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Physico-chemical properties of Lohit River in the Eastern Himalayan region, India

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ABSTRACT

In the past decade, research has been conducted on the river Brahmaputra with little or no importance accorded to the lesser-known rivers such as the Lohit, Dibang and Siang that forms the tributaries of the Brahmaputra River. The present study was conducted to assess the water quality of the Lohit River at Parshuram Kund area in Eastern Himalayan region. The water samples from four different stations were collected from up and down stream for four different seasons, namely, winter, pre-monsoon, monsoon and post-monsoon. The collected water samples were analysed for different physicochemical characteristics such as water temperature, pH, Dissolved Oxygen (DO), Conductivity, Turbidity, Total Dissolved Solids (TDS), Calcium and Chloride. The highest temperature was recorded during monsoon (31.8 degree C). The water was slightly acidic to slightly basic in nature (6.8-7.4) with highest DO during winter (8.6 mg/l). Maximum turbidity and conductivity (123.6 NTU and 97.5 µmho/cm respectively) with lowest TDS (50.1 ppm) were observed during monsoon. High chloride and calcium content (12.35 mg/l and 23.3 mg/l respectively) was recorded during winter. The results showed that the water quality is being altered during different seasons which may be attributed to various infrastructure development in and around the area.

Key words: *Brahmaputra River, Eastern Himalayan region, Lohit River, Parshuram Kund, Water quality*

Introduction

North-East India is blessed to have abundance of accessible freshwater sources in the form of various rivers, streams, lakes, swamps, marshes, etc., with the mighty Brahmaputra River along with its numerous tributaries bifurcating the whole area. The Lohit River also known as the Zayul Chu by the Tibetans and Tellu by the Mishmis is a river in China and India, which joins the Brahmaputra River in the state of Assam. This river flows through Arunachal Pradesh for 200 kilometres before entering the plains of Assam. Lohit River plays a significant role in socioeconomic aspects of the state. Being the principal river of Arunachal Pradesh, it largely contributes towards the drinking water supply, agriculture and energy needs.

Water is vital to the existence of all living organisms on earth, which is increasingly being threatened as human population increases rapidly. Water quality depends upon either or both natural influences and human activities (Kolawole *et al.*, 2008). Most of the river water are being polluted by indiscriminate disposal of sewage, industrial waste and human activities, which affects their physicochemical characteristics and microbiological quality. During the last few decades, the natural resources are continuously being contaminated all around the

world for the sake of development and flood hazard mitigation. Increasing number and amount of industrial, agricultural and commercial chemical discharges into the aquatic environment has led to the various deleterious effects on aquatic organisms. In some aquatic organisms, including fish, pollutants accumulate directly from contaminated water and indirectly via the food chain (Mohammed, 2009).

Water as a natural resource, plays an important role in the socio-economic development processes and therefore, sustainable development and management of water is needed for meeting the requirement of energy, drinking water, irrigation and food security etc. In various policies and programmes, concerns have been shown to conserve the water resources, in addition to preservation of our natural environment and alleviation of poverty and hunger. Therefore, the present study aimed to assess the water quality of the Lohit River based on some important physicochemical characteristics.

Materials and Methods

Study area

The study area is located in the Parshuram Kund area of Lohit district, Arunachal Pradesh (Table 1). Parshuram Kund is a Hindu pilgrimage site situated on the Brahmaputra plateau in the lower reaches of the Lohit River. The Kund is dedicated to sage Parshuram and is the popular site attracting pilgrims from Nepal, from across India, and from nearby states of Manipur and Assam. Over 70,000 devotees and sadhus take a holy dip in its water each year on the occasion of Makar Sankranti, in the month of January. The climate of the district is largely influenced by the nature of its terrain. Climate is sub-tropical wet and highly humid in the lower elevations and in the valleys. The area falls in heavy rainfall belt and average annual rainfall is 5179 mm.

Table 1. Geographical coordinates of the sampling stations located in Parshuram Kund area

Sl. No.	Sampling Stations	Latitude	Longitude
1	S1	27º53'1.9'' N	96º21'10.9''E
2	S2	27º52'41.7'' N	96º21'32.6'' E
3	S3	27º52'27.7'' N	96º21'52.6'' E
4	S4	27º52'25.5'' N	96º21'6.06'' E

Sampling and analysis

The study was carried out from November 2018 to March 2021 for winter and pre-monsoon season (Nov-May) assessment and monsoon and post-monsoon season (June-October) assessment. The water samples were collected from 4 study sites selected from up and downstream. The samples were taken in required quantity and transported immediately to the laboratory for different physicochemical analysis. The collected river water samples were analysed in the laboratory for temperature, pH, turbidity, conductivity, total dissolved solids (TDS), dissolved oxygen (DO), chloride and calcium following standard protocols. The temperature of each sample collected was measured on site with the use of mercury bulb thermometer, pH of water was measured by pH meter, turbidity of water was measured by turbidity meter, the dissolved oxygen determination was done by Wrinkler's Method, TDS was measured by TDS meter, conductivity was measured by conductivity meter and elements like calcium and chloride were analysed by titration method.

Results and Discussion

The water samples were analysed for different physicochemical characteristics. Total of eight physicochemical parameters were analysed namely water temperature, pH, TDS, DO, turbidity, conductivity, chloride and calcium as shown in Table 2.

The water temperature ranged from 18.1 – 31.8 ºC during 2018-2019 and 18.7 – 31.8 ºC during 2019-2020. The highest temperature was recorded during monsoon season and the lowest was recorded during winter. The water temperature recorded revealed that it changed in accordance with the seasons.

The pH of the water was slightly acidic to slightly basic in nature. The values in the year 2018-2019 ranged from 6.9 during monsoon to 7.4 during winter and post monsoon. Similar trend was observed in 2019-2020 with highest pH of 7.7 during winter. The values measured during 2018-2020 showed no indication of any significant seasonal fluctuation of pH. It may be inferred from the study that the pH of all the four sampling stations was within the acceptable range. The pH ranging 6.5-7.5 has also been reported in the spring water of Mizoram (Kumar *et al.*, 2022).

Adequate DO is necessary for good water qual-

Table 2. Physicochemical properties of Lohit River in four sampling sites at Parshuram Kund area

Parameter	Year	Stations	Seasons				Mean	±SD
			Winter	Pre-Monsoon	Monsoon	Post-monsoon		
Temperature°C	2018-2019	St-1	18.1	27.2	31.5	24.1	25.2	5.6
		St-2	19.3	29.1	33.1	25.1	26.6	5.8
		St-3	17.0	28.1	29.9	26.3	25.3	5.7
		St-4	18.3	30.0	33.0	23.9	26.3	6.5
		Avg.	18.1	28.6	31.8	24.8	25.8	5.9
	2019-2020	St-1	17.7	28.3	32.7	25.3	26.0	6.3
		St-2	19.6	29.1	30.1	22.0	25.2	5.1
		St-3	18.2	30.2	33.5	27.9	27.4	6.5
		St-4	19.3	29.7	31.1	25.9	26.5	5.2
		Avg.	18.7	29.3	31.8	25.2	26.2	5.8
pH	2018-2019	St-1	7.6	7.2	7.0	7.3	7.2	0.2
		St-2	7.1	7.3	6.9	7.8	7.2	0.3
		St-3	7.9	7.6	7.1	7.3	7.4	0.3
		St-4	7.3	7.1	6.8	7.2	7.1	0.2
		Avg.	7.4	7.3	6.9	7.4	7.2	0.3
	2019-2020	St-1	7.3	6.9	6.3	7.4	6.9	0.4
		St-2	8.1	7.7	6.8	7.2	7.4	0.5
		St-3	7.7	7.3	7.2	7.0	7.3	0.2
		St-4	7.8	7.1	6.9	7.5	7.3	0.4
		Avg.	7.7	7.2	6.8	7.2	7.2	0.3
DO (mg/l)	2018-2019	St-1	8.1	7.2	6.8	7.0	7.3	0.5
		St-2	9.1	7.1	5.5	7.2	7.2	1.4
		St-3	8.2	7.6	4.9	7.1	6.9	1.4
		St-4	8.9	7.2	6.1	7.3	7.4	1.1
		Avg.	8.6	7.3	5.8	7.1	7.2	1.1
	2019-2020	St-1	8.9	7.3	6.8	7.2	7.5	0.9
		St-2	8.1	8.0	4.8	7.2	7.0	1.5
		St-3	8.9	7.6	5.0	6.9	7.1	1.6
		St-4	9.3	7.9	6.0	7.1	7.6	1.3
		Avg.	8.8	7.7	5.7	7.1	7.3	1.3
Turbidity (NTU)	2018-2019	St-1	92.8	97.0	120.0	95.2	101.2	12.6
		St-2	88.6	93.3	133.2	91.1	101.5	12.6
		St-3	79.9	99.1	121.5	93.2	98.4	17.3
		St-4	90.1	96.2	119.9	95.3	100.3	13.2
		Avg.	87.8	96.4	123.6	93.7	100.4	15.9
	2019-2020	St-1	91.0	101.0	127.2	98.3	104.3	15.7
		St-2	88.2	91.2	160.2	90.2	107.4	35.1
		St-3	81.1	96.1	137.7	87.5	100.6	25.4
		St-4	72.1	93.4	141.1	91.9	99.6	29.3
		Avg.	83.1	95.4	141.5	91.9	103.0	26.2
Conductivity (µmho/cm)	2018-2019	St-1	72	81	93	88	83.5	7.8
		St-2	68	79	89	83	79.75	7.6
		St-3	78	88	96	91	88.25	6.5
		St-4	71	82	112	87	88	15.01
		Avg.	72.25	82.5	97.5	87.25	84.9	9.08
	2019-2020	St-1	79	88	99	91	89.25	7.1
		St-2	75	79	87	82	80.75	4.3
		St-3	63	84	102	99	87	15.4
		St-4	69	77	106	84	84	13.7
		Avg.	71.5	82	98.5	89	85.25	9.86

Table 2. *Continued ...*

Parameter	Year	Stations	Seasons				Mean	±SD
			Winter	Pre-Monsoon	Monsoon	Post-monsoon		
TDS (ppm)	2018-2019	St-1	91.5	76.3	53.1	69.4	72.5	15.9
		St-2	100.4	81.1	43.7	77.9	75.7	23.5
		St-3	102.0	89.0	47.7	81.9	80.1	23.1
		St-4	99.9	71.1	55.9	70.0	74.2	18.4
		Avg.	98.45	79.4	50.1	74.8	75.6	19.8
	2019-2020	St-1	103.1	80.2	61.0	75.2	79.8	17.4
		St-2	111.0	90.1	40.1	80.0	80.3	29.7
		St-3	104.4	66.1	60.6	79.9	77.7	19.5
		St-4	107.0	73.3	55.5	77.1	78.2	21.3
		Avg.	106.3	77.4	54.3	78.0	79.0	21.3
Chloride(mg/l)	2018-2019	St-1	11.7	9.3	5.1	9.9	9	2.7
		St-2	10.1	7.6	3.2	9.1	7.5	3.0
		St-3	12.3	8.8	3.9	8.3	8.3	3.4
		St-4	11.3	9.1	4.6	8.9	8.5	2.8
		Avg.	11.35	8.7	4.2	9.05	8.3	2.9
	2019-2020	St-1	13.1	10.5	5.8	11.0	10.1	3.0
		St-2	11.0	10.1	4.1	9.9	8.8	3.1
		St-3	13.3	7.7	2.9	10.2	8.5	4.3
		St-4	12.0	8.8	3.3	9.6	8.9	3.6
		Avg.	12.35	9.3	4.0	10.2	8.9	3.5
Calcium(mg/l)	2018-2019	St-1	26.3	20.1	12.1	22.0	20.1	5.9
		St-2	24.1	17.2	10.6	18.1	17.5	5.5
		St-3	20.7	17.6	10.0	17.7	16.5	4.5
		St-4	22.4	17.9	13.9	19.4	18.4	3.5
		Avg.	23.3	18.2	11.6	19.3	18.1	4.8
	2019-2020	St-1	29.2	18.7	10.7	20.4	19.7	7.5
		St-2	23.3	14.9	10.1	16.0	16.0	5.4
		St-3	22.7	11.3	10.4	12.8	14.3	5.6
		St-4	20.9	17.6	11.0	19.6	17.2	4.3
		Avg.	24.0	15.6	10.5	17.2	16.8	5.5

ity, survival of aquatic organism and decomposition of waste by microorganism (Islam *et al.,* 2010). Dissolved oxygen values ranged from 5.7 – 8.8 mg/l. Highest DO was recorded during winters whereas lowest was during monsoon. Similar trend was followed during both the years. Assessment of dissolved oxygen is an important parameter of water quality since oxygen influences nearly all chemical and biological processes within water bodies. As such, its measurement indicates the degree of pollution level of water. The WHO guidelines value for DO is 4-6 mg/l.

Sources such as clay, silt, sewage, and microorganisms affect the turbidity of river water. The turbidity of water ranged from 87.8 – 123.6 NTU during 2018-2019 and 83.1 – 141.5 NTU during 2019-2020. Highest values were obtained during monsoon whereas the lowest turbidity was recorded during the winter. The turbidity in the river Ganga at Haridwar was also lowest during the winter season. From the summer season onwards, the water becomes turbid due to the melting of snow and rains (Joshi *et al.,* 2009).

Similarly, the highest conductivity was found during monsoon and lowest during winter with values ranging from 71.5 – 98.5 µmho/cm. Conductivity of the water is primarily affected by the presence of dissolved salts and minerals and varies directly with temperature. The Lohit River runs through hilly terrains having boulders and gravels and as well as through plains which consist mainly of sand and silt. As such the river tends to have higher conductivity because of the presence of materials which ionize when washed into the water.

The presence of suspended solids in river water is due to the suspension of sand and clay particles

during waste discharge (Matta *et al.*, 2018). The values of TDS ranged from 50.1 – 98.4 ppm during 2018-2019 and 54.3 – 106.3 ppm during 2019-2020. Maximum TDS was recorded during winter and minimum was during monsoon.

Cation of calcium, magnesium, iron and manganese contribute to the hardness of water (Shrivastava and Patil, 2002). The chloride content ranged from 4.2 – 11.3 mg/l and 4.0 – 12.3 mg/l during 2018-2019 and 2019-2020 respectively. The calcium values ranged from 11.6 mg/l in monsoon to 23.3 mg/l in winter during 2018-2019 whereas during 2019-2020, the values ranged from 10.5 mg/l in – 24 mg/l. The presence of calcium ions leads to hardness in the water and is responsible for the formation of scales and sludge. The weathering of carbonates, sulphates and silicate minerals inadvertently leads to calcium ions in river water. However, no significant year wise change in concentration of calcium ions was observed in the study.

Conclusion

From the above study, it is revealed that, there are variations in water quality in different seasons at a same site. There were also variations in water quality at different study sites. The results indicates that water quality of the Lohit River is up to the mark for growth and development of all-natural flora and fauna. However, the alteration and deterioration of river water quality in the coming years cannot be ignored. Necessary intervention against river bank erosion and periodic monitoring of river water quality must be undertaken to ensure sustainable management and maintenance of the Lohit River at Parshuram Kund area.

References

Islam, M.S., Suravi and Meghla, N.T. 2010. Investigation on water quality in Ashulia beel, Dhaka. *Bangladesh J. Fish. Res.* 14(1-2) : 55-64.

Joshi, D.M., Kumar, A. and Agrawal, N. 2009. Studies on physico-chemical parameters to assess the water quality of River Ganga for drinking purpose in Haridwar District. *Rasayan J. Chem.* 2(1) : 195–203.

Kolawole, O.M., Ajibola, T.B. and Osuolale, O.O. 2008. Bacteriological Investigation of a wastewater discharge run-off stream in Ilorin, Nigeria. *J. Appl. Environ. Sci.* 4: 33-37.

Kumar, S., Singh, K.B. and Kumar, S. 2022. Physico-chemical characteristics of spring water of Lunglei, Mizoram. *Environment and Ecology*. 40(1): 210-214.

Matta, G., Kumar, A., Naik, P.K., Tiwari, A.K. and Berndtsson, R. 2018. Ecological analysis of nutrient dynamics and phytoplankton assemblage in the Ganga River system, Uttarakhand. *Taiwan Water Conserv.* 66(1) : 1–12.

Mohammed, F.A.S. 2009. Histopathological studies on *Tilapia zilli* and *Solea vulgaris* from lake Quran, Egypt. *WJFMS* 1(1): 29-39.

Shrivastava, V.S. and Patil, P.R. 2002. Tapti River water pollution by industrial wastes: A statistical approach. *Nat. Environ. Pollut. Technol.* 1: 279-283.