (mg/L)		
	Po-M	M	Pr-M	Po-M	M	Pr-M	Po-M	M	Pr-M	Po-M	M	Pr-M	Po-M	M	Pr-M
B	7.71	8.12	8.2	1331	1379	1314	362	318	386	191	186	198	7.75	7.8	6.2
D	7.4	7.59	7.6	1160	1179	1072	455	415	475	173	159	186	7.8	8.1	6.9
E	8.18	8.24	8.5	1221	1235	1211	367	344	486	193	164	204	8.9	9.21	7.7
K	8.17	8.19	8.2	1041	1059	1044	434	426	491	168	156	179	8.37	8.76	8.1
L	7.67	7.79	7.9	1243	1313	1265	405	379	484	184	177	195	7.3	7.8	7.2
mean	7.826	7.99	8.1	1199	1232.6	1181.2	404.6	376.4	464.4	181.8	168.4	192.4	8.024	8.334	7.22
SD	0.34	0.28	0.3	107.6	123.216	118.633	40.722	45.8726	44.207	10.986	12.7004	9.9146	0.6198	0.6273	0.7328

Table 3: Chemical parameters of water samples collected from KNP.

	Sulphate (mg/L)			Nitrate (mg/L)			Chloride (mg/L)			Carbonate (mg/L)			Bicarbonate (mg/L)		
	Po-M	M	Pr-M	Po-M	M	Pr-M	Po-M	M	Pr-M	Po-M	M	Pr-M	Po-M	M	Pr-M
B	98.46	132.9	186.34	67.54	65	72.56	231	214	211	54	69	63	121	115	96
D	154.4	140.5	176.54	84.27	88.47	89.37	112	88	94	144	88	123	111	107	98

E	59.37	77.98	82.54	56.54	66.75	85.64	143	129	133	61	54	64	106	87	71
K	46.97	64.72	69.22	80.36	71.79	88.34	116	98	105	139	131	113	96	85	78
L	45.62	51.11	65.19	48.9	47.15	57.64	124	110	116	167	105	151	85	73	68
Mean	80.96	93.43	115.97	67.52	67.832	78.71	145.2	127.8	131.8	113	89.4	102.8	103.8	93.4	82.2
SD	46.28	40.69	60.213	15.11	14.82	13.566	49.424	50.549	46.559	51.812	30.19	38.49	13.846	17.17	14.01
	96.79			71.35			134.93			101.73			93.13		
	17.74			6.37			9.11			11.84			10.80		

Table 4: Comparison of values obtained with standard guidelines.

Parameters	Analytical results of samples	Acceptable limits as per BIS IS 10500:2012	Guideline values as per WHO	Guideline values as per CPCB
Electrical conductivity (µS/cm)	1204.33±26.08	1500	<250	2000
pH	7.96±0.13	6.5-8.5	6.5-8.5	6.5-8.5
TDS (mg/L)	415.13±44.94	<500	**<1000**	-
Dissolved oxygen (mg/L)	7.86±0.57	-	**-**	>6.0
Total alkalinity (mg/L)	180.87±12.03	<200	<300	600
Chloride (mg/L)	134.93±9.11	<250	<250	1000
Sulphate (mg/L)	96.79±17.74	<200	<250	400
Nitrate (mg/L)	71.35±6.37	<45	<50	100
Carbonate (mg/L)	101.73±11.84	100-150		
Bicarbonate (mg/L)	93.13±10.80	100-150		

CONCLUSION

From the results of the present study concluded that water quality of wetlands at Keoladev National Park in up to the standards and the water is safe for wildlife using it. However, some parameters were at the highest limit. So, to maintain the water quality, observation on regular basis is compulsory.

Acknowledgement

The authors are grateful to Head, department of Botany, university of Rajasthan, to provide facilities for the work.

Conflict of interest

Authors declare that there is no conflict of interest for this work.

Author's contribution

Author, Ms. Komal has conducted the whole study while other authors helped designed the study and guided her for the work and writing manuscript.

REFERENCES

1. Perennou, C., and Ramesh, B.R., (1987). Explanatory notes on the vegetation map of Keoladev National park, French Institute of Pondichery, Pondichery and Bombay Natural History Society, Bombay.
2. Vijayan, V.S., (1991). Final report (1980-1990). Bombay natural history society.
3. APHA (American Public Health Association), (1995). American water works association and water pollution control federation, standard methods of examination of water and waste water, 19th edition, new York, USA.
4. Trivedi, R.K., and Goel, P.K., (1986). Chemical and biological methods for water pollution studies. Env. Publication.
5. Gupta, A.K., and Raghubanshi, A.K., (2002). Comparative study of enrichment of nutrients and heavy metals in river water of Ghaghra and Ganga due to Anthropogenic pressures. Poll Res. 21(3): 261-263.
6. Pandey, S.K., and Tiwari, S., (2009). Physico-chemical analysis of ground water of selected area of Ghazipur city- A case study. Nature and science. 7(1): 17-20.
7. Singh, B., Dolk, M. M., Shen, Q., & Camps-Arbestain, M., (2017). Biochar pH, electrical conductivity and liming potential. Biochar: A guide to analytical methods, 23.
8. Bhattacharya, R.K., Das C.N., and Dolui, G., (2019). Consequences of sand mining on water quality and instream biota in alluvial stream: a case-specific study in South Bengal River, India. Sustainable Water Resources Management. 5, 1815-1832.
9. Manivasakam, N., (2005). Physico-chemical examination of water sewage and industrial effluents. Physico-chemical examination of water sewage and industrial effluents., (Ed. 5).

CITATION OF THIS ARTICLE

Komal S, Vinay K M, Bindu S. Physicochemical analysis of water collected from wetland at Keoladeo National Park, Bharatpur, Rajasthan. Bull. Env. Pharmacol. Life Sci., Vol 13[2] January 2024:178-183